National Institute for Health and Care Excellence

Final

Stroke rehabilitation in adults (update)

[O] Evidence reviews for interventions for shoulder pain after stroke

NICE guideline NG236

Evidence reviews underpinning recommendations 1.14.2 to 1.14.4 and recommendations for research in the NICE guideline

October 2023

Final

These evidence reviews were developed by NICE

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1 Managing post-stroke shoulder pain

1.1 Review question

In people with shoulder pain after stroke, what is the clinical and cost effectiveness of transcutaneous electrical nerve stimulation, acupuncture, functional electrical stimulation and intra-articular steroid injection in reducing pain?

1.1.1 Introduction

Shoulder pain is very common after a stroke, in particular among individuals with arm weakness. This pain can be disabling and can prevent or interrupt rehabilitation programmes. While there is extensive literature on the management of shoulder pain in the healthy adult population, there is little research and clinical guidance for the management of post-stroke shoulder pain. Shoulder pain in this clinical cohort is complex and multifactorial in aetiology, and there has been an increase in treatment options such as electrical stimulation becoming available over the past few years. Despite this, a lack of national clinical standards means that current clinical practice tends to be more reactive rather than proactive, and clinicians may be uncertain which physical or pharmacological intervention may be the most appropriate for their patient.

1.1.2 Summary of the protocol

Table 1: PICO characteristics of review question

Population	Inclusion: • Adults (age ≥16 years) who have had a first or recurrent stroke (including people after subarachnoid haemorrhage) with shoulder pain Exclusion: • Children (age <16 years) • People after a transient ischaemic attack

Interventions	• Transcutaneous electrical nerve stimulation (TENS)
	• Functional electrical stimulation
	• Neuromuscular electrical stimulation (NMES)
	• Devices
	  ○ Tape
	  ○ Slings
	  ○ Supports
	  ○ Braces
	  ○ Other devices
	• Acupuncture/dry needling
	• Electroacupuncture
	• Intra-articular medicine injections
	  ○ Corticosteroids
	  ○ Saline
	• Injections into other sites (for example: bursae)
	  ○ Corticosteroids
	  ○ Saline
	• Nerve blocks (local anaesthetics)

Comparisons	• Each other • Placebo/sham • Usual care or no treatment
Outcomes	All outcomes are considered equally important for decision making and therefore have all been rated as critical: At time period: • <6 months • ≥6 months • Person/participant generic health-related quality of life (continuous outcomes will be prioritised) • Carer generic health-related quality of life (continuous outcomes will be prioritised) • Pain (continuous outcomes will be prioritised) • Physical function – upper limb (continuous outcomes will be prioritised) • Activities of daily living (continuous outcomes will be prioritised) • Stroke-specific Patient-Reported Outcome Measures (continuous outcomes will be prioritised) • Withdrawal due to adverse events (dichotomous outcome)
Study design	• Systematic reviews of RCTs • Parallel RCTs If insufficient RCT evidence is available, non-randomised studies will be considered if they adjust for key confounders (e.g. age, time period after stroke, pre-existing shoulder conditions), including: 1. Prospective and retrospective cohort studies 2. Case control studies (if no other evidence identified)

For full details see the review protocol in Appendix A.

1.1.3 Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in Appendix A and the methods document.

Declarations of interest were recorded according to NICE's conflicts of interest policy.

1.1.4 Effectiveness evidence

1.1.4.1 Included studies

Twenty eight randomised controlled trial studies (32 papers) were included in the review;[2-9, 14-17, 21-24, 26, 27, 33, 34, 36, 37, 39-41, 45, 46, 48-52] these are summarised in Table 2 below. Evidence from these studies is summarised in the clinical evidence summary below (Table 3).

The following interventions were compared:

- Transcutaneous electrical nerve stimulation (TENS) compared to:
  - Neuromuscular electrical stimulation (NMES)[6, 52]
  - Nerve blocks (local anaesthetic)[9]
  - Usual care or no treatment[52]
- Functional electrical stimulation (FES) compared to:
  - Usual care or no treatment[21]
- Neuromuscular electrical stimulation (NMES) compared to:
  - Transcutaneous electrical nerve stimulation (TENS)[6, 52]
  - Devices – slings[5]
  - Placebo/sham[7, 23]
  - Usual care or no treatment[40, 45, 52]
- Devices – tape compared to:
  - Placebo/sham[16, 17, 33, 48]
  - Usual care or no treatment[15, 34]
- Devices – slings compared to:
  - Neuromuscular electrical stimulation (NMES)[5]
  - Usual care or no treatment[27, 41]
- Devices – braces compared to:
  - Usual care or no treatment[14]
- Acupuncture/dry needling compared to:
  - Placebo/sham[24]
  - Usual care or no treatment[8, 26, 50, 51]
- Electroacupuncture compared to:
  - Placebo/sham[37]
- Intra-articular medicine injections – Corticosteroids compared to:
  - Placebo/sham[22, 36]
- Nerve blocks (local anaesthetic) compared to:
  - Transcutaneous electrical nerve stimulation (TENS)[9]
  - Placebo/sham[2, 39]

No relevant clinical studies including the following interventions were identified:

- Devices – supports and other devices
- Intra-articular medicine injections – saline
- Injections into other sites (for example: bursae) – corticosteroids and saline

Population and concomitant therapy factors

The populations included in the review were somewhat similar. There was a mixture of studies investigating the use of interventions in different time periods after stroke, mostly including people in the subacute or chronic time periods. The majority of studies excluded

people with previous shoulder pathology, while others did not state whether they were excluded. No study reported specifically including people with previous shoulder pathology.

Concomitant therapy use varied between studies. In the majority of cases, physiotherapy including exercise with or without manual therapy was available with the therapy being of varied intensity. In some cases, occupational therapy and speech and language therapy were provided as required. In others, additional pharmacological therapy, including paracetamol, non-steroidal anti-inflammatory drugs and opioids for pain relief and occasionally antispasticity medication, such as tizanidine were available.

Inconsistency

The majority of outcomes included evidence from one study only. Where outcomes included multiple studies, some showed inconsistency that could not be resolved by sensitivity analysis or subgroup analysis. In the majority of cases, there were less than four studies, which meant that valid subgroups could not be formed.

Background rate of oral drug use

When investigating the studies, the possibility of study enrichment through inclusion criteria specifying previous oral medication use was considered. Most studies did not report specific response criteria, while the others that discussed this possibility did not specifically include or exclude people based on this. Instead, they provided the opportunity to use oral pain relief medication to all participants. In some studies, this appeared to be provided to all participants, while in others only some of the participants received therapy. A series of sensitivity analyses were conducted investigating this and did not find that considering this resolved heterogeneity.

See also the study selection flow chart in Appendix C, study evidence tables in Appendix D, forest plots in Appendix E, and GRADE tables in Appendix F.

1.1.4.2 Excluded studies

Two Cochrane reviews, Ada 2005[1] and Price 2000[35] were identified but were not included in the review. The reasons included reviewing a different population and not investigating the effect of the intervention on pain[1] and including people where it was not explicitly stated they had shoulder pain and not including all of the comparisons stated in the protocol[35]. In these cases, the citation list was checked and all relevant studies were included in the review.

See the excluded studies list in Appendix J.

1.1.5 Summary of studies included in the effectiveness evidence

Table 2: Summary of studies included in the evidence review

Study	Intervention and comparison	Population	Outcomes	Comments
Adey-Wakeling 2013[2] Subsidiary study: Allen 2010[3]	**Nerve blocks (suprascapular nerve block)** (n=32) Suprascapular nerve block, 1mL of 40mg/mL methylprednisolone and 10mL 0.5% bupivacaine hydrochloride.	**People after a first or recurrent stroke** Age: Majority 66-79 years. N = 64 Previous shoulder pathology: Not stated/unclear.	Pain at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Acute stroke and rehabilitation wards in Australia. Funding: Supported by a grant from Foundation Dew

Study	Intervention and comparison	Population	Outcomes	Comments
	Placebo/sham (n=32) Injection of 5mL normal saline infiltrated subcutaneously to the same region. **Concomitant therapy:** All people received a 2mL subcutaneous infiltration of 1% lidocaine before injection.	Mean time period after stroke (SD): 12 (9) weeks.		Park, Repatriation General Hospital.
Chae 2005[5] Subsidiary studies: Chae 2007[4] Yu 2004[49]	**Neuromuscular electrical stimulation (NMES)** (n=32) Intramuscular electrical stimulation for 6 hours/day for 6 weeks. **Devices – slings (hemisling)** (n=29) Cuff-type hemisling with instructions to use it whenever the upper limb was unsupported. **Concomitant therapy:** All people continued to receive concomitant treatments, including pharmacologic and nonpharmacologic interventions as per their primary care physicians.	**People after a first or recurrent stroke** Mean age (SD): 59 (12.2) years. N = 61 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 129 (164) weeks.	Pain at <6 months and ≥6 months	Background rate of oral drug use: Mixed population. Setting: Outpatient follow up in the United States of America. Funding: Supported in part by grants R44HD34996 and K12HD01097 from the National Institute for Child Health and Human Development, grant M01RR0080 from the National Center for Research Resource, and by NeuroControl Corporation.
Chuang 2017[6]	**Neuromuscular electrical stimulation (NMES)** (n=19) EMG-trigger neuromuscular electrical stimulation delivered in 12	**People after a first or recurrent stroke** Mean age (SD): 60.8 (11.0) years. N = 38 Previous shoulder pathology: No	Pain at <6 months Physical function – upper limb at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in Taiwan. Funding: Partially supported by the

Study	Intervention and comparison	Population	Outcomes	Comments
	sessions over 3 days/week for 4 weeks. **Transcutaneous electrical nerve stimulation (TENS)** (n=19) TENS delivered for the same time period. **Concomitant therapy:** All people received 20 minutes of bilateral arm training.	previous shoulder pathology Mean time period after stroke (SD): 32.68 (53.80) months.		Ministry of Science and Technology (MOST-102-2314-B-182-003, 104–2314-B-182-035-MY3, and 104–2314-B-182-007-MY3) and the Healthy Aging Research Center at Chang Gung University (EMRPD1E1711), and the Chang Gung Memorial Hospital (CMRPD3E0331, CMRPD1G0041, and CMRPD3E113) in Taiwan.
de Jong 2013[7]	**Neuromuscular electrical stimulation (NMES)** (n=24) Motor amplitude NMES for two 45-minute sessions a day, five days a week for eight weeks. **Placebo/sham** (n=24) Sham arm positioning and transcutaneous electrical nerve stimulation for the same time period. **Concomitant therapy:** All people received arm stretch positioning combined with the interventions. All people received multidisciplinary stroke rehabilitation.	**People after a first or recurrent stroke** Mean age (SD): 57.5 (12.2) years. N = 48 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 43.5 (14.4) days.	Pain at <6 months Physical function – upper limb at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Neurological units of three rehabilitation centers in the Netherlands. Funding: Supported by Fonds NutsOhra (SNO-T-0702-72) and Stichting Beatrixoord Noord-Nederland.
DiLorenzo 2004[8]	**Acupuncture/dry needling** (n=54) Dry needling in four sittings every five to seven days.	**People after a first or recurrent stroke** Mean age (SD): 68.60 (7.73) years. N = 101	Pain at <6 months Physical function – upper limb at <6 months	Background rate of oral drug use: Not reported. Setting: Rehabilitation hospital providing

Study	Intervention and comparison	Population	Outcomes	Comments
	Acupuncture/dry needling: Dry needling **Usual care or no treatment** (n=47) **Concomitant therapy:** Both groups received standard rehabilitation therapy.	Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke: 3.54 weeks.		services for inpatients and outpatients in Italy Funding: No additional information.
Ersoy 2022[9]	**Nerve blocks (local anaesthetic)** (n=12) Ultrasound guided, 1mL 40mg/mL methylprednisolone with 8mL 0.5% bupivacaine hydrochloride. **Transcutaneous electrical nerve stimulation (TENS)** (n=13) 30 minutes, 5 days a week for 3 weeks. 100Hz, symmetrical waveform, 300 microsecond wave duration, 0-100mA set at the limits of tolerable pain threshold. **Concomitant therapy:** All people participation in a conventional rehabilitation program of gentle range of motion exercise, Bobath and Proprioceptive Neuromuscular Facilitation exercises.	**People after a first or recurrent stroke** Mean age (SD): 65.7 (10.6) years N = 25 Previous shoulder pathology: Not stated/unclear Time period after stroke (SD): 10.5 (11.7) units not stated/unclear	Pain at <6 months Stroke-specific Patient-Reported Outcome Measures at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatients in Turkey. Funding: Not funded.
Hartwig 2012[14]	**Devices – braces (Neuro-Lux functional orthosis)** (n=20)	**People after a first or recurrent stroke** Mean age (SD): 65 (15) years	Pain at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported.

Study	Intervention and comparison	Population	Outcomes	Comments
	Functional orthosis Neuro-Lux used between 8am and 6pm during normal daily activity. **Usual care or no treatment** (n=21) **Concomitant therapy:** All people received conventional care consisting of various passive and active movement exercises of the affected extremity under individual guidance of a therapist. Six training units of 30 minutes each were prescribed every week.	N = 41 Previous shoulder pathology: Not stated/unclear. Time period after stroke (SD): 7.9 (5.3) days		Setting: Inpatient in Germany. Funding: Financial support from Sporlastic GmbH, Nurtingen, Germany.
Heo 2015[15]	**Devices – tape** (n=18) Inelastic tape and the Jig test and pain test once a week after tape replacement every 3 days. **Usual care or no treatment** (n=18) **Concomitant therapy:** Bed physical therapy in the intensive care unit.	**People after a first or recurrent stroke** Mean age (SD): 58.7 (10.6) years. N = 36 Previous shoulder pathology: Not stated/unclear. Time period after stroke: Not stated/unclear.	Pain at <6 months	Background rate of oral drug use: Not reported. Setting: Inpatient in the Republic of Korea. Funding: No additional information.
Huang 2017[16]	**Devices – tape** (n=11) Kinesio tape applied twice per week for 3 weeks. **Placebo/sham** (n=10) Sham kinesio taping for the same time period.	**People after a first or recurrent stroke** Mean age (SD): 57 (13) years. N = 21 Previous shoulder pathology: No previous shoulder pathology.	Pain at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Inpatient in Taiwan. Funding: Funded by the Taipei Medical University and Shuang Ho Hospital.

Study	Intervention and comparison	Population	Outcomes	Comments
	Concomitant therapy: Both groups underwent identical conventional rehabilitation programmes including physical therapy and occupational therapy sessions, each lasting 60 minutes per day for 5 days per week. Speech therapy was administered according to individual needs.	Time period after stroke: 71.1 (40.5) days.		
Huang 2016[17]	**Devices – tape** (n=22) Kinesio taping applied for 3 days followed by 1 day of no taping for 3 weeks. **Placebo/sham** (n=27) Sham taping by the same methods apart from neutral tension for the same time period. **Concomitant therapy:** All people underwent inpatient rehabilitation including 1 hour physical therapy and 1 hour occupational therapy/day for 5 days/week.	**People after a first or recurrent stroke** Mean age (SD): 61.4 (10.7) years N = 49 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 28.3 (2.3) days.	Pain at <6 months Activities of daily living at <6 months Physical function – upper limb at <6 months Stroke-specific Patient-Reported Outcome Measures at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Inpatient in Taiwan Funding: Grants from Chang Gung Memorial Hospital (CMRPG8A0191 and CMRPG8A0192).
Karaahmet 2019[21]	**Functional electrical stimulation (FES)** (n=12) FES-cycling with 30 minute sessions delivered over 20 sessions, 5 times a week over 4 weeks.	**People after a first or recurrent stroke** Mean age (SD): 56.9 (16.7) years. N = 21 Previous shoulder pathology: Not stated/unclear.	Pain at <6 months Physical function – upper limb at <6 months Activities of daily living at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in Turkey. Funding: No additional information.

Study	Intervention and comparison	Population	Outcomes	Comments
	Usual care or no treatment (n=9) **Concomitant therapy:** Both groups were trained with a standard rehabilitation program, five times a week lasting 30 minutes each, totalling 20 sessions, accompanied by a specialist physiotherapist.	Mean time period after stroke (SD): 41.8 (25.3) days.		
Lakse 2009[22]	**Intra-articular medicine injection (corticosteroids)** (n=21) 1mL triamcinolone acetonide with 9mL prilocaine. **Placebo/sham** (n=17) Local anaesthetic injection only. **Concomitant therapy:** All people received transcutaneous electrical nerve stimulation and a therapeutic exercise program. All people were allowed to consume only 500-1500 mg/day paracetamol as an analgesic if needed. In both groups, people with an increase in muscle tone were given tizanidine 6mg/day.	**People after a first or recurrent stroke** Mean age (SD): 64.0 (8.4) years N = 38 Previous shoulder pathology: Not stated/unclear. Mean time period after stroke (SD): 6.5 (3.9) months.	Pain at <6 months	Background rate of oral drug use: Not reported. Setting: Inpatients in Turkey. Funding: Grant P01HD/NS33988 from the National Institute of Child Health and Human Development, the National Institute of Neurological Disorders and Stroke, and the National Center for Rehabilitation Research.
Lavi 2022[23]	**Neuromuscular electrical stimulation (NMES)** (n=14) NMES for 30 minutes for 1 week, increased up by 10	**People after a first or recurrent stroke** Mean age (SD): 70.4 (13.3) years N = 28	Pain at <6 months Physical function – upper limb at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow-up in Israel.

Study	Intervention and comparison	Population	Outcomes	Comments
	minutes each week to a maximum of 60 minutes by the 4th week. Treatment for 5 days a week for 6 weeks in total. **Placebo/sham** (n=14) Same device with amplitude turned to zero. **Concomitant therapy:** Both groups received a shoulder support and conventional therapy for shoulder strengthening. Both continued daily function and their rehabilitation routine. Both received conventional rehabilitation for an additional 2 weeks before follow up.	Previous shoulder pathology: Mixed Mean time period after stroke (SD): 0.9 (1.4) months	Activities of daily living at <6 months Withdrawal due to adverse events at <6 months	Funding: This rsearch received no external funding.
Lee 2016[24]	**Acupuncture/dry needling** (n=27) Acupuncture 3 times a week for 3 weeks. Acupuncture/dry needling: Acupuncture **Placebo/sham** (n=26) Sham acupuncture received treatment with superficial penetration at different points. **Concomitant therapy:** No additional information.	**People after a first or recurrent stroke** Mean age (SD): 57.58 (11.36) years N = 53 Previous shoulder pathology: Not stated/unclear. Time period after stroke: Majority subacute.	Pain at <6 months Activities of daily living at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in the Republic of Korea. Funding: Supported by the Korean National Rehabilitation Center, Ministry of Health & Welfare, Government of the Republic of Korea (13-B-04).
Mendigutia-Gomez 2020[26]	**Acupuncture/dry needling** (n=8)	**People after a first or recurrent stroke**	Pain at <6 months	Background rate of oral drug use: Not reported.

Study	Intervention and comparison	Population	Outcomes	Comments
	Dry needling over active trigger points delivered once and followed up after 1 week. Acupuncture/dry needling: Dry needling. **Usual care or no treatment** (n=8) **Concomitant therapy:** All people received a single session of a rehabilitation program for 45 minutes.	Mean age (SD): 48 (7) years N = 16 Previous shoulder pathology: Not stated/unclear. Mean time period after stroke (SD): 8.9 (3.8) months.	Withdrawal due to adverse events at <6 months	Setting: Hospital Beata Maria Ana in Spain. Funding: No financial support.
Moghe 2020[27]	**Devices – slings (therapeutic shoulder sling)** (n=25) Therapeutic shoulder sling with proximal group exercises for 3 weeks, 5 days per week. **Usual care or no treatment** (n=25) Conventional therapy only for 3 weeks, 5 days per week. **Concomitant therapy:** Conventional management could include education, positioning, exercises, orthotic devices and electrical stimulation.	**People after a first or recurrent stroke** Mean age (SD): 45.5 years. N = 50 Previous shoulder pathology: Not stated/unclear. Time period after stroke: Not stated/unclear.	Pain at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in India. Funding: Krishna Institute of Medical Sciences.
Pandian 2013[33]	**Devices – taping** (n=80) Shoulder taping using elastic adhesive tape kept on for 3 days at a time.	**People after a first or recurrent stroke** Mean age (SD): 57.6 (13.3) years. N = 162	Pain at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Inpatient in India.

Study	Intervention and comparison	Population	Outcomes	Comments
	Placebo/sham (n=82) Sham taping. Tape applied in the same positions without repositioning the joints. **Concomitant therapy:** All received conventional therapy including positioning, handling technique and range of motion exercises.	Previous shoulder pathology: No previous shoulder pathology. Time period after stroke: Acute.		Funding: Department of Neurology intramural research fund.
Pillastrini 2016[34]	**Devices – tape** (n=16) Neuromuscular taping technique 15 minutes per session, 4 sessions over 4 weeks. **Usual care or no treatment** (n=16) Usual care only. **Concomitant therapy:** Standard physical therapy program, 45 minutes/session, 4 sessions over 4 weeks.	**People after a first or recurrent stroke** Mean age (SD): 66 (10) years N = 32 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 3.0 (2.3) years	Pain at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: No response criteria. Setting: Outpatient follow up in Italy. Funding: This study does not have funding.
Rah 2012[36]	**Intra-articular corticosteroids** (n=29) Ultrasound-guided subacromial injection with triamcinolone 40mg with 1mL of 1% lidocaine. **Placebo/sham** (n=29) Intra-articular injection of 5mL of 1% lidocaine. **Concomitant therapy:**	**People after a first or recurrent stroke** Mean age (SD): 55.8 (11.6) years N = 58 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 21.2 (14.4) months	Pain at <6 months Activities of daily living at <6 months	Background rate of oral drug use: No response criteria. Setting: Inpatient in Republic of Korea. Funding: Supported by Ajou University (grant no. 3-2009-0090).

Study	Intervention and comparison	Population	Outcomes	Comments
	People on analgesics, if any, were told to stop administering from 5 days before the injection. All people were given picture leaflets and provided an education on home exercise programs.			
Sui 2021[37]	**Electroacupuncture** (n=17) Acupuncture followed by 30 minutes of electroacupuncture delivered once a day, five days a week for two weeks. Acupuncture/dry needling: Acupuncture **Placebo/sham** (n=15) Sham electroacupuncture therapy. Achieved through different needle insertions. **Concomitant therapy:** All received conventional drug and rehabilitation treatment. Conventional drug treatment followed the Chinese Cerebrovascular Disease Prevention and Treatment guidelines. The treatments included good limb positioning, passive shoulder movement, active shoulder strapping, rood therapy, weight training of the affected limb, and electrical	**People after a first or recurrent stroke** Mean age (SD): 52.6 (10.8) years N = 32 Previous shoulder pathology: No previous shoulder pathology. Time period after stroke: Subacute.	Pain at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in China. Funding: Projects granted from the Traditional Chinese Medicine Bureau of Guangdong Province, the National Natural Science Foundation of China, the Guangdong Basic and Applied Basic Research Foundation, the Shenzhen Science and Technology Program and the Open Project from the CAS Key Laboratory of Human-Machine Inelligence-Synergy Systems.

Study	Intervention and comparison	Population	Outcomes	Comments
	stimulation therapy. All people underwent conventional rehabilitation treatments once a day, five days a week for two weeks.			
Terlemez 2020[39]	**Nerve block (local anaesthetic)** (n=20) Two groups: one (n=10) received a local anaesthetic injection (5mL of 2% lidocaine) into the suprascapular notch. One (n=10) received a local anaesthetic and corticosteroid injection (5mL of 2% lidocaine and 1mL of betamethasone) into the suprascapular notch. **Placebo/sham** (n=10) Injection of 5mL of 2% lidocaine into the trapezius muscle. **Concomitant therapy:** No additional information.	**People after a first or recurrent stroke** Age range: 52-75 years N = 30 Previous shoulder pathology: Not stated/unclear. Mean time period after stroke: 14.4 months	Pain at <6 months	Background rate of oral drug use: Not reported. Setting: Inpatient in Turkey. Funding: No additional information.
Turkkan 2017[40]	**Neuromuscular electrical nerve stimulation (NMES)** (n=12) Neuromuscular electrical stimulation applied for 60 minutes/session in a day, 5 days a week for 4 weeks. **Usual care or no treatment** (n=12)	**People after a first or recurrent stroke** Mean age (SD): 64.1 (15.0) years N = 24 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 3.9 (3.0) months	Pain at <6 months Activities of daily living at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in Turkey. Funding: No financial support for the research and/or authorship of the article.

Study	Intervention and comparison	Population	Outcomes	Comments
	Concomitant therapy: All people used a shoulder strap and received similar conventional physiotherapy for glenohumeral subluxation (range of motion, stretching and strengthening exercises).			
van Bladel 2017[41]	**Devices – slings (Actimove or Shoulderlift)** (n=21) Two slings. One group received an Actimove® sling, the other received the Shoulderlift sling. **Usual care or no treatment** (n=11) **Concomitant therapy:** All people received an equal standard rehabilitation program aiming at avoiding complications and active exercises adjusted to the level of impairment. Furthermore, people were involved in physiotherapy focusing on balance and gait. All people received occupational therapy and if needed speech therapy and/or cognitive training.	**People after a first or recurrent stroke** Mean age (SD): 55 (13) years N = 32 Previous shoulder pathology: No previous shoulder pathology. Time period after stroke: 9.39 (4.54) weeks	Pain at <6 months Physical function – upper limb at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Not reported. Setting: Hospital inpatients in Belgium. Funding: States there are no
Wilson 2014[45] Subsidiary study: Wilson 2017[46]	**Neuromuscular electrical stimulation (NMES)** (n=13) Percutaneous nerve stimulation applied and used	**People after a first or recurrent stroke** Median age (IQR): NMES: 54 (50 to 68) years	Person/participant generic health-related quality of life at <6 months Pain at <6 months	Background rate of oral drug use: Mixed population. Setting: Urban, academic rehabilitation center

Study	Intervention and comparison	Population	Outcomes	Comments
	for 6 hours of stimulation per day for 3 weeks. **Usual care or no treatment** (n=12) Usual care receiving 8 hours of physiotherapy over a 4 week period with daily home exercises. **Concomitant therapy:** No physiotherapy or occupational therapy directed at the shoulder or experimental procedures involving the hemiparetic upper limb; no intra-articular or subacromial corticosteroid injections to the affected shoulder; may receive oral spasticity medications, but no neurolytic agents; no addition of analgesic or spasticity medications.	Usual care or no treatment: 55.5 (50 to 62.5) years N = 25 Previous shoulder pathology: No previous shoulder pathology. Median time period after stroke (IQR): NMES: 2.6 (0.9 to 4) years Usual care or no treatment: 2.3 (0.8 to 4.8) years	Physical function – upper limb at <6 months Withdrawal due to adverse events at <6 months	in the United States of America. Funding: Supports by grants from the Eunice Kennedy Shriver National Institute of Child Health and Human Development and the Clinical and Translational Science Collaborative of Cleveland, National Center for Advancing Translational Sciences component of the National Institute of Health.
Yang 2018[48]	**Devices – tape** (n=10) Kinesiology taping once a day for 5 days a week for 4 consecutive weeks. **Placebo/sham** (n=9) Tape applied in the same places but with no tension applied. **Concomitant therapy:** Electrical therapy and exercise treatment once a day, 5 days per	**People after a first or recurrent stroke** Mean age (SD): 59.5 (2.9) years N = 19 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 18.7 (1.9) weeks	Pain at <6 months	Background rate of oral drug use: Not reported. Setting: Rehabilitation centre in China. Funding: No additional information.

Study	Intervention and comparison	Population	Outcomes	Comments
	week for 4 consecutive weeks.			
Zhan 2022[50]	**Acupuncture/dry needling** (n=25) Bo's abdominal acupuncture combined with routine exercise therapy. Delivered for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week. Acupuncture/dry needling: Acupuncture. **Usual care or no treatment** (n=25) **Concomitant therapy:** Rehabilitation training for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week. At the same time, standard doses of NSAID drugs (diclofenac or paracetamol) were used.	**People after a first or recurrent stroke** Mean age (SD): 57.4 (8.7) years N = 50 Previous shoulder pathology: Not stated/unclear. Mean time period after stroke (SD): 63.9 (36.7) days	Pain at <6 months Physical function – upper limb at <6 months Activities of daily living at <6 months Withdrawal due to adverse events at <6 months	Background rate of oral drug use: Mixed population. Setting: Inpatients in China. Funding: Funded by Traditional Chinese Medicine Bureau of Guangdong Province, Opening Operation Program of Key Laboratory of Acupuncture and Moxibustion of Traditional Chinese Medicine in Guangdong and General Program of the National Natural Science foundation of China.
Zheng 2018[51]	**Acupuncture/dry needling** (n=89) Acupuncture once per day for one month continuously and the needle-retaining time was 30 minutes each time. Acupuncture/dry needling: Acupuncture. **Usual care or no treatment** (n=89) **Concomitant therapy:**	**People after a first or recurrent stroke** Mean age (SD): 53.8 (3.3) years N = 178 Previous shoulder pathology: No previous shoulder pathology. Mean time period after stroke (SD): 41.7 (7.7) days	Person/participant generic health-related quality of life at <6 months Pain at <6 months Physical function – upper limb at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in China. Funding: No additional information.

Study	Intervention and comparison	Population	Outcomes	Comments
	All people received usual rehabilitation (including postural therapy, passive movement and active movement) for 1 month (45 minutes once per day).			
Zhou 2018[52]	**Neuromuscular electrical stimulation (NMES)** (n=36) Neuromuscular electrical stimulation applied over 20 sessions of 1 hour stimulation conducted daily for 4 weeks. **Transcutaneous electrical nerve stimulation (TENS)** (n=36) Transcutaneous electrical nerve stimulation applied for 20 sessions of 1 hour stimulation conducted daily for 4 weeks. **Usual care or no treatment** (n=18) **Concomitant therapy:** People in all groups underwent a standardized rehabilitation program, which was delivered by occupational therapists and physical therapists.	**People after a first or recurrent stroke** Mean age (SD): 59.9 (10.4) years. N = 90 Previous shoulder pathology: No previous shoulder pathology. Time period after stroke: 91.0 (98.5) days.	Pain at <6 months Physical function – upper limb at <6 months Activities of daily living at <6 months Stroke-specific Patient-Reported Outcome Measures at <6 months	Background rate of oral drug use: Not reported. Setting: Outpatient follow up in China. Funding: Funding from the Research Fund of the Baoshan district of science and technology.

See Appendix D for full evidence tables.

1.1.5.1 Summary matrices

Table 3: Summary matrix of the protocol interventions compared to placebo/sham

Outcome	Time period	Neuromuscular electrical stimulation (NMES)	Devices – tape	Acupuncture/dry needling	Electroacupuncture	Intra-articular medicine injections - corticosteroids	Nerve blocks (local anaesthetic)
Person/participant generic health-related quality of life	<6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Carer generic health-related quality of life	<6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Pain	<6 months	1 outcome 1 study (n=14) Very low quality	1 outcome 4 studies (n=220) Low quality	1 outcome 1 study (n=53) Very low quality	1 outcome 1 study (n=32) Very low quality	1 outcome 2 studies (n=96) Very low quality	1 outcome 2 studies (n=84) Low quality
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Physical function – upper limb	<6 months	1 outcome 1 study (n=39) Very low quality	1 outcome 1 study (n=44) Very low quality	No evidence identified	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Activities of daily living	<6 months	No evidence identified	1 outcome 1 study (n=44) Very low quality	1 outcome 1 study (n=53) Very low quality	No evidence identified	1 outcome 1 study (n=58) Very low quality	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified

Outcome	Time period	Neuromuscular electrical stimulation (NMES)	Devices – tape	Acupuncture/dry needling	Electroacupuncture	Intra-articular medicine injections - corticosteroids	Nerve blocks (local anaesthetic)
Stroke-specific Patient-Reported Outcome Measures	<6 months	No evidence identified	1 outcome 1 study (n=44) Very low quality	No evidence identified	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Withdrawal due to adverse events	<6 months	1 outcome 1 study (n=48) Very low quality	1 outcome 3 studies (n=232) Very low quality	1 outcome 1 study (n=53) Very low quality	No evidence identified	No evidence identified	1 outcome 1 study (n=64) Low quality
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified

Table 4: Summary matrix of the protocol interventions compared to usual care or no treatment

Outcome	Time period	Transcutaneous electrical nerve stimulation (TENS)	Functional electrical stimulation (FES)	Neuromuscular electrical stimulation (NMES)	Devices - tape	Devices - slings	Devices - braces	Acupuncture/dry needling
Person/participant generic health-related quality of life	<6 months	No evidence identified	No evidence identified	2 outcomes 1 study (n=25) Very low quality	No evidence identified	No evidence identified	No evidence identified	1 outcome 1 study (n=178) Low quality
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Carer generic health-related quality of life	<6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified

Outcome	Time period	Transcutaneous electrical nerve stimulation (TENS)	Functional electrical stimulation (FES)	Neuromuscular electrical stimulation (NMES)	Devices - tape	Devices - slings	Devices - braces	Acupuncture/dry needling
Pain	<6 months	1 outcome 1 study (n=54) Very low quality	1 outcome 1 study (n=21) Very low quality	1 outcome 3 studies (n=103) Very low quality	1 outcome 2 studies (n=67) Low quality	1 outcome 2 studies (n=78) Very low quality	1 outcome 1 study (n=41) Low quality	1 outcome 4 studies (n=344) Very low quality
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Physical function – upper limb	<6 months	1 outcome 1 study (n=54) Very low quality	1 outcome 1 study (n=21) Very low quality	2 outcomes 1 study (n=79) Low-very low quality	No evidence identified	1 outcome 1 study (n=28) Very low quality	No evidence identified	2 outcomes 3 studies (n=328) Very low quality
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Activities of daily living	<6 months	1 outcome 1 study (n=54) Very low quality	1 outcome 1 study (n=21) Low quality	1 outcome 2 studies (n=78) Very low quality	No evidence identified	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Stroke-specific Patient-Reported Outcome Measures	<6 months	1 outcome 1 study (n=54) Very low quality	No evidence identified	1 outcome 1 study (n=54) Very low	No evidence identified	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified
Withdrawal due to adverse events	<6 months	No evidence identified	1 outcome 1 study (n=21)	1 outcome 1 study (n=25)	1 outcome 1 study (n=32)	1 outcome	1 outcome	1 outcome 2 studies (n=66)

Outcome	Time period	Transcutaneous electrical nerve stimulation (TENS)	Functional electrical stimulation (FES)	Neuromuscular electrical stimulation (NMES)	Devices - tape	Devices - slings	Devices - braces	Acupuncture/dry needling
			Very low quality	Low	Very low	1 study (n=32) Very low quality	1 study (n=41) Very low quality	Very low quality
	≥6 months	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified	No evidence identified

Table 5: Summary matrix of the protocol interventions compared to each other

Outcome	Time period	Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES)	Devices – slings compared to neuromuscular electrical stimulation (NMES)	Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS)
Person/participant generic health-related quality of life	<6 months	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified
Carer generic health-related quality of life	<6 months	No evidence identified	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified
Pain	<6 months	1 outcome 2 studies (n=110) Very low quality	1 outcome 1 study (n=61) Low quality	1 outcome 1 study (n=24) Very low quality
	≥6 months	No evidence identified	1 outcome 1 study (n=61) Low quality	No evidence identified
Physical function – upper limb	<6 months	1 outcome 2 studies (n=110) Very low quality	No evidence identified	No evidence identified

Outcome	Time period	Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES)	Devices – slings compared to neuromuscular electrical stimulation (NMES)	Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS)
	≥6 months	No evidence identified	No evidence identified	No evidence identified
Activities of daily living	<6 months	1 outcome 1 study (n=72) Very low quality	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified
Stroke-specific Patient-Reported Outcome Measures	<6 months	1 outcome 1 study (n=72) Very low quality	No evidence identified	1 outcome 1 study (n=24) Very low quality
	≥6 months	No evidence identified	No evidence identified	No evidence identified
Withdrawal due to adverse events	<6 months	1 outcome 1 study (n=38) Very low quality	No evidence identified	No evidence identified
	≥6 months	No evidence identified	No evidence identified	No evidence identified

1.1.6 Summary of the effectiveness evidence

1.1.6.1 Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment

Table 6: Clinical evidence summary: transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with neuromuscular electrical stimulation (NMES)	Risk difference with Transcutaneous electrical nerve stimulation (TENS)	
Pain (Numeric rating scale, 0-10, lower values are better, change score and final value) at <6 months	110 (2 RCTs) follow-up: mean 8 weeks	⊕◯◯◯ Very low[a,b]	-	The mean pain at <6 months was 1.44	MD **1.28 higher** (0.4 higher to 2.15 higher)	MID = 0.86 (0.5 x median baseline SD)
Physical function - upper limb (Fugl Meyer Assessment Upper Limb, 0-66, higher values are better, change score and final value) at <6 months	110 (2 RCTs) follow-up: mean 8 weeks	⊕◯◯◯ Very low[a,b]	-	The mean physical function - upper limb at <6 months was 25.5	MD **0.62 higher** (9 lower to 10.25 higher)	MID = 6.6 (Fugl-Meyer upper extremity = Difference by 10% of the total scale)
Activities of daily living (Barthel index, 0-100, higher values are better, change score) at <6 months	72 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[b,c]	-	The mean activities of daily living at <6 months was 11.67	MD **3.15 higher** (35.78 lower to 42.08 higher)	MID = Barthel Index 1.85 (established MID)
Stroke-specific Patient-Reported	72 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[b,c]	-	The mean stroke-specific Patient-Reported	MD **5.13 lower** (61.7 lower to 51.44 higher)	MID = 12.3 (0.5 x median

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with neuromuscular electrical stimulation (NMES)	Risk difference with Transcutaneous electrical nerve stimulation (TENS)	
Outcome Measures (stroke specific quality of life, 49-245, higher values are better, change score) at <6 months				Outcome Measures at <6 months was 17.81		baseline SD)
Withdrawal due to adverse events at <6 months	38 (1 RCT) follow-up: 8 weeks	⨁◯◯◯ Very low[d,e]	RD 0.0 (-0.1 to 0.1)	0 per 1,000	**0 fewer per 1,000** (100 fewer to 100 more)[f]	Sample size used to determine precision: 75-150 = serious imprecision, <75 = very serious imprecision.

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention, bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention and bias due to missing outcome data)

d. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process)

e. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

f. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

Table 7: Clinical evidence summary: transcutaneous electrical nerve stimulation (TENS) compared to usual care or no treatment

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Transcutaneous electrical nerve stimulation (TENS)	
Pain (Numeric rating scale, 0-10, lower values are better, change score) at <6 months	54 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[a,b]	-	The mean pain at <6 months was -1.23	MD **0.34 lower** (3.35 lower to 2.67 higher)	MID = 0.57 (0.5 x median baseline SD)
Physical function - upper limb (Fugl Meyer Assessment Upper Limb, 0-66, higher values are better, change score) at <6 months	54 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[a,b]	-	The mean physical function - upper limb at <6 months was 5.31	MD **0.15 higher** (27.48 lower to 27.78 higher)	MID = 6.6 (Fugl-Meyer upper extremity = Difference by 10% of the total scale)
Activities of daily living (Barthel index, 0-100, higher values are better, change score) at <6 months	54 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[a,b]	-	The mean activities of daily living at <6 months was 13.08	MD **1.74 higher** (39.53 lower to 43.01 higher)	MID = Barthel Index 1.85 (established MID)
Stroke-specific Patient-Reported Outcome Measures (stroke specific quality of life, 49-245, higher values are better, change score) at <6 months	54 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[a,b]	-	The mean stroke-specific Patient-Reported Outcome Measures at <6 months was 10.77	MD **1.91 higher** (43.34 lower to 47.16 higher)	MID = 15.7 (0.5 x median baseline SD)

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

1.1.6.2 Functional electrical stimulation (FES) compared to usual care or no treatment

Table 8: Clinical evidence summary: functional electrical stimulation (FES) compared to usual care or no treatment

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Functional electrical stimulation (FES)	
Pain (numeric rating scale, 0-10, lower values are better, change score) at <6 months	21 (1 RCT) follow-up: 4 weeks	⊕◯◯◯ Very low[a,b]	-	The mean pain at <6 months was 0.7	MD **2.1 lower** (3.57 lower to 0.63 lower)	MID = 1.4 (0.5 x median baseline SD)
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change score) at <6 months	21 (1 RCT) follow-up: 4 weeks	⊕◯◯◯ Very low[a,b]	-	The mean physical function - upper limb at <6 months was 12.3	MD **2.8 lower** (16.19 lower to 10.59 higher)	MID = 6.6 (Fugl-Meyer upper extremity = Difference by 10% of the total scale)
Activities of daily living (Functional Independence Measure, 18-126, higher values are better, change score) at <6 months	21 (1 RCT) follow-up: 4 weeks	⊕⊕◯◯ Low[a]	-	The mean activities of daily living at <6 months was -3.5	MD **2.5 higher** (5.82 lower to 0.82 higher)	MID = 22 (Functional independence measure established MID)
Withdrawal due to adverse events at <6 months	21 (1 RCT) follow-up: 4 weeks	⊕◯◯◯ Very low[c,d]	RD 0.00 (-0.17 to 0.17)	0 per 1,000	**0 fewer per 1,000** (170 fewer to 170 more) [e]	Sample size used to determine precision: 75-150 = serious imprecision, <75 = very serious imprecision.

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias due to the randomisation process and bias in measurement of the outcome)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias due to the randomisation process)

d. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

e. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

1.1.6.3 Neuromuscular electrical stimulation (NMES) compared to placebo/sham and usual care or no treatment

Table 9: Clinical evidence summary: neuromuscular electrical stimulation (NMES) compared to placebo/sham

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Neuromuscular electrical stimulation (NMES)	
Pain (numeric rating scale, 0-10, lower values are better, change score and final value) at <6 months	32 (2 RCTs) follow-up: mean 14 weeks	⨁◯◯◯ Very low[a,b]	-	The mean pain at <6 months was 2.7	MD **1.39 higher** (0.86 lower to 3.64 higher)	MID = 1.6 (0.5 x median baseline SD)
Physical function - upper limb (Fugl Meyer Upper Extremity, 0-66, higher values are better, change score and final value) at <6 months	39 (2 RCTs) follow-up: mean 14 weeks	⨁◯◯◯ Very low[a,b,c]	-	The mean physical function - upper limb at <6 months was 14.6	MD **7.19 higher** (9.59 lower to 23.97 higher)	MID = 6.6 (10% of Fugl Meyer scale = established MID)
Activities of daily living (functional independence living, 18-126, higher values are better, change score) at <6 months	18 (1 RCT) follow-up: 8 weeks	⨁◯◯◯ Very low[a,b]	-	The mean activities of daily living at <6 months was 14.9	MD **16.98 higher** (2.92 higher to 31.04 higher)	MID = 9.5 (0.5 x median baseline SD)
Withdrawal due to adverse events at <6 months	76 (1 RCT) follow-up: mean 14 weeks	⨁◯◯◯ Very low[a,d,e]	RD 0.03 (-0.12 to 0.17)	105 per 1,000	**30 more per 1,000** (120 fewer to 170 more) [d]	Precision calculated through Optimal Information Size (OIS)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Neuromuscular electrical stimulation (NMES)	
						due to zero events in some studies. OIS determined power for the sample size = 0.07 (0.8-0.9 = serious, <0.8 = very serious).

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 10: Clinical evidence summary: neuromuscular electrical stimulation (NMES) compared to usual care or no treatment

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Neuromuscular electrical stimulation (NMES)	
Person/participant generic health-related quality of life (SF-36 v2 physical component summary, 0-100, higher values are better, final value) at <6 months	25 (1 RCT) follow-up: 16 weeks	⊕◯◯◯ Very low[a,b]	-	The mean person/participant generic health-related quality of life at <6 months was 33.8	MD **0.3 higher** (8.99 lower to 9.59 higher)	MID = 2 (SF-36 established MID)
Person/participant generic health-related quality of life (SF-36 v2 mental component	25 (1 RCT) follow-up: 16 weeks	⊕◯◯◯ Very low[a,b]	-	The mean person/participant generic health-related quality of life at <6 months was 52.3	MD **6.3 higher** (6.48 lower to 19.08 higher)	MID = 3 (SF-36 established MID)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Neuromuscular electrical stimulation (NMES)	
summary, 0-100, higher values are better, final value) at <6 months						
Pain (visual analogue scale, numeric rating scale, worst pain 7 days, 0-100, lower values are better, change score and final values) at <6 months	103 (3 RCTs) follow-up: mean 9 weeks	⊕◯◯◯ Very low[b,c]	-	The mean pain at <6 months was 31.1	MD **17.96 lower** (30.12 lower to 5.8 lower)	MID = 12.4 (0.5 x median baseline SD)
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change score) at <6 months	54 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[b,d]	-	The mean physical function - upper limb at <6 months was 5.31	MD **0.45 lower** (24.38 lower to 23.48 higher)	MID = 6.6 (Fugl-Meyer upper extremity = Difference by 10% of the total scale)
Physical function - upper limb (Fugl Meyer Assessment, 0-100, higher values are better, final value) at <6 months	25 (1 RCT) follow-up: 16 weeks	⊕⊕◯◯ Low[a,b]	-	The mean physical function - upper limb at <6 months was 41.5	MD **35.4 higher** (6.91 lower to 77.71 higher)	MID = 10 (Fugl-Meyer upper extremity = Difference by 10% of the total scale)
Activities of daily living (Barthel index, shoulder disability questionnaire, 0-100, higher values are better, change score and final value) at <6 months	78 (2 RCTs) follow-up: mean 6 weeks	⊕◯◯◯ Very low[b,c,e]	-	The mean activities of daily living at <6 months was 37.6	MD **14.9 higher** (17.35 lower to 47.15 higher)	MID = 12.7 (0.5 x median baseline SD)
Stroke-specific Patient-	54 (1 RCT)	⊕◯◯◯	-	The mean stroke-specific	MD **7.04 higher**	MID = 12.5 (0.5

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Neuromuscular electrical stimulation (NMES)	
Reported Outcome Measures (Stroke specific quality of life, 49-245, higher values are better, change score) at <6 months	follow-up: 8 weeks	Very low[b,d]		Patient-Reported Outcome Measures at <6 months was 10.77	(41.59 lower to 55.67 higher)	x median baseline SD)
Withdrawal due to adverse events at <6 months	25 (1 RCT) follow-up: 16 weeks	⊕⊕◯◯ Low[b]	RR 0.46 (0.05 to 4.46)	167 per 1,000	**90 fewer per 1,000** (158 fewer to 577 more)	MID (precision) = RR 0.80 – 1.25.

a. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome)

d. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias due to missing outcome data)

e. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

1.1.6.4 Devices – tape compared to placebo/sham and usual care or no treatment

Table 11: Clinical evidence summary: devices – tape compared to placebo/sham

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Devices - tape	
Pain (visual analogue scale, numeric rating scale, 0-100, lower values are better, change scores and final values) at <6 months	220 (4 RCTs) follow-up: mean 4 weeks	⊕⊕◯◯ Low[a]	-	-	MD **14.11 lower** (18.32 lower to 9.91 lower)	MID = 9.1 (0.5 x median baseline SD)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Devices - tape	
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, final value) at <6 months	44 (1 RCT) follow-up: 3 weeks	⊕◯◯◯ Very low[a,b]	-	The mean physical function - upper limb at <6 months was 16.4	MD **0** (11.14 lower to 11.14 higher)	MID = 6.6 (Fugl-Meyer upper extremity = Difference by 10% of the total scale)
Activities of daily living (Barthel index, 0-100, higher values are better, final value) at <6 months	44 (1 RCT) follow-up: 3 weeks	⊕◯◯◯ Very low[a,b]	-	The mean activities of daily living at <6 months was 58.3	MD **5.5 higher** (7.24 lower to 18.24 higher)	MID = Barthel Index 1.85 (established MID)
Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life, 49-245, higher values are better, final value) at <6 months	44 (1 RCT) follow-up: 3 weeks	⊕◯◯◯ Very low[a,b]	-	The mean stroke-specific Patient-Reported Outcome Measures at <6 months was 152.7	MD **7.5 higher** (6.97 lower to 21.97 higher)	MID = 9.9 (0.5 x median baseline SD)
Withdrawal due to adverse events at <6 months	232 (3 RCTs) follow-up: mean 3 weeks	⊕◯◯◯ Very low[a,c,d]	RD -0.03 (-0.16 to 0.09)	88 per 1,000	**30 more per 1,000** (160 fewer to 90 more)[e]	Precision calculated through Optimal Information Size (OIS) due to zero events in some studies. OIS determined power for the sample size = 0.07 (0.8-0.9 = serious, <0.8 = very serious).

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Devices - tape	
c. Downgraded for heterogeneity due to conflicting number of events in different studies (zero events in one or more studies) d. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size e. Absolute effect calculated by risk difference due to zero events in at least one arm of one study						

Table 12: Clinical evidence summary: devices – tape compared to usual care or no treatment

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Devices - tape	
Pain (visual analogue scale, 0-10, lower values are better, change score and final value) at <6 months	67 (2 RCTs) follow-up: mean 8 weeks	⊕⊕◯◯ Low[a]	-	The mean pain at <6 months was 4.65	MD **1.8 lower** (2.46 lower to 1.14 lower)	MID = 0.8 (0.5 x median baseline SD)
Withdrawal due to adverse events at <6 months	32 (1 RCT) follow-up: 8 weeks	⊕◯◯◯ Very low[b,c]	RD 0.00 (-0.11 to 0.11)	0 per 1,000	**0 fewer per 1,000** (110 fewer to 110 more)	Sample size used to determine precision: 75-150 = serious imprecision, <75 = very serious imprecision.
a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome) b. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias due to deviations from the intended interventions) c. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size						

1.1.6.5 Devices – slings compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment

Table 13: Clinical evidence summary: devices – slings compared to neuromuscular electrical stimulation (NMES)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with neuromuscular electrical stimulation (NMES)	Risk difference with Devices - slings	
Pain (brief pain inventory question 12/numeric rating scale, 0-10, lower values are better, change scores) at <6 months	61 (1 RCT) follow-up: 18 weeks	⨁⨁◯◯ Low[a]	-	The mean pain at <6 months was -4.44	MD **3.76 higher** (2.32 higher to 5.2 higher)	MID = 1.1 (0.5 x median baseline SD)
Pain (brief pain inventory question 12/numeric rating scale, 0-10, lower values are better, change scores) at ≥6 months	61 (1 RCT) follow-up: 12 months	⨁⨁◯◯ Low[a]	-	The mean pain at ≥6 months was -5	MD **2.69 higher** (1.27 higher to 4.11 higher)	MID = 1.1 (0.5 x median baseline SD)

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data)

Table 14: Clinical evidence summary: devices – slings compared to usual care or no treatment

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Devices - slings	
Pain (visual analogue scale, 0-10, lower values are better, final values) at <6 months	78 (2 RCTs)	⨁◯◯◯ Very low[a,b,c]	-	The mean pain at <6 months was 4.14	MD **0.31 lower** (2.2 lower to 1.59 higher)	MID = 1.2 (0.5 x median baseline SD)
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, final values) at <6 months	28 (1 RCT) follow-up: 6 weeks	⨁◯◯◯ Very low[c,d]	-	The mean physical function - upper limb at <6	MD **2.34 lower** (11.26 lower to 6.58 higher)	MID = 6.6 (Fugl-Meyer upper extremity = Difference

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Devices - slings	
				months was 12.78		by 10% of the total scale)
Withdrawal due to adverse events at <6 months	32 (1 RCT) follow-up: 6 weeks	⨁◯◯◯ Very low[c,e]	Peto OR 4.59 (0.07 to 284.41)	0 per 1,000	**50 more per 1,000** (110 fewer to 20 more)[f]	MID (precision) = Peto OR 0.80 – 1.25.

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data, bias in measurement of the outcome and bias in selection of the reported result)

b. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

d. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias in measurement of the outcome)

e. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to deviations from the intended interventions)

f. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

1.1.6.6 Devices – braces compared to usual care or no treatment

Table 15: Clinical evidence summary: devices – braces compared to usual care or no treatment

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Devices - braces	
Pain (Shoulder Hand Syndrome score pain subscale, 0-5, lower values are better, final value) at <6 months	41 (1 RCT) follow-up: 4 weeks	⨁⨁◯◯ Low[a]	-	The mean pain at <6 months was 1.8	MD **1.4 lower** (1.9 lower to 0.9 lower)	MID = 0.53 (0.5 x median baseline SD)
Withdrawal due to adverse events at <6 months	41 (1 RCT) follow-up: 4 weeks	⨁◯◯◯ Very low[b,c]	OR 7.77 (0.15 to 391.93)	0 per 1,000	**50 more per 1,000** (80 fewer	MID (precision) = Peto OR

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Devices - braces	
					to 180 more)[d]	0.80 – 1.25.

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias due to missing outcome data)

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

d. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

1.1.6.7 Acupuncture/dry needling compared to placebo/sham and usual care or no treatment

Table 16: Clinical evidence summary: acupuncture/dry needling compared to placebo/sham

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Acupuncture/dry needling	
Pain (visual analogue scale, 0-10, lower values are better, change score) at <6 months	53 (1 RCT) follow-up: 4 weeks	⊕◯◯◯ Very low[a,b]	-	The mean pain at <6 months was -1.65	MD **1.35 lower** (2.92 lower to 0.22 higher)	MID = 0.97 (0.5 x median baseline SD)
Activities of daily living (Korean modified Barthel index, 0-100, higher values are better, final value) at <6 months	53 (1 RCT) follow-up: 4 weeks	⊕◯◯◯ Very low[a,b]	-	The mean activities of daily living at <6 months was 71.31	MD **7.75 lower** (17.56 lower to 2.06 higher)	MID = Barthel Index 1.85 (established MID)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Acupuncture/dry needling	
Withdrawal due to adverse events at <6 months	53 (1 RCT) follow-up: 4 weeks	⊕◯◯◯ Very low[a,c]	RD 0.00 (-0.07 to 0.07)	0 per 1,000	**0 fewer per 1,000** (70 fewer to 70 more)[d]	Sample size used to determine precision: 75-150 = serious imprecision, <75 = very serious imprecision.

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

d. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

Table 17: Clinical evidence summary: acupuncture/dry needling compared to usual care or no treatment

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Acupuncture/dry needling	
Person/participant generic health-related quality of life (quality of life scale, unclear scale range, higher values are better, final values) at <6 months	178 (1 RCT) follow-up: 4 weeks	⊕⊕◯◯ Low[a]	-	The mean person/participant generic health-related quality of life at <6 months was 76.68	MD **23.83 higher** (19.96 higher to 27.7 higher)	MID = 13.9 (0.5 x median baseline SD)
Pain (visual analogue scale, numeric rating scale, 0-10, lower values are better, change scores and final value) at <6 months	344 (4 RCTs) follow-up: mean 3 weeks	⊕◯◯◯ Very low[a,b,c]	-	The mean pain at <6 months was 2.72	MD **1.78 lower** (3.48 lower to 0.08 lower)	MID = 0.68 (0.5 x median baseline SD)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Acupuncture/dry needling	
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change scores) at <6 months	227 (2 RCTs) follow-up: mean 3 weeks	⊕◯◯◯ Very low[c,d,e]	-	The mean physical function - upper limb at <6 months was 7.58	MD **2.9 higher** (2.91 lower to 8.71 higher)	MID = 6.6 (Fugl-Meyer upper extremity = Difference by 10% of the total scale)
Physical function - upper limb (Rivermead Motricity Index Effectiveness, 0-100, higher values are better, final value) at <6 months	101 (1 RCT) follow-up: 3 weeks	⊕◯◯◯ Very low[c,f]	-	The mean physical function - upper limb at <6 months was 47.54	MD **2.47 higher** (3.96 lower to 8.9 higher)	MID = 7.69 (0.5 x median control group SD)
Withdrawal due to adverse events at <6 months	66 (2 RCTs) follow-up: mean 2 weeks	⊕◯◯◯ Very low[b,g,h]	RD -0.03 (-0.13 to 0.07)	30 per 1,000	**31 fewer per 1,000** (34 fewer to 28 fewer)[i]	Precision calculated through Optimal Information Size (OIS) due to zero events in some studies. OIS determined power for the sample size = 0.29 (0.8-0.9 = serious, <0.8 = very serious).

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded for heterogeneity due to conflicting number of events in different studies (zero events in one or more studies)

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with usual care or no treatment	Risk difference with Acupuncture/dry needling	
d. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to missing outcome data and bias in measurement of the outcome) e. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis f. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias in measurement of the outcome) g. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process) h. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size i. Absolute effect calculated by risk difference due to zero events in at least one arm of one study						

1.1.6.8 Electroacupuncture compared to placebo/sham

Table 18: Clinical evidence summary: electroacupuncture compared to placebo/sham

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Electroacupuncture	
Pain (visual analogue scale, 0-10, lower values are better, final values) at <6 months	32 (1 RCT) follow-up: 2 weeks	⨁◯◯◯ Very low[a,b]	-	The mean pain at <6 months was 2.93	MD **0.93 lower** (1.72 lower to 0.14 lower)	MID = 0.64 (0.5 x median baseline SD)
a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias in measurement of the outcome) b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs						

1.1.6.9 Intra-articular medicine injections – corticosteroids compared to placebo/sham

Table 19: Clinical evidence summary: intra-articular medicine injections – corticosteroids compared to placebo/sham

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Intra-articular medicine injections - corticosteroids	
Pain (visual analogue scale, 0-10, lower values are better, change score and final value) at <6 months	96 (2 RCTs) follow-up: mean 6 weeks	⊕◯◯◯ Very low[a,b,c]	-	The mean pain at <6 months was 2.86	MD **1.26 lower** (2.34 lower to 0.17 lower)	MID = 0.78 (0.5 x median baseline SD)
Activities of daily living (Barthel index, 0-100, higher values are better, final value) at <6 months	58 (1 RCT) follow-up: mean 8 weeks	⊕◯◯◯ Very low[c,d]	-	The mean activities of daily living at <6 months was 72.7	MD **4.8 higher** (6.42 lower to 16.02 higher)	MID = Barthel Index 1.85 (established MID)

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

d. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process)

1.1.6.10 Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS) and placebo/sham

Table 20: Clinical evidence summary: nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with Transcutaneous electrical nerve stimulation (TENS)	Risk difference with Nerve blocks (local anaesthetic)	
Pain (VAS, 0-100, lower values are better, change score) at <6 months	24 (1 RCT) follow-up: 3 weeks	⊕◯◯◯ Very low[a,b]	-	The mean pain at <6 months was -30	MD **25.8 lower** (50.2 lower to 1.4 lower)	MID = 12.9 (0.5 x median baseline SD)
Stroke-specific Patient-Reported Outcome Measures (SS-QOL, 0-100, higher values are better, change scores) at <6 months	24 (1 RCT) follow-up: 3 weeks	⊕◯◯◯ Very low[a,b]	-	The mean stroke-specific Patient-Reported Outcome Measures at <6 months was 2.1	MD **3.2 higher** (0.11 higher to 6.29 higher)	MID = 3.2 (0.5 x median baseline SD)

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias in measurement of the outcome)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 21: Clinical evidence summary: nerve blocks (local anaesthetic) compared to placebo/sham

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Nerve blocks (local anaesthetic)	
Pain (visual analogue scale, 0-100, lower values	84 (2 RCTs) follow-up:	⊕⊕◯◯ Low[a,b]	-	The mean pain at <6 months was 50.6	MD **17.25 lower** (28.87 lower	MID = 10.1 (0.5 x median baseline SD)

Outcomes	№ of participants (studies) Follow-up	Certainty of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects		Comments
				Risk with placebo/sham	Risk difference with Nerve blocks (local anaesthetic)	
are better, final values) at <6 months	mean 8 weeks				to 5.63 lower)	
Withdrawal due to adverse events at <6 months	64 (1 RCT) follow-up: 12 weeks	⨁⨁◯◯ Low[c]	RD 0.00 (-0.06 to 0.06)	0 per 1,000	**0 fewer per 1,000** (60 fewer to 60 more)[d]	Sample size used to determine precision: 75-150 = serious imprecision, <75 = very serious imprecision.

[a]. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis
[b]. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[c]. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size
[d]. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

See Appendix F for full GRADE tables.

1.1.7 Economic evidence

1.1.7.1 Included studies

No health economic studies were included in this review.

1.1.7.2 Excluded studies

No relevant health economic studies were excluded due to assessment of limited applicability or methodological limitations.

See also the health economic study selection flow chart in Appendix G.

1.1.8 Summary of included economic evidence

No health economic studies were included.

1.1.9 Economic model

This area was not prioritised for new cost-effectiveness analysis.

1.1.10 Unit costs

The tables below include unit costs relevant to the interventions being considered in this review. Table 22Table 22 presents staff costs related to people who may delivering interventions to reduce shoulder pain.

Electrotherapies (FES, NMES, TENS)

The cost of electrotherapies relates primarily to the staff time to administer it and will depend on how long sessions are and how often they are given, and duration of treatment. There are also equipment costs.

NMES was the most frequently evaluated of out the electrotherapy interventions (7 studies included in clinical review). The interventions varied between studies in terms of frequency and duration, with sessions ranging from 1–6-hours and were delivered between 3-7 days per week for 3-8 weeks. The included evidence for TENS reported sessions lasting 45-60 minutes, 3-7 days per week for 4-8 weeks. TENS can be delivered at home then returned for use by other patients which could lower resource use. The one study (Karaahmet 2019[21]) that assessed functional electrical stimulation (FES) was structured around 30-minute sessions of FES-cycling, delivered 5 times a week over 4 weeks (20 sessions total).

Table 22: Unit costs of health care professionals who may be involved in delivering interventions to reduce shoulder pain

Resource	Cost per working hour (hospital / community)[(a)]	Source
Band 6 PT/OT/SLT	£53 / £55	PSSRU 2021[20]
Band 7 PT/OT/SLT	£64 / £67	
Band 6 nurse	£54 / £58	
Band 7 nurse	£64 / £69	
Specialty Registrar (48-hour work week, hospital only)	£69	

Abbreviations: OT= occupational therapist; PT= physiotherapist; PSSRU= Personal Social Services Research Unit; SLT= speech and language therapist.

(a) Note: Costs per working hour include salary, salary oncosts, overheads (management and other non-care staff costs including administration and estates staff), capital overheads and qualification costs

Table 23 shows some the equipment costs related to TENS. The cost of a TENS machine varies (approximately £18-£50) depending on the type as a few are recorded in the NHS supply chain catalogue.[32] Costs for NMES and FES machines were not listed.

Previous economic evaluations of electrotherapy (TENS, NMES, FES) for treating other types of pain have not included the costs of equipment used by physiotherapists in the analysis as the per-use costs were expected to be small (MacPherson 2017,[25] Woods 2017[47]).

Table 23: Equipment costs transcutaneous electrical nerve stimulation (TENS)

Resource	Cost	Source
Direct TENS machine full kit including 4 electrodes /Dual channel TENS machine/ TENS machine TPN 200 Plus	£44.99/£31.10/£17.40	NHS Supply Chain Catalogue 2021[32]

A 2010 NHS Purchasing and Supply Agency report[38] on FES for drop foot of central neurological origin included an initial assessment appointment costing £140. This analysis also included a clinic model in which the costs of the FES device are incorporated in the ongoing clinical charges. Each ongoing clinical appointment was estimated at £300. FES can also be delivered at home; however, availability varies across current practice.

Acupuncture and electroacupuncture

The cost of acupuncture relates primarily to the staff time to administer it and will depend on how long sessions are and how often they are given, and duration of treatment.

In the clinical review, the frequency and duration for delivering acupuncture and electroacupuncture varied across studies. Acupuncture ranged from being delivered once with a 1-week follow-up to once daily for one month continuously. Sessions typically lasted 30 minutes.

Equipment costs for acupuncture relate to the needles used. A previous economic model developed for the Chronic Pain NICE guideline (NG193)[28] used a cost per needle of £0.06. A large acupuncture individual patient meta-analysis in chronic pain reported the number of needles across studies, and the most frequent range was between 10 and 14.[42]

An outpatient procedure for acupuncture for pain management is £141 (2019/2020 NHS reference costs[31]). Costs in the community setting may be lower.

One study included in the clinical review (Sui 2021[37]) provided acupuncture followed by 30 minutes of electroacupuncture delivered once a day, five days a week for two weeks. Example electroacupuncture equipment costs shown in Table 24 were taken from the analysis conducted as part of the osteoarthritis guideline update[29]. These devices were the ES-160 (included as it was used in two of the four clinical studies in the osteoarthritis review of electroacupuncture) and AS-super 4, which is a popular alternative in clinical practice. The analysis assumed that both devices have a lifespan of 5 years. Other costs associated with electrotherapy include batteries, needles, disinfectant swabs, and surgeons' gloves. The last electroacupuncture device included was the HANS-200A instrument, which was used in Sui 2021,[37] however this would not be as frequently used in an NHS clinical setting.

Table 24: Example equipment costs for electroacupuncture[(a)]

Device details	Device cost	Cost of crocodile clips	Cost of lead cables
ES-160	£395[13]	£43.24[18 (b)]	£59.50[12 (b)]

Device details	Device cost	Cost of crocodile clips	Cost of lead cables
AS-super 4	£240[11]	£23[10] (c)	£0

(a) Taken from online sources, excluding VAT.
(b) Cost of 10 units based on the assumption that 10 needles are utilised per session.
(c) Clips and cables sold together.

Devices

Table 25 reports the costs associated with the devices reported in the clinical review. Slings and tape are relatively low-cost compared[43] to the other interventions reported as the equipment costs and staff time involved in the application and correction of the devices are less resource intensive and can be incorporated into standard therapy. Taping was typically kept on for three days before being reapplied, meaning frequent visits may increase staff time compared to the sling. Shoulder braces were more expensive, with one study (Hartwig 2012)[14] reporting the use of a shoulder brace (Functional orthosis Neuro-Lux (Sporlastic GmbH, Nürtingen, Germany)) which retails online for almost €233 (£212).[43] Although this specific device was not reported in the NHS supply chain catalogue, it was noted by the committee to be one of the braces used in current practice. These interventions could also take place at home, with people tasked with wearing the devices all day or whenever the upper limb was unsupported.

Table 25: Example equipment costs of devices

Item	Unit cost	Source
Kinesiology sports tape 5.0cm x 5m[(a)]	£2.14	NHS Supply Chain Catalogue 2021[32]
Actimove Sling Adjustable 3.6cm x 10.8m[(b)]	£6.38	
Functional orthosis Neuro-Lux (Sporlastic GmbH, Nürtingen, Germany)[(c)]	£212	Vitego, 2022[43(d)]

(a) Assumed to be similar to kinesiology tape described in Huang 2016[17] and Huang 2017[16]
(b) Actimove sling was reported in van Bladel 2017[41]
(c) Example of shoulder brace cost, reported (Hartwig 2012)[14]
(d) Taken from online sources, excluding VAT.

Intra-articular medicine injections and nerve blocks

Resource use for intra-articular medicine injections and nerve blocks will relate to the drugs injected and the staff time to deliver the injections.

Table 26 presents unit costs for drugs used in intra-articular injections and nerve blocks. Saline injections were also included in the protocol, but no studies were found in the clinical review related to this and so costs are not shown.

Participants in all studies included in the clinical review received a single injection and were followed up from between 3 to 12 weeks post-intervention. This reflects current practice, with people receiving typically 1-2 injections. Drug costs per injection estimated based on the drugs and doses used in these studies are summarised in Table 26.

Table 26: Unit costs of intra-articular medicine injections and nerve blocks (local anaesthetics)

Drug	Units/pack	Cost/pack[(a)]	Cost per injection
Corticosteroids			
Triamcinolone acetonide 40 mg per 1 ml[(b)]	5	£7.45	£1.49
Triamcinolone acetonide 10 mg per 1 ml[(c)]	1	£3.63	£3.63

Methylprednisolone (as Methylprednisolone sodium succinate) 40 mg[(d)]	1	£1.58	£1.58
Betamethasone (as Betamethasone sodium phosphate) 4 mg per 1 ml[(e)]	5	£57.98	£11.60
Nerve blocks			
Bupivacaine hydrochloride 5 mg per 1 ml[(d)]	10	£7.56	£0.76
Prilocaine hydrochloride 10 mg per 1 ml[(c)]	5	£5.06	£1.01
Lidocaine hydrochloride 10 mg per 1 ml[(b)]	10	£5	£0.50
Lidocaine hydrochloride 20 mg per 1 ml[(e)]	10	£3.20	£0.32

(a) Costs are based on the NHS Drug Tariff price from the BNF,[19] accessed 25/05/22
(b) Reported in Rah 2012[36]. Participants received ultrasound-guided subacromial injection with triamcinolone 40mg with 1mL of 1% lidocaine. BNF drug cost is based on Kenalog Intra-articular / Intramuscular 40mg/1ml suspension for injection vials (Bristol-Myers Squibb Pharmaceuticals Ltd) and Lidocaine 100mg/10ml (1%) solution for injection ampoules Advanz Pharma
(c) Lakse 2009[22]; Participants received 1mL triamcinolone acetonide with 9mL prilocaine. BNF drug costs are based on Adcortyl Intra-articular / Intradermal 50mg/5ml suspension for injection vials Bristol-Myers Squibb Pharmaceuticals Ltd and Citanest 1% solution for injection 50ml vials Aspen Pharma Trading Ltd.
(d) Reported in Adey-Wakeling 2013[2]; participants received suprascapular nerve block, 1mL of 40mg/mL methylprednisolone and 10mL 0.5% bupivacaine hydrochloride. BNF drug costs are based on Solu-Medrone 40mg powder and solvent for solution for injection vials (Pfizer Ltd) and Bupivacaine 50mg/10ml (0.5%) solution for injection ampoules (Advanz Pharma).
(e) Reported in Terlemez 2020[39]; Participants received 5mL of 2% lidocaine and 1mL of betamethasone. BNF drug costs are based on Lidocaine 100mg/5ml (2%) solution for injection ampoules (A A H Pharmaceuticals Ltd) and Betamethasone 4mg/1ml solution for injection ampoules Alliance Healthcare (Distribution) Ltd

Resource use also differed for staff involvement in the injection procedure. Table 27 illustrates outpatient appointment costs associated with having an injection for pain management. All studies reported using a rehabilitation doctor to provide the injection, however, one study (Rah 2012[36]) reported that two rehabilitation doctors (physiatrists) and a radiologist attended a 2-day training course on the study procedure, physical tests, home exercise program, and ultrasonography for diagnosis and injection procedure. The training costs and ultrasound-guided subacromial injection would incur additional costs compared to the other interventions. Shoulder pain injections can also be provided in primary care settings which would incur lower costs, however this varies depending on the clinician being comfortable with administering the injection.

Table 27: Example procedural costs of intra-articular medicine injections and nerve blocks (local anaesthetics)

OPROC[(a)]	Cost	Source
Nerve Block or Destruction of Nerve, Under Image Control, for Pain Management	£910	2019/2020 NHS reference costs[31]
Nerve Block or Destruction of Nerve, for Pain Management	£529	
Injection of Therapeutic Substance into Joint Under Image Control for Pain Management	£826	
Injection of Therapeutic Substance into Joint for Pain Management	£752	

(a) Out-patient clinic - patient procedure.

1.1.11 Evidence statements

Effectiveness/Qualitative

Economic

No relevant economic evaluations were identified.

1.1.12 The committee's discussion and interpretation of the evidence

1.1.12.1. The outcomes that matter most

The committee included the following outcomes: person/participant generic health-related quality of life, carer generic health-related quality of life, pain, physical function – upper limb, activities of daily living, stroke-specific Patient-Reported Outcome Measures and withdrawal due to adverse events. All outcomes were considered equally important for decision making and therefore have all been rated as critical.

Person/participant health-related quality of life outcomes were considered particularly important as a holistic measure of the impact on the person's quality of living. Pain was considered important as a direct answer to the question. Withdrawal due to adverse events was used to understand the tolerability to the intervention, with the committee acknowledging that different interventions may have different adverse events. Mortality was not considered as it was deemed unlikely to be a result of the treatment and would be included in withdrawal due to adverse events. If mortality was an adverse events then this was highlighted to the committee during their deliberation.

The committee chose to investigate these outcomes at less than 6 months and more than and equal to 6 months, as they considered that there could be a difference in the short term and long term effects of the interventions.

The evidence for this question was limited, with some outcomes not being reported for every comparison. No study investigated the effects of interventions on carer generic health-related quality of life. The majority of outcomes were reported at less than 6 months, with only one outcome being reported at more than and equal to 6 months. The most widely reported outcome was pain.

1.1.12.2 The quality of the evidence

Twenty eight randomised controlled trial studies were included in the review. These reported a range of different comparisons:

The following interventions were compared:

- Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES), nerve blocks (local anaesthetic) and usual care or no treatment
- Functional electrical stimulation (FES) compared to usual care or no treatment
- Neuromuscular electrical stimulation (NMES) compared to transcutaneous electrical nerve stimulation (TENS), devices – slings, placebo/sham and usual care or no treatment
- Devices – tape compared to placebo/sham and usual care or no treatment
- Devices – slings compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment
- Devices – braces compared to usual care or no treatment
- Acupuncture/dry needling compared to placebo/sham and usual care or no treatment
- Electroacupuncture compared to placebo/sham
- Intra-articular medicine injections – Corticosteroids compared to placebo/sham
- Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS) and placebo/sham

No relevant clinical studies including the following interventions were identified:

- Devices – supports and other devices
- Intra-articular medicine injections – saline
- Injections into other sites (for example: bursae) – corticosteroids and saline

Studies were generally distributed evenly across the different interventions, with a limited number of studies reporting each comparison. Outcomes were of low or very low quality, with the majority being of very low quality. This was mainly due to risk of bias and imprecision. Risk of bias was a problem in a lot of studies and was mainly due to bias arising from the randomisation process, due to deviations from the intended intervention and due to missing outcome data, though all reasons for downgrading outcomes for risk of bias were present at least once during the analysis.

A large number of outcomes were downgraded due to imprecision. This was likely due to the studies included being, in general, small studies (with an average number of participants being 30 people) and that there were few studies to meta-analyse to improve the precision in the outcome.

Where meta-analysis was conducted, studies were generally downgraded for inconsistency due to heterogeneity that could not be resolved by the agreed sensitivity and subgroup analyses. Sensitivity and subgroup analyses often did not resolve the heterogeneity due to either there being an insufficient number of studies included in the results to allow for valid subgroups to be formed, or due to homogeneity in the subgroups present. The majority of studies investigated the effect of people with no previous shoulder pathology. There was a mixture of people in the subacute or chronic period after stroke. However, this did not resolve the heterogeneity when investigated.

A significant number of studies were excluded for not being reported in the English language. These studies primarily investigated the use of acupuncture. It is unclear whether these studies would be included if they were reported in English. However, there is a possibility of this influencing the results that were found from this review and so may introduce publication bias. This was highlighted to the committee during their deliberation.

These factors introduced additional uncertainty in the results. The effects on risk of bias did not appear to influence the direction of the effect in the trials. The committee took all of these factors into account when interpreting the evidence.

1.1.12.2.1 Transcutaneous electrical nerve stimulation (TENS)

Transcutaneous electrical nerve stimulation (TENS) was compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment.

- When compared to neuromuscular electrical stimulation (NMES), 5 outcomes of very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention, bias due to missing outcome data and bias in measurement of the outcome) and imprecision. The majority of outcomes included only one study, and at most two studies.
- When compared to nerve blocks (local anaesthetic), 2 outcomes of very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process and bias in measurement of the outcome) and imprecision.
- When compared to usual care or no treatment, 4 outcomes of very low quality were reported. This included the results from 1 trial with 54 participants. Outcomes were downgraded due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention and bias due to missing outcome data) and imprecision.

1.1.12.2.2 Functional electrical stimulation

Functional electrical stimulation was compared to usual care or no treatment. This comparison included 4 outcomes of low or very low quality. This included results from 1 trial with 21 participants. Outcomes were generally downgraded due to risk of bias (due to bias arising from the randomisation process and bias in measurement of the outcome) and imprecision.

1.1.12.2.3 Neuromuscular electrical nerve stimulation (NMES)

Neuromuscular electrical nerve stimulation (NMES) was compared to transcutaneous electrical nerve stimulation (TENS), slings, placebo/sham and usual care or no treatment.

- When compared to transcutaneous electrical nerve stimulation (TENS), 5 outcomes of very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention, bias due to missing outcome data and bias in measurement of the outcome) and imprecision. The majority of outcomes included only one study, and at most two studies.
- When compared to slings, 2 outcomes of low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data).
- When compared to placebo/sham, 4 outcomes of very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data) and imprecision.
- When compared to usual care or no treatment, 8 outcomes of low to very low quality were reported. These were downgraded due to risk of bias (due to a mixture of bias due to the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome), inconsistency (in one outcome) and imprecision.

1.1.12.2.4 Devices – Tape

Tape was compared to placebo/sham and usual care or no treatment.

- When compared to placebo/sham, 5 outcomes of low to very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias due to missing outcome data), inconsistency (in 1 outcome) and imprecision.
- When compared to usual care or no treatment, 2 outcomes of low and very low quality were reported. These were downgrade due to either risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome) or risk of bias (due to deviations from the intended interventions) and imprecision.

1.1.12.2.5 Devices – Slings

Slings were compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment.

- When compared to neuromuscular electrical stimulation (NMES), 2 outcomes of low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data).
- When compared to usual care or no treatment, 3 outcomes of very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention, bias due to missing outcome data, bias in measurement of the outcome and bias in selection of the reported result), inconsistency (in 1 outcome) and imprecision.

1.1.12.2.6 Devices – Braces

Braces were compared to usual care or no treatment. This comparison included 2 outcomes of low and very low quality. This included the results from 1 trial. The outcomes were downgraded for either risk of bias (due to missing outcome data and bias in the measurement of outcome) or risk of bias (due to missing outcome data) and imprecision.

1.1.12.2.7 Acupuncture/dry needling

Acupuncture/dry needling was compared to placebo/sham and usual care or no treatment.

- When compared to placebo/sham, 3 outcomes of very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data) and imprecision.
- When compared to usual care or no treatment, 5 outcomes of low or very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome), inconsistency (in 1 outcome) and imprecision.

1.1.12.2.8 Electroacupuncture

Electroacupuncture was compared to placebo/sham. This comparison included 1 outcome reported in 1 trial that was of very low quality. This was due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias in measurement of the outcome) and imprecision.

1.1.12.2.9 Intra-articular corticosteroids

Intra-articular corticosteroids were compared to placebo/sham. This comparison included 2 outcomes of very low quality. This was due to risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome), heterogeneity (in 1 outcome) and imprecision.

1.1.12.2.10 Nerve blocks (local anaesthetics)

Nerve blocks were compared to transcutaneous electrical nerve stimulation (TENS) and placebo/sham.

- When compared to transcutaneous electrical nerve stimulation (TENS), 2 outcomes of very low quality were reported. These were downgraded due to risk of bias (due to bias arising from the randomisation process and bias in measurement of the outcome) and imprecision.
- When compared to placebo/sham, 2 outcomes of low quality were reported. This was due to inconsistency (in 1 outcome) and imprecision.

1.1.12.3 Benefits and harms

1.1.12.3.1 Key uncertainties

The committee acknowledged the limited evidence available for all interventions in this review. Studies that were eligible for inclusion were often small and the quality of outcomes was often downgraded for risk of bias and imprecision. Based on this the committee agreed that more evidence investigating the effectiveness of all interventions would be important. Therefore, they agreed research recommendations to investigate this. The lack of certainty in the evidence made it difficult to determine the treatment that was most effective for shoulder pain after stroke. The committee decided that treatments where efficacy have been shown in this review should be considered as treatment options.

1.1.12.3.2 Transcutaneous electrical nerve stimulation (TENS)

Transcutaneous electrical nerve stimulation (TENS) was compared to neuromuscular electrical stimulation (NMES), nerve blocks (local anaesthetic) and usual care or no treatment. When compared to no treatment, no clinically important difference was seen in pain, physical function – upper limb, activities of daily living and stroke-specific Patient-

Reported Outcome Measures at less than 6 months. When compared to neuromuscular electrical stimulation, a clinically important benefit in activities of daily living at less than 6 months was seen with transcutaneous electrical nerve stimulation in 1 study with 72 participants, while no clinically important difference was seen in physical function – upper limb, stroke-specific Patient-Reported Outcome Measures and withdrawal due to adverse events at less than 6 months. However, a clinically important benefit of neuromuscular electrical stimulation over TENS was seen in pain at less than 6 months in 2 studies with 110 participants. When compared to nerve blocks, nerve blocks (rather than TENS) showed clinically important benefits in reducing pain and improving stroke-specific Patient-Reported Outcome Measures at less than 6 months.

The committee acknowledged the limited evidence for benefit from TENS. The evidence primarily indicated that there was no clinically important benefit from the use of TENS and that other treatments (such as neuromuscular electrical stimulation and nerve blocks) were superior to TENS. Given this, they agreed that they would not recommend TENS for use for the management of shoulder pain after stroke.

1.1.12.3.3 Functional electrical stimulation

Functional electrical stimulation was compared to usual care or no treatment. A clinically important benefit of functional electrical stimulation was seen with pain at less than 6 months. No clinically important difference was seen in physical function – upper limb, activities of daily living and withdrawal due to adverse events at less than 6 months. These outcomes were all reported in 1 study with 21 participants.

The committee acknowledged the limited evidence discussing functional electrical stimulation. While this evidence did show a clinically important benefit in reducing pain, the outcomes came from 1 small study and given that other interventions had a more robust evidence base, the committee chose to recommend use of these treatments instead. However, the committee recommended for further research in the use of functional electrical stimulation in the research recommendations for this topic to allow for a more robust evaluation of the technique. In the meantime, the committee noted that functional electrical stimulation could be a treatment that may be effective to help reduce shoulder pain, but that the evidence was not sufficient to make a recommendation at this time.

1.1.12.3.4 Neuromuscular electrical nerve stimulation (NMES)

Neuromuscular electrical nerve stimulation (NMES) was compared to transcutaneous electrical nerve stimulation (TENS), slings, placebo/sham and usual care or no treatment. When compared to placebo/sham, clinically important benefits were seen in physical function – upper limb and activities of daily living at less than 6 months. However, no clinically important difference was seen in pain and withdrawal due to adverse events at less than 6 months. When compared to usual care or no treatment, clinically important benefits were seen in pain, activities of daily living and withdrawal due to adverse events. An unclear effect was seen in person/participant generic health-related quality of life at less than 6 months where a clinically important benefit was observed in the SF-36 mental component and no clinically important difference in the SF-36 physical component. An unclear effect was also seen for physical function – upper limb, where 1 outcome with 25 participants of low quality indicated a clinically important benefit while 1 outcome with 54 participants but of very low quality indicated no clinically important difference.

When compared to transcutaneous electrical nerve stimulation, a clinically important benefit in pain at less than 6 months was seen with neuromuscular electrical stimulation in 2 studies with 110 participants, while no clinically important difference was seen in physical function – upper limb, stroke-specific Patient-Reported Outcome Measures and withdrawal due to adverse events at less than 6 months. However, a clinically important benefit of transcutaneous electrical nerve stimulation was seen in activities of daily living at less than 6 months in 1 study with 72 participants. When compared to slings, a clinically important

benefit of slings was seen in pain at less than 6 months and more than and equal to 6 months in outcomes from 1 study with 61 participants.

The committee acknowledged the inconsistency seen between the comparisons to placebo/sham and to usual care or no treatment. The comparison to placebo/sham indicated no clinically important difference of neuromuscular electrical nerve stimulation in reducing pain, while comparison to usual care or no treatment indicated a clinically important benefit. The committee agreed that the outcome showing no clinically important difference included inconsistency where 1 study showed a more beneficial effect and 1 study showed a more harmful effect, while the outcome showing benefit was based on 3 studies including 103 participants, with both outcomes being of very low quality. While they acknowledged the methodological concerns, the committee had greater certainty with the evidence of benefit. Based on the evidence of benefit when compared to usual care or no treatment, the committee agreed that neuromuscular electrical nerve stimulation should be considered for the treatment of post-stroke shoulder pain, and would also have benefits in other aspects of shoulder function, such as activities of daily living and upper limb motor function.

1.1.12.3.5 Devices – Tape

Tape was compared to placebo/sham and usual care or no treatment. When compared to placebo/sham, clinically important benefits were seen in pain and activities of daily living at less than 6 months. However, no clinically important difference was seen in physical function – upper limb, stroke-specific Patient-Reported Outcome Measures and withdrawal due to adverse events. When compared to usual care or no treatment, a clinically important difference was seen in pain at less than 6 months, while no clinically important difference was seen in withdrawal due to adverse events at less than 6 months.

The committee agreed that evidence of benefit for pain was seen when tape was compared to placebo/sham and to usual care or no treatment without showing any harms. The committee noted that taping may be useful for people with 1) hypotonic/unstable presentation of shoulder pain, 2) subacromial shoulder pain to optimise joint alignment. They acknowledged that this may not be the most common presentations of shoulder pain. A lay member on the committee discussed their experience, that tape was useful in reducing pain but would need replacing regularly and they would not be able to do that themselves. The practicalities of using tape for treatment needs to be considered by the stroke survivor and those supporting them when considering the treatment. The committee agreed that tape should be considered for the treatment of post-stroke shoulder pain.

1.1.12.3.6 Devices – Slings

Slings were compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment. When compared to usual care or no treatment, no clinically important difference was seen in pain and physical function – upper limb at less than 6 months. However, a clinically important harm of slings was seen in withdrawal due to adverse events in an outcome including 1 study with 32 participants with the outcome being of very low quality. When compared to neuromuscular electrical stimulation, a clinically important benefit of slings was seen in pain at less than 6 months and more than and equal to 6 months in outcomes from 1 study with 61 participants.

The committee agreed that there was no evidence of benefit with slings with potential evidence of harm in adverse events. However, they acknowledged that the harm in adverse events was due to 1 withdrawal in a small study, which made the applicability of this evidence limited. The committee reflected that in clinical practice there were people who would benefit from shoulder slings (including people with subluxed shoulders). Shoulder slings may be able to prevent future problems from taking place. However, they noted that sling use may lead to secondary stiffness, that can cause loss of range, pain and further disuse weakness. Taking this into account, the committee agreed that they would not make a recommendation on the use of slings as the evidence had not demonstrated convincingly

that slings were effective at reducing shoulder pain after stroke. However, they noted that for some people after stroke a sling may be an effective treatment and did not make a recommendation that they should not be used. They recommended that slings should be considered as a part of further research in this area to investigate whether they could be an effective treatment for certain causes of shoulder pain.

1.1.12.3.7 Devices – Braces

Braces were compared to usual care or no treatment. A clinically important benefit of braces was seen in pain at less than 6 months. However, a clinically important harm was observed in withdrawal due to adverse events at less than 6 months including 1 study with 41 participants with the outcome being of very low quality.

The committee acknowledge the inconsistent evidence of benefits in reducing pain but harms in withdrawal due to adverse events. The committee acknowledged that the harm in adverse events was due to 1 withdrawal in a small study, which made the applicability of this evidence limited. The committee reflected on their experience with lay members noting that they did not experience benefits from this, while healthcare professionals acknowledged that there may be some people where braces may be more helpful than others. The committee noted that this may be used for people with dense (severe) upper limb weakness and for people with subluxation. The committee weighed up these factors and agreed that due to the limited evidence compared to other interventions, they would not make a recommendation on the use of braces. However, they noted that braces may be effective for some people with shoulder pain and did not make a recommendation that braces should not be used. They included braces in a research recommendation to investigate whether they could be an effective treatment for certain causes of shoulder pain.

1.1.12.3.8 Acupuncture/dry needling

Acupuncture/dry needling was compared to placebo/sham and usual care or no treatment. When compared to placebo/sham, a clinically important benefit of acupuncture/dry needling was seen in pain at less than 6 months. No clinically important difference was seen in withdrawal due to adverse events. However, a clinically important benefit of placebo/sham was seen in activities of daily living. When compared to usual care or no treatment, clinically important benefits were seen in person/participant generic health-related quality of life and pain at less than 6 months. However, no clinically important difference was seen in physical function – upper limb and withdrawal due to adverse events at less than 6 months.

The committee acknowledged the evidence of benefits from acupuncture/dry needling. The committee acknowledged the limited evidence and how this may be further limited by a significant number of studies not being translated in English and so not being able to be checked for their relevance for inclusion in this review, which may have led to additional studies being added for this consideration. The committee agreed that acupuncture may be helpful for people with shoulder pain after stroke. The committee considered this evidence against the considerations of cost effectiveness and resource use.

Taking this into account, the committee acknowledged that there was insufficient evidence to recommend acupuncture at this time, but noted that the evidence appeared to be positive and recommended that acupuncture should have further research conducted, which included cost-effectiveness analysis, to investigate whether it could be a clinically and cost effective treatment to use for the management of shoulder pain after stroke in an NHS context.

1.1.12.3.9 Electroacupuncture

Electroacupuncture was compared to placebo/sham. 1 outcome was included for this comparison, pain at less than 6 months, where there was a clinically important benefit of electroacupuncture.

The committee acknowledged the evidence of benefits from electroacupuncture. The committee acknowledged the limited evidence and how this may be further limited by a significant number of studies not being translated in English and so not being able to be checked for their relevance for inclusion in this review, which may have led to additional studies being added for this consideration. The committee agreed that electroacupuncture may be helpful for people with shoulder pain after stroke. The committee considered this evidence against the considerations of cost effectiveness and resource use.

Taking this into account, the committee acknowledged that there was insufficient evidence to recommend electroacupuncture at this time, but noted that the evidence appeared to be positive and recommended that acupuncture should have further research conducted, which included cost-effectiveness analysis, to investigate whether it could be a clinically and cost effective treatment to use for the management of shoulder pain after stroke in an NHS context.

1.1.12.3.10 Intra-articular corticosteroids

Intra-articular corticosteroids were compared to placebo/sham. 2 outcomes were included for this comparison, pain and activities of daily living at less than 6 months, where there were clinically important benefits of intra-articular corticosteroids.

The committee acknowledged the evidence of benefits from intra-articular corticosteroids. On examining the studies, the committee noted that the identified studies only included one injection of intra-articular corticosteroids. The committee agreed that in their expert opinion there were benefits from use of intra-articular corticosteroids. The committee noted that these may be provided in primary care by general practitioners with a special interest, or in secondary care where it may be given under ultrasound guidance by radiologists, sports and exercise medicine clinicians or rehabilitation medicine physicians. Therefore, based on the limited evidence and committee's expert opinion, they agreed that intra-articular corticosteroids should be considered for the treatment of post-stroke shoulder pain.

1.1.12.3.11 Nerve blocks (local anaesthetics)

Nerve blocks were compared to TENS and placebo/sham. When compared to TENS, clinically important benefits of nerve blocks were seen in reducing pain and improving stroke-specific Patient-Reported Outcome Measures at less than 6 months. When compared to placebo/sham, a clinically important benefit of nerve blocks was seen in pain at less than 6 months. No clinically important difference was seen in withdrawal due to adverse events at less than 6 months.

The committee acknowledged the benefits from nerve blocks. The nerve blocks included in this review included a combination of local anaesthetic and corticosteroids. The committee acknowledged their experiences that nerve blocks can be useful for some people with shoulder pain after stroke. The committee noted that providing nerve blocks required specialist input to provide them, which could include anaesthetists or another interventional clinician such as a sports and exercise medicine or rehabilitation medicine consultant. Taking into account these factors, the committee agreed that nerve blocks should be considered for the treatment of post-stroke shoulder pain.

1.1.12.4 Cost effectiveness and resource use

No relevant health economic analyses were identified for this review; therefore, unit costs were presented to aid committee consideration of cost-effectiveness.

1.1.12.4.1 Electrotherapies (FES, NMES, TENS)

The cost of electrotherapies relates primarily to the staff time to administer it and will depend on frequency and duration of therapy sessions, as well as the duration of treatment. There are also equipment costs, however, these were not presented to the committee as previous

economic evaluations of electrotherapies did not include the costs of equipment as the per-use costs were expected to be small.

1.1.12.4.2 Transcutaneous electrical nerve stimulation (TENS)

The cost of a TENS machine varies (approximately £18-£50) and can be used at home which could incur less resource use relative to interventions that require staff supervision. However, the clinical evidence summarised in the section 0 indicated that there was no clinically important benefit from the use of transcutaneous electrical nerve stimulation compared to usual care and no treatment. The lack of clinical evidence and additional resource use required compared to usual care led the committee to agree to not recommend transcutaneous electrical nerve stimulation for the management of shoulder pain in post-stroke adults.

1.1.12.4.3 Functional electrical stimulation (FES)

Previous NHS reports on FES[38] included an initial assessment appointment costing £140. The analysis also included a clinic model in which the costs of the FES device are incorporated in the ongoing clinical charges. Each ongoing clinical appointment was estimated at £300. The experience of some committee members suggested a less expensive alternative where FES can be delivered at home without staff supervision, although it was acknowledged that the number of FES devices available to take home varies across current practice. The clinical evidence (section 0) showed that when FES was compared to usual care or no treatment, a clinically important benefit of FES was seen with pain at less than 6 months. However, no clinically important difference was seen in physical function – upper limb, activities of daily living and withdrawal due to adverse events at less than 6 months. Given the limited clinical evidence and lack of cost-effective evidence the committee decided to not recommend FES for the treatment of post-stroke shoulder pain.

1.1.12.4.4 Neuromuscular electrical nerve stimulation (NMES)

NMES was the most frequently evaluated of out the electrotherapy interventions (7 studies included in clinical review) and was compared to transcutaneous electrical nerve stimulation (TENS), slings, placebo/sham and usual care, or no treatment. It was challenging for the committee to determine resource use for NMES as the frequency and duration reported in the studies varied, with sessions ranging from 1–6-hours and were delivered between 3-7 days per week for 3-8 weeks.

Despite committee acknowledgement of the inconsistency seen between the comparisons to placebo/sham and to usual care or no treatment, it was agreed that there was more evidence of benefit than harm in the clinical evidence for NMES (see section 0), and agreed that and would also have benefits in other aspects of shoulder function, such as activities of daily living and upper limb motor function. For these reasons, alongside the lack of published health economic evidence, the committee agreed that NMES should be considered for the treatment of post-stroke shoulder pain.

1.1.12.4.5 Devices

The committee were informed that the following devices could take place at home which could incur lower resource use compared to other interventions in this review, with people tasked with wearing the devices all day or whenever the upper limb was unsupported.

1.1.12.4.6 Slings

The cost of the sling reported in the clinical studies was relatively low (£6.38) and staff time involved in the application and correction of the sling is less resource intensive compared to other shoulder-pain related interventions and can be incorporated into standard therapy. As previously summarised in section 0 above, 1 clinical study comparing slings to NMES found a clinically important benefit in pain at less than 6 months and more than and equal to 6

months in outcomes. No evidence of benefit was seen when slings were compared to usual care or no treatment, with limited evidence of a clinically important harm of slings for withdrawal due to adverse events. Despite limited clinical evidence, the committee's experience in clinical practice had demonstrated the benefits of shoulder slings for some individuals (including people with subluxed shoulders), alongside the potential for slings to prevent future problems from taking place. However, without cost-effectiveness evidence and no clinical evidence of benefit when compared to usual care or no treatment, the committee agreed that slings were not recommended for the treatment of post-stroke shoulder pain.

1.1.12.4.7 Tape

Tape is relatively low cost (£2.14) compared to the other devices in this review. However, both the clinical evidence and a lay member's experience of this intervention noted that a therapist is required to reapply the tape, resulting in frequent visits which could increase staff time costs. As described in section 0, studies comparing tape to usual care or no treatment placebo/sham found clinically important benefits in pain at less than 6 months. However, the comparison to placebo/sham indicated no clinically important difference in physical function – upper limb, stroke-specific Patient-Reported Outcome Measures and withdrawal due to adverse events.

The committee noted that taping would not be a practical treatment for all stroke survivors and that it may be useful for people with less common presentations of shoulder pain. This could possibly lower the impact on resource as less people would be ideal candidates for taping. Based on the limited clinical and economic evidence, the committee agreed that tape should be considered for the treatment of post-stroke shoulder pain, emphasising that stroke survivors and those supporting them should first consider the practicalities of using tape before beginning treatment.

1.1.12.4.8 Braces

One study reported the use of a shoulder brace which was significantly more costly than the other devices (£212). Although this specific device was not reported in the NHS supply chain catalogue, it was noted by a committee member this was one of the braces used in current practice and that a similar cost or higher (approximately £250) would apply for other shoulder braces typically used. It was also noted that shoulder braces are not customised to order but given the different sizes, some staff time is required for fitting the brace.

Committee members noted not everyone with post-stroke shoulder pain would be eligible for this treatment, as using a brace is thought to prevent future problems for some people while causing additional harm in others, particularly in instances where the shoulder is already very inflamed. There was limited clinical evidence (section 0) with the only included study reporting inconsistent evidence of benefits in reducing pain but harms in withdrawal due to adverse events. Given the lack of clinical evidence and economic evidence, alongside additional resource use requirements, the committee agreed to not recommend braces for the treatment of post-stroke shoulder pain.

1.1.12.4.9 Acupuncture/dry needling

The cost of acupuncture relates primarily to the staff time required to deliver treatment, with an outpatient procedure for acupuncture for pain management costing £141, although costs in the community might be lower. The frequency and duration for delivering acupuncture varied across studies, ranging from a one-off session with a 1-week follow-up to once daily for one month. Sessions typically lasted 30 minutes. Equipment costs for acupuncture are low as it mainly consists of the cost of needles (£0.06 per needle, with 10-14 needles used per session). The committee regarded acupuncture and electroacupuncture as one of the less frequently provided treatments for shoulder pain following stroke, meaning that staff training may be required to deliver these interventions.

The limited clinical evidence (reported in section 0) for acupuncture included a clinically important benefit for pain at less than 6 months for acupuncture when compared to both placebo/sham and usual care or no treatment. No clinically important difference was seen in withdrawal due to adverse events for either comparison, however a clinically important benefit was seen for placebo/sham in activities of daily living. The lack of clinical evidence for acupuncture may have been due to several studies that were not assessed because they were not published in English. Given the limited clinical evidence and lack of economic evidence, alongside additional resource use requirements, the committee agreed to not recommend acupuncture for the treatment of post-stroke shoulder pain.

1.1.12.4.10 Electroacupuncture

Aside from the staff time required to deliver electroacupuncture, example costs of electroacupuncture devices were presented to the committee, which ranged from £240-£534. Other costs associated with electrotherapy include clips, lead cables, batteries, needles, disinfectant swabs, and surgeons' gloves. Clinical evidence for electroacupuncture was based on a single study that indicated a clinically important benefit for pain at less than 6 months when compared to placebo/sham (see section 0). As with standard acupuncture, the lack of clinical evidence for electroacupuncture may have been due to several studies that were not assessed because they were not published in English.

Given the limited clinical evidence and lack of economic evidence, alongside additional resource use requirements, the committee agreed to not recommend electroacupuncture for the treatment of post-stroke shoulder pain.

1.1.12.4.11 Intra-articular corticosteroids and Nerve blocks (local anaesthetics)

Participants in all clinical studies received a single injection and were followed up from between 3 to 12 weeks post-intervention. The committee agreed that 1-2 injections was typical of current practice.

The committee were informed that resource use relates to the drugs injected and the staff time to deliver the injections. Resource use between studies differed due to the cost of drugs, as the 4 included studies used different drug combinations and doses. The average drug cost per injection for each of the combinations and doses from the studies were created using drug costs from the BNF. The cost per injection was low £1.99-£11.92, with the most expensive being attributed to betamethasone, which the committee noted would not be used in an NHS clinical setting. The impact on resource use would also be dependent on the staff involved in the injection procedure, outpatient appointment costs associated with having an injection for pain management ranged between £752-£826 (for injection of therapeutic substance) to £529-£910 (for nerve block), with the higher ranges accounting for the use of ultrasonography. Training costs are another factor that could incur additional resource use, as one study reported the use of two rehabilitation doctors (physiatrists) and a radiologist who were required to attend a 2-day training course.

When nerve blocks were compared to placebo/sham, a clinically important benefit of nerve blocks was seen in pain at less than 6 months (see section 0). No clinically important difference was seen in withdrawal due to adverse events at less than 6 months. Committee experience of nerve blocks in clinical practice has shown benefits to some people with shoulder pain after stroke. However, the committee also acknowledged the resource use associated with nerve blocks, as specialist input is required to provide them, which could include anaesthetists or another interventional clinician such as a sports and exercise medicine or rehabilitation medicine consultant. In consideration of these factors, the committee decided that nerve blocks should be considered for the treatment of post-stroke shoulder pain.

The committee noted that the clinical evidence contained only one study for intra-articular corticosteroids, which found clinically important benefits for pain and activities of daily living

at less than 6 months when compared to placebo/sham (see section 0). The committee agreed that in their expert opinion there were benefits from use of intra-articular corticosteroids. Disparity in resource use across current practice was also acknowledged, as intra-articular corticosteroids can be provided in secondary care involving specialist input, or in primary care by general practitioners (which would lower resource use); however, this is dependent on the clinician being comfortable with administering the injection. The limited clinical evidence and the committee's expert opinion, paired with a lack of economic evidence lead the committee to agree that intra-articular corticosteroids should be considered for the treatment of post-stroke shoulder pain.

1.1.12.5 Other factors the committee took into account

The committee acknowledged the potential costs of treatments. Some treatments may be accessed outside of the NHS. Electrotherapy (including transcutaneous electrical nerve stimulation and functional electrical stimulation) and devices may be purchased without healthcare professional input, which can incur costs on stroke survivors. Acupuncture and electroacupuncture may be accessed more commonly by people with an Asian family background, which can lead to inequities in care where people may access this treatment privately instead of through the NHS.

The committee acknowledged that the treatment of shoulder pain after stroke should be dependent on the cause of the shoulder pain, which is often multifactorial but can include pain from glenohumeral subluxation, spasticity of shoulder muscles, impingement, soft tissue injury, rotator cuff tears, glenohumeral capsulitis, bicipital tendinitis and shoulder hand syndrome[44]. Therefore, it could be argued that treatment needs to be specific to the person after stroke. The committee acknowledged that the included studies did not investigate all of these causes and so it is difficult to conclude which treatments are more effective for each cause. The committee agreed that pain should be managed by the cause of the pain but noted that research was not currently designed in this manner, so made a research recommendation for research to be conducted to investigate whether assessing the cause of the shoulder pain and then treating accordingly is the best management strategy for post-stroke shoulder pain.

The committee noted that the majority of the evidence investigated people who did not have pre-existing shoulder conditions but acknowledged that, if present, such conditions would also have a role on the management required.

Furthermore, the committee agreed that it was often not apparent whether shoulder pain was acute or chronic in the studies they reviewed. The epidemiology of shoulder pain after stroke is unclear, with there being limited information about the proportion of cases that persisted beyond 3 months. The committee acknowledged that chronic pain could have a significant effect and may require different management to acute pain, including psychological therapy. The involvement of psychological services to support people with chronic secondary pain due to stroke-related shoulder pain should be considered if that is thought to be appropriate by the healthcare professionals involved in the person's care.

1.1.13 Recommendations supported by this evidence review

This evidence review supports recommendations 1.14.2 to 1.14.4 and the research recommendations on the management of shoulder pain by cause and diagnostic assessment to inform management of shoulder pain.

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Appendices

Appendix A – Review protocols

Review protocol for the clinical and cost-effectiveness of interventions for shoulder pain after stroke

ID	Field	Content
0.	PROSPERO registration number	CRD42022312284
1.	Review title	In people with shoulder pain after stroke, what is the clinical and cost effectiveness of transcutaneous electrical nerve stimulation, acupuncture, functional electrical stimulation and intra-articular steroid injection in reducing pain?
2.	Review question	In people with shoulder pain after stroke, what is the clinical and cost effectiveness of transcutaneous electrical nerve stimulation, acupuncture, functional electrical stimulation and intra-articular steroid injection in reducing pain?
3.	Objective	To determine the clinical and cost-effectiveness of interventions (including transcutaneous electrical nerve stimulation, acupuncture, functional electrical stimulation and intra-articular steroid injection) aiming to reduce shoulder pain after stroke
4.	Searches	The following databases (from inception) will be searched: • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • Embase • MEDLINE • AMED Searches will be restricted by: • English language studies • Human studies Other searches: • Inclusion lists of systematic reviews The searches may be re-run 6 weeks before the final committee meeting and further studies retrieved for inclusion if relevant.

		The full search strategies will be published in the final review. Medline search strategy to be quality assured using the PRESS evidence-based checklist (see methods chapter for full details).
5.	Condition or domain being studied	Adults and young people (16 or older) after a stroke who are experiencing shoulder pain
6.	Population	Inclusion: • Adults (age ≥16 years) who have had a first or recurrent stroke (including people after subarachnoid haemorrhage) with shoulder pain Exclusion: • Children (age <16 years) • People after a transient ischaemic attack

7.	Intervention	• Transcutaneous electrical nerve stimulation (TENS)
		• Functional electrical stimulation
		• Neuromuscular electrical stimulation (NMES)
		• Devices
		  ○ Tape
		  ○ Slings
		  ○ Supports
		  ○ Braces
		  ○ Other devices
		• Acupuncture/dry needling
		• Electroacupuncture
		• Intra-articular medicine injections
		  ○ Corticosteroids
		  ○ Saline
		• Injections into other sites (for example: bursae)
		  ○ Corticosteroids
		  ○ Saline
		• Nerve blocks (local anaesthetics)

8.	Comparator/Confounding factors	• Each other • Placebo/sham • Usual care or no treatment Confounding factors • Age • Time period after stroke • Pre-existing shoulder conditions
9.	Types of study to be included	• Systematic reviews of RCTs

		• Parallel RCTs If insufficient RCT evidence is available, non-randomised studies will be considered if they adjust for key confounders (e.g. age, time period after stroke, pre-existing shoulder conditions), including: 3. Prospective and retrospective cohort studies 4. Case control studies (if no other evidence identified) Published NMAs and IPDs will be considered for inclusion.
10.	Other exclusion criteria	• Non-English language studies • Crossover RCTs • Conference abstracts will be excluded as it is expected there will be sufficient full text published studies available.
11.	Context	People with shoulder pain after a stroke (including new shoulder pain and an exacerbation of previous shoulder pain brought on by the stroke). This may include people in an acute (<7 days), subacute (7 days – 6 months) or chronic (>6 months) time horizon.
12.	Primary outcomes (critical outcomes)	All outcomes are considered equally important for decision making and therefore have all been rated as critical: At time period • <6 months • ≥6 months • Person/participant generic health-related quality of life (continuous outcomes will be prioritised) o EQ-5D o SF-6D o SF-36 o SF-12 o Other utility measures (AQOL, HUI, 15D, QWB) • Carer generic health-related quality of life (continuous outcomes will be prioritised) o EQ-5D o SF-6D o SF-36 o SF-12 o Other utility measures (AQOL, HUI, 15D, QWB) • Pain (continuous outcomes will be prioritised) o Visual analogue scale/numeric rating scales (0-10, 0-100) o Shoulder pain and disability index o Penn shoulder score

		○ Shoulder Q • Physical function – upper limb (continuous outcomes will be prioritised) ○ Fugl-Meyer assessment ○ Action Research Arm Test ○ Chedoke Arm and Hand Activity Inventory ○ Nine-hole peg test ○ Motricity Index Scale ○ Muscle Power Assessment (MRC scale) ○ Wolf Motor Function Test ○ Motor Activity Log • Activities of daily living (continuous outcomes will be prioritised) ○ Barthel Index ○ National Institutes of Health Stroke Scale ○ Orpington Prognostic Scale ○ Canadian Occupational Performance Measure ○ Extended activities of daily living ○ Functional independence measure • Stroke-specific Patient-Reported Outcome Measures (continuous outcomes will be prioritised) ○ Stroke-Specific Quality of Life (SS-QOL) ○ Stroke Impact Scale (SIS) ○ Stroke-specific Sickness Impact Profile (SA-SIP30) ○ Neuro-QOL ○ PROMIS-10 ○ Satisfaction with International Classification of Functioning, Disability and Health – Stroke (SATIS-Stroke) • Withdrawal due to adverse events (dichotomous outcome) If not mentioned above, other validated scores will be considered and discussed with the committee to deliberate on their inclusion.
14.	Data extraction (selection and coding)	All references identified by the searches and from other sources will be uploaded into EPPI reviewer and de-duplicated. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. The full text of potentially eligible studies will be retrieved and will be assessed in line with the criteria outlined above.

		A standardised form will be used to extract data from studies (see Developing NICE guidelines: the manual section 6.4). 10% of all evidence reviews are quality assured by a senior research fellow. This includes checking: • papers were included /excluded appropriately • a sample of the data extractions • correct methods are used to synthesise data • a sample of the risk of bias assessments Disagreements between the review authors over the risk of bias in particular studies will be resolved by discussion, with involvement of a third review author where necessary. Study investigators may be contacted for missing data where time and resources allow.
15.	Risk of bias (quality) assessment	Risk of bias will be assessed using the appropriate checklist as described in Developing NICE guidelines: the manual. • Systematic reviews: Risk of Bias in Systematic Reviews (ROBIS) • Randomised Controlled Trial: Cochrane RoB (2.0) • Non randomised study, including cohort studies: Cochrane ROBINS-I
16.	Strategy for data synthesis	• Pairwise meta-analyses will be performed using Cochrane Review Manager (RevMan5). Fixed-effects (Mantel-Haenszel) techniques will be used to calculate risk ratios for the binary outcomes where possible. Continuous outcomes will be analysed using an inverse variance method for pooling weighted mean differences. Heterogeneity between the studies in effect measures will be assessed using the I^2 statistic and visually inspected. An I^2 value greater than 50% will be considered indicative of substantial heterogeneity. Sensitivity analyses will be conducted based on pre-specified subgroups using stratified meta-analysis to explore the heterogeneity in effect estimates. If this does not explain the heterogeneity, the results will be presented pooled using random-effects. • GRADEpro will be used to assess the quality of evidence for each outcome, taking into account individual study quality and the meta-analysis results. The 4 main quality elements (risk of bias, indirectness, inconsistency and imprecision) will be appraised for each outcome. Publication bias is tested for when there are more than 5 studies for an outcome.

		The risk of bias across all available evidence was evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group http://www.gradeworkinggroup.org/ • Where meta-analysis is not possible, data will be presented and quality assessed individually per outcome. • WinBUGS will be used for network meta-analysis, if possible given the data identified.	
17.	Analysis of sub-groups	Sensitivity analysis to investigate background rates of oral drug use. A stepwise analysis will be conducted if heterogeneity is present: A) Removing studies where the population is selected based on specific levels of previous oral drug use (for example: people were only included if they had not achieved adequate analgesia with oral non-steroidal anti-inflammatory drugs) B) Remove all studies apart from those where a population is stated to be drug naïve when entering the study (this would only be conducted if the heterogeneity is not satisfactorily resolved by analysis A) If an analysis satisfactorily resolves heterogeneity, then studies will be removed from all analyses for the comparison regardless of whether heterogeneity is present. Sensitivity analyses will be conducted before subgroup analyses. Subgroups that will be investigated if heterogeneity is present: • Acupuncture/dry needling • No previous shoulder pathology compared to pre-existing shoulder pathology • Time period after stroke	
18.	Type and method of review	☒	Intervention
		☐	Diagnostic
		☐	Prognostic
		☐	Qualitative
		☐	Epidemiologic
		☐	Service Delivery
		☐	Other (please specify)

19.	Language	English		
20.	Country	England		
21.	Anticipated or actual start date	14/02/2022		
22.	Anticipated completion date	14/02/2023		
23.	Stage of review at time of this submission	Review stage	Started	Completed
		Preliminary searches	☐	☐
		Piloting of the study selection process	☐	☐
		Formal screening of search results against eligibility criteria	☐	☐
		Data extraction	☐	☐
		Risk of bias (quality) assessment	☐	☐
		Data analysis	☐	☐
24.	Named contact	5a. Named contact National Guideline Centre 5b Named contact e-mail StrokeRehabUpdate@nice.nhs.uk 5e Organisational affiliation of the review National Institute for Health and Care Excellence (NICE) and National Guideline Centre		
25.	Review team members	From the National Guideline Centre: Bernard Higgins (Guideline lead) George Wood (Senior systematic reviewer) Madelaine Zucker (Systematic reviewer) Kate Lovibond (Health economics lead) Claire Sloan (Health economist) Joseph Runicles (Information specialist) Nancy Pursey (Senior project manager)		
26.	Funding sources/sponsor	This systematic review is being completed by the National Guideline Centre which receives funding from NICE.		
27.	Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or		

		changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.	
28.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: https://www.nice.org.uk/guidance/indevelopment/gid-ng10175	
29.	Other registration details	N/A	
30.	Reference/URL for published protocol	N/A	
31.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: • notifying registered stakeholders of publication • publicising the guideline through NICE's newsletter and alerts • issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE.	
32.	Keywords	Acupuncture; Adults; Electroacupuncture; Functional electrical stimulation; Intra-articular medicine; Intervention; Non-pharmacological; Pharmacological; Rehabilitation; Shoulder pain; Stroke	
33.	Details of existing review of same topic by same authors	N/A	
34.	Current review status	☐	Ongoing
		☐	Completed but not published
		☒	Completed and published
		☐	Completed, published and being updated
		☐	Discontinued
35..	Additional information	N/A	
36.	Details of final publication	www.nice.org.uk	

Health economic review protocol

Review question	All questions – health economic evidence
Objectives	To identify health economic studies relevant to any of the review questions.
Search criteria	• Populations, interventions, and comparators must be as specified in the clinical review protocol above. • Studies must be of a relevant health economic study design (cost–utility analysis, cost-effectiveness analysis, cost–benefit analysis, cost–consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of health economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	A health economic study search will be undertaken using population-specific terms and a health economic study filter – see appendix B below. Databases searched: • Centre for Reviews and Dissemination NHS Economic Evaluations Database (NHS EED) – all years (closed to new records April 2015) • Centre for Reviews and Dissemination Health Technology Assessment database – all years (closed to new records March 2018) • International HTA database (INAHTA) – all years • Medline and Embase – from 2014 (due to NHS EED closure)
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2006 (including those included in the previous guideline), abstract-only studies and studies from non-OECD countries or the USA will also be excluded. Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in appendix H of Developing NICE guidelines: the manual (2014).[30] Studies published in 2006 or later that were included in the previous guideline will be reassessed for inclusion and may be included or selectively excluded based on their relevance to the questions covered in this update and whether more applicable evidence is also identified. **Inclusion and exclusion criteria** • If a study is rated as both 'Directly applicable' and with 'Minor limitations' then it will be included in the guideline. A health economic evidence table will be completed and it will be included in the health economic evidence profile. • If a study is rated as either 'Not applicable' or with 'Very serious limitations' then it will usually be excluded from the guideline. If it is excluded then a health economic evidence table will not be completed and it will not be included in the health economic evidence profile. • If a study is rated as 'Partially applicable', with 'Potentially serious limitations' or both then there is discretion over whether it should be included. **Where there is discretion** The health economist will make a decision based on the relative applicability and quality of the available evidence for that question, in discussion with the

guideline committee if required. The ultimate aim is to include health economic studies that are helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded on the basis of applicability or methodological limitations will be listed with explanation in the excluded health economic studies appendix below.

The health economist will be guided by the following hierarchies.

Setting:

- UK NHS (most applicable).
- OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden).
- OECD countries with predominantly private health insurance systems (for example, Switzerland).
- Studies set in non-OECD countries or in the USA will be excluded before being assessed for applicability and methodological limitations.

Health economic study type:

- Cost–utility analysis (most applicable).
- Other type of full economic evaluation (cost–benefit analysis, cost-effectiveness analysis, cost–consequences analysis).
- Comparative cost analysis.
- Non-comparative cost analyses including cost-of-illness studies will be excluded before being assessed for applicability and methodological limitations.

Year of analysis:

- The more recent the study, the more applicable it will be.
- Studies published in 2006 or later (including any such studies included in the previous guideline) but that depend on unit costs and resource data entirely or predominantly from before 2006 will be rated as 'Not applicable'.
- Studies published before 2006 (including any such studies included in the previous guideline) will be excluded before being assessed for applicability and methodological limitations.

Quality and relevance of effectiveness data used in the health economic analysis:

- The more closely the clinical effectiveness data used in the health economic analysis match with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline.

Appendix B – Literature search strategies

B.1 Clinical search literature search strategy

Searches were constructed using a PICO framework where population (P) terms were combined with Intervention (I) and in some cases Comparison (C) terms. Outcomes (O) are rarely used in search strategies as these concepts may not be indexed or described in the title or abstract and are therefore difficult to retrieve. Search filters were applied to the search where appropriate.

Table 28: Database parameters, filters and limits applied

Database	Dates searched	Search filter used
Medline (OVID)	Inception – 08 January 2023	Randomised controlled trials Systematic review studies Exclusions (animal studies, letters, comments, editorials, case studies/reports) English language
Embase (OVID)	Inception – 08 January 2023	Randomised controlled trials Systematic review studies Exclusions (animal studies, letters, comments, editorials, case studies/reports, conference abstracts) English language
The Cochrane Library (Wiley)	Cochrane Reviews to 2023 Issue 1 of 12 CENTRAL to 2023 Issue 1 of 12	Exclusions (clinical trials, conference abstracts)
AMED, Allied and Complementary Medicine (OVID)	Inception – 08 January 2023	Exclusions (animal studies, letters, comments, case reports)

Medline (Ovid) search terms

1.	exp Stroke/
2.	Stroke Rehabilitation/
3.	exp Cerebral Hemorrhage/
4.	(stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident").ti,ab,kf.
5.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab,kf.

6.	"brain attack*".ti,ab,kf.
7.	or/1-6
8.	Shoulder/ or Shoulder joint/ or Shoulder pain/ or Shoulder dislocation/ or Rotator Cuff/ or arm/ or upper extremity/
9.	(upper limb* or upper extremit* or upper body or arm or arms or shoulder or shoulders or rotator cuff* or glenohumeral or humeroscapular or scapulohumeral or scapulo humeral).ti,ab,kf.
10.	8 or 9
11.	7 and 10
12.	letter/
13.	editorial/
14.	news/
15.	exp historical article/
16.	Anecdotes as Topic/
17.	comment/
18.	case report/
19.	(letter or comment*).ti.
20.	or/12-19
21.	randomized controlled trial/ or random*.ti,ab.
22.	20 not 21
23.	animals/ not humans/
24.	exp Animals, Laboratory/
25.	exp Animal Experimentation/
26.	exp Models, Animal/
27.	exp Rodentia/
28.	(rat or rats or mouse or mice or rodent*).ti.
29.	or/22-28
30.	11 not 29
31.	limit 30 to English language
32.	Electric Stimulation Therapy/
33.	Electric Stimulation/
34.	Transcutaneous Electric Nerve Stimulation/
35.	Transcranial Magnetic Stimulation/
36.	((function* or neuromuscul* or peripheral* or transcutan* or transcran* or electric* or transdermal or nerve* or percutaneous) adj4 stimulat*).ti,ab,kf.
37.	((transcutan* or transcran* or electric* or analgesic) adj4 neurostimulat*).ti,ab,kf.
38.	((transcutan* or transcran* or transdermal or analgesic) adj4 electrostimulat*).ti,ab,kf.
39.	(electrotherap* or electroanalges*).ti,ab,kf.
40.	(FES or TENS or NMES or FNS or TMS).ti,ab,kf.
41.	acupuncture/ or acupuncture therapy/ or acupuncture analgesia/ or acupuncture, ear/ or electroacupuncture/ or meridians/ or acupuncture points/ or trigger points/
42.	(acupuncture* or electroacupuncture* or acupoint* or meridian* or needling or acupress* or auriculotherap* or auriculoacupunct* or moxibust*).ti,ab,kw.
43.	Injections, Intra-Articular/
44.	injection*.ti,ab,kf.
45.	exp Orthotic Devices/

46.	Splints/
47.	(support* or tape* or sling* or brace* or device* or splint*).ti,ab,kf.
48.	(orthot* or orthos*).ti,ab,kf.
49.	nerve block*.ti,ab,kf.
50.	(local anaesthetic* or local anesthetic*).ti,ab,kf.
51.	or/32-50
52.	randomized controlled trial.pt.
53.	controlled clinical trial.pt.
54.	randomi#ed.ti,ab.
55.	placebo.ab.
56.	randomly.ti,ab.
57.	Clinical Trials as topic.sh.
58.	trial.ti.
59.	or/52-58
60.	Meta-Analysis/
61.	exp Meta-Analysis as Topic/
62.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
63.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
64.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
65.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
66.	(search* adj4 literature).ab.
67.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
68.	cochrane.jw.
69.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
70.	or/60-69
71.	31 and 51
72.	71 and (59 or 70)

Embase (Ovid) search terms

1.	exp Cerebrovascular accident/
2.	exp Brain infarction/
3.	Stroke Rehabilitation/
4.	(stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident").ti,ab,kf.
5.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab,kf.
6.	"brain attack*".ti,ab,kf.
7.	Intracerebral hemorrhage/
8.	or/1-7
9.	shoulder/ or shoulder pain/ or rotator cuff/ or arm/ or upper limb/
10.	(upper limb* or upper extremit* or upper body or arm or arms or shoulder or shoulders or rotator cuff* or glenohumeral or humeroscapular or scapulohumeral or scapulo humeral).ti,ab,kf.
11.	9 or 10

12.	8 and 11
13.	letter.pt. or letter/
14.	note.pt.
15.	editorial.pt.
16.	case report/ or case study/
17.	(letter or comment*).ti.
18.	(conference abstract or conference paper).pt.
19.	or/13-18
20.	randomized controlled trial/ or random*.ti,ab.
21.	19 not 20
22.	animal/ not human/
23.	nonhuman/
24.	exp Animal Experiment/
25.	exp Experimental Animal/
26.	animal model/
27.	exp Rodent/
28.	(rat or rats or mouse or mice or rodent*).ti.
29.	or/21-28
30.	12 not 29
31.	limit 30 to English language
32.	*Electric Stimulation/
33.	electrotherapy/
34.	transcutaneous electrical nerve stimulation/
35.	transcranial magnetic stimulation/
36.	((function* or neuromuscul* or peripheral* or transcutan* or transcran* or electric* or transdermal or nerve* or percutaneous) adj4 stimulat*).ti,ab,kf.
37.	((transcutan* or transcran* or electric* or analgesic) adj4 neurostimulat*).ti,ab,kf.
38.	((transcutan* or transcran* or transdermal or analgesic) adj4 electrostimulat*).ti,ab,kf.
39.	(electrotherap* or electroanalges*).ti,ab,kf.
40.	(FES or TENS or NMES or FNS or TMS).ti,ab,kf.
41.	*acupuncture/ or acupuncture analgesia/ or auricular acupuncture/ or electroacupuncture/ or body meridian/ or acupuncture point/ or trigger point/
42.	(acupuncture* or electroacupuncture* or acupoint* or meridian* or needling or acupress* or auriculotherap* or auriculoacupunct* or moxibust*).ti,ab,kw.
43.	Injections, Intra-Articular/
44.	injection*.ti,ab,kf.
45.	orthosis/
46.	splint/
47.	(support* or tape* or sling* or brace* or device* or splint*).ti,ab,kf.
48.	(orthot* or orthos*).ti,ab,kf.
49.	nerve block*.ti,ab,kf.
50.	(local anaesthetic* or local anesthetic*).ti,ab,kf.
51.	or/32-50
52.	31 and 51
53.	random*.ti,ab.

54.	factorial*.ti,ab.
55.	(crossover* or cross over*).ti,ab.
56.	((doubl* or singl*) adj blind*).ti,ab.
57.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
58.	crossover procedure/
59.	single blind procedure/
60.	randomized controlled trial/
61.	double blind procedure/
62.	or/53-61
63.	systematic review/
64.	meta-analysis/
65.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
66.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
67.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
68.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
69.	(search* adj4 literature).ab.
70.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
71.	cochrane.jw.
72.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
73.	Or/63-72
74.	52 and (62 or 73)

Cochrane Library (Wiley) search terms

#1.	MeSH descriptor: [Stroke] explode all trees
#2.	MeSH descriptor: [Stroke Rehabilitation] explode all trees
#3.	MeSH descriptor: [Cerebral Hemorrhage] explode all trees
#4.	(stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident"):ti,ab
#5.	((cerebro* or brain or brainstem or cerebral*) near/3 (infarct* or accident*)):ti,ab
#6.	brain attack*:ti,ab
#7.	(or #1-#6)
#8.	conference:pt or (clinicaltrials or trialsearch):so
#9.	#7 not #8
#10.	MeSH descriptor: [Shoulder] explode all trees
#11.	MeSH descriptor: [Shoulder Pain] explode all trees
#12.	MeSH descriptor: [Shoulder Joint] explode all trees
#13.	MeSH descriptor: [Shoulder Dislocation] explode all trees
#14.	MeSH descriptor: [Rotator Cuff] explode all trees
#15.	MeSH descriptor: [Arm] explode all trees
#16.	MeSH descriptor: [Upper Extremity] explode all trees
#17.	(upper limb* or upper extremit* or upper body or arm or arms or shoulder or shoulders or rotator cuff* or glenohumeral or humeroscapular or scapulohumeral or scapulo humeral):ti,ab
#18.	(or #10-#17)

#19.	#9 and #18
#20.	MeSH descriptor: [Electric Stimulation Therapy] explode all trees
#21.	MeSH descriptor: [Electric Stimulation] explode all trees
#22.	MeSH descriptor: [Transcutaneous Electric Nerve Stimulation] explode all trees
#23.	MeSH descriptor: [Transcranial Magnetic Stimulation] explode all trees
#24.	((function* or neuromuscul* or peripheral* or transcutan* or transcran* or electric* or transdermal or nerve* or percutaneous) near/4 stimulat*):ti,ab
#25.	((transcutan* or transcran* or electric* or analgesic) near/4 neurostimulat*):ti,ab
#26.	((transcutan* or transcran* or transdermal or analgesic) near/4 electrostimulat*):ti,ab
#27.	(electrotherap* or electroanalges*):ti,ab
#28.	(FES or TENS or NMES or FNS or TMS):ti,ab
#29.	MeSH descriptor: [Acupuncture] explode all trees
#30.	MeSH descriptor: [Acupuncture Therapy] explode all trees
#31.	MeSH descriptor: [Acupuncture Analgesia] explode all trees
#32.	MeSH descriptor: [Acupuncture, Ear] explode all trees
#33.	MeSH descriptor: [Acupuncture, Ear] explode all trees
#34.	MeSH descriptor: [Electroacupuncture] explode all trees
#35.	MeSH descriptor: [Meridians] explode all trees
#36.	MeSH descriptor: [Acupuncture Points] explode all trees
#37.	MeSH descriptor: [Trigger Points] explode all trees
#38.	(acupuncture* or electroacupuncture* or acupoint* or meridian* or needling or acupress* or auriculotherap* or auriculoacupunct* or moxibust*):ti,ab
#39.	MeSH descriptor: [Injections, Intra-Articular] explode all trees
#40.	injection*:ti,ab
#41.	MeSH descriptor: [Orthotic Devices] explode all trees
#42.	MeSH descriptor: [Splints] explode all trees
#43.	(support* or tape* or sling* or brace* or device* or splint*):ti,ab
#44.	(orthot* or orthos*):ti,ab
#45.	nerve block*:ti,ab
#46.	(local anaesthetic* or local anesthetic*):ti,ab
#47.	(or #20-#46)
#48.	#19 and #47

AMED search terms

1.	exp Stroke/
2.	exp Cerebral Hemorrhage/
3.	(stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident").ti,ab.
4.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab.
5.	"brain attack*".ti,ab.
6.	or/1-5
7.	case report/
8.	(letter or comment*).ti.
9.	or/7-8
10.	randomized controlled trials/ or random*.ti,ab.

11.	9 not 10
12.	animals/ not humans/
13.	(rat or rats or mouse or mice or rodent*).ti.
14.	or/11-13
15.	6 not 14
16.	shoulder/ or arm/ or shoulder joint/ or shoulder pain/ or rotator cuff/ or shoulder dislocation/
17.	(upper limb* or upper extremit* or upper body or arm or arms or shoulder or shoulders or rotator cuff* or glenohumeral or humeroscapular or scapulohumeral or scapulo humeral).ti,ab.
18.	16 or 17
19.	15 and 18
20.	electric stimulation/
21.	Transcutaneous Electric Nerve Stimulation/
22.	Transcranial Magnetic Stimulation/
23.	((function* or neuromuscul* or peripheral* or transcutan* or transcran* or electric* or transdermal or nerve* or percutaneous) adj4 stimulat*).ti,ab.
24.	((transcutan* or transcran* or electric* or analgesic) adj4 neurostimulat*).ti,ab.
25.	((transcutan* or transcran* or transdermal or analgesic) adj4 electrostimulat*).ti,ab.
26.	(electrotherap* or electroanalges*).ti,ab.
27.	(FES or TENS or NMES or FNS or TMS).ti,ab.
28.	acupuncture/ or acupuncture therapy/ or acupuncture analgesia/ or acupuncture, ear/ or electroacupuncture/ or meridians/ or acupuncture points/ or trigger points/
29.	(acupuncture* or electroacupuncture* or acupoint* or meridian* or needling or acupress* or auriculotherap* or auriculoacupunct* or moxibust*).ti,ab.
30.	injections/
31.	injection*.ti,ab.
32.	Orthotic devices/
33.	Splints/
34.	(support* or tape* or sling* or brace* or device* or splint*).ti,ab.
35.	(orthot* or orthos*).ti,ab.
36.	nerve block*.ti,ab.
37.	(local anaesthetic* or local anesthetic*).ti,ab.
38.	or/20-37
39.	19 and 38

B.2 Health Economics literature search strategy

Health economic evidence was identified by conducting searches using terms for a broad Stroke Rehabilitation population. The following databases were searched: NHS Economic Evaluation Database (NHS EED - this ceased to be updated after 31st March 2015), Health Technology Assessment database (HTA - this ceased to be updated from 31st March 2018) and The International Network of Agencies for Health Technology Assessment (INAHTA). Searches for recent evidence were run on Medline and Embase from 2014 onwards for health economics, and all years for quality-of-life studies. Additional searches were run in CINAHL and PsycInfo looking for health economic evidence.

Table 2: Database parameters, filters and limits applied

Database	Dates searched	Search filters and limits applied
Medline (OVID)	Health Economics 1 January 2014 – 08 January 2023	Health economics studies Quality of life studies Exclusions (animal studies, letters, comments, editorials, case studies/reports,) English language
	Quality of Life 1946 – 08 January 2023	
Embase (OVID)	Health Economics 1 January 2014 – 08 January 2023	Health economics studies Quality of life studies Exclusions (animal studies, letters, comments, editorials, case studies/reports, conference abstracts) English language
	Quality of Life 1974 – 08 January 2023	
NHS Economic Evaluation Database (NHS EED) (Centre for Research and Dissemination - CRD)	Inception –31st March 2015	
Health Technology Assessment Database (HTA) (Centre for Research and Dissemination – CRD)	Inception – 31st March 2018	
The International Network of Agencies for Health Technology Assessment (INAHTA)	Inception - 08 January 2023	English language
PsycINFO (OVID)	1 January 2014 – 08 January 2023	Health economics studies Exclusions (animal studies, letters, case reports) Human English language
Current Nursing and Allied Health Literature - CINAHL (EBSCO)	1 January 2014 – 08 January 2023	Health economics studies Exclusions (Medline records, animal studies, letters, editorials, comments, theses) Human English language

Medline (Ovid) search terms

1.	exp Stroke/
2.	exp Cerebral Hemorrhage/
3.	(stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident").ti,ab.
4.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab.
5.	"brain attack*".ti,ab.
6.	or/1-5
7.	letter/
8.	editorial/
9.	news/
10.	exp historical article/
11.	Anecdotes as Topic/
12.	comment/
13.	case report/
14.	(letter or comment*).ti.
15.	or/7-14
16.	randomized controlled trial/ or random*.ti,ab.
17.	15 not 16
18.	animals/ not humans/
19.	exp Animals, Laboratory/
20.	exp Animal Experimentation/
21.	exp Models, Animal/
22.	exp Rodentia/
23.	(rat or rats or mouse or mice or rodent*).ti.
24.	or/17-23
25.	6 not 24
26.	Economics/
27.	Value of life/
28.	exp "Costs and Cost Analysis"/
29.	exp Economics, Hospital/
30.	exp Economics, Medical/
31.	Economics, Nursing/
32.	Economics, Pharmaceutical/
33.	exp "Fees and Charges"/
34.	exp Budgets/
35.	budget*.ti,ab.
36.	cost*.ti.
37.	(economic* or pharmaco?economic*).ti.
38.	(price* or pricing*).ti,ab.

39.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
40.	(financ* or fee or fees).ti,ab.
41.	(value adj2 (money or monetary)).ti,ab.
42.	or/26-41
43.	quality-adjusted life years/
44.	sickness impact profile/
45.	(quality adj2 (wellbeing or well being)).ti,ab.
46.	sickness impact profile.ti,ab.
47.	disability adjusted life.ti,ab.
48.	(qal* or qtime* or qwb* or daly*).ti,ab.
49.	(euroqol* or eq5d* or eq 5*).ti,ab.
50.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
51.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
52.	(hui or hui1 or hui2 or hui3).ti,ab.
53.	(health* year* equivalent* or hye or hyes).ti,ab.
54.	discrete choice*.ti,ab.
55.	rosser.ti,ab.
56.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
57.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
58.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
59.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
60.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
61.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
62.	or/43-61
63.	25 and 42
64.	25 and 62
65.	limit 63 to English language
66.	limit 64 to English language

Embase (Ovid) search terms

1.	exp Cerebrovascular accident/
2.	exp Brain infarction/
3.	(stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident").ti,ab.
4.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab.
5.	"brain attack*".ti,ab.
6.	Intracerebral hemorrhage/
7.	or/1-6
8.	letter.pt. or letter/
9.	note.pt.

10.	editorial.pt.
11.	case report/ or case study/
12.	(letter or comment*).ti.
13.	or/8-12
14.	randomized controlled trial/ or random*.ti,ab.
15.	13 not 14
16.	animal/ not human/
17.	nonhuman/
18.	exp Animal Experiment/
19.	exp Experimental Animal/
20.	animal model/
21.	exp Rodent/
22.	(rat or rats or mouse or mice).ti.
23.	or/15-22
24.	7 not 23
25.	health economics/
26.	exp economic evaluation/
27.	exp health care cost/
28.	exp fee/
29.	budget/
30.	funding/
31.	budget*.ti,ab.
32.	cost*.ti.
33.	(economic* or pharmaco?economic*).ti.
34.	(price* or pricing*).ti,ab.
35.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
36.	(financ* or fee or fees).ti,ab.
37.	(value adj2 (money or monetary)).ti,ab.
38.	or/25-37
39.	quality adjusted life year/
40.	"quality of life index"/
41.	short form 12/ or short form 20/ or short form 36/ or short form 8/
42.	sickness impact profile/
43.	(quality adj2 (wellbeing or well being)).ti,ab.
44.	sickness impact profile.ti,ab.
45.	disability adjusted life.ti,ab.
46.	(qal* or qtime* or qwb* or daly*).ti,ab.
47.	(euroqol* or eq5d* or eq 5*).ti,ab.
48.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
49.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
50.	(hui or hui1 or hui2 or hui3).ti,ab.

51.	(health* year* equivalent* or hye or hyes).ti,ab.
52.	discrete choice*.ti,ab.
53.	rosser.ti,ab.
54.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
55.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
56.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
57.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
58.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
59.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
60.	or/39-59
61.	limit 24 to English language
62.	38 and 61
63.	60 and 61

NHS EED and HTA (CRD) search terms

#1.	MeSH DESCRIPTOR Stroke EXPLODE ALL TREES
#2.	MeSH DESCRIPTOR Cerebral Hemorrhage EXPLODE ALL TREES
#3.	(stroke* or cva or poststroke* or apoplexy or "cerebrovascular accident")
#4.	(((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)))
#5.	("brain attack*")
#6.	#1 OR #2 OR #3 OR #4 OR #5

INAHTA search terms

1.	(brain attack*) OR (((cerebro* or brain or brainstem or cerebral*) and (infarct* or accident*))) OR ((stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident")) OR ("Cerebral Hemorrhage"[mhe]) OR ("Stroke"[mhe])

CINAHL search terms

1.	MH "Economics+"
2.	MH "Financial Management+"
3.	MH "Financial Support+"
4.	MH "Financing, Organized+"
5.	MH "Business+"
6.	S2 OR S3 or S4 OR S5
7.	S1 not S6
8.	MH "Health Resource Allocation"
9.	MH "Health Resource Utilization"
10.	S8 OR S9
11.	S7 OR S10
12.	(cost or costs or economic* or pharmacoeconomic* or price* or pricing*) OR AB (cost or costs or economic* or pharmacoeconomic* or price* or pricing*)
13.	S11 OR S12
14.	PT editorial
15.	PT letter
16.	PT commentary

17.	S14 or S15 or S16
18.	S13 NOT S17
19.	MH "Animal Studies"
20.	(ZT "doctoral dissertation") or (ZT "masters thesis")
21.	S18 NOT (S19 OR S20)
22.	PY 2014-
23.	S21 AND S22
24.	MW Stroke or MH Cerebral Hemorrhage
25.	stroke* or cva or poststroke* or apoplexy or "cerebrovascular accident"
26.	(cerebro* OR brain OR brainstem OR cerebral*) AND (infarct* OR accident*)
27.	"brain attack*"
28.	S24 OR S25 OR S26 OR S27
29.	S23 AND S28

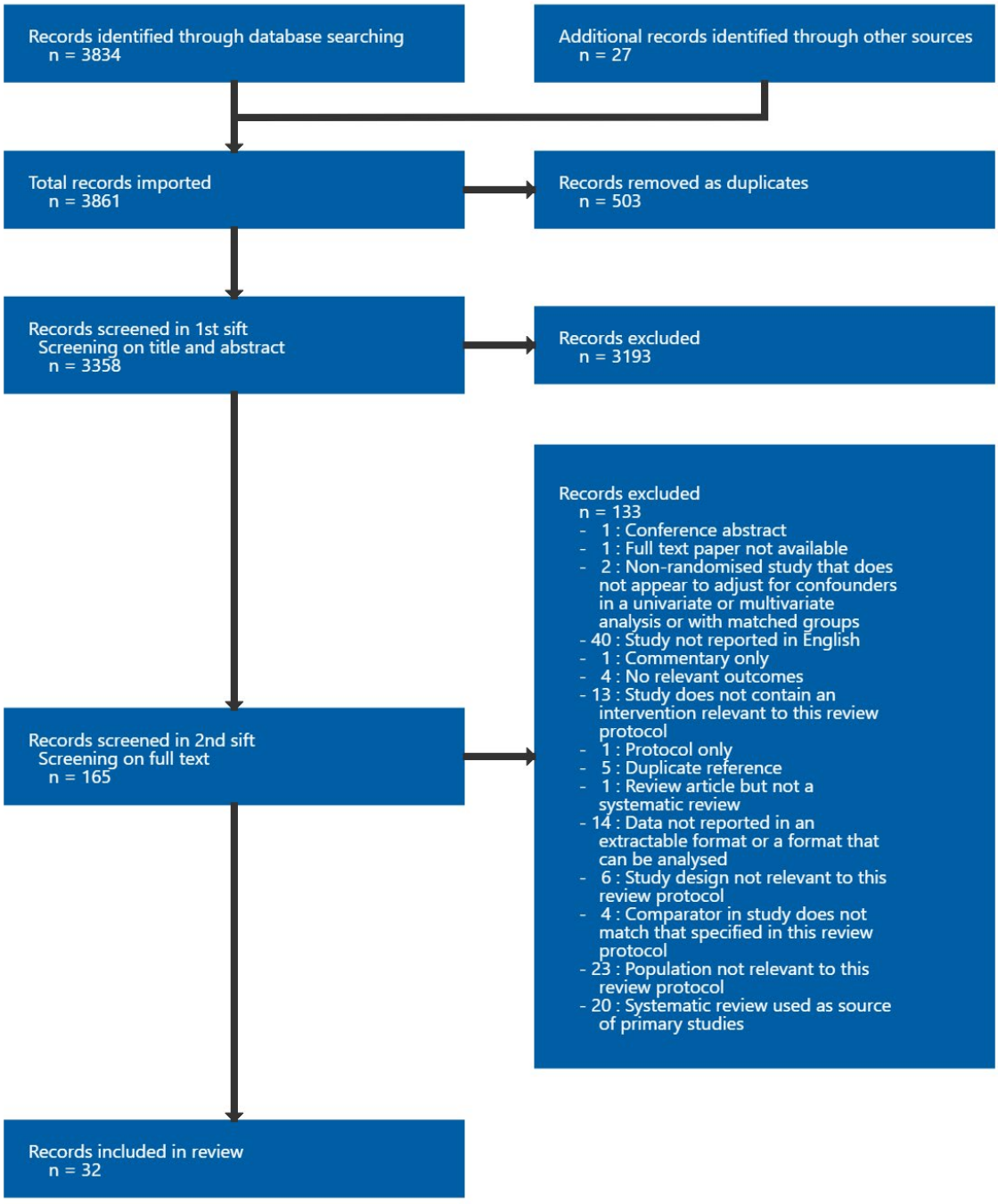
PsycINFO search terms

1.	exp Stroke/
2.	exp Cerebral hemorrhage/
3.	(stroke or strokes or cva or poststroke* or apoplexy or "cerebrovascular accident").ti,ab.
4.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab.
5.	"brain attack*".ti,ab.
6.	Cerebrovascular accidents/
7.	exp Brain damage/
8.	(brain adj2 injur*).ti.
9.	or/1-8
10.	Letter/
11.	Case report/
12.	exp Rodents/
13.	or/10-12
14.	9 not 13
15.	limit 14 to (human and english language)
16.	First posting.ps.
17.	15 and 16
18.	15 or 17
19	"costs and cost analysis"/
20.	"Cost Containment"/
21.	(economic adj2 evaluation$).ti,ab.
22.	(economic adj2 analy$).ti,ab.
23.	(economic adj2 (study or studies)).ti,ab.
24.	(cost adj2 evaluation$).ti,ab.
25.	(cost adj2 analy$).ti,ab.
26.	(cost adj2 (study or studies)).ti,ab.

27.	(cost adj2 effective$).ti,ab.
28.	(cost adj2 benefit$).ti,ab.
29.	(cost adj2 utili$).ti,ab.
30.	(cost adj2 minimi$).ti,ab.
31.	(cost adj2 consequence$).ti,ab.
32.	(cost adj2 comparison$).ti,ab.
33.	(cost adj2 identificat$).ti,ab.
34.	(pharmacoeconomic$ or pharmaco-economic$).ti,ab.
35.	or/19-34
36.	(0003-4819 or 0003-9926 or 0959-8146 or 0098-7484 or 0140-6736 or 0028-4793 or 1469-493X).is.
37.	35 not 36
38.	18 and 37

Appendix C – Effectiveness evidence study selection

Figure 1: Flow chart of clinical study selection for the review of management of shoulder pain after stroke



Appendix D – Effectiveness evidence

Adey-Wakeling, 2013

Bibliographic Reference	Adey-Wakeling, Z.; Crotty, M.; Shanahan, E. M.; Suprascapular nerve block for shoulder pain in the first year after stroke: a randomized controlled trial; Stroke; 2013; vol. 44 (no. 11); 3136-41

Study details

Secondary publication of another included study- see primary study for details	No additional information
Other publications associated with this study included in review	Allen, Z. A.; Shanahan, E. M.; Crotty, M. (2010) Does suprascapular nerve block reduce shoulder pain following stroke: a double-blind randomised controlled trial with masked outcome assessment. BMC Neurology 10: 83
Trial name / registration number	ACTRN12609000621213
Study type	Randomised controlled trial (RCT)
Study location	Australia
Study setting	Acute stroke and rehabilitation wards across Adelaide, South Australia
Study dates	2009 to 2012
Sources of funding	This study was supported by a grant from Foundation Daw Park, Research Management Committee, Repatriation General Hospital.

Inclusion criteria	Aged >18 years with a diagnosis of acute stroke within the previous 12 months; to report hemiplegic shoulder pain with a minimum VAS of 30mm (100mm scale). Minimum pain score was selected in the clinical context that invasive interventions are not routine for mild pain.
Exclusion criteria	Significant cognitive impairment (Mini-Mental State Examination <23) or language deficits (inability to follow 2-stage command, limited English) that might affect the reliability of responses to the outcome measure scales; hypersensitivity to injection agents; palliative patients.
Recruitment / selection of participants	People were recruited after education sessions and provision of brochures to each of the six facilities involved in the trial.
Intervention(s)	Nerve blocks (suprascapular nerve block) N=32 Suprascapular nerve block. Injected with a 10mL syringe and a 21-gauge 38-mm needle. 1mL of 40 mg/mL methylprednisolone and 10mL 0.5% bupivacaine hydrochloride. Anatomic landmarks were used to determine injection site into the supraspinous fossa. The needle was introduced parallel to the scapula blade and the syringe content slowly injected into the enclosed space of the supraspinous fossa. Concomitant therapy: All people received a 2mL subcutaneous infiltration of 1% lidocaine before injection.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)

Population subgroups	No additional information.
Comparator	Placebo N=32 Injection of 5mL normal saline infiltrated subcutaneously to the same region as the nerve block. Concomitant therapy: All people received a 2mL subcutaneous infiltration of 1% lidocaine before injection.
Number of participants	64
Duration of follow-up	12 weeks after injection
Indirectness	No additional information.
Additional comments	Intention to treat analysis.

Study arms

Nerve blocks (local anaesthetic) (suprascapular nerve block) (N = 32)
Suprascapular nerve block. Injected with a 10mL syringe and a 21-gauge 38-mm needle. 1mL of 40 mg/mL methylprednisolone and 10mL 0.5% bupivacaine hydrochloride. Anatomic landmarks were used to determine injection site into the supraspinous fossa. The needle was introduced parallel to the scapula blade and the syringe content slowly injected into the enclosed space of the supraspinous fossa. Concomitant therapy: All people received a 2mL subcutaneous infiltration of 1% lidocaine before injection.

Placebo/sham (N = 32)
Injection of 5mL normal saline infiltrated subcutaneously to the same region as the nerve block. Concomitant therapy: All people received a 2mL subcutaneous infiltration of 1% lidocaine before injection.

Characteristics

Arm-level characteristics

Characteristic	Nerve blocks (local anaesthetic) (suprascapular nerve block) (N = 32)	Placebo/sham (N = 32)
% Female Sample size	n = 11 ; % = 34	n = 17 ; % = 53
Mean age (SD) (years) Sample size	n = NA ; % = NA	n = NA ; % = NA
0-65 years Sample size	n = 15 ; % = 46.9	n = 16 ; % = 50
66-79 years Sample size	n = 19 ; % = 28.1	n = 13 ; % = 40.6
>80 years Sample size	n = 8 ; % = 25	n = 3 ; % = 9.4
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Weeks) Mean (SD)	13 (9)	11 (8)

Outcomes

Study timepoints

- Baseline
- 12 week (<6 months)

Continuous outcome

Outcome	Nerve blocks (local anaesthetic) (suprascapular nerve block), Baseline, N = 32	Nerve blocks (local anaesthetic) (suprascapular nerve block), 12 week, N = 32	Placebo/sham, Baseline, N = 32	Placebo/sham, 12 week, N = 32
Pain (Visual analogue scale) Scale range: 0-100. Final values. Mean (95% CI)	68.91 (62.25 to 75.56)	28.14 (17.81 to 38.46)	73.03 (66.1 to 79.99)	46.2 (34.63 to 57.78)

Pain (Visual analogue scale) - Polarity - Lower values are better

Dichotomous outcome

Outcome	Nerve blocks (local anaesthetic) (suprascapular nerve block), Baseline, N = 32	Nerve blocks (local anaesthetic) (suprascapular nerve block), 12 week, N = 32	Placebo/sham, Baseline, N = 32	Placebo/sham, 12 week, N = 32
Withdrawal due to adverse events Does not state that any cases withdrew for adverse events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Outcome	Nerve blocks (local anaesthetic) (suprascapular nerve block), Baseline, N = 32	Nerve blocks (local anaesthetic) (suprascapular nerve block), 12 week, N = 32	Placebo/sham, Baseline, N = 32	Placebo/sham, 12 week, N = 32
No of events				

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(Visualanaloguescale)-MeanNineFivePercentCI-Nerve blocks (suprascapular nerve block)-Placebo-t12

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Low
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Nerve blocks (suprascapular nerve block)-Placebo-t12

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Low
Overall bias and Directness	Overall Directness	Directly applicable

Allen, 2010

Bibliographic Reference	Allen, Z. A.; Shanahan, E. M.; Crotty, M.; Does suprascapular nerve block reduce shoulder pain following stroke: a double-blind randomised controlled trial with masked outcome assessment; BMC Neurology; 2010; vol. 10; 83

Study details

Secondary publication of another included study- see primary study for details	Adey-Wakeling, Z.; Crotty, M.; Shanahan, E. M. (2013) Suprascapular nerve block for shoulder pain in the first year after stroke: a randomized controlled trial. Stroke 44(11): 3136-41
Other publications associated with this study included in review	No additional information.

Chae, 2007

Bibliographic Reference	Chae, J.; Ng, A.; Yu, D. T.; Kirsteins, A.; Elovic, E. P.; Flanagan, S. R.; Harvey, R. L.; Zorowitz, R. D.; Fang, Z. P.; Intramuscular electrical stimulation for shoulder pain in hemiplegia: does time from stroke onset predict treatment success?; Neurorehabilitation & Neural Repair; 2007; vol. 21 (no. 6); 561-7

Study details

Secondary publication of	Chae, J., Yu, D. T., Walker, M. E. et al. (2005) Intramuscular electrical stimulation for hemiplegic shoulder pain: a 12-month follow-up of a multiple-center, randomized clinical trial. American Journal of Physical Medicine & Rehabilitation 84(11): 832-42

another included study- see primary study for details	
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	United States of America
Study setting	Outpatient follow up
Sources of funding	This work was supported in part by grants R44HD34996 and K12HD01097 from the National Institute for Child Health and Human Development, grant M01RR0080 from the National Center for Research Resources and by NeuroControl Corporation, North Ridgeville, Ohio.
Inclusion criteria	People were greater than 12 weeks poststroke (haemorrhage or nonhaemorrhagic) and at least 18 years of age; shoulder pain graded as at least 2 on BPI 12; at least 1/2 fingerbreadth of inferior glenohumeral separation by palpation with the affected limb in a dependent position without manual traction; cognitive ability to fulfill study requirements (able to recall 3 objects after 30 minutes and use an NRS).
Exclusion criteria	History of arrhythmia with haemodynamic instability; recurrent stroke with persistent neurologic deficit from a previous stroke; prestroke shoulder pathology; complex regional pain syndrome; any implantable stimulator; uncontrolled seizures (>1 per month).
Recruitment / selection of participants	No additional information.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=32

	Percutaneous intramuscular electrodes into the upper trapezius, supraspinatus, middle deltoid and posterior deltoid via a minimally invasive procedure under local anaesthesia. After 1 week of electrode stabilisation, the electrical stimulation group received 6 hours of stimulation per day for 6 weeks. Concomitant therapy: No additional information.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Mixed Some subacute, some chronic
Population subgroups	No additional information.
Comparator	Devices - slings (hemisling) N=29 Hemisling with instructions to wear the sling for at least 6 hours per day for 6 weeks. Concomitant therapy: No additional information.
Number of participants	61

Duration of follow-up	End of trial, 3 months, 6 months and 12 months (the 3 months and 12 months time points will be extracted)
Indirectness	No additional information.
Additional comments	Intention to treat analysis.

Study arms

Neuromuscular electrical stimulation (NMES) (N = 32)
Percutaneous intramuscular electrodes into the upper trapezius, supraspinatus, middle deltoid and posterior deltoid via a minimally invasive procedure under local anaesthesia. After 1 week of electrode stabilisation, the electrical stimulation group received 6 hours of stimulation per day for 6 weeks. Concomitant therapy: No additional information.

Devices - slings (hemisling) (N = 29)
Hemisling with instructions to wear the sling for at least 6 hours per day for 6 weeks. Concomitant therapy: No additional information.

Characteristics

Arm-level characteristics

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 32)	Devices - slings (hemisling) (N = 29)
% Female Sample size	n = 14 ; % = 44	n = 13 ; % = 45
Mean age (SD) (years) Mean (SD)	59.4 (11.8)	57.3 (12.9)

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 32)	Devices - slings (hemisling) (N = 29)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Weeks) Mean (SD)	123.4 (161.8)	131.3 (169.9)

Outcomes

Study timepoints

- Baseline
- 3 month (<6 months)
- 12 month (≥6 months)

Continuous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 32	Neuromuscular electrical stimulation (NMES), 3 month, N = 32	Neuromuscular electrical stimulation (NMES), 12 month, N = 32	Devices - slings (hemisling), Baseline, N = 29	Devices - slings (hemisling), 3 month, N = 29	Devices - slings (hemisling), 12 month, N = 29
Pain (BPI 12 scores) Scale range: 0-10. Change scores. Values	7.6 (2.1)	-4.5 (2.2)	-5 (1.9)	6.5 (2.3)	-0.67 (0.68)	-2.4 (2.5)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 32	Neuromuscular electrical stimulation (NMES), 3 month, N = 32	Neuromuscular electrical stimulation (NMES), 12 month, N = 32	Devices - slings (hemisling), Baseline, N = 29	Devices - slings (hemisling), 3 month, N = 29	Devices - slings (hemisling), 12 month, N = 29
are reported into early treatment and late treatment groups which are recombined for this analysis. Mean (SD)						

Pain (BPI 12 scores) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(BPI12scores)-MeanSD-Neuromuscular electrical stimulation (NMES)-Devices - slings (hemisling)-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Chae, 2005

Bibliographic Reference	Chae, J.; Yu, D. T.; Walker, M. E.; Kirsteins, A.; Elovic, E. P.; Flanagan, S. R.; Harvey, R. L.; Zorowitz, R. D.; Frost, F. S.; Grill, J. H.; Fang, Z. P.; Intramuscular electrical stimulation for hemiplegic shoulder pain: a 12-month follow-up of a multiple-center, randomized clinical trial; American Journal of Physical Medicine & Rehabilitation; 2005; vol. 84 (no. 11); 832-42

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	Chae, J., Ng, A., Yu, D. T. et al. (2007) Intramuscular electrical stimulation for shoulder pain in hemiplegia: does time from stroke onset predict treatment success?. Neurorehabilitation & Neural Repair 21(6): 561-7 Yu, D. T., Chae, J., Walker, M. E. et al. (2004) Intramuscular neuromuscular electric stimulation for poststroke shoulder pain: a multicenter randomized clinical trial. Archives of Physical Medicine & Rehabilitation 85(5): 695-704
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	United States of America
Study setting	Outpatient follow up
Study dates	No additional information.
Sources of funding	Supported in part by grants R44HD34996 and K12HD01097 from the National Institute for Child Health and Human Development, grant M01RR0080 from the National Center for Research Resource, and by NeuroControl Corporation, Valley View, Ohio.

Inclusion criteria	People >12 weeks poststroke (haemorrhagic or nonhaemorrhagic) and at least 18 years of age; shoulder pain rated as at least 2 on the 11-point numeric rating scale of the Brief Pain Inventory question 12; have at least on-half finger breadth of inferior glenohumeral separation by palpation with the affected limb in a dependent position without manual traction, and possess the cognitive ability to fulfil study requirements (able to recall three objects after 30 minutes and use of an NRS)
Exclusion criteria	History of arrhythmia with haemodynamic instability; previous stroke with persistent neurologic deficit; prestroke shoulder pathology; complex regional pain syndrome; any implantable stimulator; uncontrolled seizures (>1 per month for 1 year).
Recruitment / selection of participants	People were recruited from stroke rehabilitation outpatient clinics of seven academic medical centers in the United States.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=32 Intramuscular electrical stimulation to the supraspinatus, posterior deltoid, middle deltoid and upper trapezius for 6 hours/day for 6 weeks. All treatment sessions were carried out in the person's home. Concomitant therapy: All people continued to receive concomitant treatments, including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians. Subjects in both groups were allowed to use their hemiparetic arm for activities of daily living during the treatment period.
Sensitivity analysis - Background rate of oral drug use	Mixed population
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Chronic (>6 months)

Population subgroups	No additional information.
Comparator	Devices - slings (hemisling) N=29 Given a cuff-type hemisling with instructions to use the sling whenever the upper limb was unsupported. Concomitant therapy: All people continued to receive concomitant treatments, including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians. Subjects in both groups were allowed to use their hemiparetic arm for activities of daily living during the treatment period.
Number of participants	61
Duration of follow-up	18 weeks (3 months after end of treatment), 12 months (these two time periods will be extracted, also extracted at 6 weeks and 6 months).
Indirectness	No additional information.
Additional comments	Intention to treat and per protocol.

Study arms

Neuromuscular electrical stimulation (NMES) (N = 32)
Intramuscular electrical stimulation to the supraspinatus, posterior deltoid, middle deltoid and upper trapezius for 6 hours/day for 6 weeks. All treatment sessions were carried out in the person's home. Concomitant therapy: All people continued to receive concomitant treatments, including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians. Subjects in both groups were allowed to use their hemiparetic arm for activities of daily living during the treatment period.

Devices - slings (hemisling) (N = 29)
Given a cuff-type hemisling with instructions to use the sling whenever the upper limb was unsupported. Concomitant therapy: All people continued to receive concomitant treatments, including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians. Subjects in both groups were allowed to use their hemiparetic arm for activities of daily living during the treatment period.

Characteristics

Arm-level characteristics

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 32)	Devices - slings (hemisling) (N = 29)
% Female Sample size	n = 14 ; % = 42.4	n = 12 ; % = 42.9
Mean age (SD) (years) Mean (SD)	60 (11.4)	58 (12.9)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Weeks) Mean (SD)	123 (157)	135 (171)

Outcomes

Study timepoints

- Baseline
- 18 week (<6 months)
- 12 month (≥6 months)

Continuous outcome

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 32	Neuromuscular electrical stimulation (NMES), 18 week, N = 32	Neuromuscular electrical stimulation (NMES), 12 month, N = 32	Devices - slings (hemisling), Baseline, N = 29	Devices - slings (hemisling), 18 week, N = 29	Devices - slings (hemisling), 12 month, N = 29
Pain (brief pain inventory question 12/numeric rating scale) Scale range: 0-10. Change scores. Mean (SD)	7.59 (2.12)	-4.44 (3.68)	-5 (3.3)	6.52 (2.29)	-0.68 (1.85)	-2.31 (3.21)

Pain (brief pain inventory question 12/numeric rating scale) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(briefpaininventoryquestion12/numericratingscale)-MeanSD-Neuromuscular electrical stimulation (NMES)-Devices - slings (hemisling)-t18

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcome-Pain(briefpaininventoryquestion12/numericratingscale)-MeanSD-Neuromuscular electrical stimulation (NMES)-Devices - slings (hemisling)-t12

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Chuang, 2017

Bibliographic Reference	Chuang, L. L.; Chen, Y. L.; Chen, C. C.; Li, Y. C.; Wong, A. M.; Hsu, A. L.; Chang, Y. J.; Effect of EMG-triggered neuromuscular electrical stimulation with bilateral arm training on hemiplegic shoulder pain and arm function after stroke: a randomized controlled trial; Journal of Neuroengineering & Rehabilitation; 2017; vol. 14 (no. 1); 122

Study details

Secondary publication of	No additional information.

another included study- see primary study for details	
Other publications associated with this study included in review	No additional information.
Trial name / registration number	Clinicaltrials.gov = NCT01913509
Study type	Randomised controlled trial (RCT)
Study location	Taiwan
Study setting	Outpatient follow up from two medical centers, Mackay Memorial Hospital and Chang Gung Memorial Hospital.
Study dates	No additional information.
Sources of funding	This work was partially supported by the Ministry of Science and Technology (MOST-102-2314-B-182-003, 104–2314-B-182-035-MY3, and 104–2314-B-182- 007-MY3) and the Healthy Aging Research Center at Chang Gung University (EMRPD1E1711), and the Chang Gung Memorial Hospital (CMRPD3E0331, CMRPD1G0041, and CMRPD3E113) in Taiwan.
Inclusion criteria	First ever stroke with onset >3 months prior at time of recruitment; at least mild intensity of hemiplegic shoulder pain with activity in the past 7 days (Numerical Rating Scale score at least 1); no other neurological disorders, such as Parkinson's disease, epilepsy, multiple sclerosis etc.; adequate cognitive ability (Mini-Mental State Examination score at least 24).
Exclusion criteria	Contraindications for electrical stimulation (e.g. metal implants, cardiac pacemakers); pre-existing pathology of the shoulder, such as rotator cuff injury or tendonitis, frozen shoulder etc.; participation in any experimental rehabilitation or drug studies during the study period; change of pain medication during the study period; treatment of upper limb spasticity, including botulinum toxin injection or neurolytic or surgical procedures; aphasia; severe cognitive deficits.
Recruitment / selection of participants	People were recruited from two medical centers - Mackay Memorial Hospital and Chang Gung Memorial Hospital.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=19

	EMG-trigger neuromuscular electrical stimulation delivered in 12 sessions over a time period of 3 days/week for 4 weeks. Trigger mode was used to start the low frequency output when EMG feedback was detected. Electrodes were attached to the target muscles (i.e. supraspinatus and posterior deltoid). The gain dial was gradually increased. After a certain duration the voltage was turned down to return to a resting state. The stimulation frequency was 30Hz. The range of intensities used was 3-5 out of 10. The contraction-relaxation ratio was adjusted progressively from 10/10s to 30/10s. Concomitant therapy: All people received 20 minutes of bilateral arm training, including bilateral arm raises, bilateral arm reaching forward, bilateral shoulder abduction, and bilateral shoulder horizontal abduction at pain-free range. The number of repetitions was based on the person's capability and gradually increased throughout the treatment sessions.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Chronic (>6 months)
Population subgroups	No additional information.
Comparator	Transcutaneous electrical nerve stimulation (TENS) N=19 TENS on the supraspinous fossa and posterior deltoid muscles of the painful shoulder, which was performed by a portable stimulator unit at a frequency of 30 Hz. TENS was applied using a similar treatment protocol, electrode placement and stimulation frequency as the experimental group. According to the instructions, the level of intensity was set from 1 through 5 at the highest comfortable setting but below the motor threshold, as the intensity setting varies individually. TENS was

	initiated at a higher level of stimulation and then gradually reduced to the maximum tolerable sensory level without muscle contraction. Concomitant therapy: All people received 20 minutes of bilateral arm training, including bilateral arm raises, bilateral arm reaching forward, bilateral shoulder abduction, and bilateral shoulder horizontal abduction at pain-free range. The number of repetitions was based on the person's capability and gradually increased throughout the treatment sessions.
Number of participants	38
Duration of follow-up	2 months (1 month post-intervention)
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Neuromuscular electrical stimulation (NMES) (N = 19)
EMG-trigger neuromuscular electrical stimulation delivered in 12 sessions over a time period of 3 days/week for 4 weeks. Trigger mode was used to start the low frequency output when EMG feedback was detected. Electrodes were attached to the target muscles (i.e. supraspinatus and posterior deltoid). The gain dial was gradually increased. After a certain duration the voltage was turned down to return to a resting state. The stimulation frequency was 30Hz. The range of intensities used was 3-5 out of 10. The contraction-relaxation ratio was adjusted progressively from 10/10s to 30/10s. Concomitant therapy: All people received 20 minutes of bilateral arm training, including bilateral arm raises, bilateral arm reaching forward, bilateral shoulder abduction, and bilateral shoulder horizontal abduction at pain-free range. The number of repetitions was based on the person's capability and gradually increased throughout the treatment sessions.

Transcutaneous electrical nerve stimulation (TENS) (N = 19)
TENS on the supraspinous fossa and posterior deltoid muscles of the painful shoulder, which was performed by a portable stimulator unit at a frequency of 30 Hz. TENS was applied using a similar treatment protocol, electrode placement and stimulation frequency as the experimental group. According to the instructions, the level of intensity was set from 1 through 5 at the highest comfortable setting but below the motor threshold, as the intensity setting varies individually. TENS was initiated at a higher level of stimulation and then gradually reduced to the maximum tolerable sensory level without muscle contraction. Concomitant therapy: All people received 20 minutes of bilateral arm training, including bilateral arm raises, bilateral arm reaching forward, bilateral shoulder abduction, and bilateral shoulder horizontal abduction at pain-free range. The number of repetitions was based on the person's capability and gradually increased throughout the treatment sessions.

Characteristics

Arm-level characteristics

Characteristic	**Neuromuscular electrical stimulation (NMES) (N = 19)**	**Transcutaneous electrical nerve stimulation (TENS) (N = 19)**
% Female Sample size	n = 6 ; % = 32	n = 7 ; % = 37
Mean age (SD) (years) Mean (SD)	58.89 (11.93)	62.61 (9.59)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 19)	Transcutaneous electrical nerve stimulation (TENS) (N = 19)
Time period after stroke (Months) Mean (SD)	31.89 (55.59)	33.47 (51.94)

Outcomes

Study timepoints

- Baseline
- 8 week (<6 months)

Continuous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 19	Neuromuscular electrical stimulation (NMES), 8 week, N = 19	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 19	Transcutaneous electrical nerve stimulation (TENS), 8 week, N = 19
Pain (NRS-FRS during shoulder active range of motion) Scale range: 0-10. Final values. Study also reports pain at rest and pain during passive range of motion. The most active parameter has been used. Mean (SD)	3.89 (3)	0.63 (0.83)	3.11 (2.16)	1.95 (1.84)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 19	Neuromuscular electrical stimulation (NMES), 8 week, N = 19	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 19	Transcutaneous electrical nerve stimulation (TENS), 8 week, N = 19
Physical function - upper limb (Fugl Meyer Assessment Upper Limb) Scale range: 0-66. Final values. Mean (SD)	41.68 (20.17)	46.05 (17.03)	45.37 (17.62)	46.68 (16.45)

Pain (NRS-FRS during shoulder active range of motion) - Polarity - Lower values are better
Physical function - upper limb (Fugl Meyer Assessment Upper Limb) - Polarity - Higher values are better

Dichotomous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 19	Neuromuscular electrical stimulation (NMES), 8 week, N = 19	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 19	Transcutaneous electrical nerve stimulation (TENS), 8 week, N = 19
Withdrawal due to adverse events No drop outs No of events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(NRS-FRSduringshoulderactiverangeofmotion)-MeanSD-Neuromuscular electrical stimulation (NMES)-Transcutaneous electrical nerve stimulation (TENS)-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessmentUpperLimb)-MeanSD-Neuromuscular electrical stimulation (NMES)-Transcutaneous electrical nerve stimulation (TENS)-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcomes-Withdrawalduetoadverseevents-NoOfEvents-Neuromuscular electrical stimulation (NMES)-Transcutaneous electrical nerve stimulation (TENS)-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

de Jong, 2013

Bibliographic Reference	de Jong, L. D.; Dijkstra, P. U.; Gerritsen, J.; Geurts, A. C.; Postema, K.; Combined arm stretch positioning and neuromuscular electrical stimulation during rehabilitation does not improve range of motion, shoulder pain or function in patients after stroke: a randomised trial; Journal of Physiotherapy; 2013; vol. 59 (no. 4); 245-54

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	NTR1748
Study type	Randomised controlled trial (RCT)
Study location	The Netherlands.
Study setting	Neurological units of three rehabilitation centers in the Netherlands.
Study dates	Between August 2008 and September 2010.
Sources of funding	This study was financially supported by Fonds NutsOhra (SNO-T-0702-72) and Stichting Beatrixoord Noord-Nederland.
Inclusion criteria	First-ever or recurrent stroke (except subarachnoid haemorrhages) between two and eight weeks poststroke; age >18 years; paralysis or severe paresis of the affected arm scoring 1-3 on the recovery stages of Brunnstrom; no planned date of discharge within four weeks.

Exclusion criteria	Contraindications for electrical stimulation (eg, metal implants, cardiac pacemakers); pre-existing impairments of the affected arm (pre-existing contracture was not an exclusion criterion); severe cognitive deficits and/or severe language comprehension difficulties, defined as <3/4 correct verbal responses and/or <3 correct visual graphic rating scale scores on the AbilityQ; moderate to good arm motor control (>18 points on the Fugl-Meyer Assessment arm score).
Recruitment / selection of participants	Consecutive newly admitted patients on the neurological units.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=24 Motor amplitude NMES for two 45-minute sessions a day, five days a week for eight weeks. Simultaneous four-channel motor amplitude NMES. Concomitant therapy: All people received arm stretch positioning combined with the interventions. All people received multidisciplinary stroke rehabilitation, ie. daily training in activities of daily living by rehabilitation nurses, occupational therapists, physiotherapists and speech therapists.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.

Comparator	Placebo/sham N=24 Sham arm positioning and transcutaneous electrical nerve stimulation for 90 minutes per day, five days per week for eight weeks. Concomitant therapy: All people received arm stretch positioning combined with the interventions. All people received multidisciplinary stroke rehabilitation, ie. daily training in activities of daily living by rehabilitation nurses, occupational therapists, physiotherapists and speech therapists.
Number of participants	48
Duration of follow-up	20 weeks (<6 months)
Indirectness	No additional information.
Additional comments	Intention to treat analysis.

Study arms

Neuromuscular electrical stimulation (NMES) (N = 24)
Motor amplitude NMES for two 45-minute sessions a day, five days a week for eight weeks. Simultaneous four-channel motor amplitude NMES. Concomitant therapy: All people received arm stretch positioning combined with the interventions. All people received multidisciplinary stroke rehabilitation, ie. daily training in activities of daily living by rehabilitation nurses, occupational therapists, physiotherapists and speech therapists.

Placebo/sham (N = 24)
Sham arm positioning and transcutaneous electrical nerve stimulation for 90 minutes per day, five days per week for eight weeks. Concomitant therapy: All people received arm stretch positioning combined with the interventions. All people received multidisciplinary

stroke rehabilitation, ie. daily training in activities of daily living by rehabilitation nurses, occupational therapists, physiotherapists and speech therapists.

Characteristics

Arm-level characteristics

Characteristic	**Neuromuscular electrical stimulation (NMES) (N = 24)**	**Placebo/sham (N = 24)**
% Female Sample size	n = 8 ; % = 35	n = 11 ; % = 48
Mean age (SD) (years) Mean (SD)	56.6 (14.2)	58.4 (9.6)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (days) Mean (SD)	43.7 (13.3)	43.3 (15.5)

Number of participants reported for baseline characteristics were 23 in both arms

Outcomes

Study timepoints

- Baseline
- 20 week (<6 months)

Continuous outcome (pain on movement)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 12	Neuromuscular electrical stimulation (NMES), 20 week, N = 7	Placebo/sham, Baseline, N = 5	Placebo/sham, 20 week, N = 7
Pain (Pain on movement, NRS) Scale range: 0-10. Final values. Values takes from the individual patient data provided in the supplementary appendix. Mean (SD)	4 (2)	6 (3)	4 (3)	4 (2)

Pain (Pain on movement, NRS) - Polarity - Lower values are better

Continuous outcomes (physical function - upper limb)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 24	Neuromuscular electrical stimulation (NMES), 20 week, N = 17	Placebo/sham, Baseline, N = 24	Placebo/sham, 20 week, N = 22
Physical function - upper limnb (Fugl Meyer Upper Extremity) Scale range: 0-66. Final values. Values takes from the individual patient data provided in the supplementary appendix. Mean (SD)	9.4 (8.3)	21.7 (16.1)	9.8 (7.9)	21.7 (16.1)

Physical function - upper limnb (Fugl Meyer Upper Extremity) - Polarity - Higher values are better

Dichotomous outcome

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 24	Neuromuscular electrical stimulation (NMES), 20 week, N = 24	Placebo/sham, Baseline, N = 24	Placebo/sham, 20 week, N = 24
Withdrawal due to adverse events Intervention: 2 due to shoulder pain, 1 death, 1 increased shoulder pain, 1 severe shoulder subluxation. Control: 1 readmission to hospital, 1 forearm pain, 2 recurrent stroke. No of events	n = NA ; % = NA	n = 5 ; % = 21	n = NA ; % = NA	n = 4 ; % = 17

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome(painonmovement)-Pain(Painonmovement,NRS)-MeanSD-Neuromuscular electrical stimulation (NMES)-Placebo/sham-t20

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes(physicalfunction-upperlimb)-Physicalfunction-upperlimnb(FuglMeyerUpperExtremity)-MeanSD-Neuromuscular electrical stimulation (NMES)-Placebo/sham-t20

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Neuromuscular electrical stimulation (NMES)-Placebo/sham-t20

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

DiLorenzo, 2004

Bibliographic Reference	DiLorenzo, L.; Traballesi, M.; Morelli, D.; Pompa, A.; Brunelli, S.; Buzzi, M. G.; Formisano, R.; Hemiparetic shoulder pain syndrome treated with deep dry needling during early rehabilitation: A prospective, open-label, randomized investigation; Journal of Musculoskeletal Pain; 2004; vol. 12 (no. 2); 25-34

Study details

Secondary publication of another included study- see primary study for details	No additional information.

Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Italy
Study setting	A rehabilitation hospital providing rehabilitation services for inpatients and outpatients.
Study dates	No additional information.
Sources of funding	No additional information.
Inclusion criteria	Sequential male and female, post-cerebrovascular accident subjects of all ages; diagnosis by CT scan within first week after onset of symptoms; between the fourth and eighth week of their post-cerebrovascular accident period and reported six of higher score on the baseline self-administered 10cm pain visual analogue scale to evaluate shoulder pain on the affected side.
Exclusion criteria	Suffering pain due to a central cerebrovascular accident caused by a lesion affecting the spinothalamic pathways in the brainstem with sensory deficit; primary depression; hemiparesis due to neurosurgical procedures, cerebral tumours, head injuries or congenital cerebral palsy; worsening of pre-existing internal derangement of shoulder ligaments or tendons, adhesive capsulitis, peripheral neuropathy, complex regional pain syndrome-type 1 or 2, shoulder fractures, "neglect" syndrome; the person elected not to participate.
Recruitment / selection of participants	People were recruited from those attending the clinic.
Intervention(s)	Acupuncture/dry needling N=54 Standard rehabilitation treatment plus deep dry needling. Dry needling in four sittings every five to seven days. Shoulder muscles were treated by insertion of needles into trigger points. In the muscles where such point was not detected, needles were inserted in the middle of its body. The muscles selected for treatment in the course of this study were: supraspinatus, infraspinatus, upper and lower trapezium, levator scapulae, rhomboids, teres major, subscapularis, latissimus dorsi, triceps,

	pectoralis, and middle, upper deltoid anterior. Needles were made of stainless steel and ranged in length from 2cm to 3cm. The selection was guided by the location of the point. The preferred size was 0.34-0.40mm. Longer and thicker needles were occasionally used in the supraspinous fossa. After deep insertion, the needles were left in-situ for about five minutes and occasionally were twirled vigorously to stimulate muscle proprioceptors. Concomitant therapy: Both groups received standard rehabilitation therapy.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Dry needling
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care/no treatment N=47 Standard rehabilitation therapy only. Concomitant therapy: Both groups received standard rehabilitation therapy.
Number of participants	101

Duration of follow-up	22 days (3 weeks)
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Acupuncture/dry needling (N = 54)
Standard rehabilitation treatment plus deep dry needling. Dry needling in four sittings every five to seven days. Shoulder muscles were treated by insertion of needles into trigger points. In the muscles where such point was not detected, needles were inserted in the middle of its body. The muscles selected for treatment in the course of this study were: supraspinatus, infraspinatus, upper and lower trapezium, levator scapulae, rhomboids, teres major, subscapularis, latissimus dorsi, triceps, pectoralis, and middle, upper deltoid anterior. Needles were made of stainless steel and ranged in length from 2cm to 3cm. The selection was guided by the location of the point. The preferred size was 0.34-0.40mm. Longer and thicker needles were occasionally used in the supraspinous fossa. After deep insertion, the needles were left in-situ for about five minutes and occasionally were twirled vigorously to stimulate muscle proprioceptors. Concomitant therapy: Both groups received standard rehabilitation therapy.

Usual care or no treatment (N = 47)
Standard rehabilitation therapy only. Concomitant therapy: Both groups received standard rehabilitation therapy.

Characteristics

Arm-level characteristics

Characteristic	Acupuncture/dry needling (N = 54)	Usual care or no treatment (N = 47)
% Female	n = 40 ; % = 74	n = 33 ; % = 70

Characteristic	Acupuncture/dry needling (N = 54)	Usual care or no treatment (N = 47)
Sample size		
Mean age (SD) (years) Mean (SD)	69.56 (6.21)	67.43 (9.05)
Ethnicity Sample size	n = NA ; % = NA	n = NA ; % = NA
Caucasian Sample size	n = 54 ; % = 100	n = 47 ; % = 100
Comorbidities Sample size	n = NA ; % = NA	n = NA ; % = NA
Time period after stroke (Weeks) Range	3 to 5	3 to 4
Time period after stroke (Weeks) Mean (SD)	3.5 (NR)	3.57 (NR)

Outcomes

Study timepoints

- Baseline
- 3 week (<6 months)

Continuous outcomes

Outcome	Acupuncture/dry needling, Baseline, N = 54	Acupuncture/dry needling, 3 week, N = 54	Usual care or no treatment, Baseline, N = 47	Usual care or no treatment, 3 week, N = 47
Pain (visual analog scale) Scale range: 0-10. Final values. Mean (SD)	7.93 (0.87)	3.15 (0.8)	8.02 (0.83)	4.96 (1.12)
Physical Function - upper limb (Rivermead Motricity Index Effectiveness) (%) Scale range: 0-100. Final values. Mean (SD)	NR (NR)	50.01 (15.38)	NR (NR)	47.54 (17.34)

Pain (visual analog scale) - Polarity - Lower values are better
Physical Function - upper limb (Rivermead Motricity Index Effectiveness) - Polarity - Higher values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(visualanalogscale)-MeanSD-Acupuncture/dry needling-Usual care/no treatment-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-PhysicalFunction-upperlimb(RivermeadMotricityIndexEffectiveness)-MeanSD-Acupuncture/dry needling-Usual care/no treatment-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Ersoy, 2022

Bibliographic Reference	Ersoy, S.; Paker, N.; Kesiktas, F.N.; Bugdayci, D.S.; Karakaya, E.; Cetin, M.; Comparison of transcutaneous electrical stimulation and suprascapular nerve blockage for the treatment of hemiplegic shoulder pain; Journal of back and musculoskeletal rehabilitation; 2022

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)

Study location	Turkey.
Study setting	Outpatients.
Study dates	No additional information.
Sources of funding	This study was not supported by any foundation.
Inclusion criteria	Age at least 18 years; stroke duration <12 months before the start of the study; hemiplegic shoulder pain duration of at least 3 months.
Exclusion criteria	People with an infected skin lesion in the shoulder; uncontrolled hypertension or diabetes mellitus; dementia (Mini Mental State Examination score <24); aphasia; dysphasia; cardiac pacemaker; a botulinum toxin injection in the shoulder adductor or internal rotators within the last 3 months; or an intra-articular steroid injection into the subacromial bursa or shoulder.
Recruitment / selection of participants	People in the stroke rehabilitation unit.
Intervention(s)	Nerve blocks (suprascapular nerve block) N=12 Ultrasound guided suprascapular nerve block administered as 1mL of 40mg/mL methylprednisolone with 8mL of 0.5% bupivicaine hydrochloride. Concomitant therapy: All people participated in a conventional rehabilitation program consisting of gentle range of motion exercises and Bobath and Proprioceptive Neuromuscular Facilitation exercises were completed during the entire period.
Sensitivity analysis - Background rate of oral drug use	No response criteria
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Not stated/unclear

Subgroup 3 - Time period after stroke	Not stated/unclear
Population subgroups	No additional information.
Comparator	Transcutaneous electrical nerve stimulation (TENS) N=13 Conventional TENS applied for 30 minutes, 5 times a week for 3 weeks for a total of 15 sessions. This consisted of a 100 Hz symmetrical waveform and a 300 microsecond wave duration, with the amplitude applied within the limits of the pain threshold that the person could tolerate (of 0-100mA) while taking into account the sensory threshold value of between 5 and 9mA. Concomitant therapy: All people participated in a conventional rehabilitation program consisting of gentle range of motion exercises and Bobath and Proprioceptive Neuromuscular Facilitation exercises were completed during the entire period.
Number of participants	25
Duration of follow-up	3 weeks
Indirectness	No additional information.
Additional comments	No additional information. Only completers were included in the analysis (1 person dropped out from the TENS group as they were diagnosed with COVID-19).

Study arms

Nerve blocks (suprascapular nerve block) (N = 12)
Ultrasound guided suprascapular nerve block administered as 1mL of 40mg/mL methylprednisolone with 8mL of 0.5% bupivicaine hydrochloride. Concomitant therapy: All people participated in a conventional rehabilitation program consisting of gentle range of motion exercises and Bobath and Proprioceptive Neuromuscular Facilitation exercises were completed during the entire period.

Transcutaneous electrical nerve stimulation (TENS) (N = 13)
Conventional TENS applied for 30 minutes, 5 times a week for 3 weeks for a total of 15 sessions. This consisted of a 100 Hz symmetrical waveform and a 300 microsecond wave duration, with the amplitude applied within the limits of the pain threshold that the person could tolerate (of 0-100mA) while taking into account the sensory threshold value of between 5 and 9mA. Concomitant therapy: All people participated in a conventional rehabilitation program consisting of gentle range of motion exercises and Bobath and Proprioceptive Neuromuscular Facilitation exercises were completed during the entire period.

Characteristics

Arm-level characteristics

Characteristic	**Nerve blocks (suprascapular nerve block) (N = 12)**	**Transcutaneous electrical nerve stimulation (TENS) (N = 13)**
% Female Sample size	n = 9 ; % = 75	n = 2 ; % = 16.7
Mean age (SD) (years) Mean (SD)	69.3 (8.5)	62.3 (11.2)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Not stated/unclear) Mean (SD)	11.6 (14.6)	9.5 (8)

Outcomes

Study timepoints

- Baseline
- 3 week (End of intervention, <6 months)

Continuous outcomes

Outcome	Nerve blocks (suprascapular nerve block), Baseline, N = 12	Nerve blocks (suprascapular nerve block), 3 week, N = 12	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 13	Transcutaneous electrical nerve stimulation (TENS), 3 week, N = 12
Pain (VAS) Scale range: 0-100. Change scores. Mean (SD)	72.1 (24.6)	-55.8 (24.9)	62.5 (26.7)	-30 (35.2)
Stroke-specific Patient-Reported Outcome Measures (SS-QOL) Scale range: 0-100. Change scores. Mean (SD)	28.6 (8.7)	5.3 (5)	27.4 (3.9)	2.1 (2.2)

Pain (VAS) - Polarity - Lower values are better
Stroke-specific Patient-Reported Outcome Measures (SS-QOL) - Polarity - Higher values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(VAS)-MeanSD-Nerve blocks (suprascapular nerve block)-Transcutaneous electrical nerve stimulation (TENS)-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Stroke-specificPatient-ReportedOutcomeMeasures(SS-QOL)-MeanSD-Nerve blocks (suprascapular nerve block)-Transcutaneous electrical nerve stimulation (TENS)-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Hartwig, 2012

Bibliographic Reference	Hartwig, M.; Gelbrich, G.; Griewing, B.; Functional orthosis in shoulder joint subluxation after ischaemic brain stroke to avoid post-hemiplegic shoulder-hand syndrome: a randomized clinical trial; Clinical Rehabilitation; 2012; vol. 26 (no. 9); 807-16

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	ISRCTN 61157551
Study location	Germany.
Study setting	Inpatient.
Study dates	No additional information.
Sources of funding	Financial support from Sporlastic GmbH, Nurtingen, Germany (manufacturer of the orthosis).
Inclusion criteria	Over 18 years of age; had an ischaemic brain stroke proven by computer tomography within the last 21 days; exhibited caudal subluxation of the glenohumeral joint and hemiparesis of the upper extremity with muscle strength 0-2 (grading recommended by the Medical Research Council); had been admitted to the rehabilitation unit and could be mobilized for at least 4 hours daily. (While shoulder pain is not stated as an inclusion criteria, the shoulder-hand syndrome score shows pain between mild and moderate severity).
Exclusion criteria	High-grade neglect; severe aphasia; symptomatic transitory psychotic syndrome; treatment with opioids or analogous substances; contraindications to the use of the orthosis; planned thermic treatment or electrostimulation; any conditions (physical, mental or logistic) jeopardizing compliance with the protocol and participation in another interventional trial.
Recruitment / selection of participants	People admitted to the rehabilitation unit.

Intervention(s)	Devices - braces (Neuro-Lux functional orthosis) N=20 Functional orthosis Neuro-Lux designed to reposition the affected joint and reduce subluxation. This orthosis is available in three sizes and can be individually adapted to the person's body. People were advised to carry the orthosis between 8 am and 6pm during normal daily activity. Concomitant therapy: All people received conventional care consisting of various passive and active movement exercises of the affected extremity under individual guidance of a therapist. Six training units of 30 minutes each were prescribed every week. Supportive and symptomatic treatments of the subluxed shoulder were provided.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=21 Conventional care only.

	Concomitant therapy: All people received conventional care consisting of various passive and active movement exercises of the affected extremity under individual guidance of a therapist. Six training units of 30 minutes each were prescribed every week. Supportive and symptomatic treatments of the subluxed shoulder were provided.
Number of participants	41
Duration of follow-up	28 days (4 weeks)
Indirectness	No additional information.
Additional comments	Intention to treat analysis

Study arms

Devices - braces (Neuro-Lux functional orthosis) (N = 20)
Functional orthosis Neuro-Lux designed to reposition the affected joint and reduce subluxation. This orthosis is available in three sizes and can be individually adapted to the person's body. People were advised to carry the orthosis between 8 am and 6pm during normal daily activity. Concomitant therapy: All people received conventional care consisting of various passive and active movement exercises of the affected extremity under individual guidance of a therapist. Six training units of 30 minutes each were prescribed every week. Supportive and symptomatic treatments of the subluxed shoulder were provided.

Usual care or no treatment (N = 21)
Conventional care only. Concomitant therapy: All people received conventional care consisting of various passive and active movement exercises of the affected extremity under individual guidance of a therapist. Six training units of 30 minutes each were prescribed every week. Supportive and symptomatic treatments of the subluxed shoulder were provided.

Characteristics

Arm-level characteristics

Characteristic	Devices - braces (Neuro-Lux functional orthosis) (N = 20)	Usual care or no treatment (N = 21)
% Female Sample size	n = 10 ; % = 50	n = 8 ; % = 38
Mean age (SD) (years) Mean (SD)	64 (16)	65 (13)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (days) Mean (SD)	8.2 (5.3)	7.7 (5.3)

Outcomes

Study timepoints

- Baseline
- 4 week (<6 months)

Continuous outcome

Outcome	Devices - braces (Neuro-Lux functional orthosis), Baseline, N = 20	Devices - braces (Neuro-Lux functional orthosis), 4 week, N = 20	Usual care or no treatment, Baseline, N = 21	Usual care or no treatment, 4 week, N = 21
Pain (Shoulder Hand Syndrome score pain subscale) Scale range: 0-5. Final values. Mean (SD)	1.8 (1.1)	0.4 (0.6)	1 (1)	1.8 (1)

Pain (Shoulder Hand Syndrome score pain subscale) - Polarity - Lower values are better

Dichotomous outcome

Outcome	Devices - braces (Neuro-Lux functional orthosis), Baseline, N = 20	Devices - braces (Neuro-Lux functional orthosis), 4 week, N = 20	Usual care or no treatment, Baseline, N = 21	Usual care or no treatment, 4 week, N = 21
Withdrawal due to adverse events Intervention: 1 died. No of events	n = NA ; % = NA	n = 1 ; % = 5	n = NA ; % = NA	n = 0 ; % = 0

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(ShoulderHandSyndromescorepainsubscale)-MeanSD-Devices - braces (Neuro-Lux functional orthosis)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Devices - braces (Neuro-Lux functional orthosis)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Heo, 2015

Bibliographic Reference	Heo MY; Kim CY; Nam CW; Influence of the application of inelastic taping on shoulder subluxation and pain changes in acute stroke patients.; Journal of physical therapy science; 2015; vol. 27 (no. 11)

Study details

Secondary publication of another included	No additional information.

study- see primary study for details	
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Republic of Korea.
Study setting	Inpatient.
Study dates	No additional information.
Sources of funding	No additional information.
Inclusion criteria	Stroke patients (no additional information).
Exclusion criteria	No additional information.
Recruitment / selection of participants	No additional information.
Intervention(s)	Devices - tape N=18 Inelastic tape and the Jig test and pain test were conducted once a week after tape replacement every three days. Inelastic tape was applied to the forward and back side of the supraspinatus, pectoralis and sternal pectoralis major intermediate sections after correcting shoulder subluxation. Concomitant therapy: Bed physical therapy in the intensive care unit.

Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Not stated/unclear
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=18 Usual care only. Concomitant therapy: Bed physical therapy in the intensive care unit.
Duration of follow-up	8 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Devices - tape (N = 18)
Inelastic tape and the Jig test and pain test were conducted once a week after tape replacement every three days. Inelastic tape was applied to the forward and back side of the supraspinatus, pectoralis and sternal pectoralis major intermediate sections after correcting shoulder subluxation. Concomitant therapy: Bed physical therapy in the intensive care unit.

Usual care or no treatment (N = 18)
Usual care only. Concomitant therapy: Bed physical therapy in the intensive care unit.

Characteristics

Arm-level characteristics

Characteristic	Devices - tape (N = 18)	Usual care or no treatment (N = 18)
% Female Sample size	n = 8 ; % = 44.4	n = 7 ; % = 38.9
Mean age (SD) (years) Mean (SD)	57.1 (10.6)	60.3 (10.4)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke	NR (NR)	NR (NR)

Characteristic	Devices - tape (N = 18)	Usual care or no treatment (N = 18)
Mean (SD)		

Outcomes

Study timepoints

- Baseline
- 8 week (<6 months)

Continuous outcome

Outcome	Devices - tape, Baseline, N = 18	Devices - tape, 8 week, N = 18	Usual care or no treatment, Baseline, N = 18	Usual care or no treatment, 8 week, N = 18
Pain (Visual analogue scale) Scale range: 0-10. Final values. Mean (SD)	5.5 (1.1)	3.2 (0.8)	5.1 (0.78)	4.8 (1.4)

Pain (Visual analogue scale) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(Visualanaloguescale)-MeanSD-Devices - tape-Usual care or no treatment-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Huang, 2017

Bibliographic Reference	Huang, Y. C.; Chang, K. H.; Liou, T. H.; Cheng, C. W.; Lin, L. F.; Huang, S. W.; Effects of Kinesio taping for stroke patients with hemiplegic shoulder pain: A double-blind, randomized, placebo-controlled study; Journal of Rehabilitation Medicine; 2017; vol. 49 (no. 3); 208-215

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.

Study type	Randomised controlled trial (RCT)
Study location	Taiwan.
Study setting	Inpatient.
Study dates	January 2013 to December 2014.
Sources of funding	This study was funded by the Taipei Medical University and Shuang Ho Hospital (study number 104TMU-SHH-15).
Inclusion criteria	Unilateral ischaemic or haemorrhagic stroke lesion confirmed by computerized tomography or magnetic resonance imaging; first incidence of stroke, with onset less than 6 months prior to discharge; pain in the affected shoulder; adequate communication ability and intact cognitive function (Mini-Mental State Examination scores at least 24 points).
Exclusion criteria	Shoulder pain or a history of surgery in the affected shoulder before the onset of stroke; skin problems, wounds, or infection on the affected shoulder; experience of using kinesio taping; a history of allergy to kinesio taping.
Recruitment / selection of participants	People in the rehabilitation ward of a medical university hospital.
Intervention(s)	Devices - tape (Kinesio taping) N=11 Therapeutic kinesio taping applied using the insertion-origin muscle and space-correction technique. Nitto Denko kinesiology tape (50 mm x 4 m) was used an taping applications were performed using a modified method. One tape was applied over the long head and short head of the biceps tendon. At first, I-type strips were used with light tension (15-25%) for the supraspinatus with the arm in adduction. The strip was crossed over the line of shoulder joint. A Y-shaped strip was then applied to the biceps and deltoid muscles with light tension (15-25%) using the insertion-origin muscle technique. The head of the second strip was applied to the radial tuberosity where the biceps is inserted. The first tail of the second strip was applied along the short head of the biceps tendon to the deltoid muscle. The other tail of the second strip was applied along the long head of the biceps tendon to the deltoid muscle. Finally, the third strip was applied from the anterior to the posterior shoulder, covering the acromioclavicular joint with a 50-75% stretch. People were told to leave the tape in situ for 3 consecutive days and then remove the tape, clean the skin and treat the skin with a moisturizing lotion. The people went without tape for 1 day for 24 hours to allow the skin to recover appropriately, and then new tape was reapplied. Tape was reapplied twice per week for 3 weeks for a total of 6 applications.

	Concomitant therapy: Both groups underwent identical conventional rehabilitation programmes including physical therapy and occupational therapy sessions, each lasting 60 minutes per day for 5 days per week. Speech therapy was administered according to individual needs.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Placebo/sham N=10 Sham kinesio taping where similar taping patterns were used but without tension. People were told to leave the tape in situ for 3 consecutive days and then remove the tape, clean the skin and treat the skin with a moisturizing lotion. The people went without tape for 1 day for 24 hours to allow the skin to recover appropriately, and then new tape was reapplied. Tape was reapplied twice per week for 3 weeks for a total of 6 applications. Concomitant therapy: Both groups underwent identical conventional rehabilitation programmes including physical therapy and occupational therapy sessions, each lasting 60 minutes per day for 5 days per week. Speech therapy was administered according to individual needs.
Number of participants	21

Duration of follow-up	3 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Devices - tape (Kinesio taping) (N = 11)
Therapeutic kinesio taping applied using the insertion-origin muscle and space-correction technique. Nitto Denko kinesiology tape (50 mm x 4 m) was used an taping applications were performed using a modified method. One tape was applied over the long head and short head of the biceps tendon. At first, I-type strips were used with light tension (15-25%) for the supraspinatus with the arm in adduction. The strip was crossed over the line of shoulder joint. A Y-shaped strip was then applied to the biceps and deltoid muscles with light tension (15-25%) using the insertion-origin muscle technique. The head of the second strip was applied to the radial tuberosity where the biceps is inserted. The first tail of the second strip was applied along the short head of the biceps tendon to the deltoid muscle. The other tail of the second strip was applied along the long head of the biceps tendon to the deltoid muscle. Finally, the third strip was applied from the anterior to the posterior shoulder, covering the acromioclavicular joint with a 50-75% stretch. People were told to leave the tape in situ for 3 consecutive days and then remove the tape, clean the skin and treat the skin with a moisturizing lotion. The people went without tape for 1 day for 24 hours to allow the skin to recover appropriately, and then new tape was reapplied. Tape was reapplied twice per week for 3 weeks for a total of 6 applications. Concomitant therapy: Both groups underwent identical conventional rehabilitation programmes including physical therapy and occupational therapy sessions, each lasting 60 minutes per day for 5 days per week. Speech therapy was administered according to individual needs.

Placebo/sham (N = 10)
Sham kinesio taping where similar taping patterns were used but without tension. People were told to leave the tape in situ for 3 consecutive days and then remove the tape, clean the skin and treat the skin with a moisturizing lotion. The people went without tape for 1 day for 24 hours to allow the skin to recover appropriately, and then new tape was reapplied. Tape was reapplied twice per week for 3 weeks for a total of 6 applications. Concomitant therapy: Both groups underwent identical conventional rehabilitation programmes

including physical therapy and occupational therapy sessions, each lasting 60 minutes per day for 5 days per week. Speech therapy was administered according to individual needs.

Characteristics

Arm-level characteristics

Characteristic	Devices - tape (Kinesio taping) (N = 11)	Placebo/sham (N = 10)
% Female Sample size	n = 3 ; % = 27.3	n = 4 ; % = 40
Mean age (SD) (years) Mean (SD)	56 (13)	59 (13)
Ethnicity Sample size	n = NR	n = NR ; % = NR
Comorbidities Sample size	n = NA ; % = NA	n = NA ; % = NA
Diabetes mellitus Sample size	n = 4 ; % = 36.4	n = 5 ; % = 50
Hypertension Sample size	n = 8 ; % = 72.7	n = 7 ; % = 70
Hyperlipidaemia Sample size	n = 3 ; % = 27.3	n = 6 ; % = 60

Characteristic	Devices - tape (Kinesio taping) (N = 11)	Placebo/sham (N = 10)
Time period after stroke (days) Mean (SD)	58.45 (28.23)	85.1 (46.76)

Outcomes

Study timepoints

- Baseline
- 3 week (<6 months)

Continuous outcome

Outcome	Devices - tape (Kinesio taping), Baseline, N = 11	Devices - tape (Kinesio taping), 3 week, N = 11	Placebo/sham, Baseline, N = 10	Placebo/sham, 3 week, N = 10
Pain (numeric rating scale) Scale range: 0-10. Change scores. Mean (SD)	4.91 (2.56)	-2.36 (1.03)	3.9 (1.37)	-1.3 (0.48)

Pain (numeric rating scale) - Polarity - Lower values are better

Dichotomous outcomes

Outcome	Devices - tape (Kinesio taping), Baseline, N = 11	Devices - tape (Kinesio taping), 3 week, N = 11	Placebo/sham, Baseline, N = 10	Placebo/sham, 3 week, N = 10
Withdrawal due to adverse events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Outcome	Devices - tape (Kinesio taping), Baseline, N = 11	Devices - tape (Kinesio taping), 3 week, N = 11	Placebo/sham, Baseline, N = 10	Placebo/sham, 3 week, N = 10
No adverse events were reported. No of events				

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(numericratingscale)-MeanSD-Devices - tape (Kinesio taping)-Placebo/sham-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcomes-Withdrawalduetoadverseevents-NoOfEvents-Devices - tape (Kinesio taping)-Placebo/sham-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Huang, 2016

Bibliographic Reference	Huang, Y. C.; Leong, C. P.; Wang, L.; Wang, L. Y.; Yang, Y. C.; Chuang, C. Y.; Hsin, Y. J.; Effect of kinesiology taping on hemiplegic shoulder pain and functional outcomes in subacute stroke patients: a randomized controlled study; European journal of physical & rehabilitation medicine.; 2016; vol. 52 (no. 6); 774-781

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Taiwan
Study setting	Inpatient
Study dates	No additional information.
Sources of funding	This study was supported by grants from Chang Gung Memorial Hospital (CMRPG8A0191 and CMRPG8A0192).
Inclusion criteria	No history of stroke; stroke onset within 3 months; unilateral hemiplegia; impaired hemiplegic shoulder function (Brunnstrom motor stages I-IV).

Exclusion criteria	Previous shoulder pain or injury within the past year; systemic neuromuscular diseases; poor cognition for cooperation during the study procedures; major cardiopulmonary or other medical devices affecting the physical examination or daily activities.
Recruitment / selection of participants	People admitted to the rehabilitation unit for an inpatient rehabilitation program.
Intervention(s)	Devices - Tape N=22 Kinesio taping applied with upright position and affected shoulders in the neutral position. Medical adhesive tape was applied for 3 days followed by 1 day of no taping. Tape was applied to the medial border of the scapula to the deltoid tuberosity of the humerus and acted on the deltoid and supraspinatus muscles with an anchor at the scapula to provide proprioception biofeedback, facilitate muscle strength and improve joint stability. Tape was applied with 20-30% tension. Concomitant therapy: All people underwent inpatient rehabilitation including 1 hour physical therapy and 1 hour occupational therapy/day for 5 days/week. This included range of motion exercises, stretching exercises, postural and transferring training, strengthening exercises, balance training, standing training and ambulation training, which were prescribed depending on the functional deficits of each person.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)

Population subgroups	No additional information.
Comparator	Placebo/sham N=27 Sham taping by the same methods apart from neutral tension was applied to the elastic tape, and tape was applied from the clavicular angle to the medial epicondyle of the humerus and was targeted to the triceps brachii muscle with one anchor at the scapula. Concomitant therapy: All people underwent inpatient rehabilitation including 1 hour physical therapy and 1 hour occupational therapy/day for 5 days/week. This included range of motion exercises, stretching exercises, postural and transferring training, strengthening exercises, balance training, standing training and ambulation training, which were prescribed depending on the functional deficits of each person.
Number of participants	49
Duration of follow-up	3 weeks (end of intervention).
Indirectness	No additional information.
Additional comments	No additional information (appears to be completers only).

Study arms

Devices - Tape (N = 22)
Kinesio taping applied with upright position and affected shoulders in the neutral position. Medical adhesive tape was applied for 3 days followed by 1 day of no taping. Tape was applied to the medial border of the scapula to the deltoid tuberosity of the humerus and acted on the deltoid and supraspinatus muscles with an anchor at the scapula to provide proprioception biofeedback, facilitate muscle strength and improve joint stability. Tape was applied with 20-30% tension. Concomitant therapy: All people underwent inpatient rehabilitation including 1 hour physical therapy and 1 hour occupational therapy/day for 5 days/week. This included range of motion

exercises, stretching exercises, postural and transferring training, strengthening exercises, balance training, standing training and ambulation training, which were prescribed depending on the functional deficits of each person.

Placebo/sham (N = 27)
Sham taping by the same methods apart from neutral tension was applied to the elastic tape, and tape was applied from the clavicular angle to the medial epicondyle of the humerus and was targeted to the triceps brachii muscle with one anchor at the scapula. Concomitant therapy: All people underwent inpatient rehabilitation including 1 hour physical therapy and 1 hour occupational therapy/day for 5 days/week. This included range of motion exercises, stretching exercises, postural and transferring training, strengthening exercises, balance training, standing training and ambulation training, which were prescribed depending on the functional deficits of each person.

Characteristics

Arm-level characteristics

Characteristic	**Devices - Tape (N = 22)**	**Placebo/sham (N = 27)**
% Female Sample size	n = 6 ; % = 29	n = 8 ; % = 35
Mean age (SD) (years) Mean (SD)	60.4 (11.8)	62.2 (9.6)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR

Characteristic	Devices - Tape (N = 22)	Placebo/sham (N = 27)
Time period after stroke (days) Mean (SD)	28 (2.7)	28.5 (1.8)

Reports baseline characteristics for 21 people in the tape group and 23 people in the sham group.

Outcomes

Study timepoints

- Baseline
- 3 week (<6 months)

Continuous outcomes

Outcome	Devices - Tape, Baseline, N = 21	Devices - Tape, 3 week, N = 21	Placebo/sham, Baseline, N = 23	Placebo/sham, 3 week, N = 23
Pain (Visual analogue scale) Scale range: 0-10. Final values. Mean (SD)	2.3 (2.3)	2.6 (2.9)	3.4 (3.3)	3.2 (2.3)
Activities of daily living (Modified Barthel Index) Scale range: 0-100. Final values. Mean (SD)	50.1 (22.6)	63.8 (24.4)	43 (19.6)	58.3 (17.9)

Outcome	Devices - Tape, Baseline, N = 21	Devices - Tape, 3 week, N = 21	Placebo/sham, Baseline, N = 23	Placebo/sham, 3 week, N = 23
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) Scale range: 0-66. Final values. Mean (SD)	8.8 (12.1)	16.4 (17.6)	8.8 (11.6)	16.4 (20.1)
Stroke-specific Patient-Reported Outcome Measures (Stroke Specific Quality of Life) Scale range: 49-245. Final values. Mean (SD)	145.7 (18.9)	160.2 (25.3)	136.8 (20.6)	152.7 (23.5)

Pain (Visual analogue scale) - Polarity - Lower values are better
Activities of daily living (Modified Barthel Index) - Polarity - Higher values are better
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) - Polarity - Higher values are better
Stroke-specific Patient-Reported Outcome Measures (Stroke Specific Quality of Life) - Polarity - Higher values are better

Dichotomous outcome

Outcome	Devices - Tape, Baseline, N = 22	Devices - Tape, 3 week, N = 22	Placebo/sham, Baseline, N = 27	Placebo/sham, 3 week, N = 27
Withdrawal due to adverse events Control group: 2 recurrent stroke, 2 allergy to taping. No of events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 4 ; % = 15

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(Visualanaloguescale)-MeanSD-Devices - Tape-Placebo/sham-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdailyliving(ModifiedBarthelIndex)-MeanSD-Devices - Tape-Placebo/sham-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessmentUpperExtremity)-MeanSD-Devices - Tape-Placebo/sham-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Stroke-specificPatient-ReportedOutcomeMeasures(StrokeSpecificQualityofLife)-MeanSD-Devices - Tape-Placebo/sham-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Devices - Tape-Placebo/sham-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Karaahmet, 2019

Bibliographic Reference	Karaahmet, O. Z.; Gurcay, E.; Unal, Z. K.; Cankurtaran, D.; Cakci, A.; Effects of functional electrical stimulation-cycling on shoulder pain and subluxation in patients with acute-subacute stroke: a pilot study; International Journal of Rehabilitation Research; 2019; vol. 42 (no. 1); 36-40

Study details

Secondary publication of another included study- see primary study for details	No additional information.

Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Turkey
Study setting	Outpatient follow up.
Study dates	No additional information.
Sources of funding	No additional information.
Inclusion criteria	Ages of 18 and 80 years who had a first stroke and were subsequently hospitalized and rehabilitated for 4 weeks.
Exclusion criteria	People who provided limited cooperation and had sensory aphasia; recurrent stroke or bilateral hemiplegia; vasomotor instability (coagulation disorder); lower motor neuron disorder; limitation/instability/dislocation of the shoulder joints; severe spasticity (modified Ashworth Scale >3); pressure ulcer/skin loss at stimulation point; uncontrolled epilepsy.
Recruitment / selection of participants	People with stroke referred to the Physical Medicine and Rehabilitation Clinic.
Intervention(s)	Functional electrical stimulation (FES) N=12 Functional electrical stimulation (FES)-cycling completed while seating on a chair in front of a motorized cycle-ergometer. A current-controlled eight-channel stimulator was used with surface electrodes applied in a bipolar configuration on the anterior and posterior deltoid, biceps and triceps muscles of the affected upper extremity. Rectangular biphasic pulses with a pulse width of 300 microseconds and a stimulation frequency of 20 Hz was adopted. Stimulus intensity was placed on each muscle at a tolerated value producing visible muscle contractions. All sessions consisted of a 5-minute warm-up of passive cycling, a 15-minute training of FES-cycling and a 5-minute cool-down of passive cycling.

	Concomitant therapy: Both groups were trained with a standard rehabilitation program, five times a week lasting 30 minutes each, totalling 20 sessions, accompanied by a specialist physiotherapist. This program consisted of range of motion, stretching and strengthening exercises.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=9 Standard rehabilitation program only. Concomitant therapy: Both groups were trained with a standard rehabilitation program, five times a week lasting 30 minutes each, totalling 20 sessions, accompanied by a specialist physiotherapist. This program consisted of range of motion, stretching and strengthening exercises.
Number of participants	21
Duration of follow-up	4 weeks (post-treatment)
Indirectness	No additional information.

Additional comments	No additional information.

Study arms

Functional electrical stimulation (FES) (N = 12)
Functional electrical stimulation (FES)-cycling completed while seating on a chair in front of a motorized cycle-ergometer. A current-controlled eight-channel stimulator was used with surface electrodes applied in a bipolar configuration on the anterior and posterior deltoid, biceps and triceps muscles of the affected upper extremity. Rectangular biphasic pulses with a pulse width of 300 microseconds and a stimulation frequency of 20 Hz was adopted. Stimulus intensity was placed on each muscle at a tolerated value producing visible muscle contractions. All sessions consisted of a 5-minute warm-up of passive cycling, a 15-minute training of FES-cycling and a 5-minute cool-down of passive cycling. Concomitant therapy: Both groups were trained with a standard rehabilitation program, five times a week lasting 30 minutes each, totalling 20 sessions, accompanied by a specialist physiotherapist. This program consisted of range of motion, stretching and strengthening exercises.

Usual care or no treatment (N = 9)
Standard rehabilitation program only. Concomitant therapy: Both groups were trained with a standard rehabilitation program, five times a week lasting 30 minutes each, totalling 20 sessions, accompanied by a specialist physiotherapist. This program consisted of range of motion, stretching and strengthening exercises.

Characteristics

Arm-level characteristics

Characteristic	Functional electrical stimulation (FES) (N = 12)	Usual care or no treatment (N = 9)
% Female	n = 6 ; % = 50	n = 2 ; % = 22
Sample size		

Characteristic	Functional electrical stimulation (FES) (N = 12)	Usual care or no treatment (N = 9)
Mean age (SD) (years) Mean (SD)	56 (17.5)	58 (15.4)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (days) Mean (SD)	46.8 (10.3)	35.2 (35.7)

Outcomes

Study timepoints

- Baseline
- 4 week (<6 months)

Continuous outcomes

Outcome	Functional electrical stimulation (FES), Baseline, N = 12	Functional electrical stimulation (FES), 4 week, N = 12	Usual care or no treatment, Baseline, N = 9	Usual care or no treatment, 4 week, N = 9
Pain (numeric rating scale) Scale range: 0-10. Change scores. Mean (SD)	1.6 (2.6)	-1.4 (2.2)	2 (3)	0.7 (1.2)
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) Scale range: 0-66. Change scores. Mean (SD)	8.8 (11.4)	9.5 (8.3)	8.7 (5.1)	12.3 (19.2)
Activities of daily living (functional independence measure) Scale range: 8-126. Change scores. Mean (SD)	74.7 (12.7)	-3.5 (5.1)	74.6 (12.4)	-1 (2.5)

Pain (numeric rating scale) - Polarity - Lower values are better
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) - Polarity - Higher values are better
Activities of daily living (functional independence measure) - Polarity - Higher values are better

Dichotomous outcome

Outcome	Functional electrical stimulation (FES), Baseline, N = 12	Functional electrical stimulation (FES), 4 week, N = 12	Usual care or no treatment, Baseline, N = 9	Usual care or no treatment, 4 week, N = 9
Withdrawal due to adverse events No adverse events No of events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(numericratingscale)-MeanSD-Functional electrical stimulation (FES)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessmentUpperExtremity)-MeanSD-Functional electrical stimulation (FES)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High

Section	Question	Answer
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdailyliving(functionalindependencemeasure)-MeanSD-Functional electrical stimulation (FES)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Functional electrical stimulation (FES)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Lakse, 2009

Bibliographic Reference	Lakse, E.; Gunduz, B.; Erhan, B.; Celik, E. C.; The effect of local injections in hemiplegic shoulder pain: a prospective, randomized, controlled study; American Journal of Physical Medicine & Rehabilitation; 2009; vol. 88 (no. 10); 805-11; quiz 812

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Turkey.
Study setting	Inpatients.
Study dates	June 2004 and April 2005.
Sources of funding	This work was supported by grant P01HD/NS33988 from the National Institute of Child Health and Human Development, the National Institute of Neurological Disorders and Stroke, and the National Center for Rehabilitation Research.
Inclusion criteria	Stroke at least 8 weeks before and were diagnosed as hemiplegic shoulder pain caused by frozen shoulder or subacromial impingement syndrome. These two diagnostic groups were pooled by the study due to an insufficient number of patients.
Exclusion criteria	Severe communication or cognitive problems; earlier stroke or bilateral hemiplegia after stroke; earlier surgery or trauma of the involved shoulder; injection or physical therapy to the affected shoulder during the previous 6 months; patients with heterotopic ossification of the involved limb and dislocation or advanced subluxation according to shoulder x-rays; shoulder pain with diffuse distal limb pain; hyperesthesia, edema, dystrophic skin changes, atrophy, or infection of the involved limb; inflammation around the involved shoulder; patients with pacemaker; patients with uncontrolled diabetes mellitus and hypertension.
Recruitment / selection of participants	People hospitalised in the clinic for rehabilitation.

Intervention(s)	Intra-articular medicine injection (corticosteroids) N=21 Fifteen people diagnosed with frozen shoulder received intra-articular injection with posterior approach, whereas 6 people diagnosed with impingement syndrome received subacromial space injections also with a posterior approach. The injection was 1mL triamcinolone acetonide with 9mL of prilocaine. Concomitant therapy: All people received transcutaneous electrical nerve stimulation and a therapeutic exercise program. All people were allowed to consume only 500-1500 mg/day paracetamol as an analgesic if needed. In both groups, people with an increase in muscle tone were given tizanidine 6mg/day.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Chronic (>6 months)
Population subgroups	No additional information.
Comparator	Placebo/sham N=17 Local anaesthetic injection only.

	Concomitant therapy: All people received transcutaneous electrical nerve stimulation and a therapeutic exercise program. All people were allowed to consume only 500-1500 mg/day paracetamol as an analgesic if needed.
Number of participants	38
Duration of follow-up	4 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Intra-articular medicine injection (corticosteroids) (N = 21)
Fifteen people diagnosed with frozen shoulder received intra-articular injection with posterior approach, whereas 6 people diagnosed with impingement syndrome received subacromial space injections also with a posterior approach. The injection was 1mL triamcinolone acetonide with 9mL of prilocaine. Concomitant therapy: All people received transcutaneous electrical nerve stimulation and a therapeutic exercise program. All people were allowed to consume only 500-1500 mg/day paracetamol as an analgesic if needed. In both groups, people with an increase in muscle tone were given tizanidine 6mg/day.

Placebo/sham (N = 17)
Local anaesthetic injection only. Concomitant therapy: All people received transcutaneous electrical nerve stimulation and a therapeutic exercise program. All people were allowed to consume only 500-1500 mg/day paracetamol as an analgesic if needed. In both groups, people with an increase in muscle tone were given tizanidine 6mg/day.

Characteristics

Arm-level characteristics

Characteristic	Intra-articular medicine injection (corticosteroids) (N = 21)	Placebo/sham (N = 17)
% Female Sample size	n = 11 ; % = 52	n = 9 ; % = 53
Mean age (SD) (years) Mean (SD)	62.2 (9.1)	66.3 (6.7)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Months) Mean (SD)	5.6 (3.3)	7.6 (4.2)

Outcomes

Study timepoints

- Baseline
- 4 week (<6 months)

Continuous outcome

Outcome	Intra-articular medicine injection (corticosteroids), Baseline, N = 21	Intra-articular medicine injection (corticosteroids), 4 week, N = 21	Placebo/sham, Baseline, N = 17	Placebo/sham, 4 week, N = 17
Pain (activity visual analogue scale) Scale range: 0-10. Change scores. Mean (SD)	5.2 (1.4)	-1.6 (1.2)	5.1 (1.2)	-0.82 (0.81)

Pain (activity visual analogue scale) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(activityvisualanalogueescale)-MeanSD-Intra-articular medicine injection (corticosteroids)-Placebo/sham-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Lavi, 2022

Bibliographic Reference	Lavi, Chen; Elboim-Gabyzon, Michal; Naveh, Yuval; Kalichman, Leonid; A Combination of Long-Duration Electrical Stimulation with External Shoulder Support during Routine Daily Activities in Patients with Post-Hemiplegic Shoulder Subluxation: A Randomized Controlled Study.; International journal of environmental research and public health; 2022; vol. 19 (no. 15)

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Israel
Study setting	Outpatient follow-up
Study dates	1st November 2019 to 15th March 2021.
Sources of funding	This research received no external funding.
Inclusion criteria	Acute phase of stroke (<6 months since cerebral insult); shoulder subluxation; first stroke.
Exclusion criteria	Participation in other interventional clinical trials; age less than 19 years of age; aphasia or cognitive disorders; inability to communicate with the research staff; history of severe health problems (i.e. other neurological, musculoskeletal or mental disorders); shoulder pain/trauma/operation in the relevant shoulder pre-stroke.
Recruitment / selection of participants	People with subluxation of the shoulder due to stroke (people also had pain at baseline).
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=14

	Neuromuscular electrical stimulation 5 days a week for 6 weeks, three stimulation periods separated by 30 minute rest intervals. During the first week, each period was 30 minute long. Subsequently period were gradually increased each week by 10 minutes up to a maximum of 60 minutes starting in the fourth week. Concomitant therapy: External shoulder support was individually adjusted to all people who had undergone conventional therapy with an emphasis on shoulder strengthening. Both groups continued their daily function and rehabilitation routine. People received only conventional treatment during the follow-up period (2 weeks after the completion of the 6 week treatment).
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Mixed
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Placebo/sham therapy N=14 Device turned on but the stimulation parameters were adjusted with the amplitude not turned on. Subjects were told that they may or may not feel the stimulation.

	Concomitant therapy: External shoulder support was individually adjusted to all people who had undergone conventional therapy with an emphasis on shoulder strengthening. Both groups continued their daily function and rehabilitation routine. People received only conventional treatment during the follow-up period (2 weeks after the completion of the 6 week treatment).
Number of participants	28
Duration of follow-up	8 weeks (2 weeks after finishing treatment).
Indirectness	No additional information.
Additional comments	Method of analysis unclear. Appears to be completers only.

Study arms

Neuromuscular electrical stimulation (NMES) (N = 14)
Neuromuscular electrical stimulation 5 days a week for 6 weeks, three stimulation periods separated by 30 minute rest intervals. During the first week, each period was 30 minute long. Subsequently period were gradually increased each week by 10 minutes up to a maximum of 60 minutes starting in the fourth week. Concomitant therapy: External shoulder support was individually adjusted to all people who had undergone conventional therapy with an emphasis on shoulder strengthening. Both groups continued their daily function and rehabilitation routine. People received only conventional treatment during the follow-up period (2 weeks after the completion of the 6 week treatment).

Placebo/sham therapy (N = 14)
Device turned on but the stimulation parameters were adjusted with the amplitude not turned on. Subjects were told that they may or may not feel the stimulation. Concomitant therapy: External shoulder support was individually adjusted to all people who had undergone conventional therapy with an emphasis on shoulder strengthening. Both groups continued their daily function and rehabilitation routine. People received only conventional treatment during the follow-up period (2 weeks after the completion of the 6 week treatment).

Characteristics

Arm-level characteristics

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 14)	Placebo/sham therapy (N = 14)
% Female Sample size	n = 4 ; % = 40	n = 5 ; % = 38.5
Mean age (SD) (years) Mean (SD)	73.3 (9.81)	67.54 (15.54)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NA ; % = NA	n = NA ; % = NA
Background shoulder disease Sample size	n = 7 ; % = 70	n = 10 ; % = 76.9
Time period after stroke (Months) Mean (SD)	0.5 (0.97)	1.38 (1.61)

Number of participants NMES = 10, control = 13

Outcomes

Study timepoints

- Baseline
- 8 week (<6 months)

Continuous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 10	Neuromuscular electrical stimulation (NMES), 8 week, N = 8	Placebo/sham therapy, Baseline, N = 13	Placebo/sham therapy, 8 week, N = 10
Pain (numerical pain rating scale) Scale range: 0-10. Change scores. Mean (SD)	4.3 (3.8)	-1.38 (4.07)	3.92 (3.28)	-1.3 (4.92)
Physical function - upper limb (Fugl Meyer Assessment - upper limb) Scale range: 0-66. Change scores. Mean (SD)	24.7 (17.98)	24.88 (20.51)	13 (11.8)	7.5 (16.3)
Activities of daily living (functional independence measure) Scale range: 18-126. Change scores. Mean (SD)	58.3 (15.46)	31.88 (16.48)	52 (22.35)	14.9 (13.22)

Pain (numerical pain rating scale) - Polarity - Lower values are better

Physical function - upper limb (Fugl Meyer Assessment - upper limb) - Polarity - Higher values are better
Activities of daily living (functional independence measure) - Polarity - Higher values are better

Dichotomous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 14	Neuromuscular electrical stimulation (NMES), 8 week, N = 14	Placebo/sham therapy, Baseline, N = 14	Placebo/sham therapy, 8 week, N = 14
Withdrawal due to adverse events No of events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(numericalpainratingscale)-MeanSD-Neuromuscular electrical stimulation (NMES)-Placebo/sham therapy-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessment-upperlimb)-MeanSD-Neuromuscular electrical stimulation (NMES)-Placebo/sham therapy-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High

Section	Question	Answer
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdialyliving(FunctionalIndependenceMeasure)-MeanSD-Neuromuscular electrical stimulation (NMES)-Placebo/sham therapy-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcomes-Withdrawalduetoadverseevents-NoOfEvents-Neuromuscular electrical stimulation (NMES)-Placebo/sham therapy-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Lee, 2016

Bibliographic Reference	Lee, G. E.; Son, C.; Lee, J.; Lee, S. H.; Lee, H. J.; Lee, K. J.; Lim, S. M.; Choi, H.; Kim, D. A.; Kim, W. H.; Acupuncture for shoulder pain after stroke: A randomized controlled clinical trial; European Journal of Integrative Medicine; 2016; vol. 8 (no. 4); 373-383

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Republic of Korea.
Study setting	Outpatient follow up.
Study dates	May 2013 to December 2013.
Sources of funding	This study was supported by the Korean National Rehabilitation Center, Ministry of Health & Welfare, Government of the Republic of Korea (13-B-04).
Inclusion criteria	More than 4 weeks after stroke; aged 20 years or older; a score of at least 4 on the visual analog scale for hemiplegic shoulder pain; subjects without a previous history of shoulder injury or shoulder operation.
Exclusion criteria	People who received acupuncture treatment for hemiplegic shoulder pain within the past month; patients who experienced hypersensitivity following acupuncture; patients whose prior medical history included pacemakers, embedded neural stimulators, cardiac arrhythmia, epilepsy, or peripheral neural injury; cognitive impairment that precluded the accurate clinical assessment of the visual analogue scale score; people who had another central nervous disease or severe neurological or psychiatric symptoms (e.g. psychosis, major depressive disorder, dementia) or were taking antipsychotic medication; people who had communication difficulties or who did not provide informed consent; other patients who were considered inappropriate for participation in this trial by the conductors of the trial.

Recruitment / selection of participants	People hospitalised in the National Rehabilitation Center recruited through advertisements in the hospital.
Intervention(s)	Acupuncture/dry needling N=27 Ten needles were inserted at each session, and the unilateral (hemiplegic side) LI15, LI14, LI16, LI4, TE14, TE3, SI10, SI13, GB20 and ST36 were used for acupuncture treatment. Disposable, sterilized, stainless steel needles (length 40mm, diameter 0.25mm) inserted to a depth of 15-35mm. All needles were rotated manually at least once at each session to elicit needle sensation (de qi). The needle retention time was 15 minutes. Three times a week for 3 weeks. Concomitant therapy: No additional information.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Acupuncture
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months) Majority (77%) subacute
Population subgroups	No additional information.
Comparator	Placebo/sham N=26 People allocated to the sham acupuncture group who received treatment at with superficial penetration (less than 15mm insertion without needle manipulation) near the points of the upper arm (2 points at the medial 1/3 and lateral 3/2 between

	LI11 and LU4), the back (3 points at the same height with GV8, GV9, GV10 at the subscapular area), the scalp (2 points 30mm posterior to BL8) and the leg (3 points 30mm inferior to the mid-point between ST36 and GB34) for 15 minutes. They utilised different points to minimise the nonspecific effect of sham acupuncture. Concomitant therapy: No additional information.
Number of participants	53
Duration of follow-up	4 weeks (1 week after treatment).
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Acupuncture/dry needling (N = 27)
Ten needles were inserted at each session, and the unilateral (hemiplegic side) LI15, LI14, LI16, LI4, TE14, TE3, SI10, SI13, GB20 and ST36 were used for acupuncture treatment. Disposable, sterilized, stainless steel needles (length 40mm, diameter 0.25mm) inserted to a depth of 15-35mm. All needles were rotated manually at least once at each session to elicit needle sensation (de qi). The needle retention time was 15 minutes. Three times a week for 3 weeks. Concomitant therapy: No additional information.

Placebo/sham (N = 26)
People allocated to the sham acupuncture group who received treatment at with superficial penetration (less than 15mm insertion without needle manipulation) near the points of the upper arm (2 points at the medial 1/3 and lateral 3/2 between LI11 and LU4), the back (3 points at the same height with GV8, GV9, GV10 at the subscapular area), the scalp (2 points 30mm posterior to BL8) and the leg (3 points 30mm inferior to the mid-point between ST36 and GB34) for 15 minutes. They utilised different points to minimise the nonspecific effect of sham acupuncture. Concomitant therapy: No additional information.

Characteristics

Arm-level characteristics

Characteristic	Acupuncture/dry needling (N = 27)	Placebo/sham (N = 26)
% Female Sample size	n = 12 ; % = 44	n = 6 ; % = 23
Mean age (SD) (years) Mean (SD)	56.81 (10.23)	58.38 (12.38)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke Sample size	n = NA ; % = NA	n = NA ; % = NA
Less than 6 months Sample size	n = 23 ; % = 85	n = 18 ; % = 69
Over 6 months Sample size	n = 4 ; % = 15	n = 8 ; % = 31

Outcomes

Study timepoints

- Baseline
- 4 week (<6 months)

Continuous outcomes

Outcome	Acupuncture/dry needling, Baseline, N = 27	Acupuncture/dry needling, 4 week, N = 27	Placebo/sham, Baseline, N = 26	Placebo/sham, 4 week, N = 26
Pain (Visual analogue scale) Scale range: 0-10. Change scores. Mean (SD)	6.85 (2.01)	-3 (3.28)	7.15 (1.85)	-1.65 (2.5)
Activities of daily living (Korean modified Barthel Index) Scale range: 0-100. Final values. Mean (SD)	54.44 (19.37)	63.56 (19.23)	59.15 (25.04)	71.31 (17.17)

Pain (Visual analogue scale) - Polarity - Lower values are better
Activities of daily living (Korean modified Barthel Index) - Polarity - Higher values are better

Dichotomous outcome

Outcome	Acupuncture/dry needling, Baseline, N = 27	Acupuncture/dry needling, 4 week, N = 27	Placebo/sham, Baseline, N = 26	Placebo/sham, 4 week, N = 26
Withdrawal due to adverse events No adverse events and statement that	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Outcome	Acupuncture/dry needling, Baseline, N = 27	Acupuncture/dry needling, 4 week, N = 27	Placebo/sham, Baseline, N = 26	Placebo/sham, 4 week, N = 26
no one who withdrew did so due to adverse events No of events				

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(Visualanaloguescale)-MeanSD-Acupuncture/dry needling-Placebo/sham-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdailyliving(KoreanmodifiedBarthelIndex)-MeanSD-Acupuncture/dry needling-Placebo/sham-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Acupuncture/dry needling-Placebo/sham-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Mendigutia-Gomez, 2020

Bibliographic Reference	Mendigutia-Gomez, A.; Quintana-Garcia, M. T.; Martin-Sevilla, M.; de Lorenzo-Barrientos, D.; Rodriguez-Jimenez, J.; Fernandez-de-Las-Penas, C.; Arias-Buria, J. L.; Post-needling soreness and trigger point dry needling for hemiplegic shoulder pain following stroke; Acupuncture in Medicine; 2020; vol. 38 (no. 3); 150-157

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	Clinicaltrials.gov = NCT03703193
Study type	Randomised controlled trial (RCT)

Study location	Spain
Study setting	Hospital Beata Maria Ana, Madrid
Study dates	October to December 2018
Sources of funding	No financial support for the research, authorship and/or publication of this article.
Inclusion criteria	A first-ever unilateral stroke; demonstrate hemiplegia resulting from the stroke; be aged between 30 and 60 years; present hypertonicity in the upper extremity; present pain symptoms in the hemiplegic shoulder; exhibit active trigger points in the shoulder muscles, for which pain referral reproduced the symptoms.
Exclusion criteria	Experienced a recurrent stroke; an absence of active trigger points in the shoulder muscles reproducing shoulder symptoms; undergone previous treatments with nerve blocks or motor point injections with neurolytic agents for spasticity at any time; received previous treatment with botulinum toxin-A in the 6 months prior to the trial; severe cognitive deficits; other neurologic diseases; other medical conditions, for example, heart conditions, unstable hypertension, or fracture; a fear of needles; any contraindications to dry needling for example, anticoagulant use, infections, bleeding or psychosis.
Recruitment / selection of participants	No additional information.
Intervention(s)	Acupuncture/dry needling N=8 Dry needling over active trigger points by a physical therapist with 15 years of experience with this procedure. Once an active trigger point was located, the skin was properly cleaned with alcohol. People received therapy using 0.30mm x 40mm needles that were inserted into the skin over the trigger point area and advanced into the muscle using the "fast-in and fast-out" technique until a first local twitch response was obtained. The depth of needle insertion ranged from 10 to 15mm depending on the muscle thickness of the targeted muscle: upper trapezius, infraspinatus, subscapularis or pectoralis major. Once the first local twice response was obtained, the needle was moved up and down (3-5mm vertical motions, no rotations) for 60s until no more local twitch responses were elicited. Concomitant therapy: All people received a single session of a rehabilitation program including modulatory interventions for spasticity and pain control by a clinician with more than 20 years of experience in the management of stroke patients. People received a single session of 45 minutes duration including unilateral arm training focusing on decreased muscle tone, passive positioning of the shoulder girdle, and repetitive task training exercises.

Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Dry needling
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Chronic (>6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=8 Usual rehabilitation only. Concomitant therapy: All people received a single session of a rehabilitation program including modulatory interventions for spasticity and pain control by a clinician with more than 20 years of experience in the management of stroke patients. People received a single session of 45 minutes duration including unilateral arm training focusing on decreased muscle tone, passive positioning of the shoulder girdle, and repetitive task training exercises.
Number of participants	16
Duration of follow-up	1 week (7 days)
Indirectness	No additional information.
Additional comments	Intention to treat no dropouts

Study arms

Acupuncture/dry needling (N = 8)
Dry needling over active trigger points by a physical therapist with 15 years of experience with this procedure. Once an active trigger point was located, the skin was properly cleaned with alcohol. People received therapy using 0.30mm x 40mm needles that were inserted into the skin over the trigger point area and advanced into the muscle using the "fast-in and fast-out" technique until a first local twitch response was obtained. The depth of needle insertion ranged from 10 to 15mm depending on the muscle thickness of the targeted muscle: upper trapezius, infraspinatus, subscapularis or pectoralis major. Once the first local twice response was obtained, the needle was moved up and down (3-5mm vertical motions, no rotations) for 60s until no more local twitch responses were elicited. Concomitant therapy: All people received a single session of a rehabilitation program including modulatory interventions for spasticity and pain control by a clinician with more than 20 years of experience in the management of stroke patients. People received a single session of 45 minutes duration including unilateral arm training focusing on decreased muscle tone, passive positioning of the shoulder girdle, and repetitive task training exercises.

Usual care or no treatment (N = 8)
Usual rehabilitation only. Concomitant therapy: All people received a single session of a rehabilitation program including modulatory interventions for spasticity and pain control by a clinician with more than 20 years of experience in the management of stroke patients. People received a single session of 45 minutes duration including unilateral arm training focusing on decreased muscle tone, passive positioning of the shoulder girdle, and repetitive task training exercises.

Characteristics

Arm-level characteristics

Characteristic	Acupuncture/dry needling (N = 8)	Usual care or no treatment (N = 8)
% Female Sample size	n = 5 ; % = 62.5	n = 5 ; % = 62.5

Characteristic	Acupuncture/dry needling (N = 8)	Usual care or no treatment (N = 8)
Mean age (SD) (years) Mean (SD)	48 (6)	47 (7)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Months) Mean (SD)	9.1 (3.5)	8.7 (4)

Outcomes

Study timepoints

- Baseline
- 1 week (<6 months)

Continuous outcome

Outcome	Acupuncture/dry needling, Baseline, N = 8	Acupuncture/dry needling, 1 week, N = 8	Usual care or no treatment, Baseline, N = 8	Usual care or no treatment, 1 week, N = 8
Pain (numerical pain rating scale)	7 (1.3)	NA (NA)	7 (1.4)	NA (NA)

Outcome	Acupuncture/dry needling, Baseline, N = 8	Acupuncture/dry needling, 1 week, N = 8	Usual care or no treatment, Baseline, N = 8	Usual care or no treatment, 1 week, N = 8
Scale range: 0-10. Change scores. Mean (SD)				
Pain (numerical pain rating scale) Scale range: 0-10. Change scores. Mean (95% CI)	NA (NA to NA)	-4.9 (-6.1 to -3.7)	NA (NA to NA)	-0.5 (-1.7 to 0.7)

Pain (numerical pain rating scale) - Polarity - Lower values are better

Dichotomous outcome

Outcome	Acupuncture/dry needling, Baseline, N = 8	Acupuncture/dry needling, 1 week, N = 8	Usual care or no treatment, Baseline, N = 8	Usual care or no treatment, 1 week, N = 8
Withdrawal due to adverse events No of events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(numericalpainratingscale)-MeanNineFivePercentCI-Acupuncture/dry needling-Usual care or no treatment-t1

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Acupuncture/dry needling-Usual care or no treatment-t1

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Moghe, 2020

Bibliographic Reference	Moghe, D. M.; Kanase, S. B.; Effect of therapeutic shoulder sling and proximal control exercises on shoulder subluxation in stroke survivors; Indian Journal of Forensic Medicine and Toxicology; 2020; vol. 14 (no. 3); 222-227

Study details

Secondary publication of another included study- see primary study for details	No additional information.

Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	India
Study setting	Outpatient follow up.
Study dates	No additional information.
Sources of funding	Krishna Institute of Medical Sciences.
Inclusion criteria	No additional information.
Exclusion criteria	No additional information.
Recruitment / selection of participants	No additional information.
Intervention(s)	Devices - slings (therapeutic shoulder sling) N=25 Therapeutic shoulder sling with proximal group exercises for 3 weeks, 5 days per week. Concomitant therapy: Conventional management could include education, positioning, exercises, orthotic devices and electrical stimulation.
Sensitivity analysis - Background rate of oral drug use	Not reported

Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Not stated/unclear
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=25 Conventional therapy only for 3 weeks, 5 days per week. Concomitant therapy: Conventional management could include education, positioning, exercises, orthotic devices and electrical stimulation.
Number of participants	50
Duration of follow-up	3 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Devices - slings (therapeutic shoulder sling) (N = 25)
Therapeutic shoulder sling with proximal group exercises for 3 weeks, 5 days per week. Concomitant therapy: Conventional management could include education, positioning, exercises, orthotic devices and electrical stimulation.

Usual care or no treatment (N = 25)
Conventional therapy only for 3 weeks, 5 days per week. Concomitant therapy: Conventional management could include education, positioning, exercises, orthotic devices and electrical stimulation.

Characteristics

Arm-level characteristics

Characteristic	Devices - slings (therapeutic shoulder sling) (N = 25)	Usual care or no treatment (N = 25)
% Female Sample size	n = 9 ; % = 36	n = 10 ; % = 40
Mean age (SD) (years) Mean (SD)	45 (NR)	459 (NR)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke	n = NR ; % = NR	n = NR ; % = NR

Characteristic	Devices - slings (therapeutic shoulder sling) (N = 25)	Usual care or no treatment (N = 25)
Sample size		

Outcomes

Study timepoints

- Baseline
- 3 week (<6 months)

Continuous outcome

Outcome	Devices - slings (therapeutic shoulder sling), Baseline, N = 25	Devices - slings (therapeutic shoulder sling), 3 week, N = 25	Usual care or no treatment, Baseline, N = 25	Usual care or no treatment, 3 week, N = 25
Pain (Visual analogue scale) Scale range: 0-10. Final values. Mean (SD)	NR (NR)	4.72 (1.72)	NR (NR)	5.84 (1.38)

Pain (Visual analogue scale) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-PainVAS-MeanSD-Devices - slings (therapeutic shoulder sling)-Usual care or no treatment-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Pandian, 2013

Bibliographic Reference	Pandian, J. D.; Kaur, P.; Arora, R.; Vishwambaran, D. K.; Toor, G.; Mathangi, S.; Vijaya, P.; Uppal, A.; Kaur, T.; Arima, H.; Shoulder taping reduces injury and pain in stroke patients: randomized controlled trial; Neurology; 2013; vol. 80 (no. 6); 528-32

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	Clinicaltrial.gov = NCT01062308.

Study type	Randomised controlled trial (RCT)
Study location	India.
Study setting	Inpatient.
Study dates	August 2009 to October 2011.
Sources of funding	Department of Neurology intramural research fund.
Inclusion criteria	All first-ever stroke patients (ischaemic and haemorrhagic) with upper limb weakness within 48 hours after the ictus (at least 18 years); Brunnstrom stage of motor recovery 1 and 2; people willing to participate in the study.
Exclusion criteria	People with Glasgow Coma Scale score <7; people on ventilator; uncooperative people; people having previous history of shoulder injury; people having previous history of shoulder pain; any previous history of skin allergy to tape.
Recruitment / selection of participants	No additional information.
Intervention(s)	Devices - taping N=80 Shoulder taping and conventional treatment. Taping was initiated by first applying 3 elastic adhesive tape stirps that were 2 inches wide and approximately 10 inches long. The first strip was applied from the mid-humerus deltoid tuberosity across the scapula. The second strip was applied from the deltoid tuberosity across the clavicle to the mid-clavicle, but before the suprasternal notch; the third strip was placed from the deltoid tuberosity over the acromion process to the neck. The tape was applied and kept for 3 days along with conventional treatment. Locally available tapes like plastic micropore and elastic adhesive tape (Hospiplast) were used. Concomitant therapy: All people received conventional therapy. This included positioning, handling technique and range of motion exercises.
Sensitivity analysis - Background rate of oral drug use	Not reported

Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Acute (72 hours - 7 days)
Population subgroups	No additional information.
Comparator	Placebo/sham N=82 Sham taping and conventional treatment. Strips were applied to the same position without repositioning the joints. Concomitant therapy: All people received conventional therapy. This included positioning, handling technique and range of motion exercises.
Number of participants	162
Duration of follow-up	1 month (30 days)
Indirectness	No additional information.
Additional comments	Not clear, appears to be completers only.

Study arms

Devices - Tape (N = 80)
Shoulder taping and conventional treatment. Taping was initiated by first applying 3 elastic adhesive tape stirps that were 2 inches wide and approximately 10 inches long. The first strip was applied from the mid-humerus deltoid tuberosity across the scapula. The second strip was applied from the deltoid tuberosity across the clavicle to the mid-clavicle, but before the suprasternal notch; the third strip was placed from the deltoid tuberosity over the acromion process to the neck. The tape was applied and kept for 3 days along with conventional treatment. Locally available tapes like plastic micropore and elastic adhesive tape (Hospiplast) were used. Concomitant therapy: All people received conventional therapy. This included positioning, handling technique and range of motion exercises.

Placebo/sham (N = 82)
Sham taping and conventional treatment. Strips were applied to the same position without repositioning the joints. Concomitant therapy: All people received conventional therapy. This included positioning, handling technique and range of motion exercises.

Characteristics

Arm-level characteristics

Characteristic	**Devices - Tape (N = 80)**	**Placebo/sham (N = 82)**
% Female Sample size	n = 23 ; % = 28.7	n = 33 ; % = 40.2
Mean age (SD) (years) Mean (SD)	55.7 (13.1)	59.5 (13.2)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR

Characteristic	Devices - Tape (N = 80)	Placebo/sham (N = 82)
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke Sample size	n = NA ; % = NA	n = NA ; % = NA
Within 24 hours Sample size	n = 68 ; % = 85	n = 69 ; % = 84.1
Within 24-48 hours Sample size	n = 12 ; % = 15	n = 13 ; % = 15.9

Outcomes

Study timepoints

- Baseline
- 1 month (<6 months)

Continuous outcome

Outcome	Devices - Tape, Baseline, N = 80	Devices - Tape, 1 month, N = 64	Placebo/sham, Baseline, N = 82	Placebo/sham, 1 month, N = 72
Pain (Visual analogue scale) Scale range: 0-100. Mean difference between groups at day 30. Mean (95% CI)	NR (NR to NR)	-11.9 (-22.6 to -1.1)	NR (NR to NR)	NA (NA to NA)

Pain (Visual analogue scale) - Polarity - Lower values are better

Dichotomous outcome

Outcome	Devices - Tape, Baseline, N = 80	Devices - Tape, 1 month, N = 80	Placebo/sham, Baseline, N = 82	Placebo/sham, 1 month, N = 82
Withdrawal due to adverse events Intervention: 8 died, 1 subluxation. Control: 6 died. No of events	n = NA ; % = NA	n = 9 ; % = 11	n = NA ; % = NA	n = 6 ; % = 7

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(Visualanaloguescale)-MeanNineFivePercentCI-Devices - taping-Usual care or no treatment-t1

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High

Section	Question	Answer
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Devices - taping-Placebo/sham-t1

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Pillastrini, 2016

Bibliographic Reference	Pillastrini P; Rocchi G; Deserri D; Foschi P; Mardegan M; Naldi MT; Villafañe JH; Bertozzi L; Effectiveness of neuromuscular taping on painful hemiplegic shoulder: a randomised clinical trial.; Disability and rehabilitation; 2016; vol. 38 (no. 16)

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with	No additional information.

this study included in review	
Trial name / registration number	Clinicaltrials.gov = NCT02254876.
Study type	Randomised controlled trial (RCT)
Study location	Italy.
Study setting	Outpatient follow up.
Study dates	No additional information.
Sources of funding	This study does not have funding.
Inclusion criteria	Right or left hemiplegia resulting from an ischaemic or haemorrhagic stroke; painful shoulder syndrome with pain at rest and during functional movements of the shoulder girdle; spasticity with an Ashworth score greater than or equal to one; adult age and capable of providing consent; within 1 and 8 years from stroke; without another rehabilitative programme.
Exclusion criteria	Flaccidity; thermoalgesic sensitivity deficits or cognitive impairment; taking anti-inflammatory drugs and/or muscle relaxants during the course of the trials; previous shoulder surgery; injection of botulinum toxin to the shoulder within 6 months.
Recruitment / selection of participants	No additional information.
Intervention(s)	Devices - tape N=16 Neuromuscular taping technique - 15 minutes per session. 4 sessions over 4 weeks. Applied with a decompressive method on the pectoralis major, deltoids and supraspinatus according to the NMT Method Manual. For pectoralis major, w-shape tape was attached from the intertubercular groove of the humerus to the centre of the sternum while the person lay in a supine position. The inferior strip was applied over the abdominal muscle bundles with the limb abducted over 100 degrees, the central strip following the sternocostal muscle bundles with the limb abducted to 90 degrees and the superior strip over the clavicular bundles with the limb abducted to 80 degrees. For the deltoids, the tape was cut into a Y-shape and anchored to the deltoid tuberosity with the arm in a neutral position while the patient sat on the bed. The anterior strip was applied over the clavicular bundle of the muscle with the upper limb in extension, whereas the posterior strip following the spinal bundle with the upper limb was in elevation (elbow extended). For the supraspinatus, the NMT was used as a Y-shape piece of tape anchored from the greater tubercle of the humerus while the person sat on the bed. The superior strip was

	attached following the supraspinatus fossa and the inferior strip below the spine of the scapula, parallel to the first. Both strips were applied, keeping the person's arm in adduction with internal rotation. A 5-cm wide tape was used, and it was applied without traction (0% tension) with the muscle in a stretched position. The people in the experimental group had a total of four applications spaced approximately 5 days apart. Concomitant therapy: Standard physical therapy program, 45 minutes/session, 4 sessions over 4 weeks. Focused primarily on glenohumeral and scapulothoracic joints mobilisation in more limited direction of movement.
Sensitivity analysis - Background rate of oral drug use	No response criteria
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Chronic (>6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=16 Usual care only. Concomitant therapy: Standard physical therapy program, 45 minutes/session, 4 sessions over 4 weeks. Focused primarily on glenohumeral and scapulothoracic joints mobilisation in more limited direction of movement.

Number of participants	32
Duration of follow-up	8 weeks.
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Devices - tape (N = 16)
Neuromuscular taping technique - 15 minutes per session. 4 sessions over 4 weeks. Applied with a decompressive method on the pectoralis major, deltoids and supraspinatus according to the NMT Method Manual. For pectoralis major, w-shape tape was attached from the intertubercular groove of the humerus to the centre of the sternum while the person lay in a supine position. The inferior strip was applied over the abdominal muscle bundles with the limb abducted over 100 degrees, the central strip following the sternocostal muscle bundles with the limb abducted to 90 degrees and the superior strip over the clavicular bundles with the limb abducted to 80 degrees. For the deltoids, the tape was cut into a Y-shape and anchored to the deltoid tuberosity with the arm in a neutral position while the patient sat on the bed. The anterior strip was applied over the clavicular bundle of the muscle with the upper limb in extension, whereas the posterior strip following the spinal bundle with the upper limb was in elevation (elbow extended). For the supraspinatus, the NMT was used as a Y-shape piece of tape anchored from the greater tubercle of the humerus while the person sat on the bed. The superior strip was attached following the supraspinatus fossa and the inferior strip below the spine of the scapula, parallel to the first. Both strips were applied, keeping the person's arm in adduction with internal rotation. A 5-cm wide tape was used, and it was applied without traction (0% tension) with the muscle in a stretched position. The people in the experimental group had a total of four applications spaced approximately 5 days apart. Concomitant therapy: Standard physical therapy program, 45 minutes/session, 4 sessions over 4 weeks. Focused primarily on glenohumeral and scapulothoracic joints mobilisation in more limited direction of movement.

Usual care or no treatment (N = 16)
Usual care only. Concomitant therapy: Standard physical therapy program, 45 minutes/session, 4 sessions over 4 weeks. Focused primarily on glenohumeral and scapulothoracic joints mobilisation in more limited direction of movement.

Characteristics

Arm-level characteristics

Characteristic	**Devices - tape (N = 16)**	**Usual care or no treatment (N = 16)**
% Female Sample size	n = 3 ; % = 19	n = 6 ; % = 44
Mean age (SD) (years) Mean (SD)	66 (8)	66 (11)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (years) Mean (SD)	3.1 (2.2)	2.9 (2.3)

Control group reported to have 15 people in the baseline characteristics table.

Outcomes

Study timepoints

- Baseline
- 8 week (<6 months)

Continuous outcome

Outcome	Devices - tape, Baseline, N = 16	Devices - tape, 8 week, N = 16	Usual care or no treatment, Baseline, N = 15	Usual care or no treatment, 8 week, N = 15
Pain (Visual analogue scale) Scale range: 0-10. Final values. Mean (SD)	6.5 (2.3)	2 (2.1)	5.3 (2.1)	4.5 (1.9)

Pain (Visual analogue scale) - Polarity - Lower values are better

Dichotomous outcome

Outcome	Devices - tape, Baseline, N = 16	Devices - tape, 8 week, N = 16	Usual care or no treatment, Baseline, N = 16	Usual care or no treatment, 8 week, N = 16
Withdrawal due to adverse events No statements of people withdrawing due to adverse events. No of events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 0 ; % = 0

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(Visualanaloguescale)-MeanSD-Devices - tape-Usual care or no treatment-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Devices - tape-Usual care or no treatment-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Rah, 2012

Bibliographic Reference	Rah, U. W.; Yoon, S. H.; Moon, D. J.; Kwack, K. S.; Hong, J. Y.; Lim, Y. C.; Joen, B.; Subacromial corticosteroid injection on poststroke hemiplegic shoulder pain: a randomized, triple-blind, placebo-controlled trial; Archives of Physical Medicine & Rehabilitation; 2012; vol. 93 (no. 6); 949-56

Study details

Secondary publication of another included	No additional information.

study- see primary study for details	
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Republic of Korea.
Study setting	Inpatients.
Study dates	No additional information.
Sources of funding	Supported by the Department of Medical Sciences, The Graduate School, Ajou University (grant no. 3-2009-0090).
Inclusion criteria	Hemiplegia after stroke; hemiplegic shoulder pain of at least 1 month in duration; aged 20 to 70 years old; clinically or ultrasonographically diagnosed rotator cuff disorder, a minimum of 1 positive finding from the physical tests showing correlation with the ultrasonographic evaluation; pain defined as a score of 3 points or more on a 10-cm visual analogue scale; muscle power of deltoid grade 2 or greater on the manual muscle test by the Medical Research Council Scale; a minimum score of 20 points for the Mini-Mental State Examination to ensure the patients can make their own decision to participate in the research and express changes in pain.
Exclusion criteria	Current adhesive capsulitis (restriction of passive motion >30 degrees in at least 2 planes of movement measured to onset of pain with a gravity inclinometer); complex regional pain syndrome type I diagnosed according to the International Association for the Study of Pain; full thickness tear of the rotator cuff in ultrasonographic examination; biceps tendon disorders (not accompanying rotator cuff disorder); severe spasticity of the Modified Ashworth Scale grade 3 and 4; shoulder subluxation (the width between the inferior aspect of the acromion and the superior aspect of the head of the humerus >1 finger at a sitting or standing position without supporting the affected upper limb); severe motor weakness (muscle power of deltoid less than grade 2 on the manual muscle test); primary osteoarthritis of the glenohumeral joint in a simple radiograph; the presence of another obvious explanation for the pain (ie, fracture, radiculopathy, myofascial pain, central neuropathic pain; the presence of an unstable medical condition or a known uncontrolled systemic disease, including cancer, rheumatoid arthritis, endocrine disease, major depression or schizophrenia; previous trauma history of the currently affected shoulder; evidence of recent alcohol or drug abuse; previous corticosteroid injection history of the

	affected shoulder; incapable of communication owing to severe aphasia; people currently taking medication such as antiplatelet agent or anticoagulation with the exception of those who agreed to stop for a minimum of 5 days before the injection.
Recruitment / selection of participants	No additional information.
Intervention(s)	Intra-articular corticosteroids N=29 Ultrasound-guided subacromial injection with triamcinolone 40mg with 1mL of 1% lidocaine. The injection was given while the arms were positioned behind their backs with internal rotation and hyperextension of the shoulder with the elbow bent for longitudinal supraspinatus view. A 23-gauge, 6cm long needle that was inserted parallel to the transducer in a semioblique plane from the posterior side of the shoulder. The needle was advanced with real-time ultrasound equipment until the needle tip entered the bursa. Concomitant therapy: People on analgesics, if any, were told to stop administering from 5 days before the injection. All people were given picture leaflets and provided an education on home exercise programs based on the adopted protocol.
Sensitivity analysis - Background rate of oral drug use	No response criteria
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology Probably through the exclusion criteria
Subgroup 3 - Time period after stroke	Chronic (>6 months)
Population subgroups	No additional information.

Comparator	Placebo/sham N=29 Intra-articular injection of 5mL of 1% lidocaine using the same technique. Concomitant therapy: People on analgesics, if any, were told to stop administering from 5 days before the injection. All people were given picture leaflets and provided an education on home exercise programs based on the adopted protocol.
Number of participants	58
Duration of follow-up	8 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Intra-articular corticosteroids (N = 29)
Ultrasound-guided subacromial injection with triamcinolone 40mg with 1mL of 1% lidocaine. The injection was given while the arms were positioned behind their backs with internal rotation and hyperextension of the shoulder with the elbow bent for longitudinal supraspinatus view. A 23-gauge, 6cm long needle that was inserted parallel to the transducer in a semioblique plane from the posterior side of the shoulder. The needle was advanced with real-time ultrasound equipment until the needle tip entered the bursa. Concomitant therapy: People on analgesics, if any, were told to stop administering from 5 days before the injection. All people were given picture leaflets and provided an education on home exercise programs based on the adopted protocol.

Placebo/sham (N = 29)
Intra-articular injection of 5mL of 1% lidocaine using the same technique. Concomitant therapy: People on analgesics, if any, were told to stop administering from 5 days before the injection. All people were given picture leaflets and provided an education on home exercise programs based on the adopted protocol.

Characteristics

Arm-level characteristics

Characteristic	**Intra-articular corticosteroids (N = 29)**	**Placebo/sham (N = 29)**
% Female Sample size	n = 8 ; % = 28	n = 11 ; % = 38
Mean age (SD) (years) Mean (SD)	56.6 (12.5)	54.9 (10.6)
Ethnicity Sample size	n = NA ; % = NA	n = NA ; % = NA
Comorbidities Sample size	n = NA ; % = NA	n = NA ; % = NA
Time period after stroke (Months) Mean (SD)	23.6 (16.9)	18.8 (10.7)

Outcomes

Study timepoints

- Baseline
- 8 week (<6 months)

Continuous outcomes

Outcome	Intra-articular corticosteroids, Baseline, N = 29	Intra-articular corticosteroids, 8 week, N = 29	Placebo/sham, Baseline, N = 29	Placebo/sham, 8 week, N = 29
Pain (VAS-day score) Scale range: 0-10. Final values. Mean (SD)	5.5 (1.7)	3 (1.8)	5.7 (1.7)	4.9 (2.3)
Activities of daily living (Modified Barthel Index) Scale range: 0-100. Final values. Mean (SD)	75.7 (17.8)	77.5 (17.2)	71 (26.3)	72.7 (25.6)

Pain (VAS-day score) - Polarity - Lower values are better
Activities of daily living (Modified Barthel Index) - Polarity - Higher values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(VAS-dayscore)-MeanSD-Intra-articular corticosteroids-Placebo/sham-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Low
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdailyliving(ModifiedBarthelIndex)-MeanSD-Intra-articular corticosteroids-Placebo/sham-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Sui, 2021

Bibliographic Reference	Sui, M.; Jiang, N.; Yan, L.; Liu, J.; Luo, B.; Zhang, C.; Yan, T.; Xiang, Y.; Li, G.; Effect of Electroacupuncture on Shoulder Subluxation in Poststroke Patients with Hemiplegic Shoulder Pain: A Sham-Controlled Study Using Multidimensional Musculoskeletal Ultrasound Assessment; Pain Research & Management; 2021; vol. 2021; 5329881

Study details

Secondary publication of another included	No additional information.

study- see primary study for details	
Other publications associated with this study included in review	No additional information.
Trial name / registration number	Chinese Clinical Trial Registry: no. ChiCTR2000029051.
Study type	Randomised controlled trial (RCT)
Study location	China
Study setting	Outpatient follow up.
Study dates	October 2018 to September 2019.
Sources of funding	Supported by projects granted from the Traditional Chinese Medicine Bureau of Guangdong Province (no. 20201314), the National Natural Science Foundation of China (nos. 62001463 and 81927804), the Guangdong Basic and Applied Basic Research Foundation (no. 2021A1515011918), the Shenzhen Science and Technology Program (no. JCYJ20210324102010029) and the Open Project from the CAS Key Laboratory of Human-Machine Intelligence-Synergy Systems, Shenzhen Institute of Advanced Technology of China, Chinese Academy of Sciences (no. 2014DP173025).
Inclusion criteria	Meeting the diagnostic criteria for stroke as defined by the Chinese Guidelines for Prevention and Treatment of Cerebrovascular Diseases, be diagnosed using CT or MRI and meet the diagnostic criteria for fingerbreadth palpation of shoulder subluxation; aged 30-75 years; first stroke or previous stroke without sequelae; subluxation that appeared within one year of stroke; limb dysfunction on only one side of the body; stable vital signs; visual analogue scale pain score at least 4 points.
Exclusion criteria	Severe heart, lung, liver or kidney dysfunction; coagulation dysfunction; history of rotator cuff injury; periarthritis, shoulder surgery or shoulder trauma; malignant tumour; quadriplegia; severe speech or cognitive dysfunction; mental illness; pain caused by cancer, menopause, or fracture; poststroke depression; severe dizziness or pacemaker.
Recruitment / selection of participants	No additional information.

Intervention(s)	Electroacupuncture N=17 Electroacupuncture applied to the jian yu (LI15), bi nao (LI14), jian zhen (SI9) and jian liao (TE14) acupoints. During treatment, the patient was in a side-lying position, and the local skin was disinfected with 75% alcohol. The Huatuo acupuncture needles were inserted 1-1.5 inches vertically into the skin. The needles were lifted and twisted to produce a feeling of deqi (i.e. sensation of soreness, numbness, distention or radiating, which is considered to indicate effective needling). The acupuncture was followed by 30 minutes of electroacupuncture performed with a HANS-200A instrument using dense waves at 2/100 Hz. People underwent treatment once a day, five days a week for two weeks. Concomitant therapy: All received conventional drug and rehabilitation treatment. Conventional drug treatment followed the Chinese Cerebrovascular Disease Prevention and Treatment guidelines. The treatments included good limb positioning, passive shoulder movement, active shoulder strapping, rood therapy, weight training of the affected limb, and electrical stimulation therapy. All people underwent conventional rehabilitation treatments once a day, five days a week for two weeks.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Acupuncture
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Placebo/sham N=15

	Sham electroacupuncture treatment. The group received the same treatment as the electroacupuncture group except the location of needle insertions - the needles were applied 15mm from the lou gu (SP7), di ji (SP8), jiao xin (KI8) and zhu bin (KI9) points. Specifically after disinfection, Hua tuo acupuncture needles 1-1.5 inches long were inserted vertically into the skin of the side-lying participant, to a depth of five millimeters. Following acupuncture, the electrical stimulation was applied using the same stimulation parameters. Concomitant therapy: All received conventional drug and rehabilitation treatment. Conventional drug treatment followed the Chinese Cerebrovascular Disease Prevention and Treatment guidelines. The treatments included good limb positioning, passive shoulder movement, active shoulder strapping, rood therapy, weight training of the affected limb, and electrical stimulation therapy. All people underwent conventional rehabilitation treatments once a day, five days a week for two weeks.
Number of participants	32
Duration of follow-up	2 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Electroacupuncture (N = 17)
Electroacupuncture applied to the jian yu (LI15), bi nao (LI14), jian zhen (SI9) and jian liao (TE14) acupoints. During treatment, the patient was in a side-lying position, and the local skin was disinfected with 75% alcohol. The Huatuo acupuncture needles were inserted 1-1.5 inches vertically into the skin. The needles were lifted and twisted to produce a feeling of deqi (i.e. sensation of soreness, numbness, distention or radiating, which is considered to indicate effective needling). The acupuncture was followed by 30 minutes of electroacupuncture performed with a HANS-200A instrument using dense waves at 2/100 Hz. People underwent treatment once a day, five days a week for two weeks. Concomitant therapy: All received conventional drug and rehabilitation treatment. Conventional drug treatment followed the Chinese Cerebrovascular Disease Prevention and Treatment guidelines. The treatments

included good limb positioning, passive shoulder movement, active shoulder strapping, rood therapy, weight training of the affected limb, and electrical stimulation therapy. All people underwent conventional rehabilitation treatments once a day, five days a week for two weeks.

Placebo/sham (N = 15)
Sham electroacupuncture treatment. The group received the same treatment as the electroacupuncture group except the location of needle insertions - the needles were applied 15mm from the lou gu (SP7), di ji (SP8), jiao xin (KI8) and zhu bin (KI9) points. Specifically after disinfection, Hua tuo acupuncture needles 1-1.5 inches long were inserted vertically into the skin of the side-lying participant, to a depth of five millimeters. Following acupuncture, the electrical stimulation was applied using the same stimulation parameters. Concomitant therapy: All received conventional drug and rehabilitation treatment. Conventional drug treatment followed the Chinese Cerebrovascular Disease Prevention and Treatment guidelines. The treatments included good limb positioning, passive shoulder movement, active shoulder strapping, rood therapy, weight training of the affected limb, and electrical stimulation therapy. All people underwent conventional rehabilitation treatments once a day, five days a week for two weeks.

Characteristics

Arm-level characteristics

Characteristic	**Electroacupuncture (N = 17)**	**Placebo/sham (N = 15)**
% Female Sample size	n = 5 ; % = 29	n = 5 ; % = 33
Mean age (SD) (years) Mean (SD)	51 (12.44)	54.4 (8.16)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR

Characteristic	Electroacupuncture (N = 17)	Placebo/sham (N = 15)
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (days) Median (IQR)	33 (23 to 114)	44 (25 to 112)

Outcomes

Study timepoints

- Baseline
- 2 week (<6 months)

Continuous outcome

Outcome	Electroacupuncture, Baseline, N = 17	Electroacupuncture, 2 week, N = 17	Placebo/sham, Baseline, N = 15	Placebo/sham, 2 week, N = 15
Pain (Visual analogue scale) Scale range: 0-10. Final values. Mean (SD)	5.29 (1.26)	2 (0.94)	5.47 (1.3)	2.93 (1.28)

Pain (Visual analogue scale) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(Visualanaloguescale)-MeanSD-Electroacupuncture-Placebo/sham-t2

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Terlemez, 2020

Bibliographic Reference	Terlemez, R.; Ciftci, S.; Topaloglu, M.; Dogu, B.; Yilmaz, F.; Kuran, B.; Suprascapular nerve block in hemiplegic shoulder pain: comparison of the effectiveness of placebo, local anesthetic, and corticosteroid injections-a randomized controlled study; Neurological Sciences; 2020; vol. 41 (no. 11); 3243-3247

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.

Study type	Randomised controlled trial (RCT)
Study location	Turkey.
Study setting	Inpatient.
Study dates	No additional information.
Sources of funding	No additional information.
Inclusion criteria	Hemiplegic shoulder pain; aged >17 years with a diagnosis of acute stroke within the previous 24 months; visual analog scale score >3 (0-10 scale).
Exclusion criteria	Aphasia; cognitive impairment (Mini-Mental State Examination score <24); botulinum toxin treatment within the last 6 months; fixed contractures; bony deformities; uncontrolled diabetes mellitus; coagulopathy; hypersensitivity to injection agent.
Recruitment / selection of participants	People were selected from hospitalised patients.
Intervention(s)	Nerve blocks (local anaesthetic) N=20 Two groups: one (n=10) received a local anaesthetic injection (5mL of 2% lidocaine) into the suprascapular notch, one (n=10) received a local anaesthetic and corticosteroid injection (5mL of 2% lidocaine and 1mL of betamethasone) into the suprascapular notch. Injections were ultrasound guided in all groups. A 23-gauge spinal needle was used for injection using the out-plane technique. Concomitant therapy: No additional information.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable

Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Chronic (>6 months)
Population subgroups	No additional information.
Comparator	Placebo (local anaesthetic injection into muscle) N=10 Injection 5mL of 2% lidocaine into the trapezius muscle to provide a similar application between the two groups. Concomitant therapy: No additional information.
Number of participants	30
Duration of follow-up	1 month
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Nerve blocks (local anaesthetic) (N = 20)
Two groups: one (n=10) received a local anaesthetic injection (5mL of 2% lidocaine) into the suprascapular notch, one (n=10) received a local anaesthetic and corticosteroid injection (5mL of 2% lidocaine and 1mL of betamethasone) into the suprascapular notch. Injections were ultrasound guided in all groups. A 23-gauge spinal needle was used for injection using the out-plane technique.
Concomitant therapy: No additional information.

Placebo (local anaesthetic injection into muscle) (N = 10)
Injection 5mL of 2% lidocaine into the trapezius muscle to provide a similar application between the two groups. Concomitant therapy: No additional information.

Characteristics

Arm-level characteristics

Characteristic	Nerve blocks (local anaesthetic) (N = 20)	Placebo (local anaesthetic injection into muscle) (N = 10)
% Female Sample size	n = 9 ; % = 45	n = 6 ; % = 60
Mean age (SD) (years) Range	52 to 75	56 to 66
Mean age (SD) (years) Mean (SD)	62 (NR)	57.5 (NR)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Months) Range	52 to 75	56 to 66

Characteristic	Nerve blocks (local anaesthetic) (N = 20)	Placebo (local anaesthetic injection into muscle) (N = 10)
Time period after stroke (Months) Mean (SD)	13.8 (NR)	15 (NR)

Outcomes

Study timepoints

- Baseline
- 1 month (<6 months)

Continuous outcome

Outcome	Nerve blocks (local anaesthetic), Baseline, N = 10	Nerve blocks (local anaesthetic), 1 month, N = 10	Placebo (local anaesthetic injection into muscle), Baseline, N = 10	Placebo (local anaesthetic injection into muscle), 1 month, N = 10
Pain (Visual analogue scale) Scale range: 0-10. Final values. Mean (SD)	7.35 (2.14)	3.9 (2.13)	7.7 (2.1)	5.5 (2.1)

Pain (Visual analogue scale) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(Visualanaloguescale)-MeanSD-Nerve blocks (local anaesthetic)-Placebo (local anaesthetic injection into muscle)-t1

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Turkkan, 2017

Bibliographic Reference	Turkkan, C.; Ozturk, G. T.; Ugurlu, F. G.; Ersoz, M.; Ultrasonographic assessment of neuromuscular electrical stimulation efficacy on glenohumeral subluxation in patients with hemiplegia: a randomized-controlled study; Turkish Journal of Physical Medicine and Rehabilitation; 2017; vol. 63 (no. 4); 287-292

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.

Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	Turkey
Study setting	Outpatient follow up
Study dates	December 2013 to September 2014.
Sources of funding	No financial support for the research and/or authorship of the article.
Inclusion criteria	All people after stroke with glenohumeral subluxation (people had a level of pain at baseline according to the baseline characteristics table).
Exclusion criteria	People with severe heart failure, bilateral hemiplegia or other shoulder pathologies.
Recruitment / selection of participants	People rehabilitated at Ankara Physical Medicine and Rehabilitation Training and Research Hospital Center.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=12 Neuromuscular electrical stimulation treatment. Applied to the supraspinatus, upper trapezius and posterior deltoid muscles of the hemiplegic side for 60 minutes/session in a day, and five days a week for four weeks (a total of 20 sessions). The people were held in a sitting position (shoulder neutral position, elbow flexed 90 degrees, forearm in pronation) and a two-channel multimodal electrostimulator which has four surface electrodes with the size of 5.5x6.5cm. For supraspinatus and upper trapezius stimulation, the active electrode was placed on 5cm away from the acromion at the level of the midpoint of the scapular spine. For stimulation of posterior deltoid muscle, the active electrode was placed on 5cm distal of the posterior acromion. The intensity of electrical stimulation was administered in the range from 20 to 30mA (frequency was 25Hz, sequence pulse width was 250 microseconds). The stimulation intensity was progressively increased, until contraction was obtained based on the tolerance of each patient. Concomitant therapy: All people used a shoulder strap and received similar conventional physiotherapy for glenohumeral subluxation (range of motion, stretching and strengthening exercises).

Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=12 Usual care only. Concomitant therapy: All people used a shoulder strap and received similar conventional physiotherapy for glenohumeral subluxation (range of motion, stretching and strengthening exercises).
Number of participants	24
Duration of follow-up	4 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Neuromuscular electrical stimulation (NMES) (N = 12)
Neuromuscular electrical stimulation treatment. Applied to the supraspinatus, upper trapezius and posterior deltoid muscles of the hemiplegic side for 60 minutes/session in a day, and five days a week for four weeks (a total of 20 sessions). The people were held in a sitting position (shoulder neutral position, elbow flexed 90 degrees, forearm in pronation) and a two-channel multimodal electrostimulator which has four surface electrodes with the size of 5.5x6.5cm. For supraspinatus and upper trapezius stimulation, the active electrode was placed on 5cm away from the acromion at the level of the midpoint of the scapular spine. For stimulation of posterior deltoid muscle, the active electrode was placed on 5cm distal of the posterior acromion. The intensity of electrical stimulation was administered in the range from 20 to 30mA (frequency was 25Hz, sequence pulse width was 250 microseconds). The stimulation intensity was progressively increased, until contraction was obtained based on the tolerance of each patient. Concomitant therapy: All people used a shoulder strap and received similar conventional physiotherapy for glenohumeral subluxation (range of motion, stretching and strengthening exercises).

Usual care or no treatment (N = 12)
Usual care only. Concomitant therapy: All people used a shoulder strap and received similar conventional physiotherapy for glenohumeral subluxation (range of motion, stretching and strengthening exercises).

Characteristics

Arm-level characteristics

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 12)	Usual care or no treatment (N = 12)
% Female Sample size	n = 4 ; % = 33	n = 10 ; % = 83
Mean age (SD) (years) Mean (SD)	61.5 (10.4)	66.7 (18.1)

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 12)	Usual care or no treatment (N = 12)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Months) Mean (SD)	4 (3.3)	3.7 (2.6)

Outcomes

Study timepoints

Baseline
4 week (<6 months)

Continuous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 12	Neuromuscular electrical stimulation (NMES), 4 week, N = 12	Usual care or no treatment, Baseline, N = 12	Usual care or no treatment, 4 week, N = 12
Pain (Visual analogue scale) Scale range: 0-100. Final values. Mean (SD)	24.4 (33.9)	8.3 (16)	35.3 (32)	20 (27.1)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 12	Neuromuscular electrical stimulation (NMES), 4 week, N = 12	Usual care or no treatment, Baseline, N = 12	Usual care or no treatment, 4 week, N = 12
Activities of daily living (Shoulder Disability Questionnaire) Scale range: 0-100. Final values. Mean (SD)	60.8 (36.3)	30.6 (27)	73.2 (31.8)	62.1 (39.4)

Pain (Visual analogue scale) - Polarity - Lower values are better
Activities of daily living (Shoulder Disability Questionnaire) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(Visualanaloguescale)-MeanSD-Neuromuscular electrical stimulation (NMES)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdailyliving(ShoulderDisabilityQuestionnaire)-MeanSD-Neuromuscular electrical stimulation (NMES)-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

van Bladel, 2017

Bibliographic Reference	van Bladel, A.; Lambrecht, G.; Oostra, K. M.; Vanderstraeten, G.; Cambier, D.; A randomized controlled trial on the immediate and long-term effects of arm slings on shoulder subluxation in stroke patients; European journal of physical & rehabilitation medicine.; 2017; vol. 53 (no. 3); 400-409

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	Clinicaltrials.gov = NCT02102269.
Study type	Randomised controlled trial (RCT)

Study location	Belgium
Study setting	Hospital inpatients
Study dates	No additional information.
Sources of funding	States there are no conflict of interests with any financial organisation regarding the material discussed in the manuscript.
Inclusion criteria	People after their first stroke with a unilateral upper limb hemiparesis; all had to be able to sit upright in a chair with a back support but no arm support for at least 30 minutes.
Exclusion criteria	A score of at least 3 on the muscle testing Medical Research Council Scale for the supraspinatus or deltoideus muscles, other neurological conditions, former shoulder problems on the hemiplegic side or severe cognitive impairments.
Recruitment / selection of participants	People recruited from 3 different rehabilitation centers in Belgium.
Intervention(s)	Devices - Slings N=21 Two groups combined. One group received an Actimove(R) sling and the other received the Shoulderlift sling. Concomitant therapy: All people received an equal standard rehabilitation program aiming at avoiding complications and active exercises adjusted to the level of impairment. Furthermore people were involved in physiotherapy focusing on balance and gait. Physiotherapeutic interventions were based on a mix of different approaches (e.g. Bobath concept, Motor Learning Programme, PNF). All people received occupational therapy and if needed speech therapy and/or cognitive training.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable

Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=11 Usual care only. Concomitant therapy: All people received an equal standard rehabilitation program aiming at avoiding complications and active exercises adjusted to the level of impairment. Furthermore people were involved in physiotherapy focusing on balance and gait. Physiotherapeutic interventions were based on a mix of different approaches (e.g. Bobath concept, Motor Learning Programme, PNF). All people received occupational therapy and if needed speech therapy and/or cognitive training.
Number of participants	32
Duration of follow-up	6 weeks
Indirectness	No additional information
Additional comments	No additional information. Appears to include completers only.

Study arms

Devices - Slings (N = 21)
Two groups combined. One group received an Actimove(R) sling and the other received the Shoulderlift sling. Concomitant therapy: All people received an equal standard rehabilitation program aiming at avoiding complications and active exercises adjusted to the level of impairment. Furthermore people were involved in physiotherapy focusing on balance and gait. Physiotherapeutic interventions were based on a mix of different approaches (e.g. Bobath concept, Motor Learning Programme, PNF). All people received occupational therapy and if needed speech therapy and/or cognitive training.

Usual care or no treatment (N = 11)
Usual care only. Concomitant therapy: All people received an equal standard rehabilitation program aiming at avoiding complications and active exercises adjusted to the level of impairment. Furthermore people were involved in physiotherapy focusing on balance and gait. Physiotherapeutic interventions were based on a mix of different approaches (e.g. Bobath concept, Motor Learning Programme, PNF). All people received occupational therapy and if needed speech therapy and/or cognitive training.

Characteristics

Arm-level characteristics

Characteristic	Devices - Slings (N = 21)	Usual care or no treatment (N = 11)
% Female Sample size	n = 7 ; % = 37	n = 9 ; % = 44
Mean age (SD) (years) Mean (SD)	54 (15)	56 (9)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR

Characteristic	Devices - Slings (N = 21)	Usual care or no treatment (N = 11)
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Weeks) Mean (SD)	9.89 (4.62)	8.44 (4.22)

Intervention groups reported to include 19 people, control group reported to have 9

Outcomes

Study timepoints

- Baseline
- 6 week (<6 months)

Continuous outcomes

Outcome	Devices - Slings, Baseline, N = 19	Devices - Slings, 6 week, N = 19	Usual care or no treatment, Baseline, N = 9	Usual care or no treatment, 6 week, N = 9
Pain (visual analogue scale activity subscale) Scale range: 0-10. Final values. Mean (SD)	5.28 (2.25)	3.28 (2.73)	2.78 (2.59)	2.44 (2.01)
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) Scale range: 0-66. Final values.	7.96 (6.39)	10.44 (8.68)	8.33 (6.58)	12.78 (12.28)

Outcome	Devices - Slings, Baseline, N = 19	Devices - Slings, 6 week, N = 19	Usual care or no treatment, Baseline, N = 9	Usual care or no treatment, 6 week, N = 9
Mean (SD)				

Pain (visual analogue scale activity subscale) - Polarity - Lower values are better
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) - Polarity - Higher values are better

Dichotomous outcome

Outcome	Devices - Slings, Baseline, N = 21	Devices - Slings, 6 week, N = 21	Usual care or no treatment, Baseline, N = 11	Usual care or no treatment, 6 week, N = 11
Withdrawal due to adverse events Intervention: 1 discontinued due to discomfort. No of events	n = NA ; % = NA	n = 1 ; % = 5	n = NA ; % = NA	n = 0 ; % = 0

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(visualanaloguescaleactivitysubscale)-MeanSD-Devices - Slings-Usual care or no treatment-t6

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessmentUpperExtremity)-MeanSD-Devices - Slings-Usual care or no treatment-t6

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Devices - Slings-Usual care or no treatment-t6

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Wilson, 2014

Bibliographic Reference	Wilson, R. D.; Gunzler, D. D.; Bennett, M. E.; Chae, J.; Peripheral nerve stimulation compared with usual care for pain relief of hemiplegic shoulder pain: a randomized controlled trial; American Journal of Physical Medicine & Rehabilitation; 2014; vol. 93 (no. 1); 17-28

Study details

Secondary publication of another included study- see primary study for details	No additional information.

Other publications associated with this study included in review	Wilson, R. D., Knutson, J. S., Bennett, M. E. et al. (2017) The Effect of Peripheral Nerve Stimulation on Shoulder Biomechanics: A Randomized Controlled Trial in Comparison to Physical Therapy. American Journal of Physical Medicine & Rehabilitation 96(3): 191-198
Trial name / registration number	Clinicaltrials.gov = NCT01123382.
Study type	Randomised controlled trial (RCT)
Study location	United States of America
Study setting	An urban, academic rehabilitation center in the United States.
Study dates	No additional information.
Sources of funding	Supported by grant R01HD059777 and K24HD054600 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development and the Clinical and Translational Science Collaborative of Cleveland, UL1TR000429 from the National Center for Advancing Translational Sciences component of the National Institutes of Health and NIH roadmap for Medical Research.
Inclusion criteria	At least 21 years old; at least 3 months after stroke with new or worsened shoulder pain on their affected side; hemiplegic shoulder pain rated at least 4 out of 10 on the 11-point numeric rating scale of the Brief Pain inventory Short Form, question 3 (BPI-SF3); duration of hemiplegic shoulder pain at least 3 months; shoulder abduction weakness no more than 4 (Medical Research Council Scale).
Exclusion criteria	Evidence of joint or overlying skin infection or history of recurrent skin infections; insensate skin; at least 1 opioid or nonopioid analgesic daily for shoulder pain; daily intake of pain medications for any other chronic pain; intra-articular or subacromial steroid injections to the shoulder in the previous 3 months; botulinum toxin injection to the trapezius, pectoralis or subscapularis muscle in the previous 3 months; currently receiving physical or occupational therapies for hemiplegic shoulder pain; bleeding disorder or INR >3.0 for those on warfarin; medical instability; pregnancy; uncontrolled seizures (>1 per month in the last 6 months); uncompensated hemi-neglect; severely impaired communication or cognition; moderate to severe depression (Beck Depression Inventory-Fast Screen 13 or above); other confounding neurological conditions affecting the upper limb; other medical issues such as complex regional pain syndrome, bicipital tendonitis, myofacial pain syndrome; history or tachyarrhythmia with hemodynamic instability; any implantable stimulator such as demand pacemakers or defibrillators; valvular heart disease including artificial valves.

Recruitment / selection of participants	No additional information.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=13 Percutaneous nerve stimulation using a single percutaneous electrode. The target implantation site was identified and the depth of the deltoid muscle was determined via monopolar needle stimulation, an insulted introducer loaded with a fine-wire percutaneous lead. Strong contraction of the middle and posterior deltoid muscles verified proper positioning. Pressure was maintained at the skin surface to anchor the lead's barb in the belly of the muscle while the introducer was withdrawn leaving the lead in place. After one week for electrode stabilisation, an external stimulator was connected to the lead to stimulate at 12 Hz and 20 mA. Pulse duration (40-200 microseconds) was adjusted to produce the strongest muscle contraction without discomfort. People were prescribed 6 hours of stimulation per day for 3 weeks, to be completed in single or divided doses. The stimulator completed a cycle every 30 seconds consisting of 5 seconds to ramp up, 10 seconds at maximum stimulation, 5 seconds to ramp down, and 10 seconds without stimulation. Concomitant therapy: No physiotherapy or occupational therapy directed at the shoulder or experimental procedures involving the hemiparetic upper limb; no intra-articular or subacromial corticosteroid injections to the affected shoulder; may receive oral spasticity medications, but no neurolytic agents to shoulder adductors or internal rotators; no change in dosing of analgesic or spasticity medications; no addition of analgesic or spasticity medications.
Sensitivity analysis - Background rate of oral drug use	Mixed population
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Chronic (>6 months)

Population subgroups	No additional information.
Comparator	Usual care or no treatment N=12 Usual care receiving 8 hours of outpatient physiotherapy over a 4 week period coupled with daily home exercises. This included: proper positioning and handling, and the use of slings and supports to reduce the risk of trauma to the hemiparetic upper limb; range of motion and strengthening exercises within pain-free range and loads, respectively; task-specific therapy for participants with residual hard function to reduce impairments and improve basic and instrumental activities of daily living; home exercise program on days participants do not receive physiotherapy. Concomitant therapy: No physiotherapy or occupational therapy directed at the shoulder or experimental procedures involving the hemiparetic upper limb; no intra-articular or subacromial corticosteroid injections to the affected shoulder; may receive oral spasticity medications, but no neurolytic agents to shoulder adductors or internal rotators; no change in dosing of analgesic or spasticity medications; no addition of analgesic or spasticity medications.
Number of participants	25
Duration of follow-up	4 weeks
Indirectness	No additional information.
Additional comments	Available case intention to treat method of analysis

Study arms

Neuromuscular electrical stimulation (NMES) (N = 13)
Percutaneous nerve stimulation using a single percutaneous electrode. The target implantation site was identified and the depth of the deltoid muscle was determined via monopolar needle stimulation, an insulted introducer loaded with a fine-wire percutaneous lead. Strong contraction of the middle and posterior deltoid muscles verified proper positioning. Pressure was maintained at the skin surface to anchor the lead's barb in the belly of the muscle while the introducer was withdrawn leaving the lead in place. After one week for

electrode stabilisation, an external stimulator was connected to the lead to stimulate at 12 Hz and 20 mA. Pulse duration (40-200 microseconds) was adjusted to produce the strongest muscle contraction without discomfort. People were prescribed 6 hours of stimulation per day for 3 weeks, to be completed in single or divided doses. The stimulator completed a cycle every 30 seconds consisting of 5 seconds to ramp up, 10 seconds at maximum stimulation, 5 seconds to ramp down, and 10 seconds without stimulation. Concomitant therapy: No physiotherapy or occupational therapy directed at the shoulder or experimental procedures involving the hemiparetic upper limb; no intra-articular or subacromial corticosteroid injections to the affected shoulder; may receive oral spasticity medications, but no neurolytic agents to shoulder adductors or internal rotators; no change in dosing of analgesic or spasticity medications; no addition of analgesic or spasticity medications.

Usual care or no treatment (N = 12)

Usual care receiving 8 hours of outpatient physiotherapy over a 4 week period coupled with daily home exercises. This included: proper positioning and handling, and the use of slings and supports to reduce the risk of trauma to the hemiparetic upper limb; range of motion and strengthening exercises within pain-free range and loads, respectively; task-specific therapy for participants with residual hard function to reduce impairments and improve basic and instrumental activities of daily living; home exercise program on days participants do not receive physiotherapy. Concomitant therapy: No physiotherapy or occupational therapy directed at the shoulder or experimental procedures involving the hemiparetic upper limb; no intra-articular or subacromial corticosteroid injections to the affected shoulder; may receive oral spasticity medications, but no neurolytic agents to shoulder adductors or internal rotators; no change in dosing of analgesic or spasticity medications; no addition of analgesic or spasticity medications.

Characteristics

Arm-level characteristics

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 13)	Usual care or no treatment (N = 12)
% Female Sample size	n = 6 ; % = 46.2	n = 7 ; % = 58.3
Mean age (SD) (years)	54 (50 to 68)	55.5 (50 to 62.5)

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 13)	Usual care or no treatment (N = 12)
Median (IQR)		
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NA ; % = NA	n = NA ; % = NA
Coronary artery disease Sample size	n = 4 ; % = 30.8	n = 0 ; % = 0
Congestive heart failure Sample size	n = 0 ; % = 0	n = 0 ; % = 0
Cardiac arrhythmia Sample size	n = 1 ; % = 7.7	n = 0 ; % = 0
Diabetes mellitus Sample size	n = 4 ; % = 38.5	n = 5 ; % = 41.7
Hypertension Sample size	n = 10 ; % = 76.9	n = 12 ; % = 100
Renal Dialysis Sample size	n = 0 ; % = 0	n = 0 ; % = 0
Pulmonary disease Sample size	n = 1 ; % = 7.7	n = 2 ; % = 16.7

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 13)	Usual care or no treatment (N = 12)
Peripheral vascular disease Sample size	n = 0 ; % = 0	n = 1 ; % = 8.3
Seizure Disorder Sample size	n = 1 ; % = 7.7	n = 0 ; % = 0
Osteoarthritis Sample size	n = 3 ; % = 23.1	n = 0 ; % = 0
Cancer Sample size	n = 0 ; % = 0	n = 1 ; % = 8.3
Time period after stroke (years) Median (IQR)	2.6 (0.9 to 4)	2.3 (0.8 to 4.8)

Outcomes

Study timepoints

- Baseline
- 16 week (<6 months)

Continuous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 13	Neuromuscular electrical stimulation (NMES), 16 week, N = 13	Usual care or no treatment, Baseline, N = 12	Usual care or no treatment, 16 week, N = 12
Person/participant generic health-related quality of life (SF-36 v2) Scale range: 0-100. Final values. Mean (SE)	NA (NA)	NA (NA)	NA (NA)	NA (NA)
SF-36 physical component summary Mean (SE)	28 (2.7)	34.1 (3.2)	27.6 (2.8)	33.8 (3.5)
SF-36 mental component summary Mean (SE)	58.1 (4)	58.6 (4.3)	47.1 (4.2)	52.3 (4.9)
Pain (worst pain 7 days) Scale range: 0-10. Final values. Mean (SE)	7.5 (0.7)	3 (0.7)	7.6 (0.7)	6.1 (0.8)
Physical function - upper limb (Fugl-Meyer upper extremity) Scale range: 0-100. Final values. Mean (SE)	50.5 (14.4)	76.9 (14.6)	26.7 (15)	41.5 (15.9)

Person/participant generic health-related quality of life (SF-36 v2) - Polarity - Higher values are better
Pain (worst pain 7 days) - Polarity - Lower values are better
Physical function - upper limb (Fugl-Meyer upper extremity) - Polarity - Higher values are better

Dichotomous outcome

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 13	Neuromuscular electrical stimulation (NMES), 16 week, N = 13	Usual care or no treatment, Baseline, N = 12	Usual care or no treatment, 16 week, N = 12
Withdrawal due to adverse events Intervention: 1 medical illness. Control: 2 medical illness. No of events	n = NA ; % = NA	n = 1 ; % = 8	n = NA ; % = NA	n = 2 ; % = 17

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Person/participantgenerichealth-relatedqualityoflife(SF-36v2)-SF-36physicalcomponentsummary-MeanSE-Neuromuscular electrical stimulation (NMES)-Usual care or no treatment-t16

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Person/participantgenerichealth-relatedqualityoflife(SF-36v2)-SF-36mentalcomponentsummary-MeanSE-Neuromuscular electrical stimulation (NMES)-Usual care or no treatment-t16

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Pain(worstpain7days)-MeanSE-Neuromuscular electrical stimulation (NMES)-Usual care or no treatment-t16

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Low
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Neuromuscular electrical stimulation (NMES)-Usual care or no treatment-t16

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Low
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(Fugl-Meyerupperextremity)-MeanSE-Neuromuscular electrical stimulation (NMES)-Usual care or no treatment-t16

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Wilson, 2017

Bibliographic Reference	Wilson, R. D.; Knutson, J. S.; Bennett, M. E.; Chae, J.; The Effect of Peripheral Nerve Stimulation on Shoulder Biomechanics: A Randomized Controlled Trial in Comparison to Physical Therapy; American Journal of Physical Medicine & Rehabilitation; 2017; vol. 96 (no. 3); 191-198

Study details

Secondary publication of another included study- see primary study for details	Wilson, R. D., Gunzler, D. D., Bennett, M. E. et al. (2014) Peripheral nerve stimulation compared with usual care for pain relief of hemiplegic shoulder pain: a randomized controlled trial. American Journal of Physical Medicine & Rehabilitation 93(1): 17-28
Other publications associated with this study included in review	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	

Yang, 2018

Bibliographic Reference	Yang, L.; Yang, J.; He, C.; The Effect of Kinesiology Taping on the Hemiplegic Shoulder Pain: A Randomized Controlled Trial; Journal of Healthcare Engineering; 2018; vol. 2018; 8346432

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	China
Study setting	People at the rehabilitation center of the West China Hospital.
Study dates	April 2013 to September 2014.
Sources of funding	No additional information.
Inclusion criteria	>30 years of age; period after stroke >1 month and <6 months; diagnosed as hemiplegic shoulder pain with a period of more than 1 month, accompanied with shoulder subluxation; adequate communication abilities; the shoulder muscles can contract and move theshoulder more than 10 degrees but less than 90 degrees in flexion and/or abduction in sitting

	position, accompanying shoulder pain produced or increased; normal light touch and pin-pick sensation on the affected shoulder; the pain is caused by local problems.
Exclusion criteria	History of serious conditions or diseases such as cancer; skin problems, wounds or infections on the affected shoulder; skin allergy to the tape; history of shoulder fracture on the affected side or history of shoulder sprain on subluxation before the study; severe disease which may affect the study, such as uncontrolled hypertension or heart disease; history of intra-articular steroid injection in the past 4 weeks.
Recruitment / selection of participants	No additional information.
Intervention(s)	Devices - Tape N=10 Kinesiology taping once a day, 5 days per week for 4 consecutive weeks. Tapes of 5cm width were used. The fascilitation technique was used for the deltoid, supraspinatus and teres minor. First, the supraspinatus was taped. The shoulder was positioned in an abduction potion at about 30 degrees with a slight flexion and internal rotation, and the humeral head was repositioned to the normal place. The first 4cm of the tape was applied to the original site of supraspinatus (superior medial border of the scapula) with no tension. Then, the remaining strip was applied over the muscle to the insertion site (grater tubercle of humerus) with about 25-50% of the full available tension. After this, the patient's shoulder was placed in abduction at 30 degrees. Taping of the middle part of the deltoid muscle begun by attaching the first 4cm of the strip over the acromion process with no stretch. Then, the rest of the strip was stretched downward to the deltoid tuberosity with 20-30% of tension. For taping the teres minor, the shoulder was flexed with a little internal flexion. The base of the tape was placed on the inferior angle of the scapular. The rest of the strip was stretched with 15-25% of tension and placed along the axillary border of the scapula to the greater tuberosity of the humerus. The last one tape was used to reduce the subluxation of the shoulder and was cut into Y shape before taping. After reposition of the shoulder, the base of the tape was applied to the acromion process, and then, the two strips were stretched with a tension of 50-70% and placed along the anterior and posterior borders of deltoid separately to the deltoid tuberosity. Tapes were replaced daily. Concomitant therapy: Electrical therapy and exercise treatment once a day, 5 days per week for 4 consecutive weeks.
Sensitivity analysis - Background rate of oral drug use	Not reported

Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Placebo/sham N=9 Tapes applied in the same placed but with no tension applied. Concomitant therapy: Electrical therapy and exercise treatment once a day, 5 days per week for 4 consecutive weeks.
Number of participants	19
Duration of follow-up	4 weeks
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Devices - Tape (N = 10)
Kinesiology taping once a day, 5 days per week for 4 consecutive weeks. Tapes of 5cm width were used. The fascilitation technique was used for the deltoid, supraspinatus and teres minor. First, the supraspinatus was taped. The shoulder was positioned in an

abduction potion at about 30 degrees with a slight flexion and internal rotation, and the humeral head was repositioned to the normal place. The first 4cm of the tape was applied to the original site of supraspinatus (superior medial border of the scapula) with no tension. Then, the remaining strip was applied over the muscle to the insertion site (grater tubercle of humerus) with about 25-50% of the full available tension. After this, the patient's shoulder was placed in abduction at 30 degrees. Taping of the middle part of the deltoid muscle begun by attaching the first 4cm of the strip over the acromion process with no stretch. Then, the rest of the strip was stretched downward to the deltoid tuberosity with 20-30% of tension. For taping the teres minor, the shoulder was flexed with a little internal flexion. The base of the tape was placed on the inferior angle of the scapular. The rest of the strip was stretched with 15-25% of tension and placed along the axillary border of the scapula to the greater tuberosity of the humerus. The last one tape was used to reduce the subluxation of the shoulder and was cut into Y shape before taping. After reposition of the shoulder, the base of the tape was applied to the acromion process, and then, the two strips were stretched with a tension of 50-70% and placed along the anterior and posterior borders of deltoid separately to the deltoid tuberosity. Tapes were replaced daily. Concomitant therapy: Electrical therapy and exercise treatment once a day, 5 days per week for 4 consecutive weeks.

Placebo/sham (N = 9)
Tapes applied in the same placed but with no tension applied. Concomitant therapy: Electrical therapy and exercise treatment once a day, 5 days per week for 4 consecutive weeks.

Characteristics

Arm-level characteristics

Characteristic	**Devices - Tape (N = 10)**	**Placebo/sham (N = 9)**
% Female Sample size	n = 3 ; % = 30	n = 3 ; % = 33
Mean age (SD) (years) Mean (SD)	59 (3.2)	60 (2.3)

Characteristic	Devices - Tape (N = 10)	Placebo/sham (N = 9)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Weeks) Mean (SD)	18.3 (0.82)	19.2 (2.49)

Outcomes

Study timepoints

- Baseline
- 4 week (<6 months)

Continuous outcome

Outcome	Devices - Tape, Baseline, N = 10	Devices - Tape, 4 week, N = 10	Placebo/sham, Baseline, N = 9	Placebo/sham, 4 week, N = 9
Pain (Visual analogue scale) Scale range: 0-10. Final values. Mean (SD)	4.3 (1.2)	1.4 (0.7)	5 (0.7)	3.4 (0.8)

Pain (Visual analogue scale) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(Visualanaloguescale)-MeanSD-Devices - Tape-Placebo/sham-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Yu, 2004

Bibliographic Reference	Yu, D. T.; Chae, J.; Walker, M. E.; Kirsteins, A.; Elovic, E. P.; Flanagan, S. R.; Harvey, R. L.; Zorowitz, R. D.; Frost, F. S.; Grill, J. H.; Feldstein, M.; Fang, Z. P.; Intramuscular neuromuscular electric stimulation for poststroke shoulder pain: a multicenter randomized clinical trial; Archives of Physical Medicine & Rehabilitation; 2004; vol. 85 (no. 5); 695-704

Study details

Secondary publication of another included study- see primary study for details	Chae, J., Yu, D. T., Walker, M. E. et al. (2005) Intramuscular electrical stimulation for hemiplegic shoulder pain: a 12-month follow-up of a multiple-center, randomized clinical trial. American Journal of Physical Medicine & Rehabilitation 84(11): 832-42
Other publications associated with	No additional information.

this study included in review	
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	United States of America.
Study setting	Outpatient follow up.
Study dates	No additional information.
Sources of funding	Supported in part by the National Institute for Child Health and Human Development (grant no. R44HD34996, K12HD01097), by the National Center for Research Resource (grant no. M01RR0080) and by NeuroControl Corp.
Inclusion criteria	More than 12 weeks poststroke (haemorrhagic or nonhaemorrhage) and at least 18 years of age; shoulder pain rated as at least 2 on the 11-point numeric rating scale of the Brief Pain Inventory question 12; at least one-half finger-breadth of inferior glenohumeral separation by palpation with the affected limb in a dependent position without manual traction; ability to understand study requirements; ability to recall 3 objects after 30 minutes; ability to use an NRS.
Exclusion criteria	History of ventricular arrhythmias or any other arrhythmia with hemodynamic instability; previous stroke with persistent neurologic deficit; prestroke shoulder pathology; complex regional pain syndrome; any implantable stimulator or uncontrolled seizures (>1/month for 1 year).
Recruitment / selection of participants	People recruited from stroke rehabilitation outpatient clinics at 7 academic medical centers.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=32 Intramuscular neuromuscular electrical stimulation to the supraspinatus, posterior deltoid, middle deltoid and trapezius for 6 hours a day for 6 weeks. Stimulator on time of 20 seconds with a 5 second ramp up, 10 second plateau and 5 second ramp down period. The off time was 10 seconds. The amplitude was kept constant at 20mA. Adjusting the pulse width from 10 to 200 microseconds regulated the stimulus intensity. When electrodes were inserted paths between motor points and anticipated electrode exit sites were anaesthetised with 2% lidocaine using a 19-gauge hypodermic needle loaded with a percutaneous electrode that was tunnelled subcutaneously from the electrode exit site toward the motor point. People

	receiving NMES were allowed to continue using a hemisling if prescribed before enrollment, but instructed not to use them during NMES treatment. Concomitant therapy: All people were allowed to receive concomitant treatments including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians.
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Chronic (>6 months)
Population subgroups	No additional information.
Comparator	Devices - Slings N=29 Cuff-type hemisling with instructions to use the sling whenever the upper limb was unsupported. Concomitant therapy: All people were allowed to receive concomitant treatments including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians.

Number of participants	61
Duration of follow-up	3 months and 6 months.
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Neuromuscular electrical stimulation (NMES) (N = 32)
Intramuscular neuromuscular electrical stimulation to the supraspinatus, posterior deltoid, middle deltoid and trapezius for 6 hours a day for 6 weeks. Stimulator on time of 20 seconds with a 5 second ramp up, 10 second plateau and 5 second ramp down period. The off time was 10 seconds. The amplitude was kept constant at 20mA. Adjusting the pulse width from 10 to 200 microseconds regulated the stimulus intensity. When electrodes were inserted paths between motor points and anticipated electrode exit sites were anaesthetised with 2% lidocaine using a 19-gauge hypodermic needle loaded with a percutaneous electrode that was tunnelled subcutaneously from the electrode exit site toward the motor point. People receiving NMES were allowed to continue using a hemisling if prescribed before enrollment, but instructed not to use them during NMES treatment. Concomitant therapy: All people were allowed to receive concomitant treatments including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians.

Devices - Slings (N = 29)
Cuff-type hemisling with instructions to use the sling whenever the upper limb was unsupported. Concomitant therapy: All people were allowed to receive concomitant treatments including pharmacologic (opioid and nonopioid analgesics) and nonpharmacologic (outpatient physical and occupational therapy) interventions as per their primary care physicians.

Characteristics

Arm-level characteristics

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 32)	Devices - Slings (N = 29)
% Female Sample size	n = 14 ; % = 42.4	n = 12 ; % = 42.9
Mean age (SD) (years) Mean (SD)	60 (11.4)	58 (12.9)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (Weeks) Mean (SD)	123 (157)	135 (171)

Outcomes

Study timepoints

- Baseline
- 3 month (<6 months)
- 6 month (≥6 months)

Continuous outcome

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 32	Neuromuscular electrical stimulation (NMES), 3 month, N = 32	Neuromuscular electrical stimulation (NMES), 6 month, N = 32	Devices - Slings, Baseline, N = 29	Devices - Slings, 3 month, N = 29	Devices - Slings, 6 month, N = 29
Pain (Brief Pain Inventory question 12) Scale range: 0-10. Mean differences comparing NMES to devices. Mean (95% CI)	NA (NA to NA)	-3.3 (-4.9 to -1.8)	-2.3 (-4 to -0.7)	NA (NA to NA)	NA (NA to NA)	NA (NA to NA)
Pain (Brief Pain Inventory question 12) Scale range: 0-10. Mean differences comparing NMES to devices. Mean (SD)	7.59 (2.12)	NA (NR)	NA (NR)	6.52 (2.29)	NA (NR)	NA (NR)

Pain (Brief Pain Inventory question 12) - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcome-Pain(BriefPainInventoryquestion12)-MeanNineFivePercentCI-Neuromuscular electrical stimulation (NMES)-Devices - Slings-t3

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcome-Pain(BriefPainInventoryquestion12)-MeanNineFivePercentCI-Neuromuscular electrical stimulation (NMES)-Devices - Slings-t6

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Zhan, 2022

Bibliographic Reference	Zhan, J.; Ai, Y.; Zhan, L.; Pan, R.; Wang, Y.; Dong, C.; Wang, Q.; Chen, H.; Lu, L.; Li, M.; Effect of abdominal acupuncture combined with routine rehabilitation training on shoulder-hand syndrome after stroke: A randomized controlled trial; Integrative Medicine Research; 2022; vol. 11 (no. 2); 100805

Study details

Secondary publication of	No additional information.

another included study- see primary study for details	
Other publications associated with this study included in review	No additional information.
Trial name / registration number	ChiCTR2100045464.
Study type	Randomised controlled trial (RCT)
Study location	China
Study setting	Inpatient
Study dates	July 2017 to July 2019
Sources of funding	This study was funded by the project of Traditional Chinese Medicine Bureau of Guangdong Province (No.2018KT1043), Opening Operation Program of Key Laboratory of Acupuncture and Moxibustion of Traditional Chinese Medicine in Guangdong (No.2017B030314143), and General Program of the National Natural Science foundation of China (No.81774406).
Inclusion criteria	People who met the recognized diagnostic criteria of "stroke" and "stroke hemiplegic shoulder"; people whose stroke hemiplegic shoulder occurred after stroke and was a phase I; people whose duration of stroke was between 15 days and 6 months; people who were 20-75 years old; people who were conscious (Glasgow Coma Scale at least 13); people voluntarily participating in the study and cooperating with examinations and treatment.
Exclusion criteria	People with recurrent strokes or patients with recurrent or worsening stroke hemiplegic shoulder; people with severe heart, liver, kidney disease and moderate to severe infection; people with severe cognitive impairment or complete aphasia who cannot cooperate with the outcome evaluation; people with a shoulder fracture or nerve root cervical spondylopathy.
Recruitment / selection of participants	People with post-stroke stroke hemiplegic shoulder who were hospitalised in the rehabilitation department of Guangdong Provincial Hospital of Chinese Medicine
Intervention(s)	Acupuncture/dry needling N=25

	Bo's abdominal acupuncture combined with routine exercise therapy. The acupuncture was performed at selected acupoints: CV12, CV10, CV06, CV04, bilateral ST24, bilateral ST26, KI17 on the affected side, AB1 and AB2. The acupuncture used 0.20 mm x 30 mm needles inserted in the sequence stated before. The needles were perpendicular to the superficial level of the skin and inserted into the subcutaneous area of the above acupoints. After 3-4 minutes, CV12, CV10, CV06 and CV04 were deeply inserted (depth 20-30mm), ST24 and ST26 were moderately inserted (depth 10-15mm) and KI17, AB1 and AB2 were shallowly inserted (depth 5mm). After 30 minutes, the acupuncturist removed all the needles in the order of insertion. People received the therapy for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week. Concomitant therapy: Rehabilitation training for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week (including good limb position and active and passive exercise training of the upper limbs). People in both groups were treated with drugs for secondary prevention of stroke. At the same time, standard doses of NSAID drugs (diclofenac or paracetamol) were used.
Sensitivity analysis - Background rate of oral drug use	Mixed population
Subgroup 1 - Acupuncture/dry needling	Acupuncture
Subgroup 2 - Previous shoulder pathology	Not stated/unclear
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=25 Conventional therapy only.

	Concomitant therapy: Rehabilitation training for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week (including good limb position and active and passive exercise training of the upper limbs). People in both groups were treated with drugs for secondary prevention of stroke. At the same time, standard doses of NSAID drugs (diclofenac or paracetamol) were used.
Number of participants	50
Duration of follow-up	2 weeks
Indirectness	No additional information.
Additional comments	Full analysis set used for analysis of the primary outcome. Per protocol analysis was used in a sensitivity analysis.

Study arms

Acupuncture/dry needling (N = 25)
Bo's abdominal acupuncture combined with routine exercise therapy. The acupuncture was performed at selected acupoints: CV12, CV10, CV06, CV04, bilateral ST24, bilateral ST26, KI17 on the affected side, AB1 and AB2. The acupuncture used 0.20 mm x 30 mm needles inserted in the sequence stated before. The needles were perpendicular to the superficial level of the skin and inserted into the subcutaneous area of the above acupoints. After 3-4 minutes, CV12, CV10, CV06 and CV04 were deeply inserted (depth 20-30mm), ST24 and ST26 were moderately inserted (depth 10-15mm) and KI17, AB1 and AB2 were shallowly inserted (depth 5mm). After 30 minutes, the acupuncturist removed all the needles in the order of insertion. People received the therapy for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week. Concomitant therapy: Rehabilitation training for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week (including good limb position and active and passive exercise training of the upper limbs). People in both groups were treated with drugs for secondary prevention of stroke. At the same time, standard doses of NSAID drugs (diclofenac or paracetamol) were used.

Usual care or no treatment (N = 25)
Conventional therapy only. Concomitant therapy: Rehabilitation training for 2 weeks, each session was 30 minutes, 1 time per day and 5 times per week (including good limb position and active and passive exercise training of the upper limbs). People in both groups were treated with drugs for secondary prevention of stroke. At the same time, standard doses of NSAID drugs (diclofenac or paracetamol) were used.

Characteristics

Arm-level characteristics

Characteristic	Acupuncture/dry needling (N = 25)	Usual care or no treatment (N = 25)
% Female Sample size	n = 9 ; % = 36	n = 10 ; % = 41.67
Mean age (SD) (years) Mean (SD)	59.36 (8.73)	55.5 (8.2)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (days) Mean (SD)	59.63 (31.07)	68.17 (41.09)

The control group includes only 24 people in the baseline characteristics

Outcomes

Study timepoints

- Baseline
- 2 week (<6 months)

Continuous outcomes

Outcome	Acupuncture/dry needling, Baseline, N = 25	Acupuncture/dry needling, 2 week, N = 25	Usual care or no treatment, Baseline, N = 24	Usual care or no treatment, 2 week, N = 24
Pain (Visual analogue scale) Scale range: 0-10. Change scores. Mean (SD)	6.32 (1.49)	-3.68 (1.44)	6.42 (1.21)	-1.92 (1.35)
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) Scale range: 0-66. Change scores. Mean (SD)	21.48 (13.66)	6.2 (5.79)	20.96 (15.5)	6.42 (3.98)
Activities of daily living (Modified Barthel Index) Scale range: 0-100. Change scores. Mean (SD)	54.12 (25.94)	10.44 (11.4)	54.71 (24.55)	4.79 (5.29)

Pain (Visual analogue scale) - Polarity - Lower values are better
Physical function - upper limb (Fugl Meyer Assessment Upper Extremity) - Polarity - Higher values are better
Activities of daily living (Modified Barthel Index) - Polarity - Higher values are better

Dichotomous outcome

Outcome	Acupuncture/dry needling, Baseline, N = 25	Acupuncture/dry needling, 2 week, N = 25	Usual care or no treatment, Baseline, N = 25	Usual care or no treatment, 2 week, N = 25
Withdrawal due to adverse events Control group had 1 person withdraw due to new intracerebral haemorrhage No of events	n = NA ; % = NA	n = 0 ; % = 0	n = NA ; % = NA	n = 1 ; % = 4

Withdrawal due to adverse events - Polarity - Lower values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(Visualanaloguescale)-MeanSD-Acupuncture/dry needling-Usual care or no treatment-t2

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessmentUpperExtremity)-MeanSD-Acupuncture/dry needling-Usual care or no treatment-t2

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns

Section	Question	Answer
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdailyliving(ModifiedBarthelIndex)-MeanSD-Acupuncture/dry needling-Usual care or no treatment-t2

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Dichotomousoutcome-Withdrawalduetoadverseevents-NoOfEvents-Acupuncture/dry needling-Usual care or no treatment-t2

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable

Zheng, 2018

Bibliographic Reference	Zheng, J.; Wu, Q.; Wang, L.; Guo, T.; A clinical study on acupuncture in combination with routine rehabilitation therapy for early pain recovery of post-stroke shoulder-hand syndrome; Experimental and Therapeutic Medicine; 2018; vol. 15 (no. 2); 2049-2053

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	No additional information.
Study type	Randomised controlled trial (RCT)
Study location	China
Study setting	Outpatient follow up
Study dates	March 2012 to March 2016.
Sources of funding	No additional information.
Inclusion criteria	People diagnosed with stroke (phase I) through computer tomography, magnetic resonance imaging and clinical manifestations; people who were aged 45-70 years; people with the course of the disease ranging from 7 days to 3 months; people that were informed and agreed and signed the informed consent form.
Exclusion criteria	People with disturbance of consciousness such as somnolence and coma; people with stroke hemiplegic shoulder caused by trauma and fracture; people with transient ischaemic attack; people that were diagnosed with orthopedic disorders such as fracture of the upper extremity, scapulohumeral periarthritis and peripheral nerve injury, or mental diseases in the past; people with severe diseases of heart, kidney, liver or other organs; people that failed to cooperate with the examinations due to aphasia, loss of reading and dementia.
Recruitment / selection of participants	People who received treatment in the Second Hospital of Dalian Medical University.

Intervention(s)	Acupuncture/dry needling N=89 In additional to rehabilitation training, acupuncture. The acupoints used were three Yang meridians and other meridians of the affected extremity (such as Jianyu (LI15), Jianliao (SJ14), Jianzhen (SI9), Jianneiling (EX-UE), Quchi (LI11), Shousanli (LI10), Hegu (LI4) and Waiguan (SJ5) on the affected side. Acupuncture was conducted once per day for one month continuously and the needle-retaining time was 30 minutes each time. Concomitant therapy: All people received usual rehabilitation, including: postural therapy, passive movement and active movement. This was completed for 1 month (45 minutes/time, once/day).
Sensitivity analysis - Background rate of oral drug use	Not reported
Subgroup 1 - Acupuncture/dry needling	Acupuncture
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=89 Usual care only.

	Concomitant therapy: All people received usual rehabilitation, including: postural therapy, passive movement and active movement. This was completed for 1 month (45 minutes/time, once/day).
Number of participants	178
Duration of follow-up	1 month
Indirectness	No additional information.
Additional comments	No additional information.

Study arms

Acupuncture/dry needling (N = 89)
In additional to rehabilitation training, acupuncture. The acupoints used were three Yang meridians and other meridians of the affected extremity (such as Jianyu (LI15), Jianliao (SJ14), Jianzhen (SI9), Jianneiling (EX-UE), Quchi (LI11), Shousanli (LI10), Hegu (LI4) and Waiguan (SJ5) on the affected side. Acupuncture was conducted once per day for one month continuously and the needle-retaining time was 30 minutes each time. Concomitant therapy: All people received usual rehabilitation, including: postural therapy, passive movement and active movement. This was completed for 1 month (45 minutes/time, once/day).

Usual care or no treatment (N = 89)
Usual care only. Concomitant therapy: All people received usual rehabilitation, including: postural therapy, passive movement and active movement. This was completed for 1 month (45 minutes/time, once/day).

Characteristics

Arm-level characteristics

Characteristic	Acupuncture/dry needling (N = 89)	Usual care or no treatment (N = 89)
% Female Sample size	n = 35 ; % = 39	n = 36 ; % = 40
Mean age (SD) (years) Mean (SD)	54.25 (3.15)	53.35 (3.3)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (days) Mean (SD)	41.43 (8.01)	42.03 (7.38)

Outcomes

Study timepoints

- Baseline
- 4 week (<6 months)

Continuous outcomes

Outcome	Acupuncture/dry needling, Baseline, N = 89	Acupuncture/dry needling, 4 week, N = 89	Usual care or no treatment, Baseline, N = 89	Usual care or no treatment, 4 week, N = 89
Person/participant generic health-related quality of life (Quality of life scale) Scale range: unclear. Change scores. Mean (SD)	117.28 (27.03)	100.51 (13.84)	119.37 (28.68)	76.68 (12.46)
Pain (Visual analogue scale) Scale range: 0-10. Change scores. Mean (SD)	6.59 (1.98)	3.98 (0.86)	6.31 (2.01)	3.53 (0.64)
Physical function - upper limb (Fugl Meyer Assessment) Scale range: 0-66. Change scores. Mean (SD)	25.03 (7.37)	14.45 (3.31)	27.89 (7.15)	8.73 (3.03)

Person/participant generic health-related quality of life (Quality of life scale) - Polarity - Higher values are better
Pain (Visual analogue scale) - Polarity - Lower values are better
Physical function - upper limb (Fugl Meyer Assessment) - Polarity - Higher values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Person/participantgenerichealth-relatedqualityoflife(Qualityoflifescale)-MeanSD-Acupuncture/dry needling-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Pain(Visualanaloguescale)-MeanSD-Acupuncture/dry needling-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessment)-MeanSD-Acupuncture/dry needling-Usual care or no treatment-t4

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Zhou, 2018

Bibliographic Reference	Zhou, M.; Li, F.; Lu, W.; Wu, J.; Pei, S.; Efficiency of Neuromuscular Electrical Stimulation and Transcutaneous Nerve Stimulation on Hemiplegic Shoulder Pain: A Randomized Controlled Trial; Archives of Physical Medicine & Rehabilitation; 2018; vol. 99 (no. 9); 1730-1739

Study details

Secondary publication of another included study- see primary study for details	No additional information.
Other publications associated with this study included in review	No additional information.
Trial name / registration number	ChiCTR-TRC-13004272
Study type	Randomised controlled trial (RCT)
Study location	China
Study setting	Outpatient follow up
Study dates	February 2014 to July 2016.
Sources of funding	Funding from the Research Fund of the Baoshan district committee of science and technology, Shanghai, China.
Inclusion criteria	Hemiplegia in unilateral limb and pain in the hemiplegic shoulder poststroke; a stable condition and suitability for physical training; Mini-Mental State Examination score >24 points and being able to understand the requirements of test and training.

Exclusion criteria	A history of shoulder pain prior to stroke; an unstable medical condition or uncontrolled systemic diseases (such as respiratory failure, congestive heart failure, liver and kidney dysfunction or any other disorders affecting neuromuscular function); quadriplegia; those demanding cardiac pacemakers; administering any nonsteroidal anti-inflammatory drugs for shoulder pain prior to the study; disturbance of awareness, severe visual and cognitive impairment.
Recruitment / selection of participants	People recruited from the First Rehabilitation Hospital of Shanghai, China.
Intervention(s)	Neuromuscular electrical stimulation (NMES) N=36 Neuromuscular electrical stimulation (15Hz, pulse width 200 microseconds) applied to the supraspinatus and deltoids. Stimulation applied over 20 sessions of 1 hour stimulation were conducted daily for 4 weeks, consecutively. Concomitant therapy: People in all groups underwent a standardized rehabilitation program, which was delivered by occupational therapists and physical therapists. Transcutaneous electrical nerve stimulation (TENS) N=36 TENS (100 Hz, pulse width 100 microseconds) applied to the supraspinatus and deltoids. Stimulation applied over 20 sessions of 1 hour stimulation were conducted daily for 4 weeks, consecutively. Concomitant therapy: People in all groups underwent a standardized rehabilitation program, which was delivered by occupational therapists and physical therapists.
Sensitivity analysis - Background rate of oral drug use	Not reported

Subgroup 1 - Acupuncture/dry needling	Not applicable
Subgroup 2 - Previous shoulder pathology	No previous shoulder pathology
Subgroup 3 - Time period after stroke	Subacute (7 days - 6 months)
Population subgroups	No additional information.
Comparator	Usual care or no treatment N=18 Usual care only. Concomitant therapy: People in all groups underwent a standardized rehabilitation program, which was delivered by occupational therapists and physical therapists.
Number of participants	90
Duration of follow-up	8 weeks.
Indirectness	No additional information.
Additional comments	Per protocol analysis for efficacy outcomes (full analysis set who completed all visits and had no major protocol violations).

Study arms

Neuromuscular electrical stimulation (NMES) (N = 36)
Neuromuscular electrical stimulation (15Hz, pulse width 200 microseconds) applied to the supraspinatus and deltoids. Stimulation applied over 20 sessions of 1 hour stimulation were conducted daily for 4 weeks, consecutively. Concomitant therapy: People in all groups underwent a standardized rehabilitation program, which was delivered by occupational therapists and physical therapists.

Transcutaneous electrical nerve stimulation (TENS) (N = 36)
TENS (100 Hz, pulse width 100 microseconds) applied to the supraspinatus and deltoids. Stimulation applied over 20 sessions of 1 hour stimulation were conducted daily for 4 weeks, consecutively. Concomitant therapy: People in all groups underwent a standardized rehabilitation program, which was delivered by occupational therapists and physical therapists.

Usual care or no treatment (N = 18)
Usual care only. Concomitant therapy: People in all groups underwent a standardized rehabilitation program, which was delivered by occupational therapists and physical therapists.

Characteristics

Arm-level characteristics

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 36)	Transcutaneous electrical nerve stimulation (TENS) (N = 36)	Usual care or no treatment (N = 18)
% Female Sample size	n = 12 ; % = 33.33	n = 7 ; % = 18.75	n = 3 ; % = 16.67
Mean age (SD) (years) Mean (SD)	59.35 (10.78)	58.5 (9.07)	63.78 (11.17)

Characteristic	Neuromuscular electrical stimulation (NMES) (N = 36)	Transcutaneous electrical nerve stimulation (TENS) (N = 36)	Usual care or no treatment (N = 18)
Ethnicity Sample size	n = NR ; % = NR	n = NR ; % = NR	n = NR ; % = NR
Comorbidities Sample size	n = NR ; % = NR	n = NR ; % = NR	n = NR ; % = NR
Time period after stroke (days) Mean (SD)	73.61 (53.4)	100.88 (103.32)	105.89 (142.8)

Outcomes

Study timepoints

- Baseline
- 8 week (<6 months)

Continuous outcomes

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 36	Neuromuscular electrical stimulation (NMES), 8 week, N = 36	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 36	Transcutaneous electrical nerve stimulation (TENS), 8 week, N = 36	Usual care or no treatment, Baseline, N = 18	Usual care or no treatment, 8 week, N = 18
Pain (numeric rating scale)	4.23 (1.28)	NA (NR)	4.41 (1.24)	NA (NR)	3.72 (1.02)	NA (NR)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 36	Neuromuscular electrical stimulation (NMES), 8 week, N = 36	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 36	Transcutaneous electrical nerve stimulation (TENS), 8 week, N = 36	Usual care or no treatment, Baseline, N = 18	Usual care or no treatment, 8 week, N = 18
Scale range: 0-10. Change scores. Mean (SD)						
Pain (numeric rating scale) Scale range: 0-10. Change scores. Mean (SE)	NA (NA)	-2.24 (1.14)	NA (NA)	-1.57 (1.29)	NA (NA)	-1.23 (0.83)
Activities of daily living (barthel index) Scale range: 0-100. Change scores. Mean (SD)	46.13 (11.08)	NA (NR)	37.5 (19.39)	NA (NR)	39.44 (19.17)	NA (NR)
Activities of daily living (barthel index) Scale range: 0-100. Change scores. Mean (SE)	NA (NA)	11.67 (8.11)	NA (NA)	14.82 (18.13)	NA (NA)	13.08 (10.71)
Physical function - upper limb (Fugl Meyer Assessment)	11 (10.58)	NA (NR)	19.97 (20.09)	NA (NR)	17.28 (19.07)	NA (NR)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 36	Neuromuscular electrical stimulation (NMES), 8 week, N = 36	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 36	Transcutaneous electrical nerve stimulation (TENS), 8 week, N = 36	Usual care or no treatment, Baseline, N = 18	Usual care or no treatment, 8 week, N = 18
Scale range: 0-66. Change scores. Mean (SD)						
Physical function - upper limb (Fugl Meyer Assessment) Scale range: 0-66. Change scores. Mean (SE)	NA (NA)	4.86 (6.4)	NA (NA)	5.46 (9.52)	NA (NA)	5.31 (10.4)
Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life scale) Scale range: 49-245. Change scores. Mean (SD)	137.55 (17.97)	NA (NR)	130 (31.07)	NA (NR)	132.61 (31.9)	NA (NR)
Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life scale) Scale range: 49-245. Change scores.	NA (NA)	17.81 (21.4)	NA (NA)	12.68 (19.37)	NA (NA)	10.77 (12.56)

Outcome	Neuromuscular electrical stimulation (NMES), Baseline, N = 36	Neuromuscular electrical stimulation (NMES), 8 week, N = 36	Transcutaneous electrical nerve stimulation (TENS), Baseline, N = 36	Transcutaneous electrical nerve stimulation (TENS), 8 week, N = 36	Usual care or no treatment, Baseline, N = 18	Usual care or no treatment, 8 week, N = 18
Mean (SE)						

Pain (numeric rating scale) - Polarity - Lower values are better
Activities of daily living (barthel index) - Polarity - Higher values are better
Physical function - upper limb (Fugl Meyer Assessment) - Polarity - Higher values are better
Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life scale) - Polarity - Higher values are better

Critical appraisal - Cochrane Risk of Bias tool (RoB 2.0) Normal RCT

Continuousoutcomes-Pain(numericratingscale)-MeanSE-Neuromuscular electrical stimulation (NMES)-Transcutaneous electrical nerve stimulation (TENS)-Usual care or no treatment-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Activitiesofdailyliving(barthelindex)-MeanSE-Neuromuscular electrical stimulation (NMES)-Transcutaneous electrical nerve stimulation (TENS)-Usual care or no treatment-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High

Section	Question	Answer
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Physicalfunction-upperlimb(FuglMeyerAssessment)-MeanSE-Neuromuscular electrical stimulation (NMES)-Transcutaneous electrical nerve stimulation (TENS)-Usual care or no treatment-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Continuousoutcomes-Stroke-specificPatient-ReportedOutcomeMeasures(Strokespecificqualityoflifescale)-MeanSE-Neuromuscular electrical stimulation (NMES)-Transcutaneous electrical nerve stimulation (TENS)-Usual care or no treatment-t8

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable

Appendix E – Forest plots

E.1 Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment

E.1.1 Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES)

Figure 2: Pain (Numeric rating scale, 0-10, lower values are better, change score and final value) at <6 months

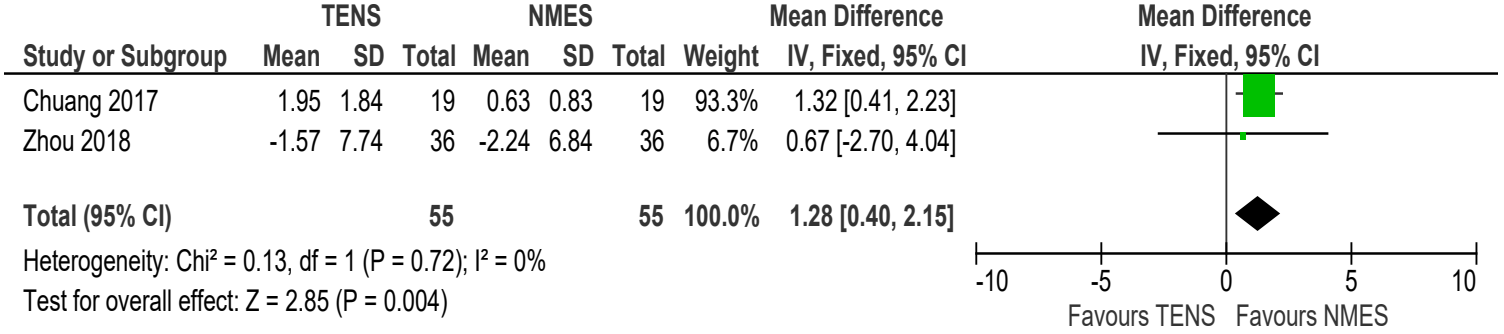


Figure 3: Physical function - upper limb (Fugl Meyer Assessment Upper Limb, 0-66, higher values are better, change score and final value) at <6 months

	TENS			NMES				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Chuang 2017	46.68	16.45	19	46.05	17.03	19	81.7%	0.63 [-10.02, 11.28]
Zhou 2018	5.46	57.12	36	4.86	38.4	36	18.3%	0.60 [-21.88, 23.08]
Total (95% CI)			**55**			**55**	**100.0%**	**0.62 [-9.00, 10.25]**

Heterogeneity: Chi² = 0.00, df = 1 (P = 1.00); I² = 0%
Test for overall effect: Z = 0.13 (P = 0.90)

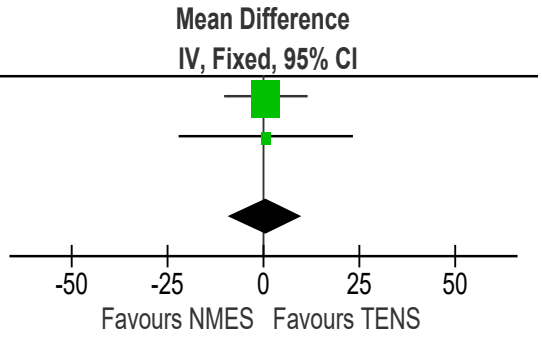


Figure 4: Activities of daily living (Barthel index, 0-100, higher values are better, change score) at <6 months

	TENS			NMES			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Zhou 2018	14.82	108.78	36	11.67	48.66	36	3.15 [-35.78, 42.08]

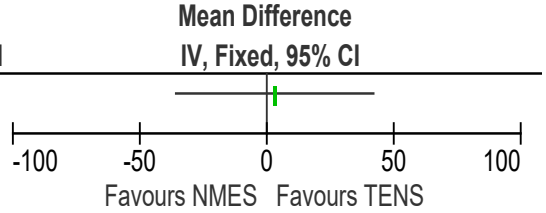


Figure 5: Stroke-specific Patient-Reported Outcome Measures (stroke specific quality of life, 49-245, higher values are better, change score) at <6 months

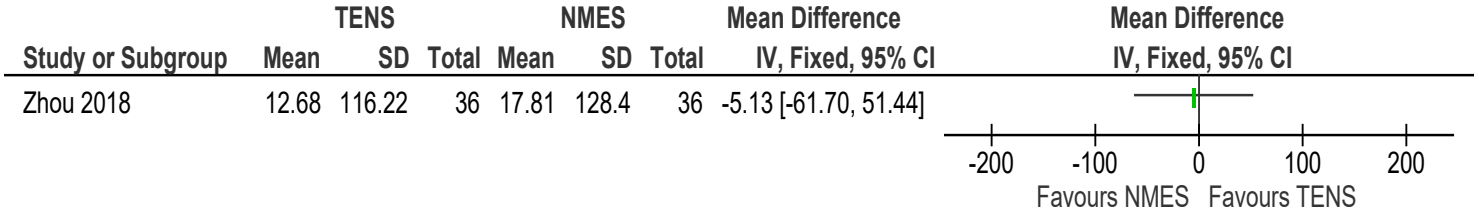
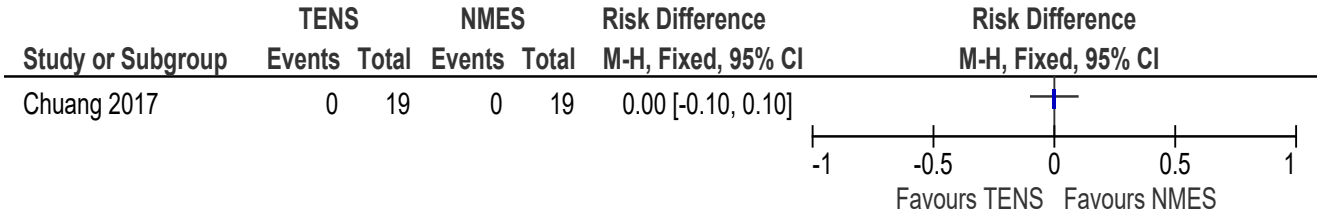


Figure 6: Withdrawal due to adverse events at <6 months



E.1.2 Transcutaneous electrical nerve stimulation (TENS) compared to usual care or no treatment

Figure 7: Pain (Numeric rating scale, 0-10, lower values are better, change score) at <6 months

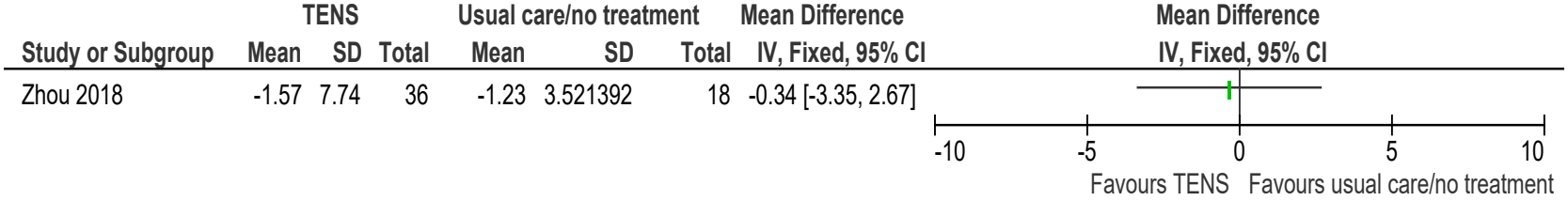


Figure 8: Physical function - upper limb (Fugl Meyer Assessment Upper Limb, 0-66, higher values are better, change score) at <6 months

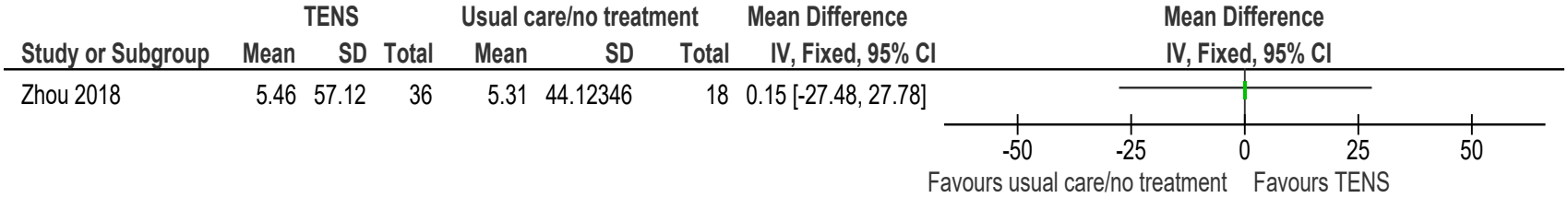


Figure 9: Activities of daily living (Barthel index, 0-100, higher values are better, change score) at <6 months

	TENS			Usual care/no treatment			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Zhou 2018	14.82	108.78	36	13.08	45.43868	18	1.74 [-39.53, 43.01]	

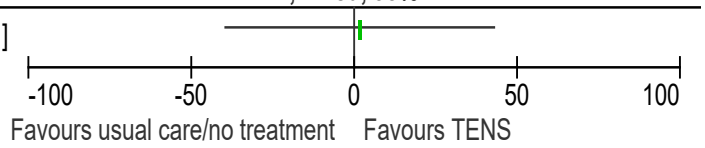
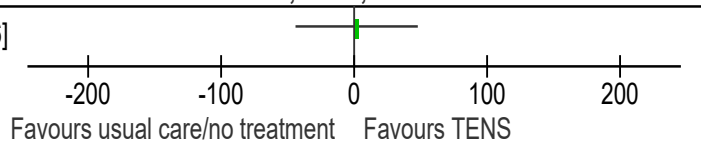


Figure 10: Stroke-specific Patient-Reported Outcome Measures (stroke specific quality of life, 49-245, higher values are better, change score) at <6 months

	TENS			Usual care/no treatment			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Zhou 2018	12.68	116.22	36	10.77	53.28757	18	1.91 [-43.34, 47.16]	



E.2 Functional electrical stimulation compared to usual care or no treatment

E.2.1 Functional electrical stimulation compared to usual care or no treatment

Figure 11: Pain (numeric rating scale, 0-10, lower values are better, change score) at <6 months

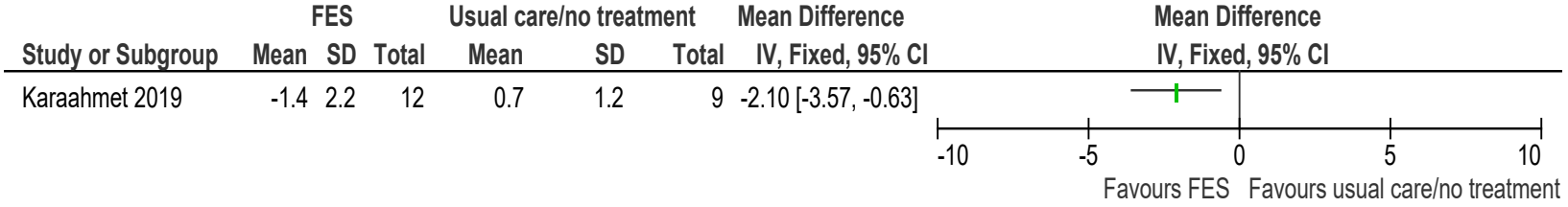


Figure 12: Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change score) at <6 months

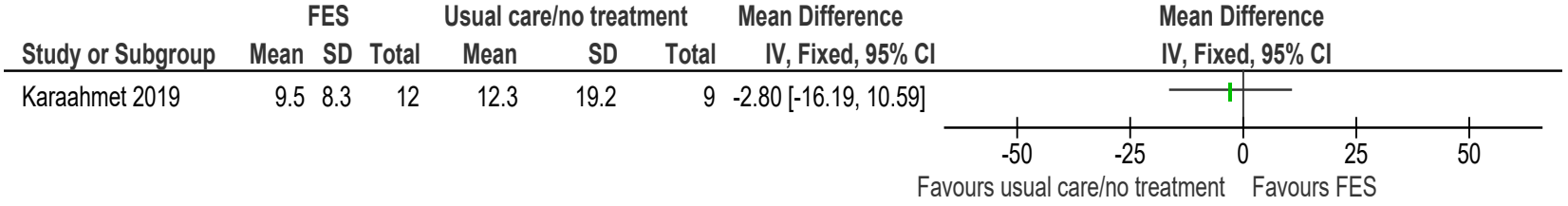


Figure 13: Activities of daily living (Functional Independence Measure, 18-126, higher values are better, change score) at <6 months

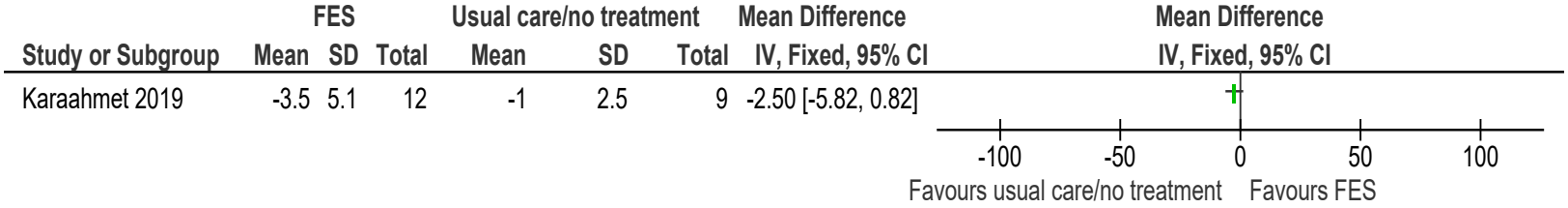
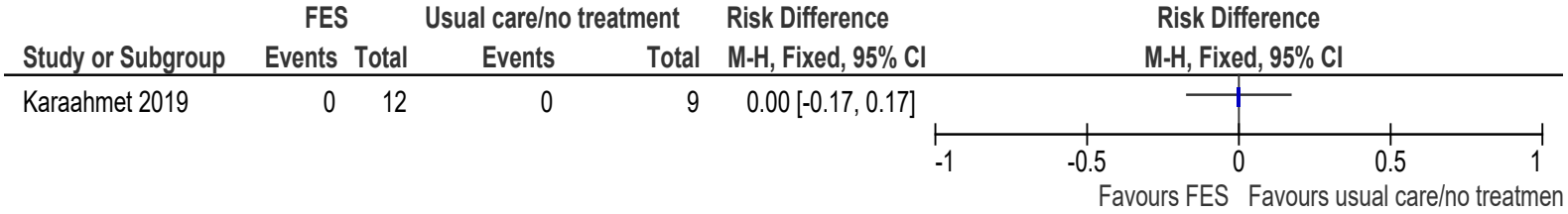


Figure 14: Withdrawal due to adverse events at <6 months



E.3 Neuromuscular electrical stimulation (NMES) compared to placebo/sham and usual care or no treatment

E.3.1 Neuromuscular electrical stimulation (NMES) compared to placebo/sham

Figure 15: Pain (numeric rating scale, 0-10, lower values are better, change score and final value) at <6 months

	NMES			Placebo/sham				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
de Jong 2013	6	3	7	4	2	7	70.7%	2.00 [-0.67, 4.67]
Lavi 2022	-1.38	4.07	8	-1.3	4.92	10	29.3%	-0.08 [-4.23, 4.07]
Total (95% CI)			**15**			**17**	**100.0%**	**1.39 [-0.86, 3.64]**

Heterogeneity: Chi² = 0.68, df = 1 (P = 0.41); I² = 0%
Test for overall effect: Z = 1.21 (P = 0.22)

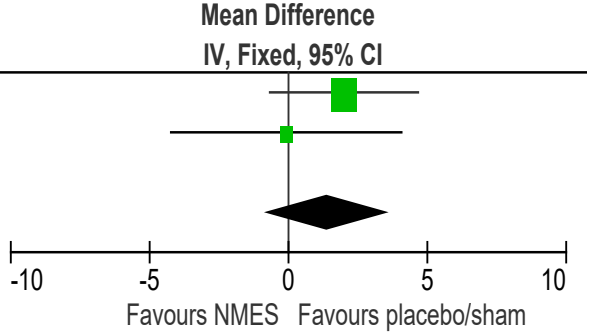


Figure 16: Physical function - upper limb (Fugl Meyer Upper Extremity, 0-66, higher values are better, change score and final value) at <6 months

Study or Subgroup	NMES Mean	NMES SD	NMES Total	Placebo/sham Mean	Placebo/sham SD	Placebo/sham Total	Weight	Mean Difference IV, Random, 95% CI
de Jong 2013	21.7	16.1	17	21.7	16.1	22	58.6%	0.00 [-10.19, 10.19]
Lavi 2022	24.88	20.51	8	7.5	16.3	10	41.4%	17.38 [-0.06, 34.82]
Total (95% CI)			**25**			**32**	**100.0%**	**7.19 [-9.59, 23.97]**

Heterogeneity: Tau² = 97.94; Chi² = 2.84, df = 1 (P = 0.09); I² = 65%
Test for overall effect: Z = 0.84 (P = 0.40)

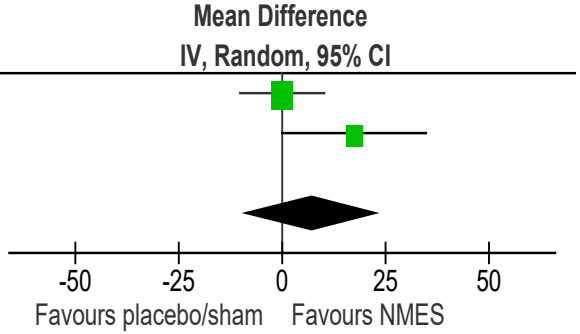


Figure 17: Activities of daily living (functional independence living, 18-126, higher values are better, change score) at <6 months

Study or Subgroup	NMES Mean	NMES SD	NMES Total	Placebo/sham Mean	Placebo/sham SD	Placebo/sham Total	Mean Difference IV, Fixed, 95% CI
Lavi 2022	31.88	16.48	8	14.9	13.22	10	16.98 [2.92, 31.04]

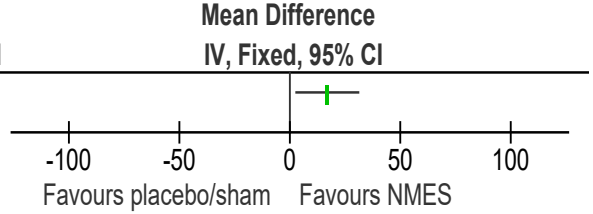
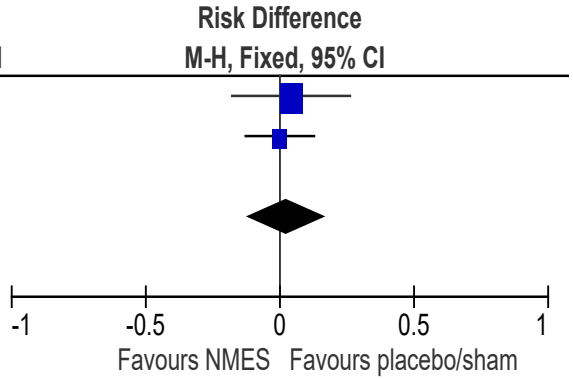


Figure 18: Withdrawal due to adverse events at <6 months

Study or Subgroup	NMES Events	NMES Total	Placebo/sham Events	Placebo/sham Total	Weight	Risk Difference M-H, Fixed, 95% CI
de Jong 2013	5	24	4	24	63.2%	0.04 [-0.18, 0.26]
Lavi 2022	0	14	0	14	36.8%	0.00 [-0.13, 0.13]
Total (95% CI)		**38**		**38**	**100.0%**	**0.03 [-0.12, 0.17]**
Total events	5		4			

Heterogeneity: Chi² = 0.18, df = 1 (P = 0.67); I² = 0%
Test for overall effect: Z = 0.35 (P = 0.73)



E.3.2 Neuromuscular electrical stimulation (NMES) compared to usual care or no treatment

Figure 19: Person/participant generic health-related quality of life (SF-36 v2 physical component summary, 0-100, higher values are better, final value) at <6 months

Study or Subgroup	NMES Mean	NMES SD	NMES Total	Usual care/no treatment Mean	Usual care/no treatment SD	Usual care/no treatment Total	Mean Difference IV, Fixed, 95% CI
Wilson 2014	34.1	11.53776	13	33.8	12.12436	12	0.30 [-8.99, 9.59]

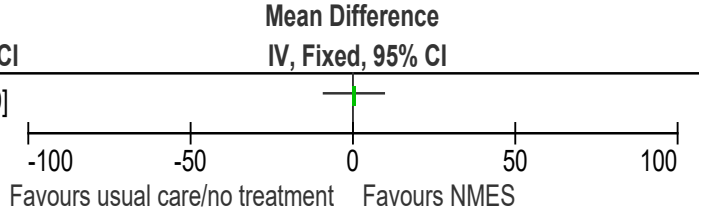


Figure 20: Person/participant generic health-related quality of life (SF-36 v2 mental component summary, 0-100, higher values are better, final value) at <6 months

Study or Subgroup	NMES Mean	NMES SD	NMES Total	Usual care/no treatment Mean	Usual care/no treatment SD	Usual care/no treatment Total	Mean Difference IV, Fixed, 95% CI
Wilson 2014	58.6	15.50387	13	52.3	16.9741	12	6.30 [-6.48, 19.08]

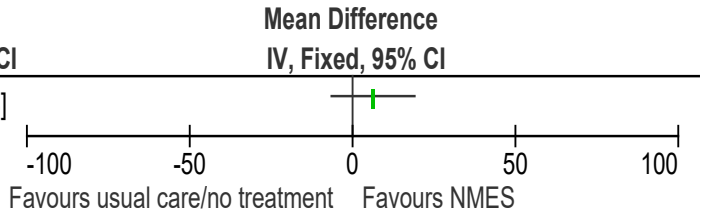


Figure 21: Pain (visual analogue scale, numeric rating scale, worst pain 7 days, 0-100, lower values are better, change score and final values) at <6 months

Study or Subgroup	NMES Mean	NMES SD	NMES Total	Usual care/no treatment Mean	Usual care/no treatment SD	Usual care/no treatment Total	Weight	Mean Difference IV, Fixed, 95% CI
Turkkan 2017	8.3	16	12	20	27.1	12	46.6%	-11.70 [-29.51, 6.11]
Wilson 2014	30	25.23886	13	61	27.71281	12	34.0%	-31.00 [-51.83, -10.17]
Zhou 2018	-22.4	68.4	36	-12.3	35.21392	18	19.3%	-10.10 [-37.74, 17.54]
Total (95% CI)			**61**			**42**	**100.0%**	**-17.96 [-30.12, -5.80]**

Heterogeneity: Chi² = 2.29, df = 2 (P = 0.32); I² = 13%
Test for overall effect: Z = 2.90 (P = 0.004)

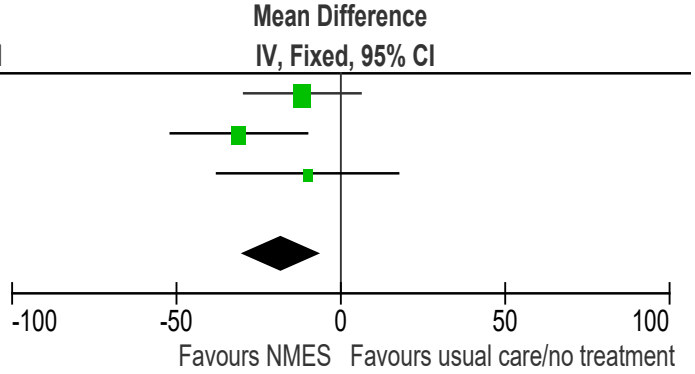


Figure 22: Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change score) at <6 months

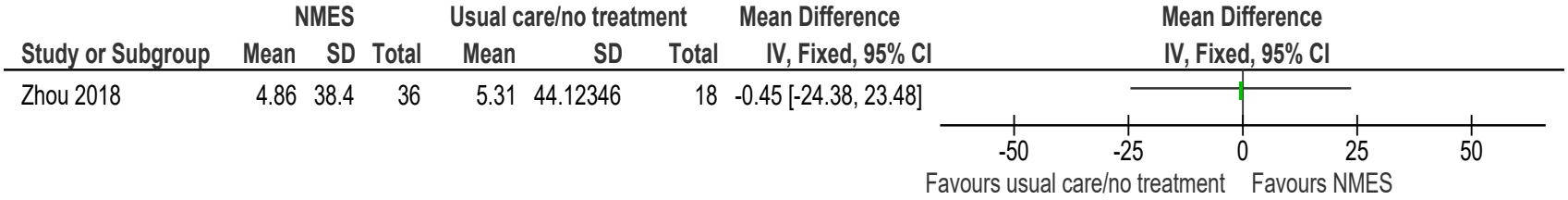


Figure 23: Physical function - upper limb (Fugl Meyer Assessment, 0-100, higher values are better, final value) at <6 months

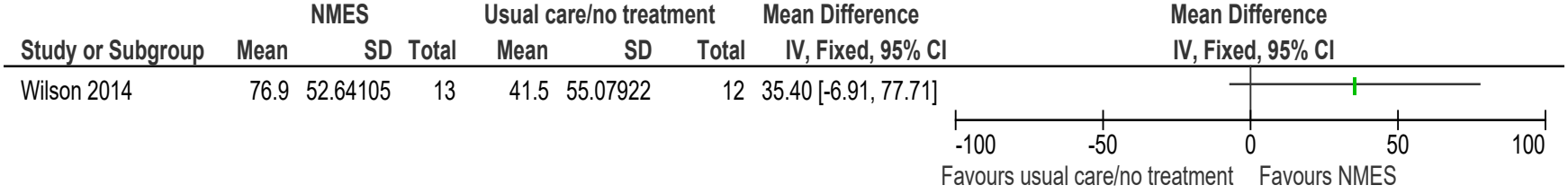


Figure 24: Activities of daily living (Barthel index, shoulder disability questionnaire, 0-100, higher values are better, change score and final value) at <6 months

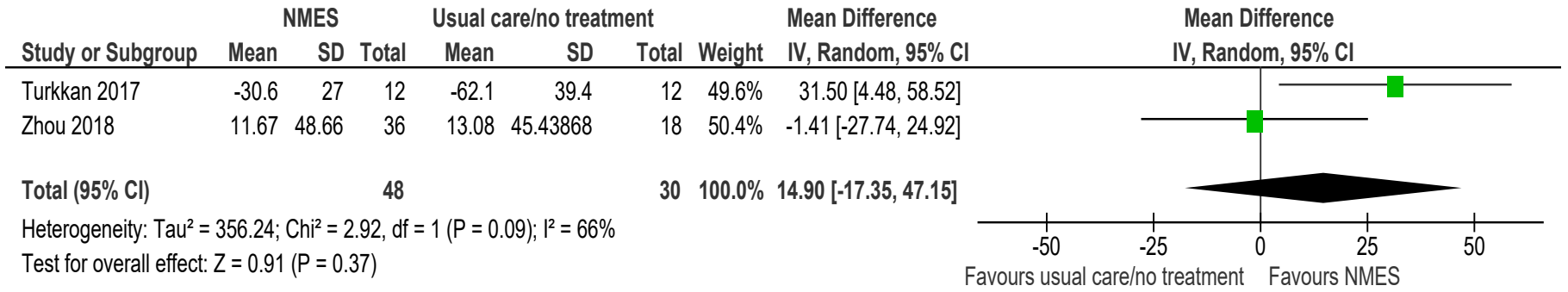


Figure 25: Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life, 49-245, higher values are better, change score) at <6 months

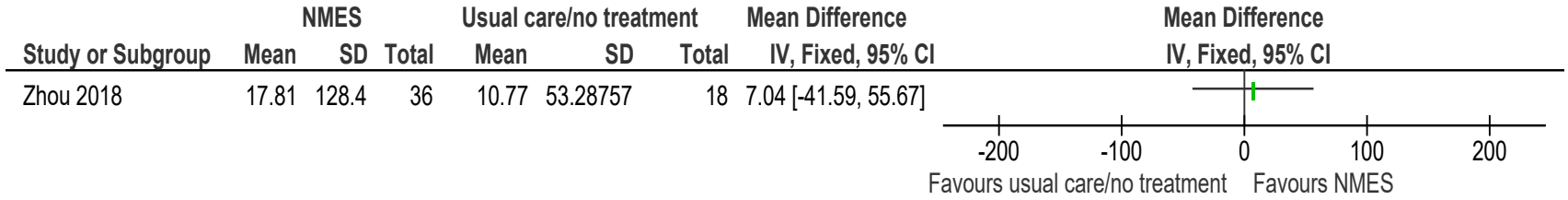
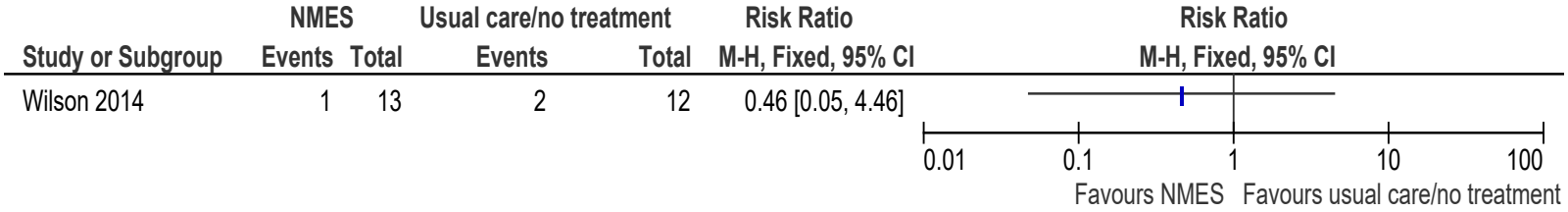


Figure 26: Withdrawal due to adverse events at <6 months



E.4 Devices – tape compared to placebo/sham and usual care or no treatment

E.4.1 Devices – tape compared to placebo/sham

Figure 27: Pain (visual analogue scale, numeric rating scale, 0-100, lower values are better, change scores and final values) at <6 months

Study or Subgroup	Mean Difference	SE	Tape Total	Placebo/sham Total	Weight	Mean Difference IV, Fixed, 95% CI
Huang 2016	-6	7.9403	21	23	7.3%	-6.00 [-21.56, 9.56]
Huang 2017	-10.6	3.4567	11	10	38.5%	-10.60 [-17.38, -3.82]
Pandian 2013	-11.9	5.4593	72	64	15.4%	-11.90 [-22.60, -1.20]
Yang 2018	-20	3.4416	9	10	38.8%	-20.00 [-26.75, -13.25]
Total (95% CI)			**113**	**107**	**100.0%**	**-14.11 [-18.32, -9.91]**

Heterogeneity: Chi² = 5.17, df = 3 (P = 0.16); I² = 42%
Test for overall effect: Z = 6.58 (P < 0.00001)

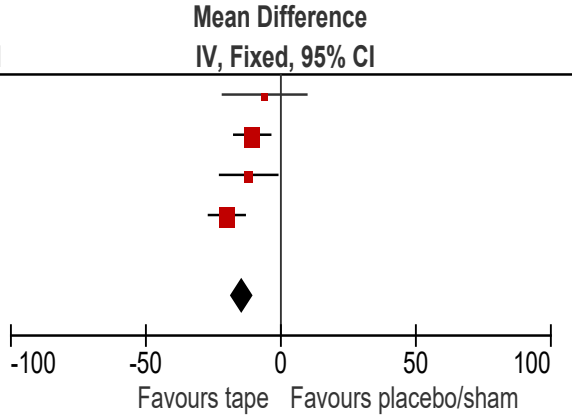


Figure 28: Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, final value) at <6 months

Study or Subgroup	Tape Mean	SD	Total	Placebo/sham Mean	SD	Total	Mean Difference IV, Fixed, 95% CI
Huang 2016	16.4	17.6	21	16.4	20.1	23	0.00 [-11.14, 11.14]

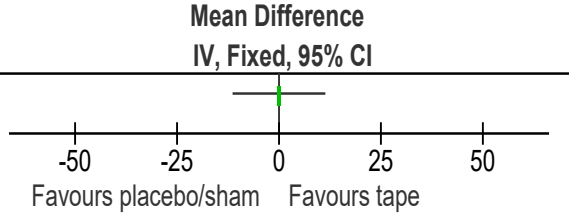


Figure 29: Activities of daily living (Barthel index, 0-100, higher values are better, final value) at <6 months

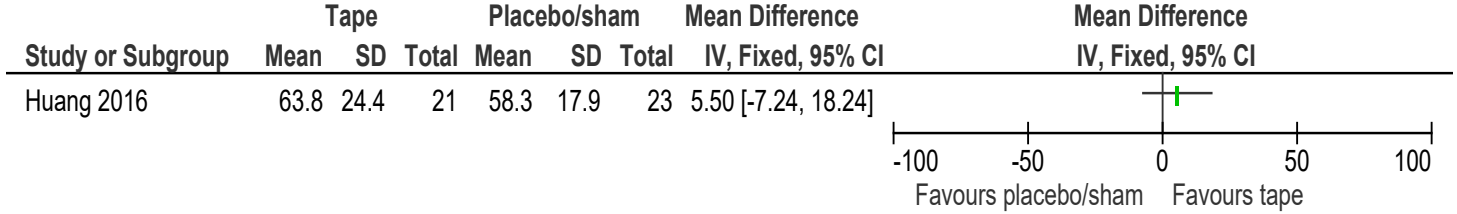


Figure 30: Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life, 49-245, higher values are better, final value) at <6 months

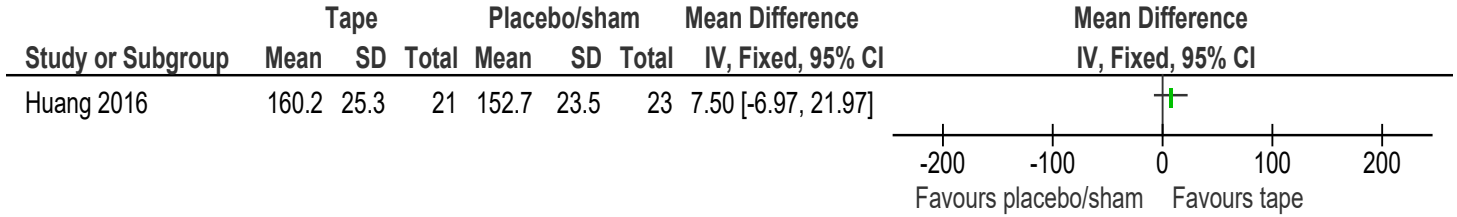
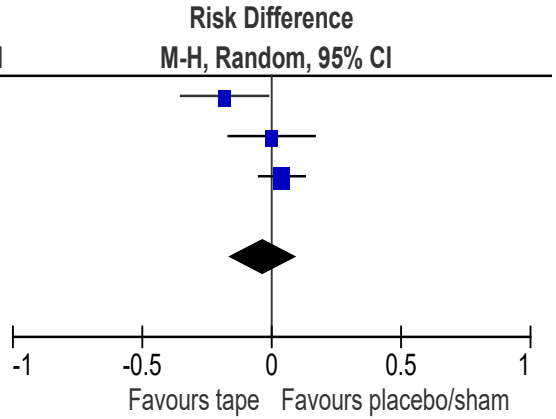


Figure 31: Withdrawal due to adverse events at <6 months

Study or Subgroup	Tape Events	Tape Total	Placebo/sham Events	Placebo/sham Total	Weight	Risk Difference M-H, Random, 95% CI
Huang 2016	0	27	4	22	28.2%	-0.18 [-0.35, -0.01]
Huang 2017	0	11	0	10	28.5%	0.00 [-0.17, 0.17]
Pandian 2013	9	80	6	82	43.3%	0.04 [-0.05, 0.13]
Total (95% CI)		**118**		**114**	**100.0%**	**-0.03 [-0.16, 0.09]**
Total events	9		10			

Heterogeneity: Tau² = 0.01; Chi² = 5.14, df = 2 (P = 0.08); I² = 61%

Test for overall effect: Z = 0.52 (P = 0.60)



E.4.2 Devices – tape compared to usual care or no treatment

Figure 32: Pain (visual analogue scale, 0-10, lower values are better, change score and final value) at <6 months

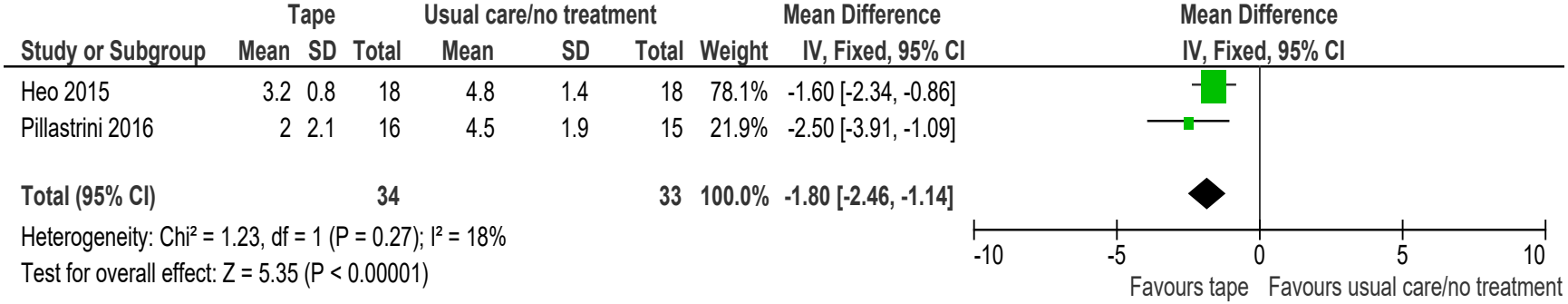
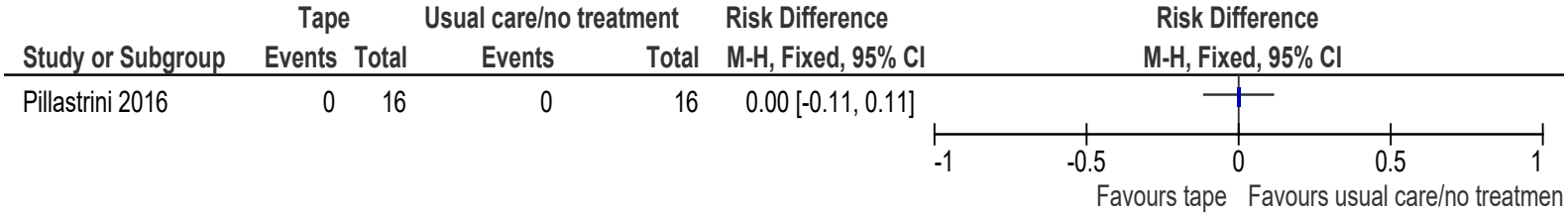


Figure 33: Withdrawal due to adverse events at <6 months



E.5 Devices – slings compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment

E.5.1 Devices – slings compared to neuromuscular electrical stimulation (NMES)

Figure 34: Pain (brief pain inventory question 12/numeric rating scale, 0-10, lower values are better, change scores) at <6 months

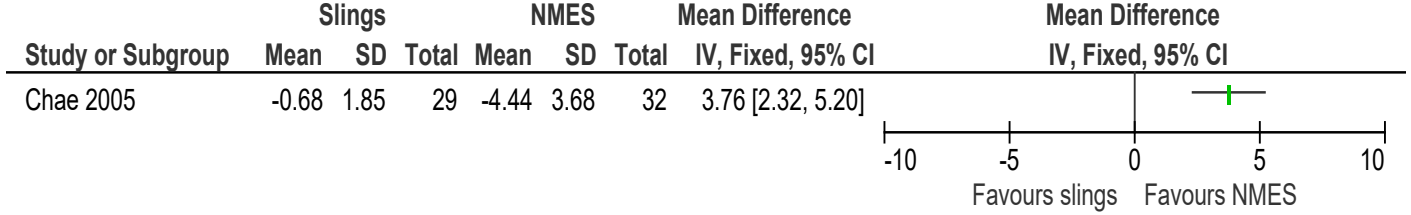
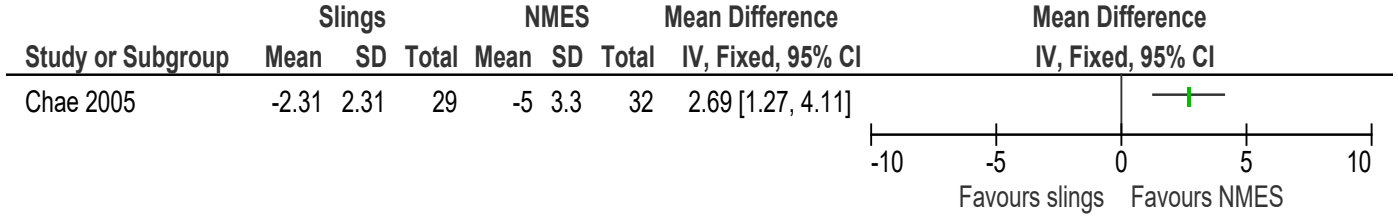


Figure 35: Pain (brief pain inventory question 12/numeric rating scale, 0-10, lower values are better, change scores) at ≥6 months



E.5.2 Devices – slings compared to usual care or no treatment

Figure 36: Pain (visual analogue scale, 0-10, lower values are better, final values) at <6 months

	Slings			Usual care/no treatment				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Moghe 2020	4.72	1.72	25	5.84	1.375	25	58.4%	-1.12 [-1.98, -0.26]
van Bladel 2017	3.28	2.73	19	2.44	2.01	9	41.6%	0.84 [-0.96, 2.64]
Total (95% CI)			**44**			**34**	**100.0%**	**-0.31 [-2.20, 1.59]**

Heterogeneity: Tau² = 1.40; Chi² = 3.71, df = 1 (P = 0.05); I² = 73%
Test for overall effect: Z = 0.32 (P = 0.75)

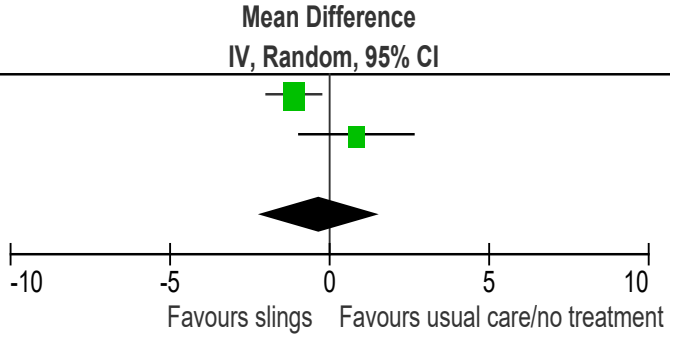


Figure 37: Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, final values) at <6 months

	Slings			Usual care/no treatment			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
van Bladel 2017	10.44	8.68	19	12.78	12.28	9	-2.34 [-11.26, 6.58]

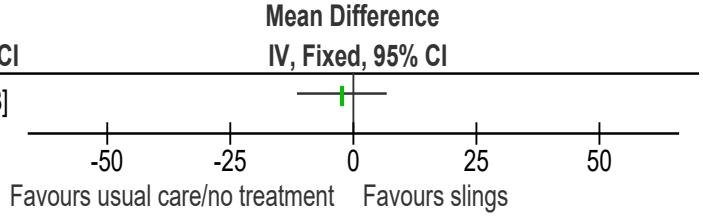
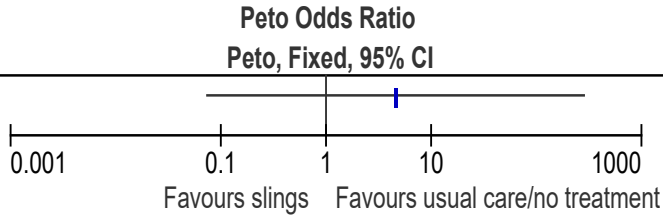


Figure 38: Withdrawal due to adverse events at <6 months

Study or Subgroup	Favours slings Events	Total	Usual care/no treatment Events	Total	Peto Odds Ratio Peto, Fixed, 95% CI
van Bladel 2017	1	21	0	11	4.59 [0.07, 284.41]



E.6 Devices – braces compared to usual care or no treatment

E.6.1 Devices – braces compared to usual care or no treatment

Figure 39: Pain (Shoulder Hand Syndrome score pain subscale, 0-5, lower values are better, final value) at <6 months

Study or Subgroup	Braces Mean	SD	Total	Usual care/no treatment Mean	SD	Total	Mean Difference IV, Fixed, 95% CI
Hartwig 2012	0.4	0.6	20	1.8	1	21	-1.40 [-1.90, -0.90]

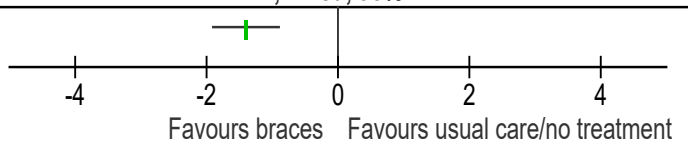
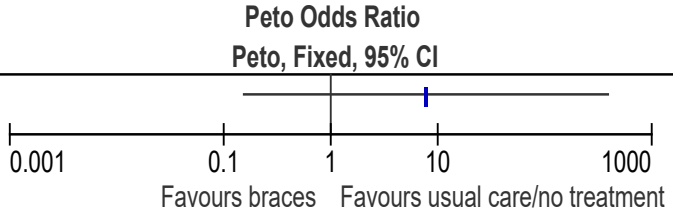


Figure 40: Withdrawal due to adverse events at <6 months

Study or Subgroup	Favours braces Events	Total	Usual care/no treatment Events	Total	Peto Odds Ratio Peto, Fixed, 95% CI
Hartwig 2012	1	20	0	21	7.77 [0.15, 391.93]



E.7 Acupuncture/dry needling compared to placebo/sham and usual care or no treatment

E.7.1 Acupuncture/dry needling compared to placebo/sham

Figure 41: Pain (visual analogue scale, 0-10, lower values are better, change score) at <6 months

Study or Subgroup	Acupuncture/dry needling Mean	SD	Total	Placebo/sham Mean	SD	Total	Mean Difference IV, Fixed, 95% CI
Lee 2016	-3	3.28	27	-1.65	2.5	26	-1.35 [-2.92, 0.22]

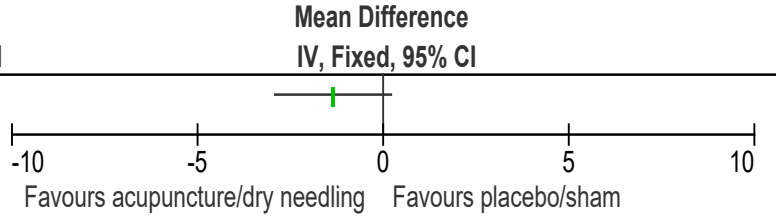


Figure 42: Activities of daily living (Korean modified Barthel index, 0-100, higher values are better, final value) at <6 months

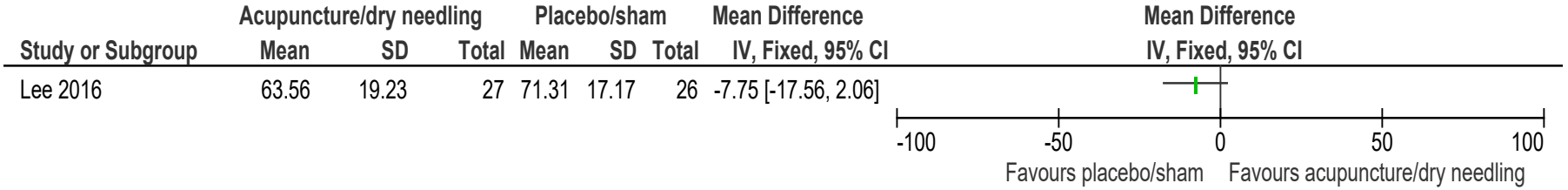
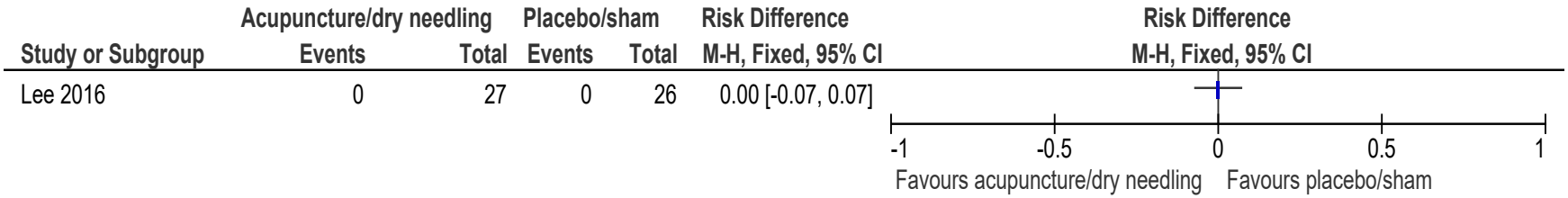


Figure 43: Withdrawal due to adverse events at <6 months



E.7.2 Acupuncture/dry needling compared to usual care or no treatment

Figure 44: Person/participant generic health-related quality of life (quality of life scale, unclear scale range, higher values are better, final values) at <6 months

	Acupuncture/dry needling			Usual care/no treatment			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Zheng 2018	100.51	13.84	89	76.68	12.46	89	23.83 [19.96, 27.70]

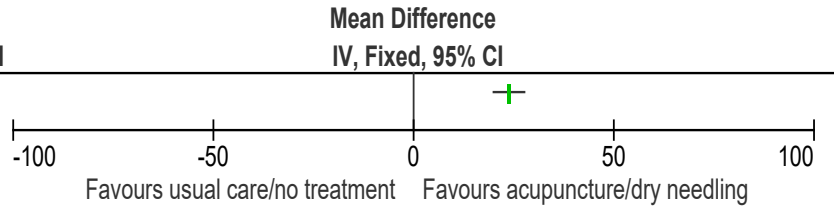


Figure 45: Pain (visual analogue scale, numeric rating scale, 0-10, lower values are better, change scores and final value) at <6 months

	Acupuncture/dry needling			Usual care/no treatment				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
DiLorenzo 2004	3.15	0.8	54	4.96	1.12	47	26.1%	-1.81 [-2.19, -1.43]
Mendigutia-Gomez 2020	-4.9	1.435371	8	-0.5	1.435371	8	22.4%	-4.40 [-5.81, -2.99]
Zhan 2022	-3.68	1.44	25	-1.92	1.35	24	25.1%	-1.76 [-2.54, -0.98]
Zheng 2018	3.98	0.86	89	3.53	0.64	89	26.4%	0.45 [0.23, 0.67]
Total (95% CI)			**176**			**168**	**100.0%**	**-1.78 [-3.48, -0.08]**

Heterogeneity: Tau² = 2.83; Chi² = 148.75, df = 3 (P < 0.00001); I² = 98%
Test for overall effect: Z = 2.06 (P = 0.04)

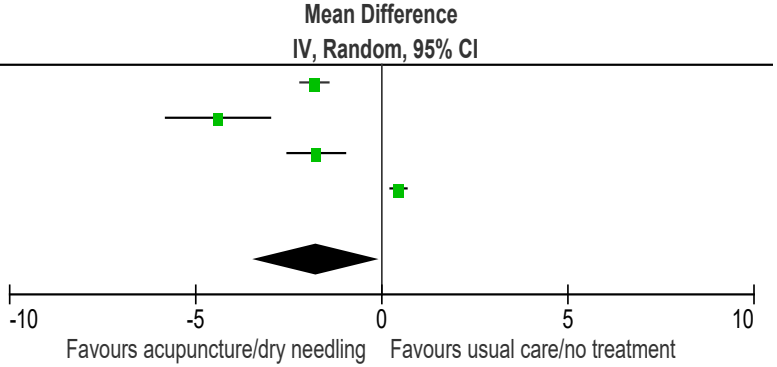


Figure 46: Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change scores) at <6 months

	Acupuncture/dry needling			Usual care/no treatment				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Zhan 2022	6.2	5.79	25	6.42	3.98	24	47.5%	-0.22 [-2.99, 2.55]
Zheng 2018	14.45	3.31	89	8.73	3.03	89	52.5%	5.72 [4.79, 6.65]
Total (95% CI)			**114**			**113**	**100.0%**	**2.90 [-2.91, 8.71]**

Heterogeneity: Tau² = 16.53; Chi² = 15.84, df = 1 (P < 0.0001); I² = 94%
Test for overall effect: Z = 0.98 (P = 0.33)

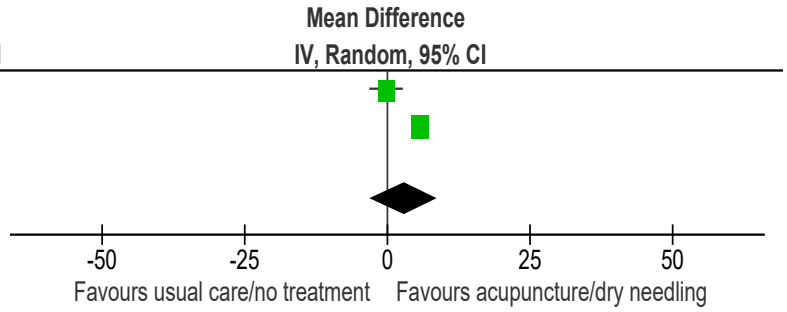


Figure 47: Physical function - upper limb (Rivermead Motricity Index Effectiveness, 0-100, higher values are better, final value) at <6 months

	Acupuncture/dry needling			Usual care/no treatment			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
DiLorenzo 2004	50.01	15.38	54	47.54	17.34	47	2.47 [-3.96, 8.90]

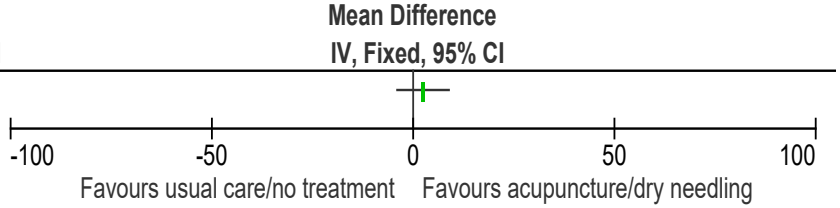
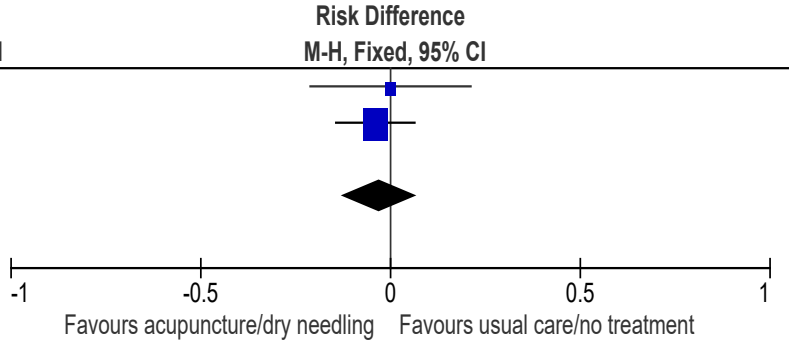


Figure 48: Withdrawal due to adverse events at <6 months

Study or Subgroup	Acupuncture/dry needling Events	Total	Usual care/no treatment Events	Total	Weight	Risk Difference M-H, Fixed, 95% CI
Mendigutia-Gomez 2020	0	8	0	8	24.2%	0.00 [-0.21, 0.21]
Zhan 2022	0	25	1	25	75.8%	-0.04 [-0.14, 0.06]
Total (95% CI)		**33**		**33**	**100.0%**	**-0.03 [-0.13, 0.07]**
Total events	0		1			

Heterogeneity: Chi² = 0.11, df = 1 (P = 0.74); I² = 0%

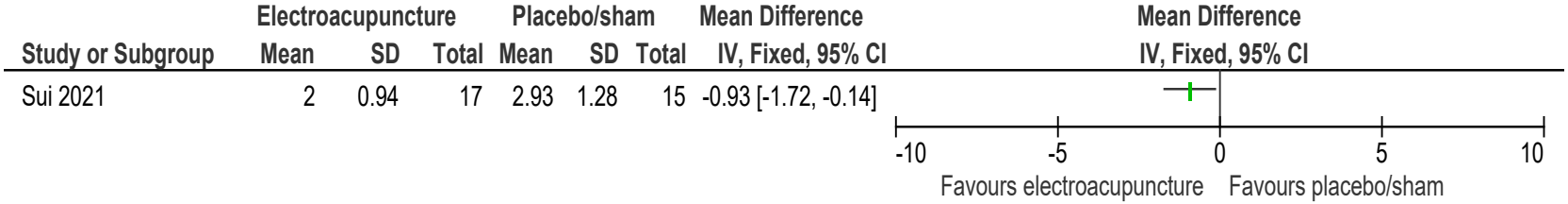
Test for overall effect: Z = 0.59 (P = 0.55)



E.8 Electroacupuncture compared to placebo/sham

E.8.1 Electroacupuncture compared to placebo/sham

Figure 49: Pain (visual analogue scale, 0-10, lower values are better, final values) at <6 months



E.9 Intra-articular medicine injections – corticosteroids compared to placebo/sham

E.9.1 Intra-articular medicine injections – corticosteroids compared to placebo/sham

Figure 50: Pain (visual analogue scale, 0-10, lower values are better, change score and final value) at <6 months

	Intra-articular corticosteroids			Placebo/sham				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Lakse 2009	-1.6	1.2	21	-0.82	0.81	17	57.5%	-0.78 [-1.42, -0.14]
Rah 2012	3	1.8	29	4.9	2.3	29	42.5%	-1.90 [-2.96, -0.84]
Total (95% CI)			**50**			**46**	**100.0%**	**-1.26 [-2.34, -0.17]**

Heterogeneity: Tau² = 0.43; Chi² = 3.13, df = 1 (P = 0.08); I² = 68%
Test for overall effect: Z = 2.27 (P = 0.02)

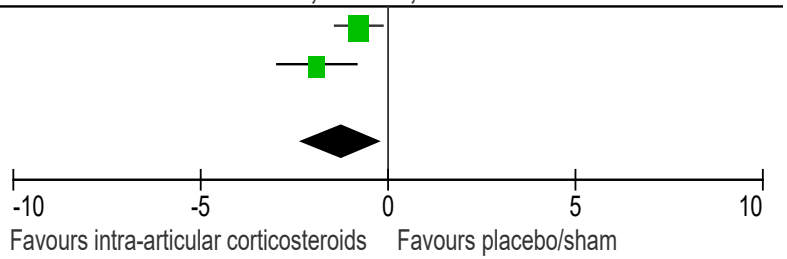
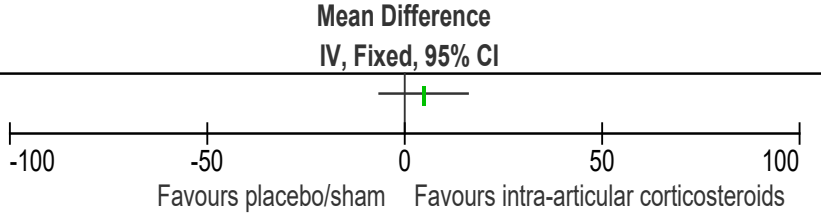


Figure 51: Activities of daily living (Barthel index, 0-100, higher values are better, final value) at <6 months

	Intra-articular corticosteroids			Placebo/sham			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Rah 2012	77.5	17.2	29	72.7	25.6	29	4.80 [-6.42, 16.02]



E.10 Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS) and placebo/sham

E.10.1 Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS)

Figure 52: Pain (VAS, 0-100, lower values are better, change score) at <6 months

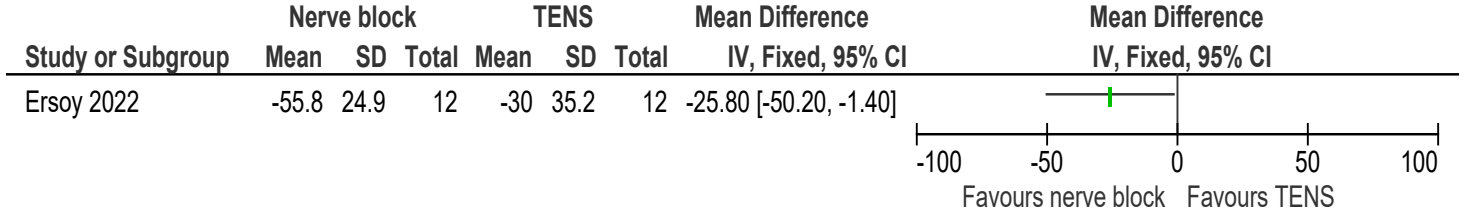
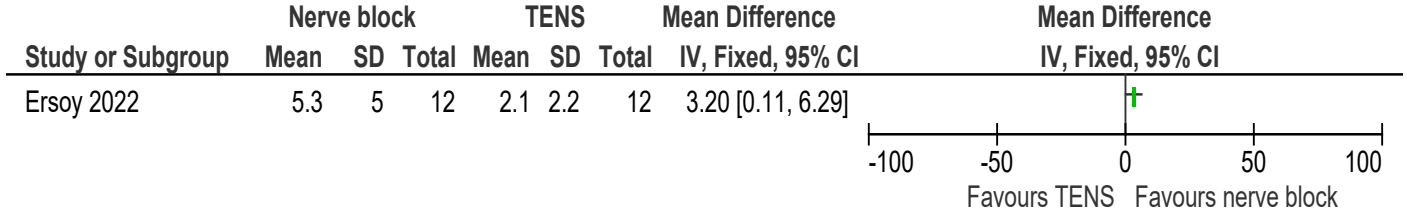


Figure 53: Stroke-specific Patient-Reported Outcome Measures (SS-QOL, 0-100, higher values are better, change scores) at <6 months



E.10.2 Nerve blocks (local anaesthetic) compared to placebo/sham

Figure 54: Pain (visual analogue scale, 0-100, lower values are better, final values) at <6 months

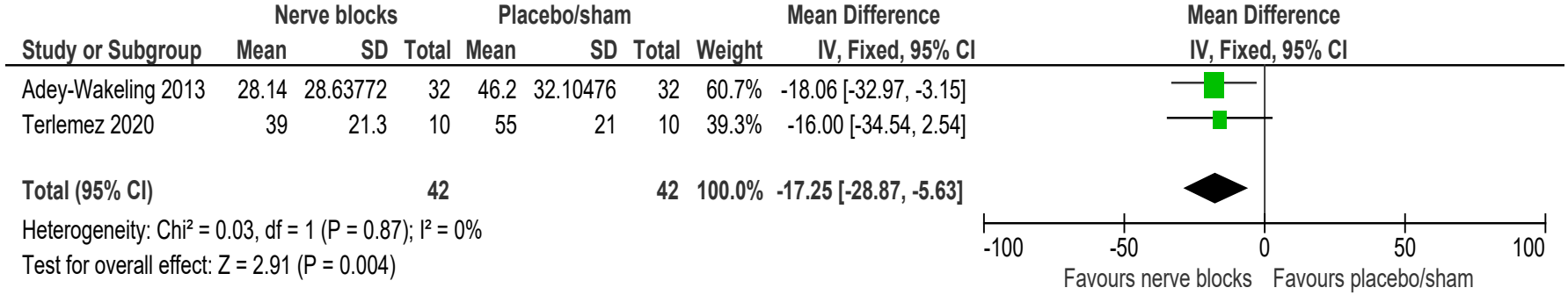
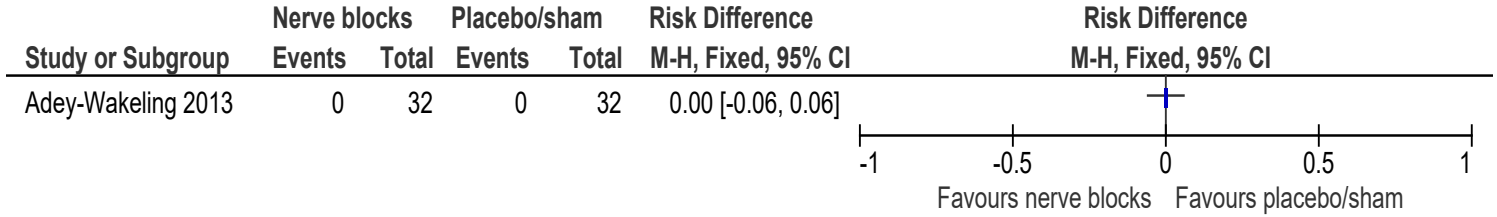


Figure 55: Withdrawal due to adverse events at <6 months



Appendix F – GRADE tables

F.1 Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment

F.1.1 Transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES)

Table 29: Clinical evidence profile: transcutaneous electrical nerve stimulation (TENS) compared to neuromuscular electrical stimulation (NMES)

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Transcutaneous electrical nerve stimulation (TENS)	neuromuscular electrical stimulation (NMES)	Relative (95% CI)	Absolute (95% CI)		
Pain (Numeric rating scale, 0-10, lower values are better, change score and final value) at <6 months (follow-up: mean 8 weeks)												
2	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	55	55	-	MD **1.28 higher** (0.4 higher to 2.15 higher)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment Upper Limb, 0-66, higher values are better, change score and final value) at <6 months (follow-up: mean 8 weeks)												
2	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	55	55	-	MD **0.62 higher** (9 lower to 10.25 higher)	⨁◯◯◯ Very low	CRITICAL
Activities of daily living (Barthel index, 0-100, higher values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[c]	not serious	not serious	very serious[b]	none	36	36	-	MD **3.15 higher** (35.78 lower to 42.08 higher)	⨁◯◯◯ Very low	CRITICAL
Stroke-specific Patient-Reported Outcome Measures (stroke specific quality of life, 49-245, higher values are better, change score) at <6 months (follow-up: 8 weeks)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Transcutaneous electrical nerve stimulation (TENS)	neuromuscular electrical stimulation (NMES)	Relative (95% CI)	Absolute (95% CI)		
1	randomised trials	very serious[c]	not serious	not serious	very serious[b]	none	36	36	-	MD **5.13 lower** (61.7 lower to 51.44 higher)	⨁◯◯◯ Very low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 8 weeks)												
1	randomised trials	serious[d]	not serious	not serious	very serious[e]	none	0/19 (0.0%)	0/19 (0.0%)	**RD 0.0** (-0.1 to 0.1)	**0 fewer per 1,000** (from 100 fewer to 100 more)[f]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention, bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention and bias due to missing outcome data)

d. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process)

e. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

f. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.1.2 Transcutaneous electrical nerve stimulation (TENS) compared to usual care or no treatment

Table 30: Clinical evidence profile: transcutaneous electrical nerve stimulation (TENS) compared to usual care or no treatment

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Transcutaneous electrical nerve stimulation (TENS)	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Pain (Numeric rating scale, 0-10, lower values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	36	18	-	MD **0.34 lower** (3.35 lower to 2.67 higher)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment Upper Limb, 0-66, higher values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	36	18	-	MD **0.15 higher** (27.48 lower to 27.78 higher)	⨁◯◯◯ Very low	CRITICAL
Activities of daily living (Barthel index, 0-100, higher values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	36	18	-	MD **1.74 higher** (39.53 lower to 43.01 higher)	⨁◯◯◯ Very low	CRITICAL
Stroke-specific Patient-Reported Outcome Measures (stroke specific quality of life, 49-245, higher values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	36	18	-	MD **1.91 higher** (43.34 lower to 47.16 higher)	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended intervention and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.2 Functional electrical stimulation compared to usual care or no treatment

F.2.1 Functional electrical stimulation compared to usual care or no treatment

Table 31: Clinical evidence profile: functional electrical stimulation compared to usual care or no treatment

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Functional electrical stimulation (FES)	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Pain (numeric rating scale, 0-10, lower values are better, change score) at <6 months (follow-up: 4 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	12	9	-	MD **2.1 lower** (3.57 lower to 0.63 lower)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change score) at <6 months (follow-up: 4 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	12	9	-	MD **2.8 lower** (16.19 lower to 10.59 higher)	⨁◯◯◯ Very low	CRITICAL
Activities of daily living (Functional Independence Measure, 18-126, higher values are better, change score) at <6 months (follow-up: 4 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	not serious	none	12	9	-	MD **2.5 lower** (5.82 lower to 0.82 higher)	⨁⨁◯◯ Low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 4 weeks)												
1	randomised trials	serious[c]	not serious	not serious	very serious[d]	none	0/12 (0.0%)	0/9 (0.0%)	**RD 0.00** (-0.17 to 0.17)	**0 fewer per 1,000** (from 170 fewer to 170 more)[e]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias due to the randomisation process and bias in measurement of the outcome)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias due to the randomisation process)

d. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

e. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.3 Neuromuscular electrical stimulation (NMES) compared to placebo/sham and usual care or no treatment

F.3.1 Neuromuscular electrical stimulation (NMES) compared to placebo/sham

Table 32: Clinical evidence profile: neuromuscular electrical stimulation (NMES) compared to placebo/sham

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Neuromuscular electrical stimulation (NMES)	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
Pain (numeric rating scale, 0-10, lower values are better, change score and final value) at <6 months (follow-up: mean 14 weeks)												
2	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	15	17	-	MD **1.39 higher** (0.86 lower to 3.64 higher)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Upper Extremity, 0-66, higher values are better, change score and final value) at <6 months (follow-up: mean 14 weeks)												
2	randomised trials	very serious[a]	serious[c]	not serious	very serious[b]	none	17	22	-	MD **7.19 higher** (9.59 lower to 23.97 higher)	⨁◯◯◯ Very low	CRITICAL

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Neuromuscular electrical stimulation (NMES)	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
Activities of daily living (functional independence living, 18-126, higher values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	8	10	-	MD **16.98 higher** (2.92 higher to 31.04 higher)	⨁◯◯◯ Very low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: mean 14 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[d,e]	none	5/38 (13.2%)	4/38 (10.5%)	**RD 0.03** (-0.12 to 0.17)	**30 more per 1,000** (from 120 fewer to 170 more)[d]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

d. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

e. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

F.3.2 Neuromuscular electrical stimulation (NMES) compared to usual care or no treatment

Table 33: Clinical evidence profile: neuromuscular electrical stimulation (NMES) compared to usual care or no treatment

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Neuromuscular electrical stimulation (NMES)	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Person/participant generic health-related quality of life (SF-36 v2 physical component summary, 0-100, higher values are better, final value) at <6 months (follow-up: 16 weeks)												
1	randomised trials	serious[a]	not serious	not serious	very serious[b]	none	13	12	-	MD **0.3 higher** (8.99 lower to 9.59 higher)	⨁◯◯◯ Very low	CRITICAL
Person/participant generic health-related quality of life (SF-36 v2 mental component summary, 0-100, higher values are better, final value) at <6 months (follow-up: 16 weeks)												
1	randomised trials	serious[a]	not serious	not serious	very serious[b]	none	13	12	-	MD **6.3 higher** (6.48 lower to 19.08 higher)	⨁◯◯◯ Very low	CRITICAL
Pain (visual analogue scale, numeric rating scale, worst pain 7 days, 0-100, lower values are better, change score and final values) at <6 months (follow-up: mean 9 weeks)												
3	randomised trials	very serious[c]	not serious	not serious	serious[b]	none	61	42	-	MD **17.96 lower** (30.12 lower to 5.8 lower)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[d]	not serious	not serious	very serious[b]	none	36	18	-	MD **0.45 lower** (24.38 lower to 23.48 higher)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment, 0-100, higher values are better, final value) at <6 months (follow-up: 16 weeks)												
1	randomised trials	serious[a]	not serious	not serious	serious[b]	none	13	12	-	MD **35.4 higher** (6.91 lower to 77.71 higher)	⨁⨁◯◯ Low	CRITICAL
Activities of daily living (Barthel index, shoulder disability questionnaire, 0-100, higher values are better, change score and final value) at <6 months (follow-up: mean 6 weeks)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Neuromuscular electrical stimulation (NMES)	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
2	randomised trials	very serious[c]	serious[e]	not serious	very serious[b]	none	48	30	-	MD **14.9 higher** (17.35 lower to 47.15 higher)	⨁◯◯◯ Very low	CRITICAL
Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life, 49-245, higher values are better, change score) at <6 months (follow-up: 8 weeks)												
1	randomised trials	very serious[d]	not serious	not serious	very serious[b]	none	36	18	-	MD **7.04 higher** (41.59 lower to 55.67 higher)	⨁◯◯◯ Very low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 16 weeks)												
1	randomised trials	not serious	not serious	not serious	very serious[b]	none	1/13 (7.7%)	2/12 (16.7%)	**RR 0.46** (0.05 to 4.46)	**90 fewer per 1,000** (from 158 fewer to 577 more)	⨁⨁◯◯ Low	CRITICAL

CI: confidence interval; **MD:** mean difference; **RR:** risk ratio

Explanations

a. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome)

d. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias due to missing outcome data)

e. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

F.4 Devices – tape compared to placebo/sham and usual care or no treatment

F.4.1 Devices – tape compared to placebo/sham

Table 34: Clinical evidence profile: devices – tape compared to placebo/sham

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Devices - tape	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, numeric rating scale, 0-100, lower values are better, change scores and final values) at <6 months (follow-up: mean 4 weeks)												
4	randomised trials	very serious[a]	not serious	not serious	not serious	none	113	107	-	MD **14.11 lower** (18.32 lower to 9.91 lower)	⨁⨁◯◯ Low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, final value) at <6 months (follow-up: 3 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	21	23	-	MD **0** (11.14 lower to 11.14 higher)	⨁◯◯◯ Very low	CRITICAL
Activities of daily living (barthel index, 0-100, higher values are better, final value) at <6 months (follow-up: 3 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	21	23	-	MD **5.5 higher** (7.24 lower to 18.24 higher)	⨁◯◯◯ Very low	CRITICAL
Stroke-specific Patient-Reported Outcome Measures (Stroke specific quality of life, 49-245, higher values are better, final value) at <6 months (follow-up: 3 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	21	23	-	MD **7.5 higher** (6.97 lower to 21.97 higher)	⨁◯◯◯ Very low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: mean 3 weeks)												
3	randomised trials	very serious[a]	serious[c]	not serious	very serious[d]	none	9/118 (7.6%)	10/114 (8.8%)	**RD -0.03** (-0.16 to 0.09)	**30 fewer per 1,000** (from 160 fewer to 90 more)[e]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded for heterogeneity due to conflicting number of events in different studies (zero events in one or more studies)

d. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

e. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.4.2 Devices – tape compared to usual care or no treatment

Table 35: Clinical evidence profile: devices – tape compared to usual care or no treatment

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Devices - tape	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, 0-10, lower values are better, change score and final values) at <6 months (follow-up: mean 8 weeks)												
2	randomised trials	very serious[a]	not serious	not serious	not serious	none	34	33	-	MD **1.8 lower** (2.46 lower to 1.14 lower)	⨁⨁◯◯ Low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 8 weeks)												
1	randomised trials	serious[b]	not serious	not serious	very serious[c]	none	0/16 (0.0%)	0/16 (0.0%)	**RD 0.00** (-0.11 to 0.11)	**0 fewer per 1,000** (from 110 fewer to 110 more)[d]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias due to deviations from the intended interventions)

c. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

d. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.5 Devices – slings compared to neuromuscular electrical stimulation (NMES) and usual care or no treatment

F.5.1 Devices – slings compared to neuromuscular electrical stimulation (NMES)

Table 36: Clinical evidence profile: devices – slings compared to neuromuscular electrical stimulation (NMES)

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Devices - slings	neuromuscular electrical stimulation (NMES)	Relative (95% CI)	Absolute (95% CI)		
Pain (brief pain inventory question 12/numeric rating scale, 0-10, lower values are better, change scores) at <6 months (follow-up: 18 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	not serious	none	29	32	-	MD **3.76 higher** (2.32 higher to 5.2 higher)	⨁⨁◯◯ Low	CRITICAL
Pain (brief pain inventory question 12/numeric rating scale, 0-10, lower values are better, change scores) at ≥6 months (follow-up: 12 months)												
1	randomised trials	very serious[a]	not serious	not serious	not serious	none	29	32	-	MD **2.69 higher** (1.27 higher to 4.11 higher)	⨁⨁◯◯ Low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data)

F.5.2 Devices – slings compared to usual care or no treatment

Table 37: Clinical evidence profile: devices – slings compared to usual care or no treatment

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Devices - slings	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, 0-10, lower values are better, final values) at <6 months												
2	randomised trials	very serious[a]	serious[b]	not serious	very serious[c]	none	44	34	-	MD **0.31 lower** (2.2 lower to 1.59 higher)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, final values) at <6 months (follow-up: 6 weeks)												
1	randomised trials	very serious[d]	not serious	not serious	serious[c]	none	19	9	-	MD **2.34 lower** (11.26 lower to 6.58 higher)	⨁◯◯◯ Very low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 6 weeks)												
1	randomised trials	very serious[e]	not serious	not serious	very serious[c]	none	1/21 (4.8%)	0/11 (0.0%)	**OR 4.59** (0.07 to 284.41)	**50 more per 1,000** (from 110 fewer to 200 more)[f]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference; **OR:** odds ratio

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data, bias in measurement of the outcome and bias in selection of the reported result)

b. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

d. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias in measurement of the outcome)

e. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to deviations from the intended interventions)

f. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.6 Devices – braces compared to usual care or no treatment

F.6.1 Devices – braces compared to usual care or no treatment

Table 38: Clinical evidence profile: devices – braces compared to usual care or no treatment

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Devices - braces	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Pain (Shoulder Hand Syndrome score pain subscale, 0-5, lower values are better, final value) at <6 months (follow-up: 4 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	not serious	none	20	21	-	MD **1.4 lower** (1.9 lower to 0.9 lower)	⨁⨁◯◯ Low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 4 weeks)												
1	randomised trials	serious[b]	not serious	not serious	very serious[c]	none	1/20 (5.0%)	0/21 (0.0%)	**OR 7.77** (0.15 to 391.93)	**50 more per 1,000** (from 80 fewer to 180 more)[d]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference; **OR:** odds ratio

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias due to missing outcome data)

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

d. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.7 Acupuncture/dry needling compared to placebo/sham and usual care or no treatment

F.7.1 Acupuncture/dry needling compared to placebo/sham

Table 39: Clinical evidence profile: acupuncture/dry needling compared to placebo/sham

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Acupuncture/dry needling	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, 0-10, lower values are better, change score) at <6 months (follow-up: 4 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	27	26	-	MD **1.35 lower** (2.92 lower to 0.22 higher)	⨁◯◯◯ Very low	CRITICAL
Activities of daily living (Korean modified barthel index, 0-100, higher values are better, final value) at <6 months (follow-up: 4 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	very serious[b]	none	27	26	-	MD **7.75 lower** (17.56 lower to 2.06 higher)	⨁◯◯◯ Very low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 4 weeks)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Acupuncture/dry needling	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
1	randomised trials	very serious[a]	not serious	not serious	very serious[c]	none	0/27 (0.0%)	0/26 (0.0%)	**RD 0.00** (-0.07 to 0.07)	**0 fewer per 1,000** (from 70 fewer to 70 more)[d]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias due to missing outcome data)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

d. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.7.2 Acupuncture/dry needling compared to usual care or no treatment

Table 40: Clinical evidence profile: acupuncture/dry needling compared to usual care or no treatment

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Acupuncture/dry needling	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Person/participant generic health-related quality of life (quality of life scale, unclear scale range, higher values are better, final values) at <6 months (follow-up: 4 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	not serious	none	89	89	-	MD **23.83 higher** (19.96 higher to 27.7 higher)	⨁⨁◯◯ Low	CRITICAL

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Acupuncture/dry needling	usual care or no treatment	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, numeric rating scale, 0-10, lower values are better, change scores and final value) at <6 months (follow-up: mean 3 weeks)												
4	randomised trials	very serious[a]	very serious[b]	not serious	serious[c]	none	176	168	-	MD **1.78 lower** (3.48 lower to 0.08 lower)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Fugl Meyer Assessment, 0-66, higher values are better, change scores) at <6 months (follow-up: mean 3 weeks)												
2	randomised trials	very serious[d]	very serious[a]	not serious	serious[c]	none	114	113	-	MD **2.9 higher** (2.91 lower to 8.71 higher)	⨁◯◯◯ Very low	CRITICAL
Physical function - upper limb (Rivermead Motricity Index Effectiveness, 0-100, higher values are better, final value) at <6 months (follow-up: 3 weeks)												
1	randomised trials	very serious[f]	not serious	not serious	serious[c]	none	54	47	-	MD **2.47 higher** (3.96 lower to 8.9 higher)	⨁◯◯◯ Very low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: mean 2 weeks)												
2	randomised trials	serious[g]	serious[b]	not serious	very serious[h]	none	0/33 (0.0%)	1/33 (3.0%)	**RD -0.03** (-0.13 to 0.07)	**30 fewer per 1,000** (from 130 fewer to 70 more)[i]	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded for heterogeneity due to conflicting number of events in different studies (zero events in one or more studies)

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

d. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to missing outcome data and bias in measurement of the outcome)

e. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

f. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias in measurement of the outcome)

g. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process)

h. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

i. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

F.8 Electroacupuncture compared to placebo/sham

F.8.1 Electroacupuncture compared to placebo/sham

Table 41: Clinical evidence profile: electroacupuncture compared to placebo/sham

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Electroacupuncture	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, 0-10, lower values are better, final values) at <6 months (follow-up: 2 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	17	15	-	MD **0.93 lower** (1.72 lower to 0.14 lower)	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions and bias in measurement of the outcome)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.9 Intra-articular medicine injections – corticosteroids compared to placebo/sham

F.9.1 Intra-articular medicine injections – corticosteroids compared to placebo/sham

Table 42: Clinical evidence profile: intra-articular medicine injections – corticosteroids compared to placebo/sham

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intra-articular medicine injections - corticosteroids	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, 0-10, lower values are better, change score and final value) at <6 months (follow-up: mean 6 weeks)												
2	randomised trials	very serious[a]	serious[b]	not serious	serious[c]	none	50	46	-	MD **1.26 lower** (2.34 lower to 0.17 lower)	⨁◯◯◯ Very low	CRITICAL
Activities of daily living (Barthel index, 0-100, higher values are better, final value) at <6 months (follow-up: mean 8 weeks)												
1	randomised trials	serious[d]	not serious	not serious	very serious[c]	none	29	29	-	MD **4.8 higher** (6.42 lower to 16.02 higher)	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process, bias due to deviations from the intended interventions, bias due to missing outcome data and bias in measurement of the outcome)

b. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

c. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

d. Downgraded by 1 increment as the majority of the evidence was of high risk of bias (due to bias arising from the randomisation process)

F.10 Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS) and placebo/sham

F.10.1 Nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS)

Table 43: Clinical evidence profile: nerve blocks (local anaesthetic) compared to transcutaneous electrical nerve stimulation (TENS)

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Nerve blocks (local anaesthetic)	Transcutaneous electrical nerve stimulation (TENS)	Relative (95% CI)	Absolute (95% CI)		
Pain (VAS, 0-100, lower values are better, change score) at <6 months (follow-up: 3 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	12	12	-	MD **25.8 lower** (50.2 lower to 1.4 lower)	⨁◯◯◯ Very low	CRITICAL
Stroke-specific Patient-Reported Outcome Measures (SS-QOL, 0-100, higher values are better, change scores) at <6 months (follow-up: 3 weeks)												
1	randomised trials	very serious[a]	not serious	not serious	serious[b]	none	12	12	-	MD **3.2 higher** (0.11 higher to 6.29 higher)	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 2 increments as the majority of the evidence was of very high risk of bias (due to bias arising from the randomisation process and bias in measurement of the outcome)

b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

F.10.2 Nerve blocks (local anaesthetic) compared to placebo/sham

Table 44: Clinical evidence profile: nerve blocks (local anaesthetic) compared to placebo/sham

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Nerve blocks (local anaesthetic)	placebo/sham	Relative (95% CI)	Absolute (95% CI)		
Pain (visual analogue scale, 0-100, lower values are better, final values) at <6 months (follow-up: mean 8 weeks)												
2	randomised trials	not serious	serious[a]	not serious	serious[b]	none	42	42	-	MD **17.25 lower** (28.87 lower to 5.63 lower)	⨁⨁◯◯ Low	CRITICAL
Withdrawal due to adverse events at <6 months (follow-up: 12 weeks)												
1	randomised trials	not serious	not serious	not serious	very serious[c]	none	0/32 (0.0%)	0/32 (0.0%)	**RD 0.00** (-0.06 to 0.06)	**0 fewer per 1,000** (from 60 fewer to 60 more)[d]	⨁⨁◯◯ Low	CRITICAL

CI: confidence interval; **MD:** mean difference

Explanations

a. Downgraded by 1 or 2 increments because heterogeneity, unexplained by subgroup analysis

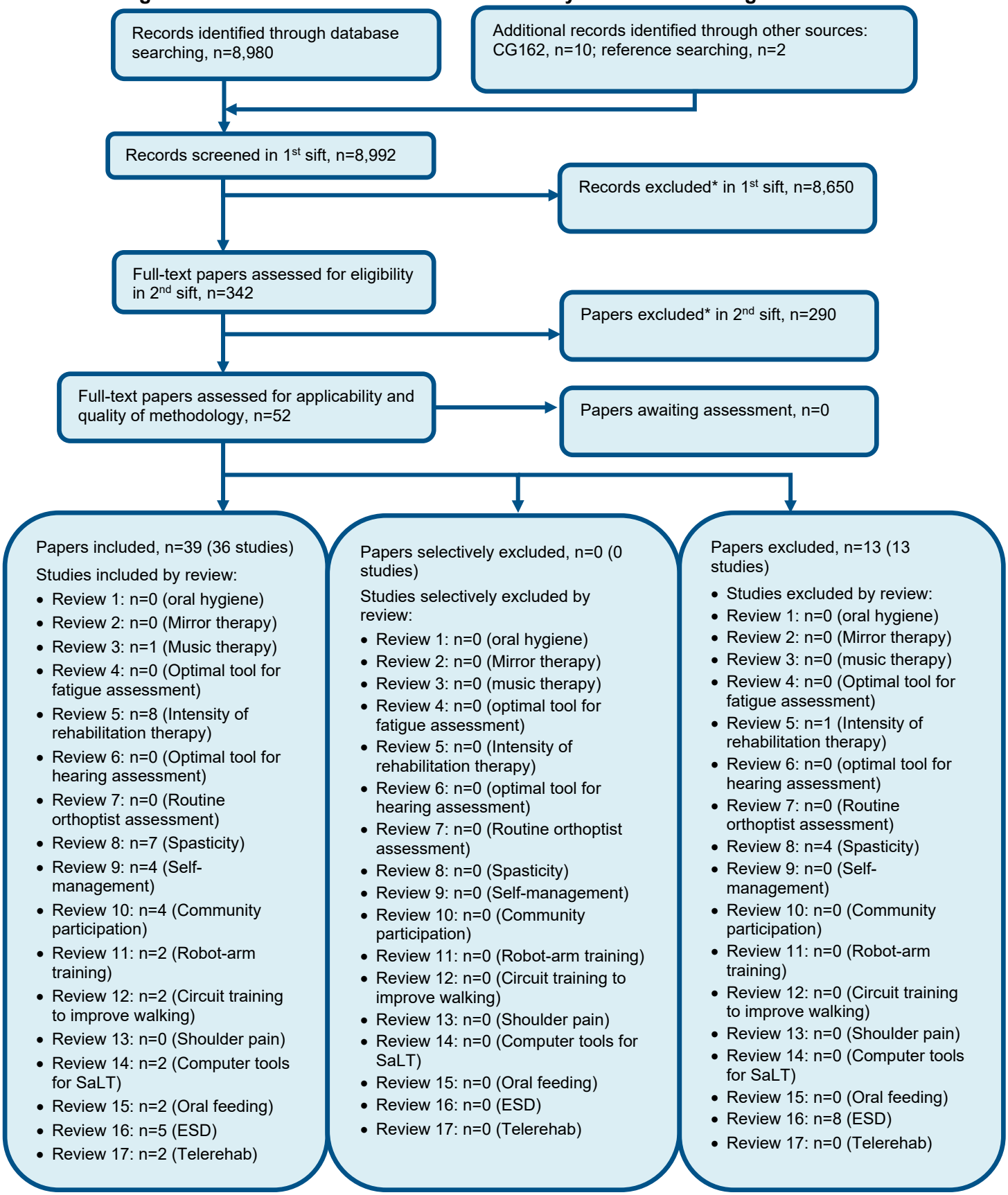
b. Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

c. Downgraded by 1 to 2 increments for imprecision due to zero events and small sample size

d. Absolute effect calculated by risk difference due to zero events in at least one arm of one study

Appendix G – Economic evidence study selection

Figure 22: Flow chart of health economic study selection for the guideline



* Non-relevant population, intervention, comparison, design or setting; non-English language

Appendix H – Economic evidence tables

No health economic studies were included in this review.

Appendix I – Health economic model

New cost-effectiveness analysis was not conducted in this area.

Appendix J – Excluded studies

Clinical studies

Table 45: Studies excluded from the clinical review

Study	Code [Reason]
(2013) Suprascapular nerve block for shoulder pain in the first year after stroke: a randomised controlled trial. Arthritis and rheumatism 65(suppl10): 464	- Duplicate reference
A, V. A. N. Bladel, Cambier, D., Lefeber, N. et al. (2020) The use of shoulder orthoses post-stroke: effects on balance and gait. A systematic review. European journal of physical & rehabilitation medicine. 56(6): 695-705	- Systematic review used as source of primary studies
Ada, L.; Foongchomcheay, A.; Canning, C. (2005) Supportive devices for preventing and treating subluxation of the shoulder after stroke. Cochrane Database of Systematic Reviews: cd003863	- Systematic review used as source of primary studies *Cochrane review that specifically included studies for people with subluxation of the shoulder after stroke, rather than all people with shoulder pain. Included only supportive devices and did not look at all of the outcomes of interest specified by the committee. Used as a source of primary studies.*
Ada, L., Foongchomcheay, A., Langhammer, B. et al. (2017) Lap-tray and triangular sling are no more effective than a hemi-sling in preventing shoulder subluxation in those at risk early after stroke: a randomized trial. European journal of physical & rehabilitation medicine. 53(1): 41-48	- Population not relevant to this review protocol *The study looks at preventing shoulder pain rather than managing shoulder pain that already exists*
Ada, L; Foongchomcheay, A; Canning, Cg (2005) Supportive devices for preventing and treating subluxation of the shoulder after stroke. Cochrane Database of Systematic Reviews	- Duplicate reference
Adey-Wakeling, Z.; Crotty, M.; Shanahan, E. M. (2013) Suprascapular nerve block reduces shoulder pain post stroke: a randomised controlled trial. International journal of stroke 8suppl1: 20-21	- Duplicate reference
Alanbay, E., Aras, B., Kesikburun, S. et al. (2020) Effectiveness of Suprascapular Nerve Pulsed Radiofrequency Treatment for Hemiplegic Shoulder Pain: A Randomized-Controlled Trial. Pain Physician 23(3): 245-252	- Study does not contain an intervention relevant to this review protocol *Suprascapular nerve pulsed radiofrequency treatment*

Study	Code [Reason]
Ancliffe J (1992) Strapping the shoulder in patients following a cerebrovascular accident (CVA): A pilot study. The Australian journal of physiotherapy 38(1): 37-40	- Non-randomised study that does not appear to adjust for confounders in a univariate or multivariate analysis or with matched groups
Appel, C.; Mayston, M.; Perry, L. (2011) Feasibility study of a randomized controlled trial protocol to examine clinical effectiveness of shoulder strapping in acute stroke patients. Clinical Rehabilitation 25(9): 833-43	- Systematic review used as source of primary studies
Arya, K. N.; Pandian, S.; Puri, V. (2018) Rehabilitation methods for reducing shoulder subluxation in post-stroke hemiparesis: a systematic review. Topics in Stroke Rehabilitation 25(1): 68-81	- Population not relevant to this review protocol *Does not specifically discuss shoulder pain* - Review article but not a systematic review *Narrative review that included single arm studies*
Badaru, U. M. (2020) Comparative Efficacy of Soft Tissue Massage and Transcutaneous Electric Nerve Stimulation in the Management of Hemiplegic Shoulder Pain. Nigerian journal of physiological sciences : official publication of the Physiological Society of Nigeria 35(2): 143-146	- Study does not contain an intervention relevant to this review protocol *Soft tissue massage (not stated to be included in the protocol)*
Baker LL and Parker K (1986) Neuromuscular electrical stimulation of the muscles surrounding the shoulder. Physical therapy 66(12): 1930-1937	- No relevant outcomes *Shoulder subluxation amount only*
Bao YH, Wang YW, Chu JM, Zhu GX, Wang CM HH (2012) Effects of electro-acupuncture combined with rehabilitation on improving upper extremity function for patients with post-stroke shoulder pain. Chin J Tradit Med Sci Tech: 59-60	- Study not reported in English
Bao YH, Wang YW, Chu JM, Zhu GX, Wang CM HH (2011) Effects of electro-acupuncture combined with rehabilitation for patients with post-stroke shoulder pain. Chin Arch Tradit Chin Med: 2536-9	- Study not reported in English
Bao, X.; Shao, Y. J.; Liu, H. Y. (2018) The effect of intraarticular injection of botulinum toxin type A, triamcinolone or saline plus rehabilitation exercise shoulder pain on patients with post-stroke. Annals of physical and rehabilitation medicine	- Conference abstract

Study	Code [Reason]
Boonsong, P.; Jaroenarpornwatana, A.; Boonhong, J. (2009) Preliminary study of suprascapular nerve block (SSNB) in hemiplegic shoulder pain. Journal of the Medical Association of Thailand 92(12): 1669-74	- Study does not contain an intervention relevant to this review protocol *The control arm received ultrasound therapy*
Bu L, Xu HQ, Tan WJ DR (2013) Effects of electro-acupuncture combined with scapular control training on shoulder pain and upper limbs function in hemiplegia patients. Glob Tradit Chin Med: 246-7	- Study not reported in English
Chatterjee S, Hayner KA, Arumugam N et al. (2016) The California Tri-pull Taping Method in the Treatment of Shoulder Subluxation After Stroke: A Randomized Clinical Trial. North American journal of medical sciences 8(4): 175-182	- Data not reported in an extractable format or a format that can be analysed *Reported beta coefficients only*
Chau, J. P. C., Lo, S. H. S., Yu, X. et al. (2018) Effects of Acupuncture on the Recovery Outcomes of Stroke Survivors with Shoulder Pain: A Systematic Review. Frontiers in neurology [electronic resource]. 9: 30	- Systematic review used as source of primary studies
Chen HX, He MF XR (2011) Clinical observation on the combination of abdominal acupuncture and rehabilitation in treating omalgia after stroke. J Nanjing Univ Tradit Chin Med: 333-5	- Study not reported in English
Chen J (2016) Effects of acupuncture combined with exercise for patients with poststroke shoulder pain. Womens Health Res: 79-81	- Study not reported in English
Chen Y, Huang TS LK (2015) Clinical research of using acupuncture and rehabilitation training in the treatment of post-stroke shoulder-hand syndrome stage I. Sichuan Tradit Chin Med: 150-2	- Study not reported in English
Chen, C. H., Chen, T. W., Weng, M. C. et al. (2000) The effect of electroacupuncture on shoulder subluxation for stroke patients. Kaohsiung Journal of Medical Sciences 16(10): 525-32	- Full text paper not available
Church, C., Price, C., Pandyan, A. D. et al. (2006) Randomized controlled trial to evaluate the effect of surface neuromuscular electrical stimulation to the shoulder after acute stroke. Stroke 37(12): 2995-3001	- Data not reported in an extractable format or a format that can be analysed *Reported outcomes as medians and interquartile ranges*

Study	Code [Reason]
Cuesta-Gomez, A., Carratala-Tejada, M., Molina-Rueda, F. et al. (2019) Functional electrical stimulation improves reaching movement in the shoulder and elbow muscles of stroke patients: A three-dimensional motion analysis. Restorative Neurology & Neuroscience 37(3): 231-238	- No relevant outcomes *Kinematic data only*
Dacre, J. E.; Beeney, N.; Scott, D. L. (1989) Injections and physiotherapy for the painful stiff shoulder. Annals of the Rheumatic Diseases 48(4): 322-5	- Commentary only
Dall'Agnol, M. S. and Cechetti, F. (2018) Kinesio Taping Associated with Acupuncture in the Treatment of the Paretic Upper Limb After Stroke. Jams Journal of Acupuncture & Meridian Studies 11(2): 67-73	- Data not reported in an extractable format or a format that can be analysed *Reported median and interquartile range only*
de Oliveira Cacho, R., Cacho, E. W. A., Ortolan, R. L. et al. (2015) Trunk restraint therapy: the continuous use of the harness could promote feedback dependence in poststroke patients: a randomized trial. Medicine 94(12): e641	- Population not relevant to this review protocol *No statement about shoulder pain*
de Sire, A., Moggio, L., Demeco, A. et al. (2021) Efficacy of rehabilitative techniques in reducing hemiplegic shoulder pain in stroke: Systematic review and meta-analysis. Annals of Physical & Rehabilitation Medicine 65(5): 101602	- Systematic review used as source of primary studies
Deng, P., Zhao, Z., Zhang, S. et al. (2021) Effect of kinesio taping on hemiplegic shoulder pain: A systematic review and meta-analysis of randomized controlled trials. Clinical Rehabilitation 35(3): 317-331	- Systematic review used as source of primary studies
Dorsch, S.; Ada, L.; Canning, C. G. (2014) EMG-triggered electrical stimulation is a feasible intervention to apply to multiple arm muscles in people early after stroke, but does not improve strength and activity more than usual therapy: a randomized feasibility trial. Clinical Rehabilitation 28(5): 482-90	- Population not relevant to this review protocol *No statement about shoulder pain*
Dyer, S.; Mordaunt, D. A.; Adey-Wakeling, Z. (2020) Interventions for Post-Stroke Shoulder Pain: An Overview of Systematic Reviews. International journal of general medicine 13: 1411-1426	- Study design not relevant to this review protocol *Review of reviews*

Study	Code [Reason]
Ekim, A.; Armağan, O.; Oner, C. (2008) Efficiency of TENS treatment in hemiplegic shoulder pain: a placebo controlled study. Agri : Agri (Algoloji) Dernegi'nin Yayin organidir [Journal of the Turkish Society of Algology] 20(1): 41-46	- Study not reported in English
Ellis, M. D.; Sukal-Moulton, T.; Dewald, J. P. (2009) Progressive shoulder abduction loading is a crucial element of arm rehabilitation in chronic stroke. Neurorehabilitation & Neural Repair 23(8): 862-9	- Population not relevant to this review protocol *Excluded if they had an acute or chronic painful condition of the upper limb*
Faghri, P. D. and Rodgers, M. M. (1997) The effects of functional neuromuscular stimulation-augmented physical therapy program in the functional recovery of hemiplegic arm in stroke patients. Clinical Kinesiology 51(1): 9-15	- Data not reported in an extractable format or a format that can be analysed *Outcomes reported in graphical form only*
Faghri, P. D., Rodgers, M. M., Glaser, R. M. et al. (1994) The effects of functional electrical stimulation on shoulder subluxation, arm function recovery, and shoulder pain in hemiplegic stroke patients. Archives of Physical Medicine & Rehabilitation 75(1): 73-9	- Data not reported in an extractable format or a format that can be analysed *Outcomes reported in graphical form*
Fil, A., Armutlu, K., Atay, A. O. et al. (2011) The effect of electrical stimulation in combination with Bobath techniques in the prevention of shoulder subluxation in acute stroke patients. Clinical Rehabilitation 25(1): 51-9	- Population not relevant to this review protocol *Does not include presence of shoulder pain as an inclusion criteria*
Fu M KS (2015) Efficacy Observation on Functional Electrical Stimulation for Shoulder Pain after Stroke. Chinese Manipul Rehabil: 11-4	- Study not reported in English
Glize, Bertrand, Cook, Amandine, Benard, Antoine et al. (2022) Early multidisciplinary prevention program of post-stroke shoulder pain: A randomized clinical trial. Clinical rehabilitation 36(8): 1042-1051	- Population not relevant to this review protocol *Prevention of shoulder pain rather than people with shoulder pain*
Grampurohit, N.; Pradhan, S.; Kartin, D. (2015) Efficacy of adhesive taping as an adjunt to physical rehabilitation to influence outcomes post-stroke: a systematic review. Topics in Stroke Rehabilitation 22(1): 72-82	- Systematic review used as source of primary studies
Griffin, A. and Bernhardt, J. (2006) Strapping the hemiplegic shoulder prevents development	- Population not relevant to this review protocol

Study	Code [Reason]
of pain during rehabilitation: a randomized controlled trial. Clinical Rehabilitation 20(4): 287-95	*Includes people at risk of developing pain rather than people who have pain (excludes people who had more than minimal shoulder pain)*
Gu, P. and Ran, J. J. (2016) Electrical Stimulation for Hemiplegic Shoulder Function: A Systematic Review and Meta-Analysis of 15 Randomized Controlled Trials. Archives of Physical Medicine and Rehabilitation 97(9): 1588-1594	- Study not reported in English
Gustafsson, L. and McKenna, K. (2006) A programme of static positional stretches does not reduce hemiplegic shoulder pain or maintain shoulder range of motion--a randomized controlled trial. Clinical Rehabilitation 20(4): 277-86	- Population not relevant to this review protocol *Only includes people who do not have shoulder pain at baseline*
Hanger, H. C., Whitewood, P., Brown, G. et al. (2000) A randomized controlled trial of strapping to prevent post-stroke shoulder pain. Clinical Rehabilitation 14(4): 370-80	- Population not relevant to this review protocol *Study aims to prevent shoulder pain rather than managing existing shoulder pain*
Hara, Y., Ogawa, S., Tsujiuchi, K. et al. (2008) A home-based rehabilitation program for the hemiplegic upper extremity by power-assisted functional electrical stimulation. Disability & Rehabilitation 30(4): 296-304	- Population not relevant to this review protocol *Shoulder pain is not stated to be needed as a component for inclusion*
Hartwig, M.; Gelbrich, G.; Griewing, B. (2012) Functional orthosis in shoulder joint subluxation after ischaemic brain stroke to avoid post-hemiplegic shoulder-hand syndrome: a randomized controlled trial. Clinical rehabilitation 26(9): 807-816	- Duplicate reference
He SS GS (2016) Evaluation of abdominal acupuncture and rehabilitation treatment for shoulder-hand syndrome (period 1) after stroke. Clin Acupunct Moxi : 11-3	- Study not reported in English
Hesse, S., Werner, C., Pohl, M. et al. (2008) Mechanical arm trainer for the treatment of the severely affected arm after a stroke: a single-blinded randomized trial in two centers. American Journal of Physical Medicine & Rehabilitation 87(10): 779-88	- Study does not contain an intervention relevant to this review protocol *Mechanical arm trainer*
Hochsprung, A., Dominguez-Matito, A., Lopez-Hervas, A. et al. (2017) Short- and medium-term effect of kinesio taping or electrical stimulation in	- Population not relevant to this review protocol

Study	Code [Reason]
hemiplegic shoulder pain prevention: A randomized controlled pilot trial. Neurorehabilitation 41(4): 801-810	*Study is looking at preventing shoulder pain and all people have no pain at baseline*
Hong LR, Chen B, Yu SM, Huang XS, Wang JP XY (2011) Efficacy of acupuncture plus rehabilitation training in treating shoulder-hand syndrome after hemiparalysis. Med J Chin Peoples Armed Police Forces 22: 658-60	- Study not reported in English
Hou, Yajing, Zhang, Tong, Liu, Wei et al. (2022) The Effectiveness of Ultrasound-Guided Subacromial-Subdeltoid Bursa Combined With Long Head of the Biceps Tendon Sheath Corticosteroid Injection for Hemiplegic Shoulder Pain: A Randomized Controlled Trial. Frontiers in neurology 13: 899037	- Comparator in study does not match that specified in this review protocol *Compares injection into the bursa and sheath to injection into the bursa alone which is not specified as a comparison in the protocol*
Huang, Z. Q., Pei, J., Wang, W. M. et al. (2015) Clinical observation of acupuncture plus medicine and function training for post-stroke shoulder-hand syndrome. Shanghai journal of acupuncture and moxibustion [shang hai zhen jiu za zhi] 34(6): 511-512	- Study not reported in English
Hurd MM; Farrell KH; Waylonis GW (1974) Shoulder sling for hemiplegia: friend or foe?. Archives of physical medicine and rehabilitation 55(11): 519-522	- Data not reported in an extractable format or a format that can be analysed *Pain reported as the number of people with severe pain rather than as a continuous outcome scale - categorical data only*
Hwang, K. H., Lee, J. H., Sim, Y. J. et al. (2010) Strapping on Subluxation of the Hemiplegic Shoulder: effects of Elasticity Difference Strapped. Journal of korean academy of rehabilitation medicine 34(3): 304-309	- Study not reported in English
Jeong, Y. G., Jeong, Y. J., Kim, H. S. et al. (2020) Predictors of the effect of an arm sling on gait efficiency in stroke patients with shoulder subluxation: a pre-post design clinical trial. Physiotherapy Theory & Practice: 1-8	- Study design not relevant to this review protocol *Cross over trial, <1 week follow up period*
Jia CJ, Ni GX, Tan H ZX (2012) Effects of acupuncture combined with rehabilitation for stroke survivors with stage I shoulder hand syndrome. Changchun Univ Tradit Chin Med: 711-2	- Study not reported in English
Jin, Y. S.; Yuan, B.; Zhang, G. Z. (2015) The clinical research on shoulder acupuncture	- Study not reported in English

Study	Code [Reason]
combined with upper limb function training to improve upper limb motor functions in patients with hemiplegia after stroke. Henan traditional chinese medicine [henan zhong yi] 35(1): 142-144	
Jonsdottir, J., Thorsen, R., Aprile, I. et al. (2017) Arm rehabilitation in post stroke subjects: A randomized controlled trial on the efficacy of myoelectrically driven FES applied in a task-oriented approach. PLoS ONE [Electronic Resource] 12(12): e0188642	- Population not relevant to this review protocol *Median visual analogue scale for pain was 0 at baseline*
Jung, K. M. and Choi, J. D. (2019) The Effects of Active Shoulder Exercise with a Sling Suspension System on Shoulder Subluxation, Proprioception, and Upper Extremity Function in Patients with Acute Stroke. Medical Science Monitor 25: 4849-4855	- Population not relevant to this review protocol *No statement that people had to have shoulder pain*
Jung, K., Jung, J., In, T. et al. (2017) The influence of Task-Related Training combined with Transcutaneous Electrical Nerve Stimulation on paretic upper limb muscle activation in patients with chronic stroke. Neurorehabilitation 40(3): 315-323	- Population not relevant to this review protocol *Does not include pain in the inclusion criteria with no statement about pain throughout the study*
Kim EB and Kim YD (2015) Effects of kinesiology taping on the upper-extremity function and activities of daily living in patients with hemiplegia. Journal of physical therapy science 27(5): 1455-1457	- Population not relevant to this review protocol *Does not specifically include people with shoulder pain (taping involves the lower back as well as the shoulder)*
Kim, Min Gyun, Lee, Seung Ah, Park, Eo Jin et al. (2022) Elastic Dynamic Sling on Subluxation of Hemiplegic Shoulder in Patients with Subacute Stroke: A Multicenter Randomized Controlled Trial. International journal of environmental research and public health 19(16)	- Population not relevant to this review protocol *Minimal pain at baseline with pain not present as an inclusion criteria*
Kim, T. H. and Chang, M. C. (2021) Comparison of the effectiveness of pulsed radiofrequency of the suprascapular nerve and intra-articular corticosteroid injection for hemiplegic shoulder pain management. Journal of Integrative Neuroscience 20(3): 687-693	- Study does not contain an intervention relevant to this review protocol *Pulsed radiofrequency ablation*
Kobayashi, H, Onishi, H, Ihashi, K et al. (1999) Reduction in subluxation and improved muscle function of the hemiplegic shoulder joint after therapeutic electrical stimulation. Journal of Electromyography and Kinesiology 9(5): 327-36.	- Population not relevant to this review protocol *Not all participants had shoulder pain*

Study	Code [Reason]
Koog, Y. H., Jin, S. S., Yoon, K. et al. (2010) Interventions for hemiplegic shoulder pain: systematic review of randomised controlled trials. Disability & Rehabilitation 32(4): 282-91	- Systematic review used as source of primary studies
Koyuncu, E., Nakipoglu-Yuzer, G. F., Dogan, A. et al. (2010) The effectiveness of functional electrical stimulation for the treatment of shoulder subluxation and shoulder pain in hemiplegic patients: A randomized controlled trial. Disability & Rehabilitation 32(7): 560-6	- Data not reported in an extractable format or a format that can be analysed *Reported median and interquartile range values only*
Krempen, J. F., Silver, R. A., Hadley, J. et al. (1977) The use of the Varney Brace for subluxating shoulders in stroke and upper motor neuron injuries. Clinical orthopaedics and related research 122: 204-206	- Study design not relevant to this review protocol *Single arm non-randomised study*
Leandri M, Parodi CI, Corrieri N et al. (1990) Comparison of TENS treatments in hemiplegic shoulder pain. Scandinavian journal of rehabilitation medicine 22(2): 69-71	- No relevant outcomes *Reports kinematic outcomes only*
Lee, J. A., Park, S. W., Hwang, P. W. et al. (2012) Acupuncture for shoulder pain after stroke: a systematic review. Journal of Alternative & Complementary Medicine 18(9): 818-23	- Systematic review used as source of primary studies
Lee, J. H., Baker, L. L., Johnson, R. E. et al. (2017) Effectiveness of neuromuscular electrical stimulation for management of shoulder subluxation post-stroke: a systematic review with meta-analysis. Clinical Rehabilitation 31(11): 1431-1444	- Systematic review used as source of primary studies
Lee, S. H. and Lim, S. M. (2016) Acupuncture for Poststroke Shoulder Pain: A Systematic Review and Meta-Analysis. Evidence-Based Complementary & Alternative Medicine: eCAM 2016: 3549878	- Systematic review used as source of primary studies
Lerma Castano, P. R., Rodriguez Laiseca, Y. A., Montealegre Suarez, D. P. et al. (2020) Effects of kinesiotaping combined with the motor relearning method on upper limb motor function in adults with hemiparesis after stroke. Journal of Bodywork & Movement Therapies 24(4): 546-553	- Data not reported in an extractable format or a format that can be analysed *Data in graphical form only*

Study	Code [Reason]
Li B. (2015) Treating 57 cases of stroke shoulder-hand syndrome by acupuncture. Clin J Chin Med: 40-1	- Study not reported in English
Li, N., Tian, F., Wang, C. et al. (2012) Therapeutic effect of acupuncture and massage for shoulder-hand syndrome in hemiplegia patients: a clinical two-center randomized controlled trial. Journal of Traditional Chinese Medicine 32(3): 343-349	- Study does not contain an intervention relevant to this review protocol *Intervention includes manipulation (manual therapy) combined with electroacupuncture which was not included in the protocol*
Lin HX, Ye GQ, Liao HX, Lin FY LB (2014) Acupuncture combined with rehabilitation training in the treatment of shoulder-hand syndrome after stroke. World Chin Med: 84, 85-8	- Study not reported in English
Lin, L. F., Lin, Y. J., Lin, Z. H. et al. (2018) Feasibility and efficacy of wearable devices for upper limb rehabilitation in patients with chronic stroke: a randomized controlled pilot study. European journal of physical & rehabilitation medicine. 54(3): 388-396	- Study does not contain an intervention relevant to this review protocol *Wearable devices to help monitor exercise that do not fit to the definition of devices used in the review*
Linn, S. L.; Granat, M. H.; Lees, K. R. (1999) Prevention of shoulder subluxation after stroke with electrical stimulation. Stroke 30(5): 963-8	- Population not relevant to this review protocol *Aiming at preventing shoulder subluxation and pain rather than treating existing pain*
Liu, J., Feng, W., Zhou, J. et al. (2020) Effects of sling exercise therapy on balance, mobility, activities of daily living, quality of life and shoulder pain in stroke patients: a randomized controlled trial. European Journal of Integrative Medicine 35 (no pagination)	- Study does not contain an intervention relevant to this review protocol *Sling exercise therapy rather than a sling device*
Liu, S. and Shi, Z. Y. (2013) Observation on the therapeutic effect of scalp acupuncture and body acupuncture in combination with rehabilitation exercise for hemiplegia and shoulder pain after stroke. World Journal of Acupuncture - Moxibustion 23(1): 21-26	- No relevant outcomes *Reported outcomes including results of blood tests only*
Liu, S., Zhang, C. S., Cai, Y. et al. (2019) Acupuncture for Post-stroke Shoulder-Hand Syndrome: A Systematic Review and Meta-Analysis. Frontiers in neurology [electronic resource]. 10: 433	- Systematic review used as source of primary studies
Lu, J., Zhang, L. X., Liu, K. J. et al. (2010) Clinical observation on electroacupuncture	- Study not reported in English

Study	Code [Reason]
combined with rehabilitation techniques for treatment of shoulder subluxation after stroke. Zhongguo zhen jiu [Chinese acupuncture & moxibustion] 30(1): 31-34	
Manigandan, J. B., Ganesh, G. S., Pattnaik, M. et al. (2014) Effect of electrical stimulation to long head of biceps in reducing gleno humeral subluxation after stroke. Neurorehabilitation 34(2): 245-52	- Comparator in study does not match that specified in this review protocol *Comparing electrical stimulation applied to different muscles associated with the shoulder*
Mao Y, Xue L, Xue J EA (2016) Efficacy of low frequency electric stimulation plus acupuncture for hemiplegia and shoulder pain. Med J Qilu 31: 592-3	- Study not reported in English
McCabe, J., Monkiewicz, M., Holcomb, J. et al. (2015) Comparison of robotics, functional electrical stimulation, and motor learning methods for treatment of persistent upper extremity dysfunction after stroke: a randomized controlled trial. Archives of Physical Medicine & Rehabilitation 96(6): 981-90	- Population not relevant to this review protocol *Does not state that people have to experience pain to be included in the study*
Meng, F. Y. and Wen, J. (2014) Effect of warm acupuncture stimulation of Waiguan (TE 5) on post-stroke shoulder-hand syndrome. Zhen CI yan jiu = acupuncture research 39(3): 228-31, 251	- Study not reported in English
Nadler, M. and Pauls, M. (2017) Shoulder orthoses for the prevention and reduction of hemiplegic shoulder pain and subluxation: systematic review. Clinical Rehabilitation 31(4): 444-453	- Systematic review used as source of primary studies
Nakipoglu-Yuzer, G. F.; Koyuncu, E.; Ozgirgin, N. (2010) Effectiveness of functional electrical stimulation on upper extremity rehabilitation outcomes in patients with hemiplegia due to cerebrovascular accident. Turkiye fiziksel tip ve rehabilitasyon dergisi 56(4): 177-181	- Study not reported in English
Niaki, A. S., Momenzadeh, S., Mohammadinasab, H. et al. (2011) Evaluating the effects of local injections of bupivacaine and triamcinolone acetate on shoulder joint pain and restricted range of motion following cerebrovascular accidents. Tehran University Medical Journal 69(6): 381-387	- Study not reported in English

Study	Code [Reason]
Page, T. and Lockwood, C. (2003) Prevention and management of shoulder pain in the hemiplegic patient. JBI Library of Systematic Reviewis 1(4): 1-28	- Systematic review used as source of primary studies
Pan, R., Zhou, M., Cai, H. et al. (2018) A randomized controlled trial of a modified wheelchair arm-support to reduce shoulder pain in stroke patients. Clinical Rehabilitation 32(1): 37-47	- Data not reported in an extractable format or a format that can be analysed *Reports median and interquartile range values for outcomes only*
Peng, L., Zhang, C., Zhou, L. et al. (2018) Traditional manual acupuncture combined with rehabilitation therapy for shoulder hand syndrome after stroke within the Chinese healthcare system: a systematic review and meta-analysis. Clinical Rehabilitation 32(4): 429-439	- Systematic review used as source of primary studies
Price, C. I. and Pandyan, A. D. (2000) Electrical stimulation for preventing and treating post-stroke shoulder pain. Cochrane Database of Systematic Reviews: cd001698	- Systematic review used as source of primary studies *Cochrane review including only electrical stimulation. Includes some studies that do not explicitly state that people have shoulder pain. Does not include all of the outcomes specified by the committee that needed to be included. References checked.*
Price, Cim and Pandyan, Ad (2000) Electrical stimulation for preventing and treating post-stroke shoulder pain. Cochrane Database of Systematic Reviews	- Duplicate reference
Qiu, H., Li, J., Zhou, T. et al. (2019) Electrical Stimulation in the Treatment of Hemiplegic Shoulder Pain: A Meta-Analysis of Randomized Controlled Trials. American Journal of Physical Medicine & Rehabilitation 98(4): 280-286	- Systematic review used as source of primary studies
Ratmansky M; Defrin R; Soroker N (2012) A randomized controlled study of segmental neuromyotherapy for post-stroke hemiplegic shoulder pain. Journal of rehabilitation medicine 44(10): 830-836	- Study does not contain an intervention relevant to this review protocol *Combination of nerve block, local anaesthetic injection, TENS and manual therapy*
Ravichandran, H., Janakiraman, B., Sundaram, S. et al. (2019) Systematic Review on Effectiveness of shoulder taping in Hemiplegia. Journal of Stroke & Cerebrovascular Diseases 28(6): 1463-1473	- Systematic review used as source of primary studies

Study	Code [Reason]
Shang, Y. J., Ma, C. C., Cai, Y. Y. et al. (2008) Clinical study on acupuncture combined with rehabilitation therapy for treatment of poststroke shoulder-hand syndrome. Zhongguo zhen jiu [Chinese acupuncture & moxibustion] 28(5): 331-333	- Study not reported in English
Shi DK TX (2011) Carpus-ankle acupuncture combined with physical therapy for patients with post-stroke shoulder pain: a randomized controlled trial. J Chengdu Univ Tradit Chin Med: 33-5	- Study not reported in English
Shimodozono, M., Noma, T., Matsumoto, S. et al. (2014) Repetitive facilitative exercise under continuous electrical stimulation for severe arm impairment after sub-acute stroke: a randomized controlled pilot study. Brain Injury 28(2): 203-10	- Population not relevant to this review protocol *Does not explicitly mention shoulder pain in the inclusion criteria*
Shin, S., Yang, S. P., Yu, A. et al. (2019) Effectiveness and safety of electroacupuncture for poststroke patients with shoulder pain: study protocol for a double-center, randomized, patient- and assessor-blinded, sham-controlled, parallel, clinical trial. BMC Complementary & Alternative Medicine 19(1): 58	- Protocol only
Snels, I. A., Beckerman, H., Twisk, J. W. et al. (2000) Effect of triamcinolone acetonide injections on hemiplegic shoulder pain : A randomized clinical trial. Stroke 31(10): 2396-401	- Data not reported in an extractable format or a format that can be analysed *Reports median values and interquartile ranges only*
Sonde, L., Gip, C., Fernaeus, S. E. et al. (1998) Stimulation with low frequency (1.7 Hz) transcutaneous electric nerve stimulation (low-tens) increases motor function of the post-stroke paretic arm. Scandinavian Journal of Rehabilitation Medicine 30(2): 95-9	- Data not reported in an extractable format or a format that can be analysed *Reported F and P values only*
Sun YZ, Wang YJ WW (2012) Effect of acupuncture plus rehabilitation training on shoulder-hand syndrome due to ischemic stroke. J Acupunct Tuina Sci: 109-13	- Study not reported in English
Sun ZY, Han SK, Cao WJ, Liu JH, Zuo LQ LG (2013) Effects of Buqi Huatan Tongluo recipe combined with interior-exterior meridians acupuncture on spasticity relief for patients with shoulder hand syndrome after stroke. Shaanxi J Tradit Chin Med: 1004-6	- Study not reported in English

Study	Code [Reason]
Tang D, Wu WP SX (2016) A randomized controlled trial on the effects of meridians-based acupuncture combined with function training for shoulder hand syndrome after stroke. Clin Acupunct Moxi: 26-9	- Study not reported in English
Tong, S., Su, L., Lü, H. B. et al. (2013) Observation on the efficacy of acupuncture at key acupoints combined with rehabilitation therapy for spasmodic hemiplegia after cerebral infarction. Zhongguo zhen jiu [Chinese acupuncture & moxibustion] 33(5): 399-402	- Study not reported in English
Vafadar, A. K.; Cote, J. N.; Archambault, P. S. (2015) Effectiveness of functional electrical stimulation in improving clinical outcomes in the upper arm following stroke: a systematic review and meta-analysis. BioMed Research International 2015: 729768	- Systematic review used as source of primary studies
Vasconcellos da Silva, W., de Medeiros Cirne, G. N., Meneses da Silva Filho, E. et al. (2018) Functional electrical stimulation reduces pain and shoulder subluxation in chronic post-stroke patients?. Manual therapy, posturology & rehabilitation journal 16: 1-5	- Study design not relevant to this review protocol *Case study*
Wan, W. R., Wang, T. L., Cheng, S. L. et al. (2013) Post-stroke shoulder-hand syndrome treated with acupuncture and rehabilitation: a randomized controlled trial. Zhongguo zhen jiu [Chinese acupuncture & moxibustion] 33(11): 970-974	- Study not reported in English
Wang RY; Chan RC; Tsai MW (2000) Functional electrical stimulation on chronic and acute hemiplegic shoulder subluxation. American journal of physical medicine & rehabilitation 79(4): 385	- Study design not relevant to this review protocol *Crossover trial*
Wang, Z., Lin, Z., Zhang, Y. et al. (2020) Motor entry point acupuncture for shoulder abduction dysfunction after stroke: A randomized controlled feasibility trial. European Journal of Integrative Medicine 35 (no pagination)	- Comparator in study does not match that specified in this review protocol *Comparing acupuncture performed at different sites*
Wang, Z, Lin, Z, Zhang, Y et al. (2020) Motor entry point acupuncture for shoulder abduction dysfunction after stroke: A randomized controlled trial. European Journal of Integrative Medicine 35	- Comparator in study does not match that specified in this review protocol *Compares two types of acupuncture*

Study	Code [Reason]
Wayne, P. M., Krebs, D. E., Macklin, E. A. et al. (2005) Acupuncture for upper-extremity rehabilitation in chronic stroke: a randomized sham-controlled study. Archives of Physical Medicine & Rehabilitation 86(12): 2248-55	- Population not relevant to this review protocol *Shoulder pain is not included as an inclusion criteria*
Wei, W. X. J., Fong, K. N. K., Chung, R. C. K. et al. (2019) "Remind-to-Move" for Promoting Upper Extremity Recovery Using Wearable Devices in Subacute Stroke: A Multi-Center Randomized Controlled Study. IEEE Transactions on Neural Systems & Rehabilitation Engineering 27(1): 51-59	- Study does not contain an intervention relevant to this review protocol *Device that cueing movement/is related to movement and is not the type of device discussed in the protocol*
Whitehair, V. C., Chae, J., Hisel, T. et al. (2019) The effect of electrical stimulation on impairment of the painful post-stroke shoulder. Topics in Stroke Rehabilitation 26(7): 544-547	- Non-randomised study that does not appear to adjust for confounders in a univariate or multivariate analysis or with matched groups
Wilson, R. D., Page, S. J., Delahanty, M. et al. (2016) Upper-Limb Recovery After Stroke: A Randomized Controlled Trial Comparing EMG-Triggered, Cyclic, and Sensory Electrical Stimulation. Neurorehabilitation & Neural Repair 30(10): 978-987	- Population not relevant to this review protocol *Does not specifically focus on shoulder pain with very limited information about pain*
Wu DJ, Wu ZJ LW (2017) Effects of acupuncture combined with rehabilitation for patients with shoulder hand syndrome after stroke. Pract Tradit Chin Med: 169-70	- Study not reported in English
Wu JY, Ye BY, Xue XH, Huang SE, Lin ZC HJ (2015) Observations on the efficacy of wrist-ankle acupuncture plus continuous exercise therapy for poststroke shoulder pain. Shang J Acupunct Moxi: 409-11	- Study not reported in English
Wu MB, Liao RX, Yang HH, Li N, Ling HL, Liu XH EA (2016) Observation on the clinical effects of the internal and external combined with sequential therapy for treating shoulder-hand syndrome. China Med Pharm: 13-7	- Study not reported in English
Xu F, Li HL ZZ (2015) A randomized controlled trial on the effectiveness of acupuncture combined with rehabilitation for post-stroke shoulder hand syndrome. Chin J Trauma Disabil Med: 141-2	- Study not reported in English
Yamamoto, S.; Tanaka, S.; Motojima, N. (2018) Comparison of ankle-foot orthoses with plantar	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
flexion stop and plantar flexion resistance in the gait of stroke patients: A randomized controlled trial. Prosthetics & Orthotics International 42(5): 544-553	*Device for the ankle and foot rather than shoulder*
Yang D, Xie M, Zhang CE, Ye BY SG (2009) Effects of electro-acupuncture combined with rehabilitation for patients with shoulder hand syndrome. Liaoning J Tradit Chin Med: 1770-1	- Study not reported in English
Yang, C. Y., Joo, M. C., Kil, E. Y. et al. (2006) Electromyographically Triggered Electrical Stimulation on Shoulder Subluxation in Hemiplegic Stroke Patients. Journal of the korean geriatrics society 10(1): 36-42	- Study not reported in English
Yang, C., Xu, H., Wang, R. et al. (2020) The management of hemiplegic shoulder pain in stroke subjects undergoing pulsed radiofrequency treatment of the suprascapular and axillary nerves: a pilot study. Annals of Palliative Medicine 9(5): 3357-3365	- Study does not contain an intervention relevant to this review protocol *Pulsed radiofrequency treatment of the suprascapular and axillary nerves*
Yasar, E., Vural, D., Safaz, I. et al. (2011) Which treatment approach is better for hemiplegic shoulder pain in stroke patients: intra-articular steroid or suprascapular nerve block? A randomized controlled trial. Clinical Rehabilitation 25(1): 60-8	- Data not reported in an extractable format or a format that can be analysed *Reported as F and p values rather than values for each intervention at each time period.*
Yin, J. C., Zhou, G. P., Zhou, G. H. et al. (2015) Therapeutic observation of acupuncture at the interiorly-exteriorly related meridians plus rehabilitation training for post-stroke shoulder-hand syndrome. Shanghai journal of acupuncture and moxibustion [shang hai zhen jiu za zhi] 34(1): 7-9	- Study not reported in English
Zhan, Jie, Wei, Xiaojing, Tao, Chenyang et al. (2022) Effectiveness of acupuncture combined with rehabilitation training vs. rehabilitation training alone for post-stroke shoulder pain: A systematic review and meta-analysis of randomized controlled trials. Frontiers in medicine 9: 947285	- Systematic review used as source of primary studies
Zhang XR LW (2015) The effects of acupuncture combined with rehabilitation for stage I shoulder hand syndrome patients. China Med Eng: 200	- Study not reported in English

Study	Code [Reason]
Zhang ZX, Zhang Y, Yu TY GH (2012) The effects of acupuncture on Jiantong point combined with exercise for post-stroke shoulder pain patients. Shandong Med J: 82-3	- Study not reported in English
ZHAO Li-sheng WJ (2017) Effect of Kinesio Taping on Subluxation of Shoulder in Hemiplegic Patients after Stroke. 10(23): 1200-1202	- Data not reported in an extractable format or a format that can be analysed *Graphical form only*
Zhao, H., Nie, W., Sun, Y. et al. (2015) Warm Needling Therapy and Acupuncture at Meridian-Sinew Sites Based on the Meridian-Sinew Theory: Hemiplegic Shoulder Pain. Evidence-Based Complementary & Alternative Medicine: eCAM 2015: 694973	- Study does not contain an intervention relevant to this review protocol *Includes the use of moxibustion with acupuncture which is not included in the protocol*
Zhong CQ, Ni DL, Lin WJ CF (2016) Effects of acupuncture combined with rehabilitation for patients with hand shoulder syndrome after stroke. Hainan Med: 1687-8	- Study not reported in English
Zhou XY CW (2016) Effects of intradermal needle retention combined with acupuncture for patients with post-stroke shoulder pain. Med Forum	- Study not reported in English

Health Economic studies

Published health economic studies that met the inclusion criteria (relevant population, comparators, economic study design, published 2006 or later and not from non-OECD country or USA) but that were excluded following appraisal of applicability and methodological quality are listed below. See the health economic protocol for more details.

Table 46: Studies excluded from the health economic review

Reference	Reason for exclusion
None	

Appendix K – Research recommendations – full details

K.1 Research recommendation

What is the clinical and cost-effectiveness of diagnostic assessment to decide the choice of management for shoulder pain after stroke?

K.1.1 Why this is important

Shoulder pain is very common and disabling problem after a stroke. It can have a huge impact on a person's health-related quality of life and ability to participate in rehabilitation. Post-stroke shoulder pain in is complex and multifactorial in aetiology, and different causes of post-stroke shoulder pain may impact the efficacy of various treatment options. A number of causes of post-stroke shoulder pain have been identified including: rotator cuff tears, abnormal muscle tone, glenohumeral subluxation, impingement, tendinopathy and shoulder hand syndrome. This review has identified several treatments that may be effective in reducing post stroke shoulder pain including: taping, NMES, intra-articular corticosteroid injection and nerve blocks. However, the evidence base was limited in the amount of evidence and in linking the cause of the shoulder pain to the intervention. Some interventions may be more effective at managing certain types of shoulder pain than others.

In order to further assess the effectiveness of the interventions identified as clinically effective in the guideline, a research recommendation was made to investigate the effect of using a diagnostic assessment to assess the cause of the shoulder pain and then to use that knowledge to assess the correct treatment to use, compared to usual care. This would be useful as this would help to support the idea that people should have comprehensive assessments of the cause of shoulder pain. The trial would include an internal subgroup analysis as to which treatment was selected to treat which cause of pain to understand whether that treatment was effective for treating that cause of pain.

K.1.2 Rationale for research recommendation

Importance to 'patients' or the population	Post stroke shoulder pain affects a large proportion of stroke survivors and can cause significant distress and limit their ability to engage in therapy. Causes of post stroke shoulder pain are multi factorial and improved diagnostic assessment of the potential causes may lead to more targeted person-centred treatments and improved clinical outcomes.
Relevance to NICE guidance	A number of effective treatment options for post stroke shoulder pain have been identified in this review but there is no specific guidance on what diagnostic assessment should be performed to identify causes of the shoulder pain. Further evidence to identify the most effective diagnostic techniques will help inform future NICE guidance and assist clinicians decision making. Improved diagnostic assessments may also lead to more targeted treatments and patient centred care.
Relevance to the NHS	Post stroke shoulder pain is a common condition, which can lead to increased hospital stays and morbidity. Understanding of the causes of shoulder pain is important for effective management. Therefore, further research to investigate if a particular diagnostic assessment

	leads to better outcomes if important for the NHS and could result in reduced hospital stays.
National priorities	None identified.
Current evidence base	This review identified several treatment options that may be effective in managing post-stroke shoulder pain. The evidence did not show in which people certain treatments are more effective than others, including whether people with certain shoulder problems respond better to specific treatments. More evidence about this may help to refine recommendations and lead to better care in the future.
Equality considerations	No specific equality considerations were identified. The committee noted that in general throughout the guideline, people with communication and cognitive difficulties, older people and people who have had a previous stroke or transient ischaemic attack were excluded from trials but are people that the guideline is for. Therefore, research should aim to include these people where possible.

K.1.3 Modified PICO table

Population	Inclusion:
	• Adults (age ≥16 years) who have had a first or recurrent stroke and are experiencing shoulder pain.
	• Stratified by the diagnosis of the cause of the shoulder pain (diagnosed during the trial):
	  ○ Rotator cuff tears
	  ○ Abnormal muscle tone
	  ○ Glenohumeral subluxation
	  ○ Impingement
	  ○ Tendinopathy
	  ○ Shoulder hand syndrome
	  ○ Unclear
	  ○ Mixed
	Intra-articular
	Exclusion:
	• Children (age <16 years)
	• People who have had a transient ischaemic attack

Intervention	• Comprehensive diagnostic assessment (including clinical history, examination and imaging [for example: x-ray, ultrasound, MRI] as required) leading to diagnosis of a definite cause of post-stroke shoulder pain, followed by selection of the most appropriate treatment from a list of:
	  ○ Taping
	  ○ NMES
	  ○ Intra-articular corticosteroids

	○ Nerve block (local anaesthetic)
Comparator	• Usual care
Outcome	At time period • <6 months • ≥6 months • Person/participant generic health-related quality of life • Carer generic health-related quality of life • Pain • Activities of daily living • Stroke-specific Patient-Reported Outcome Measures • Hospitalisation • Cost effectiveness data/resource use • Withdrawal due to adverse events
Study design	Randomised controlled trial
Timeframe	6 months
Additional information	Subgroup analysis: • Initial treatment choice: ○ Taping ○ NMES ○ Intra-articular corticosteroids ○ Nerve block (local anaesthetic)

K.2 Research recommendation

For people with different causes of shoulder pain after stroke, what is the clinical and cost-effectiveness of interventions in reducing pain?

K.2.1 Why this is important

Shoulder pain is a very common and disabling problem after a stroke. It can have a huge impact on a person's health-related quality of life, activities of daily living and ability to participate in rehabilitation. Post-stroke shoulder pain in is complex and different causes of post-stroke shoulder pain may impact the efficacy of various treatment options. A number of causes of post stroke shoulder pain have been identified, including: rotator cuff tears, abnormal muscle tone, glenohumeral subluxation, impingement, tendinopathy, and shoulder hand syndrome. This review has identified several treatments that may be effective at reducing post-stroke shoulder pain, including: taping, NMES, intra-articular corticosteroid injection and nerve blocks. However, evidence supporting these was limited and there was no cost effectiveness evidence for the interventions. The evidence failed to identity the underlying causes of people's shoulder pain which may have a large impact on the effectiveness of various treatments. Further research to determine which treatments are effective for different causes of shoulder pain is important to make treatment more targeted and person centred.

K.2.2 Rationale for research recommendation

Importance to 'patients' or the population	Post-stroke shoulder pain affects a large proportion of stroke survivors and can cause significant distress, impact activities of daily living and severely limit their ability to engage in therapy. It is unclear if different causes of shoulder pain affect the efficacy of various treatment options. Further research would help ensure patients are getting the most effective treatments for their condition.
Relevance to NICE guidance	Several effective treatment options for post-stroke shoulder pain have been identified in this review. However, it is unknown which of these are effective for different causes of shoulder pain. Further research to determine the efficacy of various treatments for different causes of shoulder would ensure treatment is tailored to individual patients and allow future guidance to be more specific in its recommendations.
Relevance to the NHS	Post-stroke shoulder pain is a common condition, which can lead to distress and increased hospital stay. Effective and tailored management of shoulder pain may lead better outcomes for the person who has had a stroke, cost savings, and reduced hospital stays.
National priorities	None identified.
Current evidence base	This review identified a number of treatment options that are effective in managing post-stroke shoulder pain. Research investigating the efficacy of each treatment for various causes of post-stroke shoulder pain was not covered in this review.
Equality considerations	No specific equality considerations were identified. The committee noted that in general throughout the guideline, people with communication and cognitive difficulties, older people and people who have had a previous stroke or transient ischaemic attack were excluded from trials but are people that the guideline is for. Therefore, research should aim to include these people where possible.

K.2.3 Modified PICO table

Population	Inclusion: • Adults (age ≥16 years) who have had a first or recurrent stroke and are experiencing shoulder pain Exclusion: • Children (age <16 years) • People who have had a transient ischaemic attack
Intervention	• Transcutaneous electrical nerve stimulation (TENS) • Functional electrical stimulation

	• Neuromuscular electrical stimulation (NMES)
	• Devices
	  ○ Tape
	  ○ Slings
	  ○ Supports
	  ○ Braces
	  ○ Other devices
	• Acupuncture/dry needling
	• Electroacupuncture
	• Intra-articular medicine injections
	  ○ Corticosteroids
	  ○ Saline
	• Injections into other sites (for example: bursae)
	  ○ Corticosteroids
	  ○ Saline
	• Nerve blocks (local anaesthetics)

Comparator	• Each other • Placebo/sham • Usual care
Outcome	At time periods • <6 months • ≥6 months • Person/participant generic health-related quality of life • Carer generic health-related quality of life • Pain • Activities of daily living • Stroke-specific Patient-Reported Outcome Measures • Hospitalisation • Cost effectiveness data/resource use • Withdrawal due to adverse events
Study design	Randomised controlled trials
Timeframe	6 months

Additional information	Subgroup:
	• Cause of the shoulder pain:
	  ○ Rotator cuff tears
	  ○ Abnormal muscle tone
	  ○ Glenohumeral subluxation
	  ○ Impingement
	  ○ Tendinopathy
	  ○ Shoulder hand syndrome
	  ○ Unclear
	  ○ Mixed