National Institute for Health and Care Excellence

Final

Joint replacement (primary): hip, knee and shoulder

[L] Evidence review for patella resurfacing

NICE guideline NG157

Intervention evidence review underpinning recommendation 1.7.2 and the research recommendation in the NICE guideline

March 2020

Final

This evidence review was developed by the National Guideline Centre, hosted by the Royal College of Physicians

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1 Patella resurfacing

1.1 Review question: In adults having primary elective knee replacement, what is the clinical and cost effectiveness of total knee replacement with patella resurfacing versus total knee replacement without patella resurfacing versus total knee replacement with selective resurfacing?

1.2 Introduction

Patella resurfacing can be undertaken during knee replacement surgery and is the removal of the under surface of the kneecap and insertion of a plastic surface in its place. Current practice suggests there is inconsistency in the use of patella resurfacing in primary total knee replacement. During total knee replacement the bottom end of the thigh bone (femur) and top end of the shin bone (tibia) are routinely replaced. However, the under surface of the kneecap (patella) does not always need to be replaced and many surgeons therefore chose not to replace it. The National Joint Registry records that approximately one third of patients have their patella resurfaced and two thirds do not. Some surgeons routinely resurface the patella in all patients and others never resurface the patella. A third group resurface the patella 'selectively' based on their experience and their assessment of the person's condition or based on their assessment during the operation.

Those who resurface the patella state concerns that if the patella is not resurfaced, pain at the front of the knee can persist after surgery, increasing the likelihood of patient dissatisfaction, and also the need for future surgery to replace the kneecap at a later date, if people have pain. Further surgery is associated with an additional inpatient hospital stay, is painful, and exposes the patient to the risk of complications such as infection, as well as an additional cost to the NHS. Those who do not resurface the patella believe that it does not affect the levels of post-operative pain and patient satisfaction, that it prolongs the surgical time, and that resurfacing risks causing significant injury to the knee cap and associated structures (for example fractures, tendon ruptures) which are often difficult to treat.

This review seeks to discover the most clinical and cost-effective approach to patella resurfacing in adults having primary elective knee replacement.

1.3 PICO table

For full details see the review protocol in Appendix A:

Table 1: PICO characteristics of review question

Population	Adults who are eligible for either total knee replacement with or without patella resurfacing.
Interventions	• Total knee replacement with patella resurfacing • Total knee replacement with selective resurfacing • Total knee replacement without patella resurfacing
Comparisons	• Interventions compared to each other
Outcomes	**Critical** • Mortality: life expectancy • Mortality: 30 day • Quality of life at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years

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	• Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years
	• Revision of joint replacement:
	  ○ major – revision of the tibia femoral compartments
	  ○ minor secondary patella resurfacing
	Important
	• Surgical site infection
	  ○ Deep
	  ○ superficial
	• Length of stay
	• Reoperation (excluding revision) at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years
	• Major adverse events as described by the studies (For example, VTE, myocardial infarction)

Study design	Randomised controlled trials

1.4 Clinical evidence

1.4.1 Included studies

A search was conducted for randomised trials comparing the effectiveness of patella resurfacing versus no patella resurfacing.

Twenty eight studies were included in the review ;[8, 12, 17, 19, 20, 29, 32-35, 39, 47, 51, 58, 62, 71, 75, 77, 83, 89, 90, 95, 104, 105, 108, 112 40, 74] these are summarised in Table **2** below. Evidence from these studies is summarised in the clinical evidence summary below (Table 3).

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 H:

1.4.2 Excluded studies

See the excluded studies list in Appendix I:

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1.4.3 Summary of clinical studies included in the evidence review

Table 2: Summary of studies included in the evidence review

Study	Intervention and comparison	Population	Outcomes	Comments
Ali 2016[8]	Patella resurfacing (n=35) Versus No patella resurfacing (n=39)	Adults with primary osteoarthritis eligible for knee replacement Age (mean, SD) = 68.5 years (4)	PROMs: • Knee injury and Osteoarthritis Outcome Score (KOOS) at later than 6 weeks up to 1 year • Knee injury and Osteoarthritis Outcome Score (KOOS) after at least 2 years	Finland
Aunan 2016[12]	Patella resurfacing (n=64) Versus No patella resurfacing (n=66)	Adults with primary osteoarthritis eligible for knee replacement Age (mean, range) Resurfacing group: = 69 years (42 to 82) Non-resurfaced group: = 70 years (48 to 82)	PROMs: • Knee injury and Osteoarthritis Outcome Score (KOOS) at later than 6 weeks up to 1 year • Knee injury and Osteoarthritis Outcome Score (KOOS) after at least 2 years • Knee Society Score at later than 6 weeks up to 1 year • Knee Society Score after at least 2 years • Oxford knee score at later than 6 weeks up to 1 year • Oxford knee score after at least 2 years Deep surgical site infection	Norway
Barrack 1997, Burnett, 2009, Barrack 2001, and Burnett 2007[17, 19, 33, 34]	Patella resurfacing (n=58) Versus No patella resurfacing (n=60)	Adults with degenerative osteoarthritis severe enough to warrant knee replacement Age (mean, range)	PROMs: • Knee Society Score after at least 2 years Revision	USA

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Study	Intervention and comparison	Population	Outcomes	Comments
		Resurfaced group: = 65.3 years (27 to 82 years) Non-resurfaced group: = 67.1 years (30 to 87 years)		
Beaupre 2012[20]	Patella resurfacing (n=21) Versus No patella resurfacing (n=17)	Adults scheduled for surgery to treat non-inflammatory arthritis Age (mean, SD) Resurfaced group: = 64.9 years (4) Non-resurfaced group: = 62 years (5.6)	PROMs: • Western Ontario and McMaster Universities Osteoarthritis Index at later than 6 weeks up to 1 year Quality of life at later than 6 weeks up to 1 year Revision Reoperation	Canada
Bourne 1995 and Burnett 2004[29, 35]	Patella resurfacing (n=50) Versus No patella resurfacing (n=50)	Adults with osteoarthritis eligible for knee replacement Age (mean, SD) Resurfaced group: = 72 years (7) Non-resurfaced group: = 68 years (7)	PROMs: • Knee Society Score at later than 6 weeks up to 1 year • Knee Society Score after at least 2 years Revision	Canada
Campbell 2006[39]	Patella resurfacing (n=46) Versus No patella resurfacing (n=54)	Adults with degenerative osteoarthritis severe enough to warrant knee replacement Age (mean, range) Resurfaced group:	PROMs: • Knee Society Score after at least 2 years Surgical site infection Major adverse events Reoperation	Australia

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Study	Intervention and comparison	Population	Outcomes	Comments
		= 71 years (53 to 88) Non-resurfaced group: = 73 years (54 to 86)		
Chawla 2019[40]	Patella resurfacing (n=50) Versus No patella resurfacing (n=50)	Adults with primary osteoarthritis eligible for knee replacement Aged over 50 years	PROMs: • Knee society score after at least 2 years Surgical site infection Deep surgical site infection	India
Feller 1996[47]	Patella resurfacing (n=19) Versus No patella resurfacing (n=19)	Adults with primary osteoarthritis eligible for knee replacement Age (mean, SD) Resurfaced group: = 70.5 years (6.6) Non-resurfaced group: = 71.1 years (5.6)	PROMs: • Hospital for special surgery after at least 2 years • Patella score after at least 2 years	Australia
Gildone 2005[51]	Patella resurfacing (n=28) Versus No patella resurfacing (n=28)	Adults with osteoarthritis eligible for knee replacement Age (mean, range) = 74.1 years (65 to 89)	No usable outcomes.	Italy
Johnston 2009, Breeman 2011and Murray 2014[32, 58, 74]	Patella resurfacing (n=861) Versus No patella resurfacing (n=854)	Adults eligible for primary knee replacement surgery Age (mean, SD) = 70 years	PROMs: • Oxford knee score at later than 6 weeks up to 1 year • Oxford knee score after at least	UK The KAT trial

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Study	Intervention and comparison	Population	Outcomes	Comments
		(8)	2 years Quality of life at later than 6 weeks up to 1 year Quality of life at least 2 years Minor revision Major revision Length of stay Major adverse events	
Kaseb 2018[62]	Patella resurfacing (n=24) Versus No patella resurfacing (n=26)	Adults scheduled for surgery with unsuccessful non-surgical treatment to treat non-inflammatory arthritis Age (mean, SD) = 64.8 years (7.8)	PROMs: • Western Ontario and McMaster Universities Osteoarthritis Index at later than 6 weeks up to 1 year • Knee Society Score at later than 6 weeks up to 1 year Quality of life at later than 6 weeks up to 1 year	Iran
Mayman 2003[71]	Patella resurfacing (n=50) Versus No patella resurfacing (n=50)	Adults with osteoarthritis eligible for knee replacement Age (mean, SD) Resurfaced group: = 72 years (7) Non-resurfaced group: = 68 years (7)	Revision	Canada
Myles 2006[75]	Patella resurfacing (n=25) Versus No patella resurfacing (n=25)	Adults with osteoarthritis eligible for knee replacement Age (mean, SD) = 70 years (9.2)	PROMs: • Western Ontario and McMaster Universities Osteoarthritis Index at later than 6 weeks up to 1 year	UK

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Study	Intervention and comparison	Population	Outcomes	Comments
			• American Knee Society Knee Score at later than 6 weeks up to 1 year	
Partio 1995[83]	Patella resurfacing (n=47) Versus No patella resurfacing (n=48)	Adults with osteoarthritis or rheumatoid arthritis eligible for knee replacement Age (mean, range) Resurfaced group: = 69 years (58 to 78) Non-resurfaced group: = 66 years (40 to 83)	Deep surgical site infection Major adverse events	Finland
Roberts 2015[89]	Patella resurfacing (n=178) Versus No patella resurfacing (n=172)	Adults with primary osteoarthritis eligible for knee replacement Age (mean, SD) = 70.75 years (8.05)	PROMs: • Knee Society Score after at least 2 years Revision Surgical site infection • Superficial Deep	USA
Schroeder-Boersch 1998[90]	Patella resurfacing (n=20) Versus No patella resurfacing (n=20)	Adults with osteoarthritis eligible for knee replacement Age (mean, range) = 72.6 years (59 to 79)	No usable outcomes.	Germany
Smith 2008[95]	Patella resurfacing (n=87) Versus No patella resurfacing (n=94)	Adults with osteoarthritis eligible for knee replacement Age (mean, range) Resurfacing group: 71.9 years (54.4 to 88.1)	PROMs: • Knee Society Score after at least 2 years Revision Reoperation	Australia

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Study	Intervention and comparison	Population	Outcomes	Comments
		Non-resurfacing group: 71.2 years (52.9 to 84.9)		
Vukadin 2017[104]	Patella resurfacing (n=30) Versus No patella resurfacing (n=30)	Adults with osteoarthrosis eligible for knee replacement Age (mean, SD) Resurfacing group: = 68.1 years (7) Non-resurfacing group: = 66.6 years (6.4)	PROMs: • Knee Society Score at later than 6 weeks up to 1 year • Knee Society Score after at least 2 years • Oxford knee score at later than 6 weeks up to 1 year • Oxford knee score after at least 2 years	Serbia
Waikakul 2000[105]	Patella resurfacing (n=21) Versus No patella resurfacing (n=26)	Adults with primary osteoarthrosis eligible for knee replacement Age (mean, SD) = 72.25 years (9.01)	PROMs: • Knee Society Score at later than 6 weeks up to 1 year • Knee Society Score after at least 2 years	Thailand
Waters 2003[108]	Patella resurfacing (n=243) Versus No patella resurfacing (n=231)	Adults eligible for primary knee replacement Age (mean, range) = 69.1 years (35 to 89)	PROMs: • Knee Society Score after at least 2 years	UK
Wood 2002[112]	Patella resurfacing (n=92) Versus No patella resurfacing (n=128)	Adults with primary osteoarthrosis eligible for knee replacement Age (mean, SD) Resurfaced group: 73.7 years (6.5)	PROMs: • Knee Society Score after at least 2 years Revision Reoperation	Australia

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Study	Intervention and comparison	Population	Outcomes	Comments
		Non-resurfaced group: 73.7 years (6.4)		
Studies including selective resurfacing				
Newman 2000[77]	Selective patella resurfacing (n=41) Versus Patella resurfacing (n=42) Versus No patella resurfacing (n=42)	Adults with osteoarthritis eligible for knee replacement Age (mean) Resurfaced group: = 71.2 years Non-resurfaced group: = 72.5 years	Revision	UK In the selective resurfacing group the decision to resurface the patella was left to the discretion of the operating surgeon, who based his decision on the patients' pre-operative symptoms and the state of the patella articular cartilage.

See Appendix D: for full evidence tables.

1.4.4 Quality assessment of clinical studies included in the evidence review

Table 3: Clinical evidence summary: Patella resurfacing versus no patella resurfacing

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Patella resurfacing (95% CI)
Mortality	Not reported				
Quality of life later than 6 weeks up to 1 year EQ-5D	1715 (1 study) 3 months	LOW[1] due to risk of bias		The mean quality of life in the control groups was 0.69	The mean quality of life in the intervention groups was 0.01 higher

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Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Patella resurfacing (95% CI)
					(0.01 lower to 0.03 higher)
Quality of life after at least 2 years EQ-5D	1715 (1 study) 10 years	LOW[1] due to risk of bias		The mean quality of life in the control groups was 0.65	The mean quality of life in the intervention groups was 0.02 higher (0.02 lower to 0.06 higher)
Quality of life later than 6 weeks up to 1 year SF-12 - mental subscale	1715 (1 study) 3 months	LOW[1] due to risk of bias		The mean quality of life in the control groups was 51.14	The mean quality of life in the intervention groups was 0.07 higher (0.95 lower to 1.09 higher)
Quality of life after at least 2 years SF-12 - mental subscale	856 (1 study) 10 years	LOW[1] due to risk of bias		The mean quality of life in the control groups was 48.9	The mean quality of life in the intervention groups was 0.30 higher (1.17 lower to 1.77 higher)
Quality of life later than 6 weeks up to 1 year SF-12 physical subscale	1715 (1 study) 3 months	LOW[1] due to risk of bias		The mean quality of life in the control groups was 38.68	The mean quality of life in the intervention groups was 0.74 higher (0.13 lower to 1.61 higher)
Quality of life after at least 2 years SF-12 physical subscale	1715 (1 study) 10 years	LOW[1] due to risk of bias		The mean quality of life in the control groups was 37.3	The mean quality of life in the intervention groups was 0.20 higher (1.31 lower to 1.71 higher)
Quality of life later than 6 weeks up to 1 year SF-36 scale, RAND-36 scale, KOOS - QoL subscale. Scale from: 0 to 100.	291 (4 studies) 6 - 12 months	VERY LOW[1,2,3] due to risk of bias, inconsistency, imprecision		The mean quality of life in the control groups was 54.29	The mean quality of life in the intervention groups was 0.05 standard deviations lower (0.63 lower to 0.52 higher)
PROMs - Quality of life after at least 2 years KOOS scale. Scale from: 0	203 (2 studies) 3 to 6 years	LOW[1] due to risk of bias		The mean proms - quality of life in the control groups was 78	The mean proms - quality of life in the intervention groups was 2.42 higher

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Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Patella resurfacing (95% CI)
to 100.					(9.31 lower to 14.15 higher)
PROMs – Symptoms later than 6 weeks up to 1 year KOOS scale. Scale from: 0 to 100.	74 (1 study) 3 months	LOW[1,2] due to risk of bias, imprecision		The mean proms - symptoms in the control groups was 67	The mean proms - symptoms in the intervention groups was 6 lower (12.61 lower to 0.61 higher)
PROMs – Symptoms after at least 2 years KOOS scale. Scale from: 0 to 100.	74 (1 study) 6 years	MODERATE[1] due to risk of bias		The mean proms - symptoms in the control groups was 88	The mean proms - symptoms in the intervention groups was 1 lower (6.47 lower to 4.47 higher)
PROMs – Pain later than 6 weeks up to 1 year KOOS scale. Scale from: 0 to 100.	74 (1 study) 3 months	VERY LOW[1,2] due to risk of bias, imprecision		The mean proms - pain in the control groups was 76	The mean proms - pain in the intervention groups was 5 lower (11.63 lower to 1.63 higher)
PROMs – Pain after at least 2 years KOOS scale. Scale from: 0 to 100.	74 (1 study) 6 years	VERY LOW[1,2] due to risk of bias, imprecision		The mean proms - pain in the control groups was 92	The mean proms - pain in the intervention groups was 3 lower (8.02 lower to 2.02 higher)
PROMs - Function later than 6 weeks up to 1 year KSS score, AKSS score. Scale from: 0 to 100.	387 (5 studies) 3 to 12 months	LOW[1] due to risk of bias		The mean proms - function in the control groups was 83.17	The mean proms - function in the intervention groups was 0.66 lower (3.58 lower to 2.26 higher)
PROMs – Function after at least 2 years KSS score. Scale from: 0 to 100.	662 (6 studies) 2 to 7.8 years	LOW[1] due to risk of bias		The mean proms - function in the control groups was 71	The mean proms - function in the intervention groups was 1.03 higher (0.57 lower to 2.63 higher)
PROMs – Clinical Score later than 6 weeks up to 1 year KSS score. Scale from: 0 to 100.	384 (5 studies) 3 to 12 months	VERY LOW[1,2,3] due to risk of bias, inconsistency, imprecision		The mean proms - clinical in the control groups was 83	The mean proms - clinical in the intervention groups was 0.50 higher (3.88 lower to 4.88 higher)

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Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Patella resurfacing (95% CI)
PROMs – Clinical Score after at least 2 years KSS score. Scale from: 0 to 100.	1243 (10 studies) 2 to 7.8 years	VERY LOW[1,3] due to risk of bias, inconsistency		The mean proms - clinical in the control groups was 84.6	The mean proms - clinical in the intervention groups was 0.60 higher (0.67 lower to 1.87 higher)
PROMs - Knee score of excellent and good after at least 2 years Knee society score	100 (1 study) 5 years	LOW[1] due to risk of bias	RR 0.94 (0.84 to 1.04)	960 per 1000	58 fewer per 1000 (from 154 fewer to 38 more)
PROMs - Total score later than 6 weeks up to 1 year Oxford Knee Score, WOMAC score, AKSS. Scale from: 0 to 100.	2004 (5 studies) 1 years	LOW[1] due to risk of bias		The mean proms - total score in the control groups was 41	The mean proms - total score in the intervention groups was 0.08 standard deviations higher (0.00 lower to 0.17 higher)
PROMs - Total score after at least 2 years Oxford Knee Score, HSS Score. Scale from: 0 to 100.	1023 (4 studies) 2 to 5 years	LOW[1] due to risk of bias		The mean proms - total score in the control groups was 52.325	The mean proms - total score in the intervention groups was 0.01 standard deviations higher (0.11 lower to 0.14 higher)
PROMs - Knee score after at least 2 years Patellar Score. Scale from: 0 to 40.	36 (1 study) 3 years	LOW[1] due to risk of bias		The mean proms - knee score in the control groups was 27.8	The mean proms - knee score in the intervention groups was 2.2 lower (5.06 lower to 0.66 higher)
PROMs - stiffness score later than 6 weeks up to 1 year WOMAC scale. Scale from: 0 to 100.	88 (2 studies) 6-12 months	LOW[1] due to risk of bias		The mean proms - stiffness score in the control groups was 6.7	The mean proms - stiffness score in the intervention groups was 0.30 higher (0.78 lower to 0.84 higher)
PROMs - Physical function later than 6 weeks up to 1 year WOMAC scale. Scale from:	88 (2 studies) 6-12 months	LOW[1] due to risk of bias		The mean proms - physical function in the control groups was 34.1	The mean proms - physical function in the intervention groups was 0.17 lower

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Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Patella resurfacing (95% CI)
0 to 100.					(5.45 lower to 5.12 higher)
PROMs – Pain later than 6 weeks up to 1 year WOMAC scale. Scale from: 0 to 100.	88 (2 studies) 6-12 months	LOW[1] due to risk of bias		The mean proms - pain in the control groups was 25.45	The mean proms - pain in the intervention groups was 1.11 lower (2.81 lower to 0.60 higher)
Minor revision after at least 2 years	2781 (9 studies) 10 years	LOW[1,4] due to risk of bias, inconsistency	Peto OR 0.30 (0.18 to 0.49)	37 per 1000	30 fewer per 1000 (from 40 fewer to 20 fewer)
Major revision after at least 2 years	2168 (4 studies) 10 years	VERY LOW[1,2,3] due to risk of bias, inconsistency, imprecision	Peto OR 0.97 (0.61 to 1.52)	36 per 1000	0 fewer per 1000 (from 20 fewer to 10 more)
Superficial surgical site infection after at least 2 years	550 (3 studies) 10 years	VERY LOW[1,2] due to risk of bias, imprecision	Peto OR 1.85 (0.45 to 7.57)	11 per 1000	10 more per 1000 (from 10 fewer to 30 more)
Deep surgical site infection after at least 2 years	674 (4 studies) 2 to 7.8 years	VERY LOW[1,2] due to risk of bias, imprecision	Peto OR 7.45 (1.05 to 52.93)	0 per 1000	10 more per 1000 (from 0 more to 30 more)
Reoperation after at least 2 years	417 (3 studies) 2 to 4 years	VERY LOW[1,2,4] due to risk of bias, inconsistency, imprecision	Peto OR 0.60 (0.16 to 2.27)	26 per 1000	10 fewer per 1000 (from 40 fewer to 20 more)
Length of stay	1649 (1 study)	LOW[1] due to risk of bias		The mean length of stay in the control groups was 9.84	The mean length of stay in the intervention groups was 0.36 higher (0.14 lower to 0.86 higher)
Major adverse events after	1833	VERY LOW[1,2,4]	Peto OR	31 per 1000	10 fewer per 1000

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Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Patella resurfacing (95% CI)
at least 2 years Deep vein thrombosis	(3 studies) 10 years	due to risk of bias, inconsistency, imprecision	0.82 (0.47 to 1.44)		(from 20 fewer to 10 more)
Major adverse events after at least 2 years Confirmed MI	1638 (1 study) 10 years	VERY LOW[1,2] due to risk of bias, imprecision	RR 2.96 (0.60 to 14.60)	2 per 1000	5 more per 1000 (from 1 fewer to 33 more)

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[3] Heterogeneity unexplained by subgroup analysis.
[4] Downgraded by 1 or 2 increments because the number of zero events varies across arms.

Table 4: Clinical evidence summary: Selective patella resurfacing versus no patella resurfacing

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with No resurfacing	Risk difference with Selective patella resurfacing (95% CI)
Mortality	Not reported				
Quality of life	Not reported				
Patient Reported Outcome Measures (PROMs)	Not reported				
Major revision	Not reported				
Minor revision	83 (1 study) 10 years	LOW[1] due to imprecision	RR 0.17 (0.02 to 1.36)	143 per 1000	119 fewer per 1000 (from 140 fewer to 51 more)

[1] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[2] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was

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Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with No resurfacing	Risk difference with Selective patella resurfacing (95% CI)
at very high risk of bias.					

Table 5: Clinical evidence summary: Selective patella resurfacing versus patella resurfacing

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Patellar resurfacing	Risk difference with Selective patella resurfacing (95% CI)
Mortality	Not reported				
Quality of life	Not reported				
Patient Reported Outcome Measures (PROMs)	Not reported				
Major revision	Not reported				
Minor revision	83 (1 study) 5 years	LOW[1] due to imprecision	Peto OR 0.13 (0 to 6.66)	24 per 1000	20 fewer per 1000 (from 90 fewer to 40 more)

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

See Appendix F: for full GRADE tables.

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1.5 Economic evidence

1.5.1 Included studies

Two health economic studies were identified with the relevant comparison and have been included in this review.[74, 110] The studies are summarised in the health economic evidence profile below (Table 6) and the health economic evidence table in Appendix H:

1.5.2 Excluded studies

One economic study relating to this review question was identified but excluded due to the availability of more applicable evidence.[32] The study is listed in Appendix I: with reasons for exclusion given.

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

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1.5.3 Summary of studies included in the economic evidence review

Table 6: Health economic evidence profile: Patellar resurfacing versus No patellar resurfacing

Study	Applicability	Limitations	Other comments	Incremental cost	Incremental effects	Cost effectiveness	Uncertainty
Murray 2014[74] (UK)	Directly applicable[(a)]	Minor limitations[(b)]	A within-trial cost utility analysis alongside the KAT RCT. It compared patellar resurfacing versus no patellar resurfacing after TKA. Participants were followed up for 10 years.	Patellar resurfacing saves £104 per person.	Patellar resurfacing gives 0.187 extra QALYs person.	Patellar resurfacing dominates (less costly and more effective) No patellar resurfacing.	Probabilistic sensitivity analysis which showed that patellar resurfacing had a probability of being 95% cost effective at a celling ratio of £20,000 per QALY. The results were robust to changes in the time horizon, discount rates, costing methodology.
Weeks 2018[110] (Canada)	Partially applicable[(c)]	Potentially serious limitations[(d)]	A cost utility analysis with Markov model. The model used a TKA cohort to compare patellar resurfacing to no patellar resurfacing. There are 3 possible post-operative states: well, patellofemoral pain, or a serious adverse event.	Patellar resurfacing saves £263 per person.	Patellar resurfacing gives 0.64 extra QALYs person.	Patellar resurfacing dominates (is both cost saving and gives greater health outcomes) No patellar resurfacing.	A one-way sensitivity analysis showed that the incremental cost is sensitive to the secondary resurfacing rate.

Abbreviations: KAT: Knee Arthroplasty Trial; QALY: quality-adjusted life years; RCT: randomised controlled trial; TKA: total knee arthroplasty

(a) A within trial cost utility analysis that followed up relevant costs and outcomes in participants for 10 years after primary TKA. QALYs were derived from EQ-5D

(b) 48% of patients did not respond at the 10 year follow-up. Missing data was imputed where necessary. Intervention effect is taken from a single RCT, albeit a large and well conducted one, as opposed to a systematic review.

(c) A cost utility analysis using a Markov model with relevant comparators, costs and outcomes. QALYs were derived from EQ-5D.

(d) It is a study with a Canadian perspective but much of the data is Australian and UK NJR data, and costs are presented in US dollars. Confidence intervals for total and incremental outcome and cost differences are not reported. Costs and outcomes were discounted at 5% instead of 3.5%. Limited sensitivity analysis included a small one-way analysis and no probabilistic analysis.

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1.5.4 Clinical evidence statements

Patella resurfacing versus no patella resurfacing

28 RCTs reported on patella resurfacing compared to no patella resurfacing. Outcomes were often divided into 3 time points; short (6 weeks or earlier), moderate (later than 6 weeks up to 1 year), and long (after at least 2 years).

A benefit was found for patella resurfacing in 1 moderate term quality of life outcome, and late term minor revision, and reoperation (low or very low quality, n=291to2781).

There was a benefit for no resurfacing in 1 late term PROM outcome, deep surgical site infection, superficial surgical site infection after at least 2 years, and myocardial infarction (low or very low quality, n=36 to1638).

There was no clinical difference between interventions for 12 moderate term outcomes; 3 quality of life, 9 PROMs, 10 long term outcomes; 4 quality of life, 6 PROMs, and 3 other outcomes; major revision, length of stay and DVT (1 moderate quality and all the rest low or very low, n=74 to2004).

Selective patella resurfacing versus no patella resurfacing

1 RCT showed a clinically important benefit of selective resurfacing for minor revision (low quality, n=83).

Selective patella resurfacing versus patella resurfacing

1 RCT showed a clinically important benefit of resurfacing for minor revision (low quality, n=83).

1.5.5 Health economic evidence statements

Two cost-utility analyses found that patella resurfacing was dominant (less costly and more effective) compared to no patella resurfacing in people who had undergone total knee replacement. One of these studies was assessed as directly applicable with minor limitations. The other was assessed as partially applicable with potentially serious limitations.

1.6 The committee's discussion of the evidence

1.6.1 Interpreting the evidence

1.6.1.1 The outcomes that matter most

The critical outcomes were mortality, revision of joint replacement (major and minor), quality of life and Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier (short term), later than 6 weeks up to 1 year (moderate term) or after at least 2 years (long term). Revision of joint replacement was separated into major or minor, as they imply different levels and types of revision. Major was classed as revision of the tibia femoral compartments with minor classed as secondary patella resurfacing. The benefits of knee joint replacement operations may not present themselves immediately after surgery; they may take months or years to become apparent. Therefore, multiple time points were necessary to capture this variation in outcomes as rehabilitation occurs.

The important outcomes were deep and superficial surgical site infection, length of stay, reoperation and major adverse events such as venous thromboembolism (VTE) or myocardial infarction (MI).

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1.6.1.2 The quality of the evidence

Twenty eight studies were included in the review, with outcomes graded as moderate to very low quality due to risk of bias, imprecision or inconsistency. The majority of the evidence was of low quality mainly due to lack of allocation concealment and blinding, contributing to a higher risk of bias. There was often imprecision due to confidence intervals crossing the default minimal important difference (MID) lines. Inconsistency was present in several analyses due to heterogeneity unexplained by subgroup analysis.

1.6.1.3 Benefits and harms

The majority of the studies (n=27) compared patella resurfacing to no patella resurfacing, with one study comparing the above as well as selective patella resurfacing.

The majority of evidence showed no clinically important difference for patella resurfacing compared to no resurfacing which included quality of life (EQ-5D and SF-12 scales), PROMs (KOOS, Knee society score, Oxford knee score, hospital for special surgery score, American knee society score and WOMAC scale), major revision, length of stay and major adverse events (DVT) at multiple time-points. A clinically important benefit of resurfacing was found for quality of life (SF-36 scale) and PROMs (WOMAC stiffness subscale) in the short term and minor revision and reoperation in the long term. A clinically important benefit of no resurfacing was found for PROMs (patella score and American Knee Society Score) in the short and long term. Superficial and deep surgical site infection and major adverse events (confirmed MI) in the long term also showed a clinically important benefit for no resurfacing.

For the selective resurfacing comparisons, 1 RCT found a clinically important benefit for selective resurfacing for minor revision at long term when compared to no resurfacing. No other outcomes were reported.

The committee spoke about the background of the decision to resurface when it is not definitively required for successful knee replacement surgery. If the knee is not resurfaced then it is thought that cartilage defects can develop and cause pain and reduce function. In these cases people often have secondary resurfacing operations to address this pain and function problems. A decision therefore has to be made on whether to resurface a knee joint during the primary joint replacement operation. The committee consensus was that recovery from a resurfaced joint replacement is no different from a non-resurfaced joint replacement. Resurfacing during the primary knee replacement operation avoids an early revision of secondary resurfacing surgery. However, initial resurfacing is not strictly necessary as the person may have never develop pain or function problems related to the patellofemoral joint. In addition, there are complications related to the resurfacing operations such as patella fractures and these can be hard to treat. The committee indicated that modern implants are believed to incur fewer patella fractures. The committee agreed that if resurfacing is not done at the primary knee joint replacement surgery, then some people will be resurfaced at a later date, usually to address pain in the patellofemoral joint. This is an additional significant operation for the person and involves similar risks of infection and adverse events to the first.

The committee discussed how current care is inconsistent. A committee member indicated that recent data indicated 35-40% of knee replacements have patella resurfacing during the primary operation and this is through varying decision-making methodologies. There are surgeons who do no primary or secondary resurfacing, do no primary resurfacing, do selective resurfacing, or resurface everyone. A surgeon may decide to resurface everyone because they believe removing the possibility of future secondary resurfacing is better for the person than the risks of complications and there are economic implications to further surgeries. There are people on the other hand, who believe that undertaking surgery on people that is not necessary at the time and may well never be necessary in the future should not be done at the primary stage. There are surgeons who do not undertake resurfacing at the primary stage and that secondary resurfacing is not effective for reducing pain and therefore do not carry them out either. The final option is for selective resurfacing at

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the primary stage, this decision could be made on the basis of a physical assessment of the patella or patient characteristics that might influence a surgeon's decision to resurface. However, the committee agreed that there is currently uncertainty as to how one should best decide to selectively resurface someone.

For people who do not have resurfacing during primary surgery but develop knee pain, a decision on whether to undertake secondary resurfacing must be made. As mentioned above some surgeons do not carry out secondary resurfacing operations but most will consider them. The committee spoke about the apparent effectiveness of secondary resurfacing. The consensus belief was that secondary resurfacing works to reduce pain in 50% of people who receive the surgery. It is understood that the results of secondary resurfacing are inconsistent though they mentioned that this may be worsened by inappropriate usage of secondary resurfacing. It might be that persistent pain is not caused by patella surface problems and will not be solved by resurfacing. The uncertainty of the effectiveness of secondary resurfacing could be seen as a benefit of resurfacing everyone having primary total knee replacement. In addition this operation would not be necessary or indeed possible if everyone was resurfaced to begin with. Fewer operations are preferred by the people undergoing joint replacement surgery.

The committee agreed the clinical evidence in the review did not differentiate from the three strategies adequately to recommend them on that basis. No resurfacing in the primary operation versus resurfacing everyone in the primary operation was the comparison covered by most of the RCTs. The committee did not consider the evidence strong enough to recommend either on that basis. There was only 1 RCT on selective resurfacing and the evidence from this one study was limited to only 1 outcome for each comparison. Again the committee could not make a recommendation based on this evidence. However there was strong economic evidence that resurfacing everyone was cost saving over not resurfacing people, and that people would have less secondary operations with a decision to resurface in every case, if a strategy of secondary resurfacing for those who are judged to need it is widely used.

The committee also made a research recommendation on selective resurfacing as most of the studies included in this review investigated resurfacing compared to no resurfacing. However the committee agreed that people undergoing primary knee replacement surgery may prefer surgeons to decide during surgery whether to do the resurfacing based on demographic factors and the state of the patella they observe when commencing surgery. This decision making process could be part of the discussion between the person and surgeon that happens before the operation. More studies investigating this might allow recommendations for this in future guidelines.

Two other factors discussed by the committee were:

- A modern trend highlighted by the Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) that indicated fewer secondary resurfacing events but variation between different implant designs. This might be due to different designs of articulation, or implants that allow for higher flexion.
- There are non-surgical treatment options for people with higher potential for patellofemoral pain. This could be fuller engagement with the rehabilitation component of care.

1.6.2 Cost effectiveness and resource use

The economic evidence presented showed that patella resurfacing is dominant (less costly and more effective) when compared to no resurfacing over a 10-year time horizon. Overall, patella resurfacing saved £104 per person compared to no resurfacing.

There was limited evidence to suggest that there was a clinical difference beyond a reduced revision rate in the patella resurfacing group. However, the economic evidence did show a

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clear difference. The initial inpatient stay was more expensive for patella resurfacing (£202 more per person), which was driven by the cost of components. However, this expense is more than offset by the £305 saving per resurfaced person over the subsequent 10 years. The longer term saving is driven by reduced hospital readmissions related to the study knee. Other costs, including outpatient service costs (the same to within £1) and GP consultation services cost (the same to within £6-7) were very similar between the 2 arms. There was agreement from the lay perspective that fewer hospital readmissions in the long term is favourable.

It was noted that in the study population, those who had a knee condition that was clearly indicated for either of the procedures were excluded from the study. The committee felt that the equipoise in the remaining randomly allocated people actually reflected a selectively resurfaced population. However, there was also a large degree of cross over in the trial.

If a person does not have their patella resurfaced at the time of the initial knee replacement, there is a reasonable chance that they will need a resurfacing procedure at a later date. This will have an additional cost implication. Secondary resurfacing does not have consistent results, anecdotally 50% of people get better after a secondary resurfacing and 50% do not. The inconsistency of secondary resurfacing may be born out of poor diagnosis.

It was suggested that there is variation in the difference in costs between the interventions, with patella resurfacing being more expensive, such that some hospitals need to apply to their CCG in writing in order to proceed with patella resurfacing. Despite this, there is still a net cost saving for patella resurfacing at a 10 year time horizon. Furthermore, both patella resurfacing and non-resurfacing procedures map to the same HRG, which would represent a similar cost from a commissioning perspective.

Neither option is without its own subsequent risk for patients: there is a risk of patella fracture for those who are resurfaced initially; and there is a risk that secondary resurfacing will be needed for those who are not resurfaced initially. Expanding the comparator, no (initial) resurfacing, to no initial or secondary resurfacing, would have proven informative due to the committee's uncertainty of the clinical and cost effectiveness of secondary resurfacing. The economic evidence did not explore this option as a comparator. A review on the clinical and cost effectiveness of secondary resurfacing would have proven informative, although it fell outside of the scope for primary arthroplasties.

The committee agreed that there was not enough evidence, clinical nor economic; to make any recommendation on selective resurfacing, although sentiment was that this may be best option. A 'consider' recommendation for resurfacing was discussed, however, it was decided against as in the short term horizon, the outcomes are equal and patella resurfacing is more expensive. Therefore budget holders may decide not to do patella resurfacing procedures, even though it is associated with net savings over 10-years. A stronger 'offer' recommendation is more likely to see the net savings realised over a time horizon of 10 years.

The NJR 15th Annual Report suggests that approximately 40% of people (roughly 84,000 primary elective annual procedures in 2017 according to Hospital Episode Statistics data) have their patella resurfaced out of all knee replacements. If the remaining 50,400 had their patella resurfaced (who would otherwise not have been resurfaced), given a £104 saving per person, the recommendation would save the NHS £5.24 million over a 10- year time horizon.

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Appendices

Appendix A: Review protocols

Table 7: Review protocol: Patella resurfacing

ID	Field	Content
0.	PROSPERO registration number	Not registered
1.	Review title	Total knee replacement with patella resurfacing versus total knee replacement without patella resurfacing versus selective patella resurfacing
2.	Review question	In adults having primary elective knee replacement, what is the clinical and cost effectiveness of total knee replacement with patella resurfacing versus total knee replacement without patella resurfacing versus total knee replacement with selective resurfacing?
3.	Objective	There are people who are eligible for either knee replacement with or without patella resurfacing. There are 3 interventions for consideration in people having total knee replacement where both resurfacing and not resurfacing are an option. These interventions are: patella resurfacing, no patella resurfacing, or selective patella resurfacing. This question seeks to find which of these interventions is most clinically and cost effective.
4.	Searches	The following databases will be searched: Cochrane Central Register of Controlled Trials (CENTRAL) Cochrane Database of Systematic Reviews (CDSR) Embase MEDLINE Searches will be restricted by: English language Human studies Letters and comments are excluded. Other searches: Inclusion lists of relevant systematic reviews will be checked by the reviewer. The searches may be re-run 6 weeks before final committee meeting and further studies retrieved for inclusion if relevant.

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ID	Field	Content
		The full search strategies will be published in the final review.
5.	Condition or domain being studied	Knee joint replacement
6.	Population	Inclusion: Adults who are eligible for either total knee replacement with or without patella resurfacing. Exclusion: • Adults having joint replacement as immediate treatment following fracture. • Adults having revision joint replacement. • Adults having joint replacement as treatment for primary or secondary cancer affecting the bones.
7.	Intervention/Exposure/Test	Total knee replacement with patella resurfacing, Total knee replacement with selective resurfacing Total knee replacement without patella resurfacing
8.	Comparator/Reference standard/Confounding factors	Interventions compared to each other
9.	Types of study to be included	Randomised controlled trials If no well-conducted RCTs are available then observational studies with multivariate analysis will be investigated.
10.	Other exclusion criteria	Non-English language studies. Abstracts will be excluded as it is expected there will be sufficient full text published studies available.
11.	Context	N/A
12.	Primary outcomes (critical outcomes)	Mortality: life expectancy Mortality: 30 day (dichotomous) Quality of life at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years (continuous) Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years

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ID	Field	Content
		(continuous) Revision of joint replacement (time to event): major – revision of the tibia femoral compartments minor secondary patella resurfacing
13.	Secondary outcomes (important outcomes)	Surgical site infection (dichotomous) deep superficial Length of stay (continuous) Reoperation (excluding revision) at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years Major adverse events as described by the studies (For example, VTE, myocardial infarction) To be extracted when not included within a PROM: Function at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years (continuous). Pain at 6 weeks or earlier, later than 6 weeks up to 1 year, at least 2 years (continuous)
14.	Data extraction (selection and coding)	EndNote will be used for reference management, sifting, citations and bibliographies. Titles and/or abstracts of studies retrieved using the search strategy and those from additional sources will be screened for inclusion. The full text of potentially eligible studies will be retrieved and will be assessed for eligibility in line with the criteria outlined above. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. An in-house developed database; EviBase, will be used for data extraction. A standardised form is followed to extract data from studies (see Developing NICE guidelines: the manual section 6.4) and for undertaking assessment of study quality. Summary evidence tables will be produced including information on: study setting; study population and participant demographics and baseline characteristics; details of the intervention and control interventions; study methodology' recruitment and missing data rates; outcomes and times of measurement; critical appraisal ratings. A second reviewer will quality assure the extracted data. Discrepancies will be identified and resolved through discussion (with a third reviewer where necessary).
15.	Risk of bias (quality) assessment	Risk of bias will be assessed using the appropriate checklist as described in Developing NICE guidelines: the manual. For Intervention reviews the following checklist will be used according to study design being assessed: Systematic reviews: Risk of Bias in Systematic Reviews (ROBIS) Randomised Controlled Trial: Cochrane RoB (2.0)

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ID	Field	Content
		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.
16.	Strategy for data synthesis	Where possible, data will be meta-analysed. Pairwise meta-analyses will be performed using Cochrane Review Manager (RevMan5) to combine the data given in all studies for each of the outcomes stated above. A fixed effect meta-analysis, with weighted mean differences for continuous outcomes and risk ratios for binary outcomes will be used, and 95% confidence intervals will be calculated for each outcome. Heterogeneity between the studies in effect measures will be assessed using the I^2 statistic and visually inspected. We will consider an I^2 value greater than 50% 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 using random-effects. GRADE pro will be used to assess the quality of 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. If the population included in an individual study includes children aged under 12, it will be included if the majority of the population is aged over 12, and downgraded for indirectness if the overlap into those aged less than 12 is greater than 20%. Publication bias is tested for when there are more than 5 studies for an outcome. Other bias will only be taken into consideration in the quality assessment if it is apparent. Where meta-analysis is not possible, data will be presented and quality assessed individually per outcome. If sufficient data is available to make a network of treatments, WinBUGS will be used for network meta-analysis.
17.	Analysis of sub-groups	Age: Not elderly ~<75 years old (study defined) Elderly ~>75 years old (study defined) Indication: osteoarthritis not osteoarthritis

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ID	Field	Content			
		Specific implant: type/brand/model Method of selective resurfacing			
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	07/01/19			
22.	Anticipated completion date	20/03/20			
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			

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ID	Field	Content
		5b Named contact e-mail 5e Organisational affiliation of the review National Institute for Health and Care Excellence (NICE) and the National Guideline Centre
25.	Review team members	From the National Guideline Centre: Mr Carlos Sharpin [Guideline lead] Mr Alex Allen [Senior Systematic Reviewer] Ms Rafina Yarde [Systematic reviewer] Mr Robert King [Health economist] Ms Agnès Cuyàs [Information specialist] Ms Eleanor Priestnall [Project Manager] [Others]
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: [NICE guideline webpage].
29.	Other registration details	
30.	Reference/URL for published protocol	
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

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ID	Field	Content	
		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	Patella, resurfacing, joint replacement, total knee replacement, selective resurfacing	
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	

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Table 8: 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.
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2003, abstract-only studies and studies from low or middle-income countries (e.g. most 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).[76] **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,

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	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 2003 or later but that depend on unit costs and resource data entirely or predominantly from before 2003 will be rated as 'Not applicable'. • Studies published before 2003 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.

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Appendix B: Literature search strategies

The literature searches for this review are detailed below and complied with the methodology outlined in Developing NICE guidelines: the manual.[76]

For more detailed information, please see the Methodology Review.

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 for interventions as these concepts may not be well described in title, abstract or indexes and therefore difficult to retrieve. Search filters were applied to the searches where appropriate.

Table 9: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline (OVID)	1946 – 01 May 2019	Exclusions Randomised controlled trials Systematic review studies Observational studies
Embase (OVID)	1974 – 01 May 2019	Exclusions Randomised controlled trials Systematic review studies Observational studies
The Cochrane Library (Wiley)	Cochrane Reviews to 2019 Issue 5 of 12 CENTRAL to 2019 Issue 5 of 12	None

Medline (Ovid) search terms

1.	arthroplasty, replacement, knee/
2.	((joint* or knee*) adj3 (replace* or prosthe* or endoprosthe* or implant* or arthroplast*)).ti,ab.
3.	1 or 2
4.	letter/
5.	editorial/
6.	news/
7.	exp historical article/
8.	Anecdotes as Topic/
9.	comment/
10.	case report/
11.	(letter or comment*).ti.
12.	or/4-11
13.	randomized controlled trial/ or random*.ti,ab.
14.	12 not 13
15.	animals/ not humans/
16.	exp Animals, Laboratory/
17.	exp Animal Experimentation/
18.	exp Models, Animal/

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19.	exp Rodentia/
20.	(rat or rats or mouse or mice).ti.
21.	or/14-20
22.	3 not 21
23.	limit 22 to English language
24.	(Total and (partial or unicompartment* or unicondylar or compartment* or resurf* or re-surf* or patell*)).ti,ab.
25.	(partial and (Total or unicompartment* or unicondylar or compartment* or resurf* or re-surf* or patell*)).ti,ab.
26.	((unicompartment* or unicondylar or compartment*) and (Total or partial or resurf* or re-surf* or patell*)).ti,ab.
27.	((resurf* or re-surf* or patell*) and (Total or partial or unicondylar or unicompartment* or compartment*)).ti,ab.
28.	((medial or lateral) adj3 (compart* or unicompart* or unicondylar)).ti,ab.
29.	or/24-28
30.	23 and 29
31.	randomized controlled trial.pt.
32.	controlled clinical trial.pt.
33.	randomi#ed.ti,ab.
34.	placebo.ab.
35.	randomly.ti,ab.
36.	Clinical Trials as topic.sh.
37.	trial.ti.
38.	or/31-37
39.	Meta-Analysis/
40.	exp Meta-Analysis as Topic/
41.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
42.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
43.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
44.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
45.	(search* adj4 literature).ab.
46.	(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.
47.	cochrane.jw.
48.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
49.	or/39-48
50.	Epidemiologic studies/
51.	Observational study/
52.	exp Cohort studies/
53.	(cohort adj (study or studies or analys* or data)).ti,ab.
54.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
55.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
56.	Controlled Before-After Studies/
57.	Historically Controlled Study/

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58.	Interrupted Time Series Analysis/
59.	(before adj2 after adj2 (study or studies or data)).ti,ab.
60.	or/51-60
61.	exp case control study/
62.	case control*.ti,ab.
63.	or/62-63
64.	61 or 64
65.	Cross-sectional studies/
66.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
67.	or/66-67
68.	61 or 68
69.	61 or 64 or 68
70.	30 and (38 or 49 or 69)

Embase (Ovid) search terms

1.	knee replacement/
2.	((joint* or knee*) adj3 (replace* or prosthe* or endoprosthe* or implant* or arthroplast*)).ti,ab.
3.	or/1-2
4.	letter.pt. or letter/
5.	note.pt.
6.	editorial.pt.
7.	case report/ or case study/
8.	(letter or comment*).ti.
9.	or/4-8
10.	randomized controlled trial/ or random*.ti,ab.
11.	9 not 10
12.	animal/ not human/
13.	nonhuman/
14.	exp Animal Experiment/
15.	exp Experimental Animal/
16.	animal model/
17.	exp Rodent/
18.	(rat or rats or mouse or mice).ti.
19.	or/11-18
20.	3 not 19
21.	limit 20 to English language
22.	(Total and (partial or unicompartment* or unicondylar or compartment* or resurf* or re-surf* or patell*)).ti,ab.
23.	(partial and (Total or unicompartment* or unicondylar or compartment* or resurf* or re-surf* or patell*)).ti,ab.
24.	((unicompartment* or unicondylar or compartment*) and (Total or partial or resurf* or re-surf* or patell*)).ti,ab.
25.	((resurf* or re-surf* or patell*) and (Total or partial or unicondylar or unicompartment* or compartment*)).ti,ab.
26.	((medial or lateral) adj3 (compart* or unicompart* or unicondylar)).ti,ab.
27.	or/22-26

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28.	21 and 27
29.	random*.ti,ab.
30.	factorial*.ti,ab.
31.	(crossover* or cross over*).ti,ab.
32.	((doubl* or singl*) adj blind*).ti,ab.
33.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
34.	crossover procedure/
35.	single blind procedure/
36.	randomized controlled trial/
37.	double blind procedure/
38.	or/29-37
39.	systematic review/
40.	meta-analysis/
41.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
42.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
43.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
44.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
45.	(search* adj4 literature).ab.
46.	(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.
47.	cochrane.jw.
48.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
49.	or/39-48
50.	Clinical study/
51.	Observational study/
52.	family study/
53.	longitudinal study/
54.	retrospective study/
55.	prospective study/
56.	cohort analysis/
57.	follow-up/
58.	cohort*.ti,ab.
59.	58 and 59
60.	(cohort adj (study or studies or analys* or data)).ti,ab.
61.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
62.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
63.	(before adj2 after adj2 (study or studies or data)).ti,ab.
64.	or/51-57,60-64
65.	exp case control study/
66.	case control*.ti,ab.
67.	or/66-67
68.	65 or 68
69.	cross-sectional study/

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70.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
71.	or/70-71
72.	65 or 72
73.	65 or 68 or 72
74.	28 and (38 or 49 or 73)

Cochrane Library (Wiley) search terms

#1.	MeSH descriptor: [Arthroplasty, Replacement, Knee] this term only
#2.	((joint* or knee*) near/3 (replace* or prosthe* or endoprosthe* or implant* or arthroplast*)):ti,ab
#3.	(OR #1-#2)
#4.	(Total and (partial or unicompartment* or unicondylar or compartment* or resurf* or re-surf* or patell*)):ti,ab
#5.	(partial and (Total or unicompartment* or unicondylar or compartment* or resurf* or re-surf* or patell*)):ti,ab
#6.	((unicompartment* or unicondylar or compartment*) and (Total or partial or resurf* or re-surf* or patell*)):ti,ab
#7.	((resurf* or re-surf* or patell*) and (Total or partial or unicondylar or unicompartment* or compartment*)):ti,ab
#8.	((medial or lateral) near/3 (compart* or unicompart* or unicondylar)):ti,ab
#9.	(OR #4-#8)
#10.	#3 AND #9

B.2 Health Economics literature search strategy

Health economic evidence was identified by conducting a broad search relating to the joint replacement population in NHS Economic Evaluation Database (NHS EED – this ceased to be updated after March 2015) and the Health Technology Assessment database (HTA) with no date restrictions. NHS EED and HTA databases are hosted by the Centre for Research and Dissemination (CRD). Additional health economics searches were run in Medline and Embase.

Table 10: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline	2014 – 01 May 2019	Exclusions Health economics studies
Embase	2014 – 01 May 2019	Exclusions Health economics studies
Centre for Research and Dissemination (CRD)	HTA - Inception – 01 May 2019 NHSEED - Inception to March 2015	None

Medline (Ovid) search terms

1.	arthroplasty/ or arthroplasty, replacement/ or arthroplasty, replacement, hip/ or arthroplasty, replacement, knee/ or arthroplasty, replacement, shoulder/ or hemiarthroplasty/
2.	joint prosthesis/ or hip prosthesis/ or knee prosthesis/ or shoulder prosthesis/
3.	((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)).ti,ab.

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4.	or/1-3
5.	letter/
6.	editorial/
7.	news/
8.	exp historical article/
9.	Anecdotes as Topic/
10.	comment/
11.	case report/
12.	(letter or comment*).ti.
13.	or/5-12
14.	randomized controlled trial/ or random*.ti,ab.
15.	13 not 14
16.	animals/ not humans/
17.	exp Animals, Laboratory/
18.	exp Animal Experimentation/
19.	exp Models, Animal/
20.	exp Rodentia/
21.	(rat or rats or mouse or mice).ti.
22.	or/15-21
23.	4 not 22
24.	limit 23 to English language
25.	Economics/
26.	Value of life/
27.	exp "Costs and Cost Analysis"/
28.	exp Economics, Hospital/
29.	exp Economics, Medical/
30.	Economics, Nursing/
31.	Economics, Pharmaceutical/
32.	exp "Fees and Charges"/
33.	exp Budgets/
34.	budget*.ti,ab.
35.	cost*.ti.
36.	(economic* or pharmaco?economic*).ti.
37.	(price* or pricing*).ti,ab.
38.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
39.	(financ* or fee or fees).ti,ab.
40.	(value adj2 (money or monetary)).ti,ab.
41.	or/25-40
42.	24 and 41

Embase (Ovid) search terms

1.	*arthroplasty/ or *replacement arthroplasty/ or *hip replacement/ or *knee replacement/ or *shoulder replacement/ or *hemiarthroplasty/
2.	*joint prosthesis/ or *hip prosthesis/ or *knee prosthesis/ or *shoulder prosthesis/

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3.	((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)).ti,ab.
4.	or/1-3
5.	letter.pt. or letter/
6.	note.pt.
7.	editorial.pt.
8.	case report/ or case study/
9.	(letter or comment*).ti.
10.	or/5-9
11.	randomized controlled trial/ or random*.ti,ab.
12.	10 not 11
13.	animal/ not human/
14.	nonhuman/
15.	exp Animal Experiment/
16.	exp Experimental Animal/
17.	animal model/
18.	exp Rodent/
19.	(rat or rats or mouse or mice).ti.
20.	or/12-19
21.	4 not 20
22.	limit 21 to English language
23.	health economics/
24.	exp economic evaluation/
25.	exp health care cost/
26.	exp fee/
27.	budget/
28.	funding/
29.	budget*.ti,ab.
30.	cost*.ti.
31.	(economic* or pharmaco?economic*).ti.
32.	(price* or pricing*).ti,ab.
33.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
34.	(financ* or fee or fees).ti,ab.
35.	(value adj2 (money or monetary)).ti,ab.
36.	or/23-35
37.	22 and 36

NHS EED and HTA (CRD) search terms

#1.	MeSH DESCRIPTOR arthroplasty
#2.	MeSH DESCRIPTOR arthroplasty, replacement
#3.	MeSH DESCRIPTOR arthroplasty, replacement, hip

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#4.	MeSH DESCRIPTOR arthroplasty, replacement, knee
#5.	MeSH DESCRIPTOR arthroplasty, replacement, shoulder
#6.	MeSH DESCRIPTOR hemiarthroplasty
#7.	MeSH DESCRIPTOR joint prosthesis
#8.	MeSH DESCRIPTOR hip prosthesis
#9.	MeSH DESCRIPTOR knee prosthesis
#10.	MeSH DESCRIPTOR shoulder prosthesis
#11.	(((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)))
#12.	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11) IN NHSEED
#13.	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11) IN HTA

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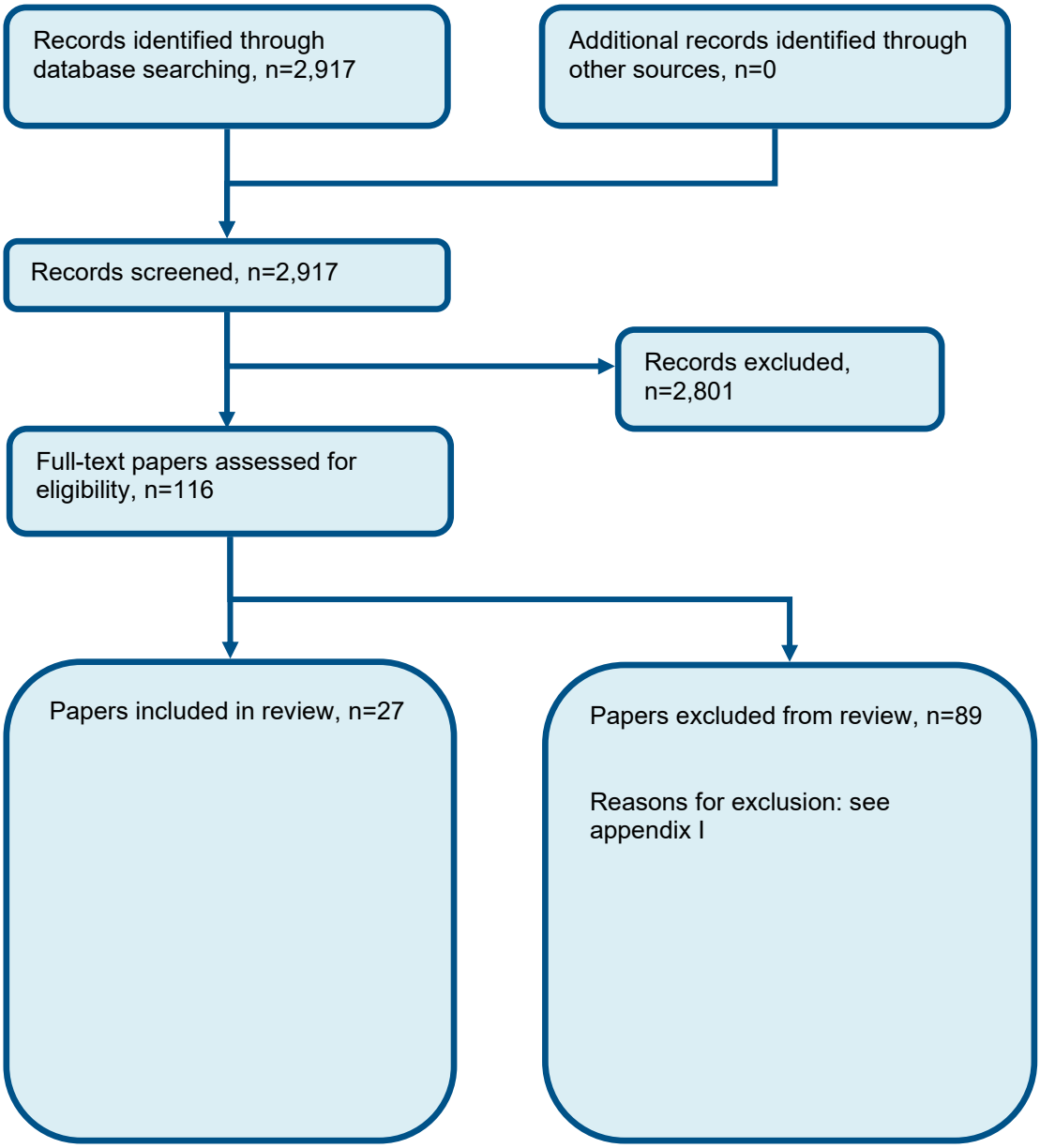
Appendix C: Clinical evidence selection

Figure 1: Flow chart of clinical study selection for the review of patella resurfacing



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Appendix D: Clinical evidence tables

Study	Ali 2016[8]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=74)
Countries and setting	Conducted in Finland; Setting: The patients were operated on at Trelleborg Hospital.
Line of therapy	Not applicable
Duration of study	Intervention + follow up: 6 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	This study involved 74 patients aged between 60 and 75 years with primary osteoarthritis
Exclusion criteria	The exclusion criteria were bilateral TKA, posttraumatic OA (e.g. fractures), previous high tibial osteotomy, rheumatoid arthritis, other forms of arthritis, severe heart failure, neurological disease, diseases that influence physical function, having undergone TKA or THA during the previous 12 months, patellar thickness of less than 22 mm (perioperative measurement), dementia, or being unable to speak Swedish. Patients who used antidepressants, neuroleptics, anticonvulsive drugs, or steroids were also excluded.
Age, gender and ethnicity	Age - Mean (SD): 68.5 (4). Gender (M:F): 45 female, 29 male. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: Osteoarthritis 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=35) Intervention 1: Total knee replacement - with patella resurfacing. The patients were operated on at Trelleborg Hospital between February 2008 and December 2009, by 5 senior orthopaedic surgeons sub-specialized in arthroplasty surgery. When the patient was randomized to patellar resurfacing, preparation of the patella was done according to the Triathlon CR knee system. Tibial, femoral, and patellar components were cemented at the same time. . Duration 6 years FU. Concurrent medication/care: All the patients had a tourniquet, a standard straight central skin incision, medial parapatellar arthrotomy, and patellar eversion. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:

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	(n=39) Intervention 2: Total knee replacement - without patella resurfacing. The patients were operated on at Trelleborg Hospital between February 2008 and December 2009, by 5 senior orthopaedic surgeons sub-specialized in arthroplasty surgery. Duration 6 years FU. Concurrent medication/care: All the patients had a tourniquet, a standard straight central skin incision, medial parapatellar arthrotomy, and patellar eversion. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Academic or government funding (Financial support was received from Region Skåne, the Erik and Angelica Sparre Foundation, and the Medical Faculty of Lund University.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year
- Actual outcome: KOOS - pain at 3 months ; Group 1: mean 71 (SD 15); n=35, Group 2: mean 76 (SD 14); n=39
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: 40 - resurfaced, 44 - un resurfaced ; Group 1 Number missing: 0; Group 2 Number missing: 0
- Actual outcome: KOOS - QOL at 3 months ; Group 1: mean 58 (SD 17); n=35, Group 2: mean 64 (SD 20); n=39
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: 22- resurfaced, 26 - un resurfaced ; Group 1 Number missing: 0; Group 2 Number missing: 0
- Actual outcome: KOOS - Symptoms at 3 months ; Group 1: mean 61 (SD 14); n=35, Group 2: mean 67 (SD 15); n=39
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: 46- resurfaced, 44 - un resurfaced ; Group 1 Number missing: 0; Group 2 Number missing: 0

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: KOOS - pain at 6 years; Group 1: mean 89 (SD 11); n=35, Group 2: mean 92 (SD 11); n=39
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: 40 - resurfaced, 44 - un resurfaced ; Group 1 Number missing: 2, Reason: patients died; Group 2 Number missing: 3, Reason: patients died
- Actual outcome: KOOS - QOL at 6 years ; Group 1: mean 75 (SD 20); n=35, Group 2: mean 79 (SD 22); n=39
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: 22- resurfaced, 26 - un resurfaced ; Group 1 Number missing: 2, Reason: patients died; Group 2 Number missing: 3, Reason: patients died
- Actual outcome: KOOS - Symptoms at 6 years; Group 1: mean 87 (SD 11); n=35, Group 2: mean 88 (SD 13); n=39
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,

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Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: 46- resurfaced, 44 - un resurfaced ; Group 1 Number missing: 2, Reason: patients died; Group 2 Number missing: 3, Reason: patients died	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Aunan 2016[12]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=129 knees)
Countries and setting	Conducted in Norway; Setting: All patients underwent surgery at Sykehuset Innlandet Hospital Trust, Lillehammer, Norway.
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Inclusion criteria were patients younger than 85 years with primary knee osteoarthritis.
Exclusion criteria	Exclusion criteria were knees with severe deformity of bone and/or ligaments that made them unsuitable for a standard cruciate-retaining prosthesis, patellar thickness less than 18 mm measured on calibrated digital radiographs, and isolated patello-femoral arthrosis. Also excluded were knees with secondary osteoarthritis (except for meniscal sequelae), previous surgery on the extensor mechanism, patients with a severe medical disability preventing them from climbing 1 level of stairs, and patients who were not able to fill out the patient-reported outcome measures (KOOS and Oxford knee score).
Recruitment/selection of patients	153 consecutive patients scheduled for primary TKA at our institution between November 2007 and March 2011 were assessed for eligibility for this study.
Age, gender and ethnicity	Age - Mean (range): no resurfacing - 69 (42-82), resurfacing - 70 (48-82). Gender (M:F): 73 females, 56 male. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=64) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfacing - Patellar resurfacing was performed with the onlay technique, removing bone of the same thickness as the prosthetic component, and accepting up to 1 mm over- or under-resection. . Duration N/A. Concurrent medication/care: All knees were operated on through a standard midline incision and a medial parapatellar arthrotomy, using a cruciate retaining, fixed-bearing prosthesis (NexGen; Zimmer, Warsaw, IN) and a measured resection technique. All components were cemented. . All operations were performed in a bloodless field, with a tourniquet on the proximal part of the thigh set between 250 and 350 mmHg depending on the patient's blood pressure and soft tissues. No intra-articular anesthesia was used. Indirectness: No indirectness

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	Further details: 1. Method of selective resurfacing: (n=66) Intervention 2: Total knee replacement - without patella resurfacing. People with no patellar resurfacing - In the non-resurfaced patellas, osteophytes were removed. Duration N/A. Concurrent medication/care: All knees were operated on through a standard midline incision and a medial parapatellar arthrotomy, using a cruciate retaining, fixed-bearing prosthesis (NexGen; Zimmer, Warsaw, IN) and a measured resection technique. All components were cemented. All operations were performed in a bloodless field, with a tourniquet on the proximal part of the thigh set between 250 and 350 mmHg depending on the patient's blood pressure and soft tissues. No intra-articular anesthesia was used. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year
- Actual outcome: KOOS quality of life score at 1 year at 1 year ; Group 1: mean 85 (SD 17); n=63, Group 2: mean 78 (SD 23); n=66
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0
- Actual outcome: Knee society score at 1 year at 1 year; Group 1: mean 89 (SD 12); n=63, Group 2: mean 84 (SD 15); n=66
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0
- Actual outcome: Knee society function score at 1 year at 1 year; Group 1: mean 88 (SD 17); n=63, Group 2: mean 87 (SD 16); n=66
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0
- Actual outcome: Oxford score at 1 year at 1 year; Group 1: mean 17 (SD 6); n=63, Group 2: mean 19 (SD 7); n=66
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: KOOS quality of life score at 3 years at 3 years; Group 1: mean 85 (SD 19); n=63, Group 2: mean 77 (SD 23); n=66
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0
- Actual outcome: Knee society score at 3 years at 3 years; Group 1: mean 92 (SD 9); n=63, Group 2: mean 90 (SD 14); n=66
Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0

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- Actual outcome: Knee society function score at 3 years at 3 years; Group 1: mean 83 (SD 21); n=63, Group 2: mean 83 (SD 21); n=66 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0 - Actual outcome: Oxford score at 3 years at 3 years; Group 1: mean 17 (SD 6); n=63, Group 2: mean 18 (SD 7); n=66 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0 Protocol outcome 3: Superficial surgical site infection at before JR is revised - Actual outcome: Hematogenous infection 2 years after operation at 2 years; Group 1: 1/63, Group 2: 0/66 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: lost to follow up; Group 2 Number missing: 0	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study (subsidiary papers)	Barrack 1997[19] (Barrack 2001[17], Burnett 2007[33], Burnett 2009[34])
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=89)
Countries and setting	Conducted in USA
Line of therapy	1st line
Duration of study	Intervention + follow up: 10 year FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients who were to have a total knee arthroplasty at one of the 3 university-affiliated teaching hospitals were included in the study. The indication for the operation was degenerative osteoarthritis that was severe enough to warrant TKA after an adequate trial of non-operative therapy.
Exclusion criteria	The criteria for exclusion included a previous tibial osteotomy or operation involving the extensor mechanism, a history of septic osteoarthritis or osteomyelitis, a severe medical disability that limited the ability to walk, disabling disease involving other joints of the lower extremities, inflammatory arthropathy, and severe deformity (varus angulation, valgus angulation, or flexion contracture or more than 15 degrees).
Age, gender and ethnicity	Age - Mean (range): resurfacing group - 65.3 (27 to 82 years), no resurfacing - 67.1 (30 to 87 years). Gender (M:F): 68 male, 18 female. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: Osteoarthritis 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=58) Intervention 1: Total knee replacement - with patella resurfacing. Resurfacing - The operative technique included external rotation of the femoral component, lateralization of the femoral and tibial components and medialisation of the patellar component. All components were inserted with cement, and all patellar components were all-polyethylene. . Duration N/A. Concurrent medication/care: All patients received the same posterior cruciate-sparing prosthesis. All operations were performed by, or under the direct supervision of one of the authors. All procedures were performed with a uniform approach and technique. All patients were managed with the same perioperative regimen, including administration of antibiotics and prophylaxis against venous thrombosis. Physical therapy was conducted in a uniform fashion for all patients at each institution, according to a protocol provided to the therapists. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=60) Intervention 2: Total knee replacement - without patella resurfacing. No resurfacing - A patelloplasty was carried out, including removal of osteophytes, smoothing of fibrillated cartilage, and drilling of eburnated

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	bone. . Duration N/A. Concurrent medication/care: All patients received the same posterior cruciate-sparing prosthesis. All operations were performed by, or under the direct supervision of one of the authors. All procedures were performed with a uniform approach and technique. All patients were managed with the same perioperative regimen, including administration of antibiotics and prophylaxis against venous thrombosis. Physical therapy was conducted in a uniform fashion for all patients at each institution, according to a protocol provided to the therapists. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Study funded by industry (The funding source was a grant from the Zimmer Corporation, Warsaw, Indiana.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: The Knee Society Clinical Score at 2 years at 2 years; Mean; , Comments: Mean (range)
resurfacing - 174.5 (98 to 199)
no resurfacing - 170.9 (108 to 200);
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: resurfaced - 88, non-resurfaced - 91.4; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome: The Knee Society Clinical Score at 5-7 years at 5-7 years; Mean; , Comments: Mean (range)
resurfaced - 161.6 (47 to 200)
not resurfaced - 169.1 (52 to 200) ;
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: resurfaced - 88, non-resurfaced - 91.4; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome: The Knee Society Clinical Score at 10 years at 10 years; Group 1: mean 59 (SD 40); n=38, Group 2: mean 62 (SD 39); n=40
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: resurfaced - 88, non-resurfaced - 91.4; Group 1 Number missing: 9, Reason: lost to follow up, 1 excluded; Group 2 Number missing: 5, Reason: lost to follow up, 1 excluded

Protocol outcome 2: Major revision: tibia femoral compartments at time to event
- Actual outcome: Revision due to a patellofemoral problem by 10 years at 10 years; Group 1: 5/58, Group 2: 0/60; Comments: 2 required revision for patella related complication (aseptic loosening and patellar osteonecrosis), 3 had a revision for a reason not related to a patellofemoral problem (infection, tibial liner exchange and open reduction and internal fixation of a periprosthetic)
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

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Protocol outcome 3: Minor revision: secondary patella resurfacing at time to event - Actual outcome: Revision due to a patellofemoral problem by 10 years at 10 years; Group 1: 0/58, Group 2: 7/60; Comments: all resurfaced due to anterior pain Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event ;Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Beaupre 2012[20]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=38)
Countries and setting	Conducted in Canada
Line of therapy	1st line
Duration of study	Intervention + follow up: 5-10 year FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Eligible subjects were scheduled for primary TKA to treat non-inflammatory arthritis and were less than 75 years old.
Exclusion criteria	Subjects were excluded if they had a history of knee sepsis, previous patellectomy, high tibial osteotomy, knee flexion contracture, varus/valgus deformity of greater than 20 degrees, less than 90 degrees of knee flexion or tibial or femoral bone deficiency requiring augmentation.
Recruitment/selection of patients	Subjects were recruited from 1996 to 1999 from three fellowship-trained arthroplasty surgeons at one tertiary Canadian health center during their preoperative assessment.
Age, gender and ethnicity	Age - Mean (SD): resurfaced - 64.9 (4.0), non-resurfaced - 62.0 (5.6) . Gender (M:F): 26 female, 12 male. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=21) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfacing - Subjects randomized to the Resurfaced group received an all polyethylene patellar implant. . Duration N/A. Concurrent medication/care: The Profix™ Total Knee System, a posterior cruciate retaining, fixed bearing prosthesis manufactured by Smith and Nephew, Inc. was utilized in all subjects. Standard surgical technique including a midline incision and medial parapatellar exposure was utilized and all components were cemented. All surgeries were done under tourniquet and a postoperative drain was utilized. A standardized clinical pathway was followed ensuring that all subjects received similar preoperative, perioperative and postoperative care; early mobilization was encouraged starting the first postoperative day. All subjects were weight bearing as tolerated with the assistance of walking aids for the first six postoperative weeks. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:

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	(n=17) Intervention 2: Total knee replacement - without patella resurfacing. People with no patellar resurfacing - those randomized to the non-resurfaced group had no operative intervention involving the patella. Duration N/A. Concurrent medication/care: The Profix™ Total Knee System, a posterior cruciate retaining, fixed bearing prosthesis manufactured by Smith and Nephew, Inc. was utilized in all subjects. Standard surgical technique including a midline incision and medial parapatellar exposure was utilized and all components were cemented. All surgeries were done under tourniquet and a postoperative drain was utilized. A standardized clinical pathway was followed ensuring that all subjects received similar preoperative, perioperative and postoperative care; early mobilization was encouraged starting the first postoperative day. All subjects were weight bearing as tolerated with the assistance of walking aids for the first six postoperative weeks. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Study funded by industry (This study was supported by an unrestricted research grant from Smith and Nephew INC.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Quality of life at later than 6 weeks up to 1 year
- Actual outcome: RAND-36 general health at 1 year at 1 year; Group 1: mean -8.2 (SD 17.5); n=21, Group 2: mean 5.8 (SD 10.6); n=17
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: died; Group 2 Number missing: 1, Reason: died

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year
- Actual outcome: WOMAC - stiffness at 1 year at 1 year; Group 1: mean 24.4 (SD 24.5); n=21, Group 2: mean 8.3 (SD 32.3); n=17
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: died; Group 2 Number missing: 1, Reason: died
- Actual outcome: WOMAC - pain at 1 year at 1 year; Group 1: mean 32.9 (SD 18.2); n=21, Group 2: mean 34.3 (SD 21.5); n=17
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: died; Group 2 Number missing: 1, Reason: died
- Actual outcome: WOMAC - function at 1 year at 1 year; Group 1: mean 24.1 (SD 16.6); n=21, Group 2: mean 19.5 (SD 16.9); n=17
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: died; Group 2 Number missing: 1, Reason: died

Protocol outcome 3: Minor revision: secondary patella resurfacing at time to event
- Actual outcome: Revisions within 10 years at 10 years; Group 1: 1/21, Group 2: 2/17; Comments: revised for persistent anterior knee pain, knee instability secondary to insufficient polyethylene liner thickness
Risk of bias: All domain - ; Indirectness of outcome: No indirectness

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Protocol outcome 4: Reoperation at later than 2 years - Actual outcome: Reoperation after 2 years at 2 years; Group 1: 0/21, Group 2: 1/17; Comments: for septic arthritis secondary to a perforated viscus, Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 1, Reason: died; Group 2 Number missing: 1, Reason: died	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 2 years ; Major revision: tibia femoral compartments at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study (subsidiary papers)	Bourne 1995[29] (Burnett 2004[35])
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=100)
Countries and setting	Conducted in Canada
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	100 patients with osteoarthritic knees were recruited.
Exclusion criteria	Exclusion criteria included previous patellectomy, inflammatory arthritis, patellar fracture, patellar instability, previous extensor mechanism procedures, high tibial osteotomy, severe valgus or varus deformity (>15°), previous unicondylar knee replacement, and a history of septic arthritis or osteomyelitis.
Age, gender and ethnicity	Age - Mean (SD): resurfaced - 72 (7), not resurfaced - 68 (7). Gender (M:F): 58 female, 42 male. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=50) Intervention 1: Total knee replacement - with patella resurfacing. People with patellar resurfacing - patella was resurfaced. Duration N/A. Concurrent medication/care: Same total knee replacement was used. All patients were treated with a single type of prosthesis that featured an anatomic patellofemoral joint. All knees were cruciate-retaining with a cemented tibial baseplate and a cement less femoral component. An all-polyethylene (PE), dome-shaped, cemented patellar component was used. Callipers were used to measure the patellar thickness intraoperatively, and in all resurfacing procedures an attempt to restore the baseline composite height was attempted. All patients received 48 hours of postoperative antibiotics intravenously. Thromboembolic prophylaxis included compression stockings and oral warfarin while in the hospital, followed by 6 weeks of postoperative oral aspirin. Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=50) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing - patellar not resurfaced. . Duration N/A. Concurrent medication/care: Same total knee replacement was used. All patients were treated with a single type of prosthesis that featured an anatomic patellofemoral joint. All knees were cruciate-retaining with a cemented tibial baseplate and a cement less femoral component. An all-polyethylene (PE), dome-shaped, cemented patellar component was used.

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	Callipers were used to measure the patellar thickness intraoperatively, and in all resurfacing procedures an attempt to restore the baseline composite height was attempted. All patients received 48 hours of postoperative antibiotics intravenously. Thromboembolic prophylaxis included compression stockings and oral warfarin while in the hospital, followed by 6 weeks of postoperative oral aspirin. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year
- Actual outcome: Knee society clinical rating at 6 months at 6 months; Group 1: mean 81 (SD 14); n=50, Group 2: mean 80 (SD 11); n=48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A
- Actual outcome: Knee society function clinical rating at 6 months at 6 months; Group 1: mean 65 (SD 18); n=50, Group 2: mean 63 (SD 23); n=48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee society clinical rating at 2 years at 2 years; Group 1: mean 81 (SD 15); n=50, Group 2: mean 87 (SD 8); n=48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A
- Actual outcome: Knee society function clinical rating at 2 years at 2 years; Group 1: mean 67 (SD 26); n=50, Group 2: mean 76 (SD 19); n=48
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A
- Actual outcome: Knee society clinical rating at mean of 7.3 years at 7.3 years; Group 1: mean 86.9 (SD 12.8); n=50, Group 2: mean 85 (SD 13.5); n=50
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A
- Actual outcome: Knee society function clinical rating at mean of 7.3 years at 7.3 years; Group 1: mean 58.7 (SD 24.7); n=50, Group 2: mean 59.5 (SD 25.3); n=50
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A

Protocol outcome 3: Minor revision: secondary patella resurfacing at time to event
- Actual outcome: Revision by 2 years at 2 years; Group 1: 0/50, Group 2: 2/50; Comments: Both did not have their patellofemoral joints resurfaced and both reported severe anterior pain. Each patient responded well to patellar resurfacing at revision arthroplasty.

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not needed? included in 10 year outcome Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A - Actual outcome: Revision by 10 years at 10 years; Group 1: 2/50, Group 2: 9/50; Comments: Mean time to revision - 6.3 years 9 - anterior pain, modular tibial base plate PE wear or osteolysis and sepsis, Both did not have their patellofemoral joints resurfaced and both reported severe anterior pain. Each patient responded well to patellar resurfacing at revision arthroplasty. 2 - patellar fragmentation, sepsis Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Major revision: tibia femoral compartments at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Campbell 2006[39]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=100)
Countries and setting	Conducted in Australia
Line of therapy	1st line
Duration of study	Intervention + follow up: 10 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	The indication for surgery was degenerative osteoarthritis, with symptoms sufficient to warrant total knee replacement after the failure of conservative treatment.
Exclusion criteria	Patients were excluded from the study if they lived in a remote area, had undergone a previous osteotomy or patellofemoral procedure, had inflammatory arthritis or isolated patellofemoral disease, a varus or valgus deformity of more than 25˚ or if there was major bone deficiency on the pre-operative radiographs or at surgery.
Age, gender and ethnicity	Age - Mean (range): resurfaced - 71 (53 to 88), non-resurfaced - 73 (54 to 86). Gender (M:F): 72 female, 28 male. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=46) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfacing - patella resurfaced. Duration N/A. Concurrent medication/care: All patients underwent a Miller-Galante II (Zimmer, Warsaw, Indiana) TKR using prostheses with or without a Miller-Galante II polyethylene patellar component. The posterior cruciate ligament was retained in all cases. Patellar osteophytes were resected when present. The femoral component was externally rotated 3˚ from the posterior condylar axis using the guides provided by the manufacturer. Soft-tissue releases were performed as necessary to ensure anatomical tracking of the patella within the patellofemoral groove, without the application of any external stabilising force. The femoral and tibial components were not cemented, with the exception of one tibial component in a patient with markedly osteoporotic bone. All operations were performed or supervised by an experienced consultant surgeon (CB, PD, GM, AM, PL, AMi or TS). Intra-operative observation of the patellar articular cartilage was graded according to the criteria of Outerbridge. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:

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	(n=54) Intervention 2: Total knee replacement - without patella resurfacing. People with no patella resurfacing - patella not resurfaced. Duration N/A. Concurrent medication/care: All patients underwent a Miller-Galante II (Zimmer, Warsaw, Indiana) TKR using prostheses with or without a Miller-Galante II polyethylene patellar component. The posterior cruciate ligament was retained in all cases. Patellar osteophytes were resected when present. The femoral component was externally rotated 3˚ from the posterior condylar axis using the guides provided by the manufacturer. Soft-tissue releases were performed as necessary to ensure anatomical tracking of the patella within the patellofemoral groove, without the application of any external stabilising force. The femoral and tibial components were not cemented, with the exception of one tibial component in a patient with markedly osteoporotic bone. All operations were performed or supervised by an experienced consultant surgeon (CB, PD, GM, AM, PL, AMi or TS). Intra-operative observation of the patellar articular cartilage was graded according to the criteria of Outerbridge. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Academic or government funding (The authors gratefully acknowledge the financial support of the Australian Orthopaedic Association and the Adelaide Bone and Joint Research Foundation.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee Society Score at 4 years at 4 years; Group 1: mean 71.8 (SD 14.2); n=46, Group 2: mean 74.9 (SD 14); n=54
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 18, Reason: lost to follow up, severe dementia, died, refused due to poor general health; Group 2 Number missing: 24, Reason: lost to follow up, severe dementia, died, refused due to poor general health
- Actual outcome: Knee Society Score - clinical and function at 4 years at 4 years; Group 1: mean 137.6 (SD 37.7); n=46, Group 2: mean 135.5 (SD 31.8); n=54
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 18, Reason: lost to follow up, severe dementia, died, refused due to poor general health; Group 2 Number missing: 24, Reason: lost to follow up, severe dementia, died, refused due to poor general health

Protocol outcome 2: Minor revision: secondary patella resurfacing at time to event
- Actual outcome: Patellofemoral reoperation at 10 years; Group 1: 1/46, Group 2: 2/54; Comments: patellae resurfaced due to anterior knee pain

Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 18, Reason: lost to follow up, severe dementia, died, refused due to poor general health; Group 2 Number missing: 24, Reason: lost to follow up, severe dementia, died, refused due to poor general health

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Protocol outcome 3: Superficial surgical site infection at before JR is revised - Actual outcome: Superficial infections at 10 years; Group 1: 3/46, Group 2: 2/54 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 18, Reason: lost to follow up, severe dementia, died, refused due to poor general health; Group 2 Number missing: 24, Reason: lost to follow up, severe dementia, died, refused due to poor general health Protocol outcome 4: Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised - Actual outcome: Deep vein thrombosis at 10 years; Group 1: 2/46, Group 2: 4/54 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 18, Reason: lost to follow up, severe dementia, died, refused due to poor general health; Group 2 Number missing: 24, Reason: lost to follow up, severe dementia, died, refused due to poor general health	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Major revision: tibia femoral compartments at time to event; Deep surgical site Infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

Study	**Chawla 2019[40]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=100)
Countries and setting	Conducted in India
Line of therapy	1st line
Duration of study	Intervention + follow up: 5 year follow up
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Aged >50 years
Exclusion criteria	Included history of patellar fracture, age <50 years, patellofemoral instability, prior patellectomy, prior knee

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	replacement surgery, prior hip replacement surgery, patient with osteoarthritis of hip, prior history of tibial condyle or distal femoral fractures.
Age, gender and ethnicity	Age - --: N/A. Gender (M:F): 20 male, 80 female . Ethnicity: N/A
Further population details	1. Age: Not stated / Unclear 2. Indication: Not stated / Unclear 3. Specific implant: Not applicable
Indirectness of population	No indirectness
Interventions	(n=50) Intervention 1: Total knee replacement - with patella resurfacing. Patella resurfacing - patellar preparation was done using a saw and 3 peg oval patellar button component was used. . Duration N/A. Concurrent medication/care: The arthroplasty was performed by senior surgeon following standard approach with medial parapatellar arthromoty under combined spinal and epidural anaesthesia. All patients received size specific femoral and tibial components. All components were cemented. Patients were made to walk on second postoperative day and put on continuous passive motion along with isometric quadriceps exercises with full weight bearing. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=50) Intervention 2: Total knee replacement - without patella resurfacing. No patellar resurfacing - Patelloplasty was done in which osteophytes were removed by trimming around patellar and denervating it. Patellofemoral tracking was assessed in all cases after trial component insertion and after implantation of definitive implants. . Duration N/A. Concurrent medication/care: The arthroplasty was performed by senior surgeon following standard approach with medial parapatellar arthromoty under combined spinal and epidural anaesthesia. All patients received size specific femoral and tibial components. All components were cemented. Patients were made to walk on second postoperative day and put on continuous passive motion along with isometric quadriceps exercises with full weight bearing. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated (N/A)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee society score of excellent or good at 5 years at 5 years ; Group 1: 45/50, Group 2: 48/50
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0; Group 2 Number missing: 0

Protocol outcome 2: Deep surgical site Infection at before JR is revised
- Actual outcome: Deep surgical site infection at 5 years at 5 years ; Group 1: 1/50, Group 2: 0/50

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Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0; Group 2 Number missing: 0 Protocol outcome 3: Superficial surgical site infection at before JR is revised - Actual outcome: Superficial surgical site infection at 5 years at 5 years ; Group 1: 1/50, Group 2: 1/50 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0; Group 2 Number missing: 0	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Feller 1996[47]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=40)
Countries and setting	Conducted in Australia
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients who had a technically uncomplicated primary TKA for osteoarthritis
Exclusion criteria	We excluded patients who previously had a patellar realignment operation or other major surgery such as a high tibial osteotomy. Three patients with severe deformity of the patella were also excluded at the time of operation, before randomisation.
Age, gender and ethnicity	Age - Mean (SD): resurfaced - 70.5 (6.6), not resurfaced - 71.1 (5.6). Gender (M:F): 17 female, 21 male. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=19) Intervention 1: Total knee replacement - with patella resurfacing. People with patellar resurfacing - patella was resurfaced. Duration N/A. Concurrent medication/care: The surgical technique was similar in all cases using a medial parapatellar approach and the PCA Modular prosthesis (Howmedica, Rutherford, New Jersey). Knees with larger or non-contained defects were excluded. The femoral and tibial components were inserted without cement, but in the resurfacing group an all-polyethylene offset-dome patellar component was cemented into position. Peripheral osteophytes were excised in both groups but no surgery was performed on the articular cartilage or subchondral bone of the retention group. Patellar tracking was checked at the end of the operation; no patient required any adjustment by procedures such as lateral release. Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=19) Intervention 2: Total knee replacement - without patella resurfacing. People without patellar resurfacing - patella not resurfaced. Duration N/A. Concurrent medication/care: The surgical technique was similar in all cases using a medial parapatellar approach and the PCA Modular prosthesis (Howmedica, Rutherford, New Jersey). Knees with larger or non-contained defects were excluded. The femoral and tibial components were inserted without cement, but in the resurfacing group an all-polyethylene offset-dome

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	patellar component was cemented into position. Peripheral osteophytes were excised in both groups but no surgery was performed on the articular cartilage or subchondral bone of the retention group. Patellar tracking was checked at the end of the operation; no patient required any adjustment by procedures such as lateral release. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years - Actual outcome: Hospital for Special Surgery (HSS) knee score at 3 years at 3 years; Group 1: mean 85.7 (SD 7); n=18, Group 2: mean 88.6 (SD 5.2); n=18 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A - Actual outcome: Patellar score at 3 years at 3 years; Group 1: mean 25.6 (SD 4.8); n=18, Group 2: mean 27.8 (SD 3.9); n=18 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Gildone 2005[51]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=56)
Countries and setting	Conducted in Italy
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	People with osteoarthritis of the knee were enrolled.
Exclusion criteria	Exclusion criteria included previous patellectomy, inflammatory arthritis, patellar fracture, patellar instability, previous extensor mechanism procedures, high tibial osteotomy, severe valgus or varus deformity (>15 degrees), severe flexion contracture (>15 degrees), previous unicondylar knee replacement, and a history of septic arthritis or osteomyelitis.
Age, gender and ethnicity	Age - Mean (range): 74.1 (65 to 89). Gender (M:F): 17 male, 39 female. Ethnicity: N/A
Further population details	1. Age: Elderly ~>75 years old (study defined) 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=28) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfacing. . Duration N/A. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=28) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing. . Duration N/A. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Patient Reported Outcome Measures (PROMs) at later than 2 years ; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to

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	event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Kaseb 2018[62]
Study type	RCT (randomised; Parallel)
Number of studies (number of participants)	(n=50)
Countries and setting	Conducted in Iran; Setting:
Line of therapy	1st line
Duration of study	Intervention + follow up: 6 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	The eligible subjects were patients under 70 years old with non-inflammatory arthritis and unsuccessful non-surgical treatment who were scheduled for TKA.
Exclusion criteria	Patients with inflammatory arthritis, history of patellectomy, high tibial osteotomy, patellar fracture, varus/valgus deformity of greater than 20 degrees, or flexion contracture more than 25 degrees and extensive bone defect were excluded from the study.
Recruitment/selection of patients	A total of 50 patients with OAK at two university-affiliated teaching hospitals were recruited.
Age, gender and ethnicity	Age - Mean (SD): 64.8 (7.8). Gender (M:F): 42 female, 8 male. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=24) Intervention 1: Total knee replacement - with patella resurfacing. People with patellar resurfacing - patellar was resurfaced and performed using all-polyethylene prosthesis. Duration N/A. Concurrent medication/care: Standard surgical technique including a midline incision and medial parapatellar exposure was utilized in all patients. All surgeries were done under tourniquet pressure. The Profix™ Total Knee System, a posterior cruciate sacrificing, fixed bearing prosthesis manufactured by Zimmer Inc. was used in all subjects with cemented components. In cases where both knees needed surgery, each knee was randomized independently. A standardized clinical pathway was followed ensuring all subjects received similar preoperative, perioperative and postoperative care; early mobilization was encouraged starting the first postoperative day. Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=26) Intervention 2: Total knee replacement - without patella resurfacing. People with patellar not resurfaced - this was achieved with osteophyte removal, electro-cauterization in the 5mm edge of the patella, and fibrillated cartilage smoothing. Duration N/A. Concurrent medication/care: Standard surgical

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	technique including a midline incision and medial parapatellar exposure was utilized in all patients. All surgeries were done under tourniquet pressure. The Profix™ Total Knee System, a posterior cruciate sacrificing, fixed bearing prosthesis manufactured by Zimmer Inc. was used in all subjects with cemented components. In cases where both knees needed surgery, each knee was randomized independently. A standardized clinical pathway was followed ensuring all subjects received similar preoperative, perioperative and postoperative care; early mobilization was encouraged starting the first postoperative day. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Quality of life at later than 6 weeks up to 1 year
- Actual outcome: SF-36 at 6 months at 6 months; Group 1: mean 79.12 (SD 15); n=24, Group 2: mean 69.36 (SD 18.8); n=26
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year
- Actual outcome: Knee Society Knee score at 6 months at 6 months; Group 1: mean 84.75 (SD 6.2); n=24, Group 2: mean 83.46 (SD 8.7); n=26
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A
- Actual outcome: Knee Society Function score at 6 months at 6 months; Group 1: mean 83.75 (SD 13.4); n=24, Group 2: mean 87.73 (SD 19.2); n=26
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A
- Actual outcome: WOMAC score at 6 months at 6 months; Group 1: mean 23.8 (SD 16.7); n=24, Group 2: mean 18.79 (SD 15.7); n=26
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 0, Reason: N/A

Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 2 years ; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial

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infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years	

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Study (subsidiary papers)	KAT trial: Johnston 2009[58] (Breeman 2011[32], Murray 2014[74])
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=2352)
Countries and setting	Conducted in United Kingdom
Line of therapy	1st line
Duration of study	Intervention + follow up: 5 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Stratified then randomised
Inclusion criteria	All patients under the care of a collaborating surgeon were potentially eligible for inclusion if a decision had been made for them to have primary TKA. A patient remained eligible only if the surgeon remained convinced that there was no indication for one particular choice within the trial.
Exclusion criteria	A patient was not eligible for trial inclusion if the surgeon considered a particular type of operation to be clearly indicated.
Age, gender and ethnicity	Age - Mean (SD): 70 (8). Gender (M:F): 763 male, 952 female. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: Not stated / Unclear 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=861) Intervention 1: Total knee replacement - with patella resurfacing. Total knee replacement with patella resurfacing. Duration N/A. Concurrent medication/care: All other aspects of care, such as prophylaxis against DVT, were left to the discretion of the responsible surgeon. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=854) Intervention 2: Total knee replacement - without patella resurfacing. Total knee replacement without patella resurfacing. . Duration N/A. Concurrent medication/care: All other aspects of care, such as prophylaxis against DVT, were left to the discretion of the responsible surgeon. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Other author(s) funded by industry (The Knee Arthroplasty Trial is funded by the NIHR Health Technology Assessment Programme.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITHOUT PATELLA RESURFACING versus WITH PATELLA

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RESURFACING

Protocol outcome 1: Quality of life at later than 6 weeks up to 1 year
- Actual outcome: EQ-5D at 3 months at 3 months; Group 1: mean 0.69 (SD 0.25); n=854, Group 2: mean 0.7 (SD 0.24); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 0.40 +/- 0.30, no resurfacing - 0.39 +/- 0.31; Group 1 Number missing: 66, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 71, Reason: Lost to follow up, declined, non-responder
- Actual outcome: SF-12 - physical component at 3 months at 3 months; Group 1: mean 38.68 (SD 9.06); n=854, Group 2: mean 39.42 (SD 9.35); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 31.07 +/- 8.05, no resurfacing - 31.26 +/- 8.5; Group 1 Number missing: 66, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 71, Reason: Lost to follow up, declined, non-responder
- Actual outcome: SF-12 - mental component at 3 months at 3 months; Group 1: mean 51.14 (SD 10.97); n=854, Group 2: mean 51.21 (SD 10.6); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 50.70 +/- 11.37, no resurfacing - 49.73 +/- 11.20; Group 1 Number missing: 66, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 71, Reason: Lost to follow up, declined, non-responder

Protocol outcome 2: Quality of life at later than 2 years
- Actual outcome: EQ-5D at 5 years at 5 years; Group 1: mean 0.61 (SD 0.34); n=854, Group 2: mean 0.63 (SD 0.34); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 0.40 +/- 0.30, no resurfacing - 0.39 +/- 0.31; Group 1 Number missing: 93, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 91, Reason: Lost to follow up, declined, non-responder
- Actual outcome: SF-12 - physical component at 5 years at 5 years; Group 1: mean 39.39 (SD 11.48); n=854, Group 2: mean 39.61 (SD 11.01); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 31.07 +/- 8.05, no resurfacing - 31.26 +/- 8.5; Group 1 Number missing: 93, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 91, Reason: Lost to follow up, declined, non-responder
- Actual outcome: SF-12 - mental component at 5 years at 5 years; Group 1: mean 50.08 (SD 10.52); n=854, Group 2: mean 50.83 (SD 10.36); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 50.70 +/- 11.37, no resurfacing - 49.73 +/- 11.20; Group 1 Number missing: 93, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 91, Reason: Lost to follow up, declined, non-responder
- Actual outcome: EQ-5D at 10 years at 10 years; Group 1: mean 0.647 (SD 0.302); n=424, Group 2: mean 0.665 (SD 0.287); n=443
Risk of bias: All domain - ; Indirectness of outcome: No indirectness
- Actual outcome: SF-12 - physical component at 10 years at 10 years; Group 1: mean 37.3 (SD 11.1); n=416, Group 2: mean 37.5 (SD 11.5); n=440
Risk of bias: All domain - ; Indirectness of outcome: No indirectness
- Actual outcome: SF-12 - mental component at 10 years at 10 years; Group 1: mean 48.9 (SD 11); n=416, Group 2: mean 49.2 (SD 11); n=440
Risk of bias: All domain - ; Indirectness of outcome: No indirectness

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Protocol outcome 3: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year
- Actual outcome: Oxford Knee Score at 3 months at 3 months; Group 1: mean 30.49 (SD 9.45); n=854, Group 2: mean 31.19 (SD 9.56); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 18.49 +/- 7.39, no resurfacing - 18.15 +/- 7.66; Group 1 Number missing: 66, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 71, Reason: Lost to follow up, declined, non-responder

Protocol outcome 4: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Oxford Knee Score at 5 years at 5 years; Group 1: mean 34.57 (SD 10.25); n=854, Group 2: mean 35.01 (SD 10.55); n=861
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 18.49 +/- 7.39, no resurfacing - 18.15 +/- 7.66; Group 1 Number missing: 93, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 91, Reason: Lost to follow up, declined, non-responder
- Actual outcome: Oxford Knee Score at 10 years at 10years; Group 1: mean 33.5 (SD 10.8); n=380, Group 2: mean 33.6 (SD 11.3); n=418
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Resurfacing - 18.49 +/- 7.39, no resurfacing - 18.15 +/- 7.66; Group 1 Number missing: 66, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 71, Reason: Lost to follow up, declined, non-responder

Protocol outcome 5: Major revision: tibia femoral compartments at time to event
- Actual outcome: Any major operation within 10 years at 10 years; Group 1: 39/830, Group 2: 26/841
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 75, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 96, Reason: Lost to follow up, declined, non-responder

Protocol outcome 6: Minor revision: secondary patella resurfacing at time to event
- Actual outcome: Patella revision within 10 years at 10 years; Group 1: 0/830, Group 2: 2/841
Risk of bias: All domain - ; Indirectness of outcome: No indirectness

Protocol outcome 7: Length of stay at in hospital
- Actual outcome: Days in hospital at N/A; Group 1: mean 9.84 (SD 4.5); n=815, Group 2: mean 10.2 (SD 5.7); n=834
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 75, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 96, Reason: Lost to follow up, declined, non-responder

Protocol outcome 8: Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised

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- Actual outcome: Treated DVT or PE postoperatively at Postoperatively ; Group 1: 22/813, Group 2: 21/825 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 75, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 96, Reason: Lost to follow up, declined, non-responder - Actual outcome: Confirmed myocardial infarction postoperatively at Postoperatively ; Group 1: 2/813, Group 2: 6/825 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 75, Reason: Lost to follow up, declined, non-responder ; Group 2 Number missing: 96, Reason: Lost to follow up, declined, non-responder	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event ;Mortality at within 30 days; Quality of life at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Mayman 2003[71]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=100)
Countries and setting	Conducted in Canada
Line of therapy	1st line
Duration of study	Intervention + follow up: 10 year FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	People with osteoarthritic knees were recruited.
Exclusion criteria	People excluded if they had inflammatory arthritis or if the procedure was being performed primarily to treat patellofemoral symptoms.
Age, gender and ethnicity	Age - Mean (SD): resurfaced - 72 +/ 7, not resurfaced - 68+/7. Gender (M:F): 42 female, 58 male. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=50) Intervention 1: Total knee replacement - with patella resurfacing. People had patellar resurfacing - All patients were treated with a single prosthesis that featured an anatomically designed femoral grove and intercondylar notch. The patellar component was a dome shaped all polyethylene, cemented component. . Duration N/A. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=50) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing. Duration N/A. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	No funding (No benefits or funds were received in support of this study.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Minor revision: secondary patella resurfacing at time to event

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- Actual outcome: Revision within 10 years at 10 years; Group 1: 2/50, Group 2: 5/50 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Patient Reported Outcome Measures (PROMs) at later than 2 years ; Major revision: tibia femoral compartments at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Myles 2006[75]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=50)
Countries and setting	Conducted in United Kingdom; Setting: All subject tests were carried out in the outpatient clinic.
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients under the care of two consultant and orthopaedic surgeons awaiting a unilateral primary total knee arthroplasty over a period of nine months, were included.
Exclusion criteria	Criteria was inflammatory polyarthritis, hip osteoarthritis and lower limb disorders causing abnormal gait or significant pain, dementia, severe visual impairment, neurological conditions affecting movement and failure to give informed consent.
Age, gender and ethnicity	Age - Mean (SD): 70 (9.2). Gender (M:F): 24 female, 26 male. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=25) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfacing - Two flexible electrogonimeters were used to the flexion-extension angle of the knees with respect to time. This was attached to flexible plastic strips which were adjusted to the length of the patients' shank and thigh. These plastic strips were then attached to the skin over the lateral border of the subject's leg using double sided medical tape. Small, lightweight, thin profile, foot switches were also attached to the heel and first metatarsal area of the soles of both feet inside the shoes. Both the electrogonimeters and foot switches were connected via thin flexible cables to a small, lightweight, battery driven, data logger, which powered the instruments and recorded the channels of data at 50 Hz for up to 5 minutes. Data was downloaded to a portable PC. Subjects were asked to perform 11 functional activities. All activities were performed at the subjects' self-selected speed. The minimum and maximum knee joint angles of both knees were recorded for each subject performing the activities. . Duration N/A. Concurrent medication/care: Two flexible electrogonimeters were used to the flexion-extension angle of the knees with respect to time. This was attached to flexible plastic strips which were adjusted to the length of the patients' shank and thigh. These plastic strips were then attached to the skin over the lateral border of the subject's leg using double sided medical tape. Small, lightweight, thin profile, foot switches were also attached to the heel and first metatarsal area of the soles of both feet inside the shoes. Both the electrogonimeters and foot switches were connected

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	via thin flexible cables to a small, lightweight, battery driven, data logger, which powered the instruments and recorded the channels of data at 50 Hz for up to 5 minutes. Data was downloaded to a portable PC. Subjects were asked to perform 11 functional activities. All activities were performed at the subjects' self-selected speed. The minimum and maximum knee joint angles of both knees were recorded for each subject performing the activities. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: Not applicable (n=25) Intervention 2: Total knee replacement - without patella resurfacing. People without patellar resurfacing - Two flexible electrogonimeters were used to the flexion-extension angle of the knees with respect to time. This was attached to flexible plastic strips which were adjusted to the length of the patients' shank and thigh. These plastic strips were then attached to the skin over the lateral border of the subject's leg using double sided medical tape. Small, lightweight, thin profile, foot switches were also attached to the heel and first metatarsal area of the soles of both feet inside the shoes. Both the electrogonimeters and foot switches were connected via thin flexible cables to a small, lightweight, battery driven, data logger, which powered the instruments and recorded the channels of data at 50 Hz for up to 5 minutes. Data was downloaded to a portable PC. Subjects were asked to perform 11 functional activities. All activities were performed at the subjects' self-selected speed. The minimum and maximum knee joint angles of both knees were recorded for each subject performing the activities. . Duration N/A. Concurrent medication/care: Two flexible electrogonimeters were used to the flexion-extension angle of the knees with respect to time. This was attached to flexible plastic strips which were adjusted to the length of the patients' shank and thigh. These plastic strips were then attached to the skin over the lateral border of the subject's leg using double sided medical tape. Small, lightweight, thin profile, foot switches were also attached to the heel and first metatarsal area of the soles of both feet inside the shoes. Both the electrogonimeters and foot switches were connected via thin flexible cables to a small, lightweight, battery driven, data logger, which powered the instruments and recorded the channels of data at 50 Hz for up to 5 minutes. Data was downloaded to a portable PC. Subjects were asked to perform 11 functional activities. All activities were performed at the subjects' self-selected speed. The minimum and maximum knee joint angles of both knees were recorded for each subject performing the activities. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: Not applicable
Funding	Academic or government funding (This work was supported by a Knee Research Fellowship awarded to C M Myles by DePuy International Limited.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year
- Actual outcome: AKSS knee score at 4 months at 4 months; Group 1: mean 80 (SD 12); n=25, Group 2: mean 77.4 (SD 11.8); n=25

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	Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: AKSS function score at 4 months at 4 months; Group 1: mean 61.5 (SD 11.8); n=25, Group 2: mean 68.4 (SD 12.5); n=25 Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: WOMAC pain score at 4 months at 4 months; Group 1: mean 4.5 (SD 3.6); n=25, Group 2: mean 3.4 (SD 2.5); n=25 Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: WOMAC stiffness score at 4 months at 4 months; Group 1: mean 2.9 (SD 1.6); n=25, Group 2: mean 2.9 (SD 1.3); n=25 Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: WOMAC physical function score at 4 months at 4 months; Group 1: mean 21 (SD 11.4); n=25, Group 2: mean 19.3 (SD 10.5); n=25 Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at later than 2 years - Actual outcome: AKSS knee score at 18-24 months at 18-24 months; Group 1: mean 83.2 (SD 14.8); n=25, Group 2: mean 83.4 (SD 16.1); n=25 Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: AKSS function score at 18-24 months at 18-24 months; Group 1: mean 63.6 (SD 17.6); n=25, Group 2: mean 79.2 (SD 18.3); n=25 Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: WOMAC pain score at 18-24 months at 18-24 months; Group 1: mean 2.4 (SD 2.2); n=25, Group 2: mean 3.3 (SD 3.3); n=25 Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: WOMAC stiffness score at 18-24 months at 18-24 months; Group 1: mean 1.7 (SD 1.4); n=25, Group 2: mean 2 (SD 1.8); n=25 Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome: WOMAC physical function score at 18-24 months at 18-24 months; Group 1: mean 17.4 (SD 10.3); n=25, Group 2: mean 15.6 (SD 12.6); n=25 Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital;

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	Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Newman 2000[77]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=125 knees)
Countries and setting	Conducted in United Kingdom
Line of therapy	1st line
Duration of study	Intervention + follow up: 5 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Only cases of osteoarthritis suitable for a posterior cruciate sparing replacement were considered for the trial.
Exclusion criteria	Previous surgery to the extensor mechanism, an upper tibial osteotomy or evidence of inflammatory arthritis disqualified the case, as did gross deformity likely to necessitate the use of a stabilised prosthesis.
Age, gender and ethnicity	Age - Other: Mean - 72 (resurfaced), 71.2 (not resurfaced), 72.5 (selected resurfaced). Gender (M:F): 41 male, 83 female. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=42) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfacing - all knees were treated with a posterior cruciate sparing Kinematic modular knee replacement which was routinely cemented. . Duration N/A. Concurrent medication/care: Three doses of prophylactic antibiotic were used starting at induction of anaesthesia; all procedures were performed under tourniquet which was released after wound closure; a medial parapatellar approach was used throughout the trial. The operations were carried out by a number of surgeons many of whom were trainees. Soft tissue releases were carried out at the discretion of the operating surgeon. A standard post-operative mobilisation regime was used starting on day 2. In the immediate post-operative period, both the knee and patient were carefully monitored and any complications noted. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=41) Intervention 2: Total knee replacement - with selective resurfacing. People with selective patella resurfacing - all knees were treated with a posterior cruciate sparing Kinematic modular knee replacement which was routinely cemented. . Duration N/A. Concurrent medication/care: Three doses of prophylactic antibiotic were used starting at induction of anaesthesia; all procedures were performed under tourniquet which was released after wound closure; a medial parapatellar approach was used throughout the trial. The

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	operations were carried out by a number of surgeons many of whom were trainees. Soft tissue releases were carried out at the discretion of the operating surgeon. A standard post-operative mobilisation regime was used starting on day 2. In the immediate post-operative period, both the knee and patient were carefully monitored and any complications noted. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=42) Intervention 3: Total knee replacement - without patella resurfacing. People without patella resurfacing - all knees were treated with a posterior cruciate sparing Kinematic modular knee replacement which was routinely cemented. . Duration N/A. Concurrent medication/care: Three doses of prophylactic antibiotic were used starting at induction of anaesthesia; all procedures were performed under tourniquet which was released after wound closure; a medial parapatellar approach was used throughout the trial. The operations were carried out by a number of surgeons many of whom were trainees. Soft tissue releases were carried out at the discretion of the operating surgeon. A standard post-operative mobilisation regime was used starting on day 2. In the immediate post-operative period, both the knee and patient were carefully monitored and any complications noted. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITH SELECTIVE RESURFACING

Protocol outcome 1: Minor revision: secondary patella resurfacing at time to event
- Actual outcome: Minor revision at 5 years at 5 years; Group 1: 0/42, Group 2: 1/41; Comments: 1 needed revision of patellar button because of subluxation and loosening.
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 2: Minor revision: secondary patella resurfacing at time to event
- Actual outcome: Minor revision at 5 years at 5 years; Group 1: 0/42, Group 2: 6/42; Comments: 6 knees underwent secondary patella resurfacing for severe anterior knee pain.
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

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RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH SELECTIVE RESURFACING versus WITHOUT PATELLA RESURFACING Protocol outcome 1 Minor revision: secondary patella resurfacing at time to event - Actual outcome: Minor revision at 5 years at 5 years; Group 1: 1/41, Group 2: 6/42 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Patient Reported Outcome Measures (PROMs) at later than 2 years ; Major revision: tibia femoral compartments at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Partio 1995[83]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=95 knees)
Countries and setting	Conducted in Finland
Line of therapy	1st line
Duration of study	Intervention + follow up: 3 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	N/A
Exclusion criteria	N/A
Age, gender and ethnicity	Age - Mean (range): non-resurfaced - 66 (40-83), resurfaced - 69 (58-78). Gender (M:F): 21 male, 71 female. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Extra comments	.
Indirectness of population	No indirectness
Interventions	(n=47) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfaced - the patella was reflected laterally. All patellar components were fixed with cement. After implantation of components, patellar tracking was assessed by moving the knee slowly from full extension to 90 degrees of flexion. An incision was made between the iliotibial tract and the biceps femoris tendon extending below the joint line. . Duration N/A. Concurrent medication/care: The postoperative regimen consisted of early mobilisation and range of movement exercises using CPM apparatus. Patients with cementless femoral or tibial components were ordered to restrict weight bearing for 6 weeks. In patients with cemented femoral and tibial components, full weight bearing was allowed immediately after operation. Antibiotics and anti-thrombosis drugs were given prophylactically in all cases. Further details: 1. Method of selective resurfacing: (n=48) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing - all non-surfaced patella were trimmed by excision of osteophytes and scar tissue, but no effort was made to save degenerate cartilage. . Duration N/A. Concurrent medication/care: The postoperative regimen consisted of early mobilisation and range of movement exercises using CPM apparatus. Patients with cementless femoral or tibial components were ordered to restrict weight bearing for 6 weeks. In patients

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	with cemented femoral and tibial components, full weight bearing was allowed immediately after operation. Antibiotics and anti-thrombosis drugs were given prophylactically in all cases. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Superficial surgical site infection at before JR is revised
- Actual outcome: Hematogenic infection at 3 years at 3 years; Group 1: 1/47, Group 2: 0/48
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2, Reason: 2 died; Group 2 Number missing: 2, Reason: 2 died

Protocol outcome 2: Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised
- Actual outcome: Deep thromboses at 3 years at 3 years; Group 1: 0/47, Group 2: 2/48
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2, Reason: 2 died; Group 2 Number missing: 2, Reason: 2 died

Protocol outcome 3: Pain at later than 2 years
- Actual outcome: Anterior knee pain at 3 years at 3 years; Group 1: 1/47, Group 2: 11/48
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2, Reason: 2 died; Group 2 Number missing: 2, Reason: 2 died
- Actual outcome: Compression knee pain at 3 years at 3 years; Group 1: 4/47, Group 2: 22/48
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2, Reason: 2 died; Group 2 Number missing: 2, Reason: 2 died

Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Patient Reported Outcome Measures (PROMs) at later than 2 years ; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year

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Study	Roberts 2015[89]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=270)
Countries and setting	Conducted in USA
Line of therapy	1st line
Duration of study	Intervention + follow up: mean 7.8 year FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients undergoing primary TKA for a primary diagnosis of osteoarthritis were recruited.
Exclusion criteria	Patients with inflammatory arthritis, avascular necrosis, previous patellar fracture or osteotomy, or who were undergoing revision knee arthroplasty were excluded. Patients who were found at the time of surgery to have any exposed bone on the patellar articular surface were excluded.
Age, gender and ethnicity	Age - Mean (SD): 70.75 (8.05). Gender (M:F): 170 male, 100 female. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=178) Intervention 1: Total knee replacement - with selective resurfacing. People with patella resurfacing - The patellar was everted and the patellofemoral joint inspected. If exposed bone was found on the patellar articular surface or grossly evident chondrocalcinosis, the patellar was resurfaced and the patient not included in the study. If no exposed bone was found on the patellar articular surface, an envelope was opened instructing the surgeon whether or not to resurface the patella. If the patient was undergoing a simultaneous bilateral total knee replacement, only a single envelope was opened and both patellae were treated the same. Patellar osteophytes were excised. When the patella was resurfaced the composite patellar thickness was restored to within 2 mm of the pre-resection thickness. . Duration N/A. Concurrent medication/care: Postoperatively a continuous passive motion machine was used for the duration of the hospitalisation. Weight bearing as tolerated was allowed immediately; no immobilisation devices were used. Physical therapy was prescribed three times a week from 4 to 6 weeks. Surgical procedure performed under spinal anaesthesia. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=172) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing - The patellar was everted and the patellofemoral joint inspected. If exposed bone was found on the patellar articular surface or grossly evident chondrocalcinosis, the patellar was resurfaced and the

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	patient not included in the study. If no exposed bone was found on the patellar articular surface, an envelope was opened instructing the surgeon whether or not to resurface the patella. If the patient was undergoing a simultaneous bilateral total knee replacement, only a single envelope was opened and both patellae were treated the same. Patellar osteophytes were excised. When the patella was resurfaced the composite patellar thickness was restored to within 2 mm of the pre-resection thickness. . Duration N/A. Concurrent medication/care: Postoperatively a continuous passive motion machine was used for the duration of the hospitalisation. Weight bearing as tolerated was allowed immediately; no immobilisation devices were used. Physical therapy was prescribed three times a week from 4 to 6 weeks. Surgical procedure performed under spinal anesthesia. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Equipment / drugs provided by industry (Contribution and support of DePuy Orthopaedics, PeaceHealth Southwest Washington Medical Centre and study coordinators: Lynette Alber, Sherri Tzvetcoff and Charlanne Sappington)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH SELECTIVE RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee Society score at 2 years at 2 years; Group 1: mean 83.7 (SD 12.3); n=135, Group 2: mean 84 (SD 13.2); n=138
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10, Reason: 6 withdrew, 4 incapacity to return: limited health/cognition ; Group 2 Number missing: 5, Reason: 2 lost contact, 1 withdrew, 2 incapacity to return: limited health/cognition
- Actual outcome: Knee Society function score at 2 years at 2 years; Group 1: mean 63 (SD 27.4); n=164, Group 2: mean 60 (SD 28.8); n=162
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10, Reason: 6 withdrew, 4 incapacity to return: limited health/cognition ; Group 2 Number missing: 5, Reason: 2 lost contact, 1 withdrew, 2 incapacity to return: limited health/cognition
- Actual outcome: Knee Society score at 10 years at 10 years; Group 1: mean 88 (SD 9); n=54, Group 2: mean 86.6 (SD 11.9); n=42
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10, Reason: 6 withdrew, 4 incapacity to return: limited health/cognition ; Group 2 Number missing: 5, Reason: 2 lost contact, 1 withdrew, 2 incapacity to return: limited health/cognition
- Actual outcome: Knee Society function score at 10 years at 10 years; Group 1: mean 65.6 (SD 28); n=67, Group 2: mean 59.8 (SD 26.3); n=47
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10, Reason: 6 withdrew, 4 incapacity to return: limited health/cognition ; Group 2 Number missing: 5, Reason: 2 lost contact, 1 withdrew, 2 incapacity to return: limited health/cognition

Protocol outcome 2: Minor revision: secondary patella resurfacing at time to event

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- Actual outcome: Revision at 10 years; Group 1: 5/178, Group 2: 9/172; Comments: All occurred more than 2 years postoperatively. Revised for anterior knee pain or chronic effusions and synovitis secondary to polyethylene wear. Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10, Reason: 6 withdrew, 4 incapacity to return: limited health/cognition ; Group 2 Number missing: 5, Reason: 2 lost contact, 1 withdrew, 2 incapacity to return: limited health/cognition Protocol outcome 3: Deep surgical site Infection at before JR is revised - Actual outcome: Deep surgical site infection at 2.5 years at 10 years; Group 1: 1/178, Group 2: 0/172 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10, Reason: 6 withdrew, 4 incapacity to return: limited health/cognition ; Group 2 Number missing: 5, Reason: 2 lost contact, 1 withdrew, 2 incapacity to return: limited health/cognition Protocol outcome 4: Superficial surgical site infection at before JR is revised - Actual outcome: Superficial site infection (in immediate postoperative period) at 2 years; Group 1: 1/178, Group 2: 0/172 Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 10, Reason: 6 withdrew, 4 incapacity to return: limited health/cognition ; Group 2 Number missing: 5, Reason: 2 lost contact, 1 withdrew, 2 incapacity to return: limited health/cognition	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Major revision: tibia femoral compartments at time to event; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Schroeder-boersch 1998[90]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=40)
Countries and setting	Conducted in Germany
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Osteoarthritis, 50-79 years
Exclusion criteria	Rheumatoid arthritis, avascular necrosis, posttraumatic arthritis, tumour patient, <50 or >79 years, body weight by Broca exceeding 130%, preoperative high activity level
Age, gender and ethnicity	Age - Mean (range): 72.6 (59 to 79). Gender (M:F): Define. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	
Funding	Funding not stated
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Patient Reported Outcome Measures (PROMs) at later than 2 years ; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Smith 2008[95]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=164)
Countries and setting	Conducted in Australia
Line of therapy	1st line
Duration of study	Intervention + follow up: mean 4 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with osteoarthritis (OA) under-going primary TKR.
Exclusion criteria	Patients with inflammatory arthritis, a history of patellar fracture, patellectomy, patellofemoral instability or prior unicondylar knee replacement were excluded.
Recruitment/selection of patients	All patients with osteoarthritis (OA) under-going primary TKR at two university-affiliated teaching hospitals were evaluated for inclusion in the study.
Age, gender and ethnicity	Age - Mean (range): resurfacing - 71.9 (54.4 to 88.1), not resurfaced - 71.2 (52.9 to 84.9). Gender (M:F): 91 male, 90 female . Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	Serious indirectness: data includes 17 patients undergoing bilateral procedure
Interventions	(n=87) Intervention 1: Total knee replacement - with patella resurfacing. People with patellar resurfacing - Patellar resurfacing was undertaken using a cemented, inset Profix-domed component. The height of the patella was measured before and after operation, and in no case differed by more than 2 mm. Duration N/A. Concurrent medication/care: Surgery was performed by one of three experienced surgeons (including DJW) or their trainees under supervision. All the components were cemented. A midline skin incision and a medial parapatellar, mid vastus or lateral approach was used, with preservation of the infrapatellar fat pad. The TKRs with and without patellar resurfacing were comparable in terms of the operative variables of the surgical approach, the surgeon and lateral release at operation. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=94) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing - In the case of patellar retention a patelloplasty was performed, which involved only resection of marginal, protuberant osteophytes and loose flaps of cartilage. Duration N/A. Concurrent medication/care: Surgery was performed by one of three experienced surgeons (including DJW) or their trainees under

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	supervision. All the components were cemented. A midline skin incision and a medial parapatellar, mid vastus or lateral approach was used, with preservation of the infrapatellar fat pad. The TKRs with and without patellar resurfacing were comparable in terms of the operative variables of the surgical approach, the surgeon and lateral release at operation. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Other author(s) funded by industry (The author or one or more of the authors have received or will receive benefits for personal or professional use from a commercial party related directly or indirectly to the subject of this article. In addition, benefits have been or will be directed to a research fund, foundation, educational institution, or other non-profit organisation with which one or more of the authors are associated.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee Society score at mean 4 years FU at 4 years; Group 1: mean 46.2 (SD 20.1); n=73, Group 2: mean 50 (SD 16.8); n=86
Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 12, Reason: 4 withdrew due to ill health/ moving away/ transport problems, 7 died, 1 lost to FU; Group 2 Number missing: 7, Reason: 3 withdrew due to ill health/ moving away/ transport problems, 3 died, 1 lost to FU
- Actual outcome: Knee Society function score at mean 4 years FU at 4 years; Group 1: mean 14.4 (SD 19.3); n=73, Group 2: mean 18.6 (SD 19.5); n=86
Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 12, Reason: 4 withdrew due to ill health/ moving away/ transport problems, 7 died, 1 lost to FU; Group 2 Number missing: 7, Reason: 3 withdrew due to ill health/ moving away/ transport problems, 3 died, 1 lost to FU

Protocol outcome 2: Major revision: tibia femoral compartments at time to event
- Actual outcome: Two stage revision at mean 4 years FU at 4 years; Group 1: 2/73, Group 2: 1/86; Comments: The three infected TKRs underwent two-stage revision, two with patellar resurfacing at 34 and 40 months and one without at 26 months, respectively, after surgery.
Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 12, Reason: 4 withdrew due to ill health/ moving away/ transport problems, 7 died, 1 lost to FU; Group 2 Number missing: 7, Reason: 3 withdrew due to ill health/ moving away/ transport problems, 3 died, 1 lost to FU

Protocol outcome 3: Reoperation at later than 2 years
- Actual outcome: Reoperation (unrelated to the patellofemoral joint) at mean 4 years FU at 4 years; Group 1: 2/73, Group 2: 3/86; Comments: 2 in resurfacing group - an arthrotomy was performed at five weeks and an arthroscopic washout at six weeks after operation, both for infection.
3 in non-resurfacing group - were an exchange to a conforming plus tibial insert at seven months because of instability, removal of a posterior ganglion at 15 months, and an arthroscopic washout and exchange of the tibial insert performed for infection at four months after operation.
Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low,

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Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 12, Reason: 4 withdrew due to ill health/ moving away/ transport problems, 7 died, 1 lost to FU; Group 2 Number missing: 7, Reason: 3 withdrew due to ill health/ moving away/ transport problems, 3 died, 1 lost to FU	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Vukadin 2017[104]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=60)
Countries and setting	Conducted in Serbia
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 years FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	The inclusion criteria were as follows: symptomatic angular valgus deformities of more than 10° and less than 25° with knee arthrosis in patients older than 55 years in whom radiographic signs of patellofemoral arthrosis are present as well as Outerbridge Grade III and IV intraoperative degenerative patellar or femoral defects (15).
Exclusion criteria	Patients with rheumatoid arthritis and inflammatory arthritis were excluded from the study. Septic arthritis-induced degenerative knee disorder was another exclusion criterion.
Age, gender and ethnicity	Age - Mean (SD): resurfacing - 68.1 (7.034), not resurfaced - 66.6 (6.431). Gender (M:F): 27 male, 33 female. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=30) Intervention 1: Total knee replacement - with patella resurfacing. People with patellar resurfacing - patellar was resurfaced. Duration N/A. Concurrent medication/care: All patients were operated by the same surgical team. The same type of implant was used in all patients - Zimmer Nexgen LPS-type with cemented fixation. In brief, after a longitudinal skin incision, the standard median parapatellar approach was used. Distal femoral cut was performed according to preoperative planning in order to place the femoral component perpendicular to the lower extremity's mechanical axis. Proximal tibial resection was then performed in order to position the tibial component perpendicular to the tibial mechanical axis. Bone cuts were made with minimum bone resection needed. Lateral soft tissue release was made in a step-wise manner. Rotation of the femoral component was determined in accordance with the transepicondylar axis. The size of the components was determined and femoral cuts completed. The soft tissue balance was reassessed, release repeated if necessary and the articular insert chosen. After trial components proved to be well-balanced, uncompromised range of motion definitive components were cemented and implanted after thorough preparation. The patellar surface was

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	inspected and in random selected patients, if cartilage showed degenerative changes graded Outerbridge III or more, patella was prepared. The follow-up comprised regular clinical and radiographic check-ups, 3 and 6 months and one and two years after surgery. Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=30) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing - patellar was not resurfaced. Duration N/A. Concurrent medication/care: All patients were operated by the same surgical team. The same type of implant was used in all patients - Zimmer Nexgen LPS-type with cemented fixation. In brief, after a longitudinal skin incision, the standard median parapatellar approach was used. Distal femoral cut was performed according to preoperative planning in order to place the femoral component perpendicular to the lower extremity's mechanical axis. Proximal tibial resection was then performed in order to position the tibial component perpendicular to the tibial mechanical axis. Bone cuts were made with minimum bone resection needed. Lateral soft tissue release was made in a step-wise manner. Rotation of the femoral component was determined in accordance with the transepicondylar axis. The size of the components was determined and femoral cuts completed. The soft tissue balance was reassessed, release repeated if necessary and the articular insert chosen. After trial components proved to be well-balanced, uncompromised range of motion definitive components were cemented and implanted after thorough preparation. The patellar surface was inspected and in random selected patients, if cartilage showed degenerative changes graded Outerbridge III or more, patella was prepared. The follow-up comprised regular clinical and radiographic check-ups, 3 and 6 months and one and two years after surgery. Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee Society Score at 3 months at 3 months; Group 1: mean 84.77 (SD 6.597); n=30, Group 2: mean 82.83 (SD 8.601); n=30
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 1, Reason: 1 excluded from analysis
- Actual outcome: Knee Society Score at 2 years at 2 years; Group 1: mean 92.27 (SD 2.447); n=30, Group 2: mean 92.2 (SD 2.265); n=30
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 1, Reason: 1 excluded from analysis
- Actual outcome: Knee Society Function Score at 3 months at 3 months; Group 1: mean 84.83 (SD 10.866); n=30, Group 2: mean 83.17 (SD 9.513);

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n=30 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 1, Reason: 1 excluded from analysis - Actual outcome: Knee Society Function Score at 2 years at 2 years; Group 1: mean 96.93 (SD 3.118); n=30, Group 2: mean 95.5 (SD 3.848); n=30 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 1, Reason: 1 excluded from analysis - Actual outcome: Oxford Knee Score at 3 months at 3 months; Group 1: mean 40.57 (SD 2.622); n=30, Group 2: mean 40.2 (SD 2.172); n=30 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 1, Reason: 1 excluded from analysis - Actual outcome: Oxford Knee Score at 2 years at 2 years; Group 1: mean 45.27 (SD 2.348); n=30, Group 2: mean 45.2 (SD 2.024); n=30 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 0, Reason: N/A; Group 2 Number missing: 1, Reason: 1 excluded from analysis	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Waikakul 2000[105]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=47)
Countries and setting	Conducted in Thailand
Line of therapy	1st line
Duration of study	Intervention + follow up: 2 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Inclusion criteria of the patients were primary osteoarthritis of the knee stage III or IV on the operated side with asymptomatic or osteoarthrosis stage I to II which needed no surgery during the follow-up on the other side, adequate soft tissue balance was performed, no evidence of systemic neurological disorders and spinal problems, no underlying disease which compromised neural functions, the ability to walk with or without walking aids before surgery and active movement of the knee from 0 to 90 degrees or more on both knees.
Exclusion criteria	The exclusion criteria were patients who had knee surgery or injury before the trial, inability to walk before the trial, patients under 60 years old, technical error during total knee replacement, incomplete follow up and patients who needed knee surgery on the other side during the follow up.
Age, gender and ethnicity	Age - Mean (SD): 72.25 (9.01). Gender (M:F): 18 male, 29 female. Ethnicity: N/A
Further population details	1. Age: Not elderly ~<75 years old (study defined) 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=21) Intervention 1: Total knee replacement - with patella resurfacing. People with patellar resurfacing - patients underwent TKA with Insall-Burnstein II prosthesis with patellar resurfacing. The conventional steps and techniques were used. The articular cartilage of the patella was examined and staged before resurfacing was performed. After the operation, closed drainage system was used. . Duration N/A. Concurrent medication/care: Perioperative antibiotic administration with cefazolin and amikacin was used in every patient. Pressure dressing with posterior slap was used to temporarily immobilise the knee in full extension. The drain was removed 48 hours after the operation. All dressings and slaps were removed on the 7th post-operative day. Active and passive continuous knee motion exercises were applied to every patient. Partial weight bearing with walking aids and knee brace were used for another 2 months. Quadriceps exercise and position sense training with eye control were used in every patient. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:

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	(n=26) Intervention 2: Total knee replacement - without patella resurfacing. People without patellar resurfacing - patients underwent TKA with Insall-Burnstein II prosthesis without patellar resurfacing. The conventional steps and techniques were used. After the operation, closed drainage system was used. . Duration N/A. Concurrent medication/care: Perioperative antibiotic administration with cefazolin and amikacin was used in every patient. Pressure dressing with posterior slap was used to temporarily immobilise the knee in full extension. The drain was removed 48 hours after the operation. All dressings and slaps were removed on the 7th post-operative day. Active and passive continuous knee motion exercises were applied to every patient. Partial weight bearing with walking aids and knee brace were used for another 2 months. Quadriceps exercise and position sense training with eye control were used in every patient. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year - Actual outcome: Knee rating scale at 3 months at 3 months; Group 1: mean 43 (SD 2.9); n=21, Group 2: mean 48.6 (SD 4.5); n=26 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at later than 2 years - Actual outcome: Knee rating scale at 2 years at 2 years; Group 1: mean 76.6 (SD 2.5); n=21, Group 2: mean 77.2 (SD 2.6); n=26 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Study	Waters 2003[108]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=514 knees)
Countries and setting	Conducted in United Kingdom
Line of therapy	1st line
Duration of study	Intervention + follow up: Mean FU 5.3 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients undergoing primary total knee replacement with the Press-Fit Condylar prosthesis.
Exclusion criteria	N/A
Age, gender and ethnicity	Age - Mean (range): 69.1 (35 to 89). Gender (M:F): 233 female, 157 male. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=243) Intervention 1: Total knee replacement - with patella resurfacing. Patellar resurfaced - patellar was resurfaced. Care was taken to maintain correct patellar alignment, and a lateral release was performed if patellar tracking was impaired. . Duration N/A. Concurrent medication/care: The operation was performed through a standard medial parapatellar approach. All patients were managed with antibiotic prophylaxis from the time of induction of anaesthesia until the wound had healed. Prophylaxis against deep vein thrombosis was continued until the patient was discharged from the hospital. Various methods of prophylaxis were used, including warfarin, low molecular weight heparin, and foot pumps. Each knee was splinted in extension for 48 hour, although static quadriceps exercises were started without delay. Weight bearing was commenced at 24 hours, and flexion was initiated at 48 hours once the splint had been removed. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=231) Intervention 2: Total knee replacement - without patella resurfacing. People without patellar resurfacing - patients underwent trimming of osteophytes. . Duration N/A. Concurrent medication/care: The operation was performed through a standard medial parapatellar approach. All patients were managed with antibiotic prophylaxis from the time of induction of anaesthesia until the wound had healed. Prophylaxis against deep vein thrombosis was continued until the patient was discharged from the hospital. Various methods of prophylaxis were used, including warfarin, low molecular weight heparin, and foot pumps. Each knee was splinted in extension for 48 hour, although static quadriceps exercises were started without delay.

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	Weight bearing was commenced at 24 hours, and flexion was initiated at 48 hours once the splint had been removed. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing:
Funding	Other author(s) funded by industry (In support of their research or preparation of this manuscript, one or more of the authors received grants or outside funding from Johnson and Johnson.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee Society Score at 5.8 years (OA population) at 5.8 years; Group 1: mean 91.4 (SD 5.93); n=201, Group 2: mean 88.5 (SD 10.23); n=202; Comments: in those with osteoarthritis
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: N/A, Reason: excluded due to frailty of patella, lost to FU, died; Group 2 Number missing: N/A, Reason: excluded due to frailty of patella, lost to FU, died
- Actual outcome: Knee Society Score at 5.8 years (RA population) at 5.8 years; Group 1: mean 85.8 (SD 9.41); n=42, Group 2: mean 84.2 (SD 9.64); n=29; Comments: in those with RA
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: N/A, Reason: excluded due to frailty of patella, lost to FU, died; Group 2 Number missing: N/A, Reason: excluded due to frailty of patella, lost to FU, died

Protocol outcome 2: Pain at later than 2 years
- Actual outcome: Anterior knee pain at 5.8 years at 5.8 years; Group 1: 13/243, Group 2: 58/231
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: N/A, Reason: excluded due to frailty of patella, lost to FU, died; Group 2 Number missing: N/A, Reason: excluded due to frailty of patella, lost to FU, died

Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Major revision: tibia femoral compartments at time to event; Minor revision: secondary patella resurfacing at time to event; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Reoperation at later than 2 years ; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ;

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Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year

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Study	Wood 2002[112]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=220 knees)
Countries and setting	Conducted in Australia
Line of therapy	1st line
Duration of study	Intervention + follow up:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients with osteoarthritis scheduled to undergo a primary TKA.
Exclusion criteria	Patients with inflammatory arthritis, a history of patellar fracture, a prior patellectomy, patellofemoral instability, or a prior unicondylar knee replacement were excluded.
Age, gender and ethnicity	Age - Mean (SD): resurfaced - 73.7 (6.5), non-resurfaced - 73.7 (6.4). Gender (M:F): 116 men, 104 women. Ethnicity: N/A
Further population details	1. Age: 2. Indication: 3. Specific implant:
Indirectness of population	No indirectness
Interventions	(n=92) Intervention 1: Total knee replacement - with patella resurfacing. People with patella resurfacing - patella resurfaced. . Duration N/A. Concurrent medication/care: Surgery was performed by one of six experienced surgeons or their trainees under supervision. A Miller-Galante II prosthesis was implanted in all patients, and all components were cemented. When the patella was to be retained, a patelloplasty was performed. A midline skin incision and a standard medial parapatellar approach with preservation of the infrapatellar fat pad were used in all patients. Radiographs were made immediately postoperatively and annually thereafter. . Indirectness: No indirectness Further details: 1. Method of selective resurfacing: (n=128) Intervention 2: Total knee replacement - without patella resurfacing. People without patella resurfacing - patella not resurfaced. When the patella was to be retained, a patelloplasty was performed. . Duration N/A. Concurrent medication/care: Surgery was performed by one of six experienced surgeons or their trainees under supervision. A Miller-Galante II prosthesis was implanted in all patients, and all components were cemented. When the patella was to be retained, a patelloplasty was performed. A midline skin incision and a standard medial parapatellar approach with preservation of the infrapatellar fat pad were used in all patients. Radiographs were made immediately postoperatively and annually thereafter. . Indirectness: No indirectness

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	Further details: 1. Method of selective resurfacing:
Funding	Other author(s) funded by industry (In support of their research or preparation of this manuscript, one or more of the authors received grants or outside funding from Zimmer. None of the authors received payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WITH PATELLA RESURFACING versus WITHOUT PATELLA RESURFACING

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at later than 2 years
- Actual outcome: Knee Score at 48 months at 48 months; Median (inter quartile range)
resurfaced - 87.0 (10.0)
non-resurfaced - 86.5 (11.0)
;
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 14, Reason: died, withdrew, lost to follow up, 9 the patella was too small so were excluded ; Group 2 Number missing: 6, Reason: died, withdrew, lost to follow up
- Actual outcome: Function at 48 months at 48 months; Median (interquartile range)
resurfaced - 70.0 (32.5)
non-resurfaced - 65.0 (28.5);
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 14, Reason: died, withdrew, lost to follow up, 9 the patella was too small so were excluded ; Group 2 Number missing: 6, Reason: died, withdrew, lost to follow up

Protocol outcome 2: Major revision: tibia femoral compartments at time to event
- Actual outcome: Revision of patellar component at 48 months; Group 1: 5/92, Group 2: 0/128
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 14, Reason: died, withdrew, lost to follow up, 9 the patella was too small so were excluded ; Group 2 Number missing: 6, Reason: died, withdrew, lost to follow up

Protocol outcome 3: Minor revision: secondary patella resurfacing at time to event
- Actual outcome: Patellar resurfacing for anterior knee pain at 48 months; Group 1: 0/92, Group 2: 12/128
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 14, Reason: died, withdrew, lost to follow up, 9 the patella was too small so were excluded ; Group 2 Number missing: 6, Reason: died, withdrew, lost to follow up

Protocol outcome 4: Reoperation at later than 2 years
- Actual outcome: Reoperation for maltracking at 48 months; Group 1: 1/92, Group 2: 2/128

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Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 14, Reason: died, withdrew, lost to follow up, 9 the patella was too small so were excluded ; Group 2 Number missing: 6, Reason: died, withdrew, lost to follow up	
Protocol outcomes not reported by the study	Mortality: life expectancy at time to event; Mortality at within 30 days; Quality of life at 6 weeks or earlier; Quality of life at later than 6 weeks up to 1 year; Quality of life at later than 2 years ; Patient Reported Outcome Measures (PROMs) at 6 weeks or earlier; Patient Reported Outcome Measures (PROMs) at later than 6 weeks up to 1 year; Deep surgical site Infection at before JR is revised; Superficial surgical site infection at before JR is revised; Length of stay at in hospital; Reoperation at 6 weeks or earlier; Reoperation at later than 6 weeks up to 1 year; Major adverse events as described by the studies (for example, VTE, myocardial infarction) at before JR is revised; Function at 6 weeks or earlier; Function at later than 6 weeks up to 1 year; Function at later than 2 years ; Pain at 6 weeks or earlier; Pain at later than 6 weeks up to 1 year; Pain at later than 2 years

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Appendix E: Forest plots

E.1 Patella resurfacing versus no patella resurfacing

Figure 2: Quality of life, EQ-5D

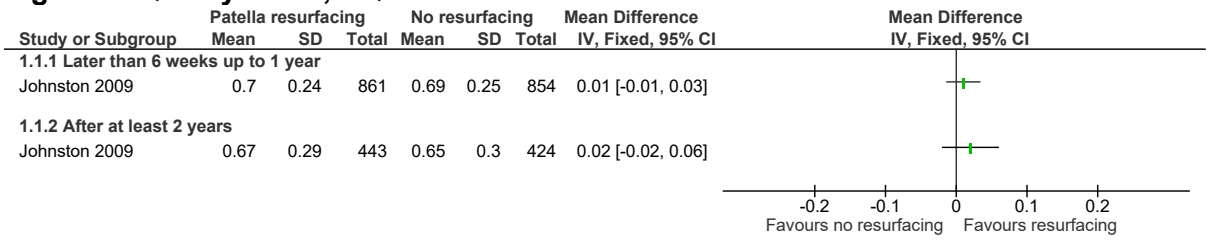

Figure 3: Quality of life, SF-12 – mental subscale

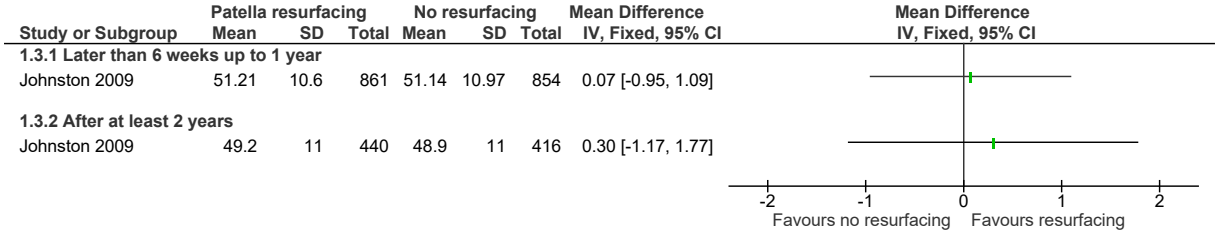

Figure 4: Quality of life, SF-12 – physical subscale

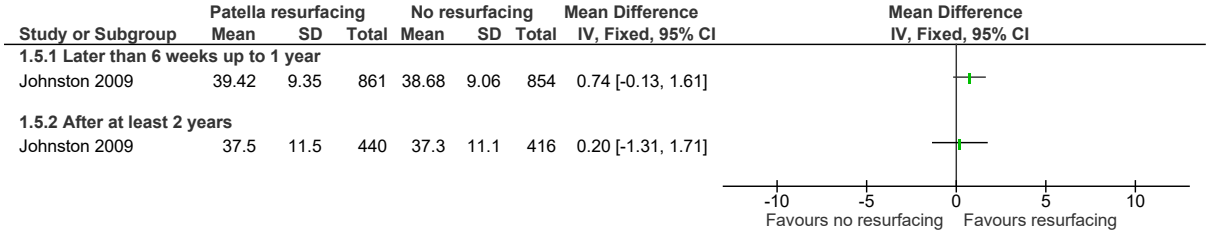

Figure 5: Quality of life, SF-36, RAND-36 scale, KOOS – quality of life later than 6 weeks up to 1 year

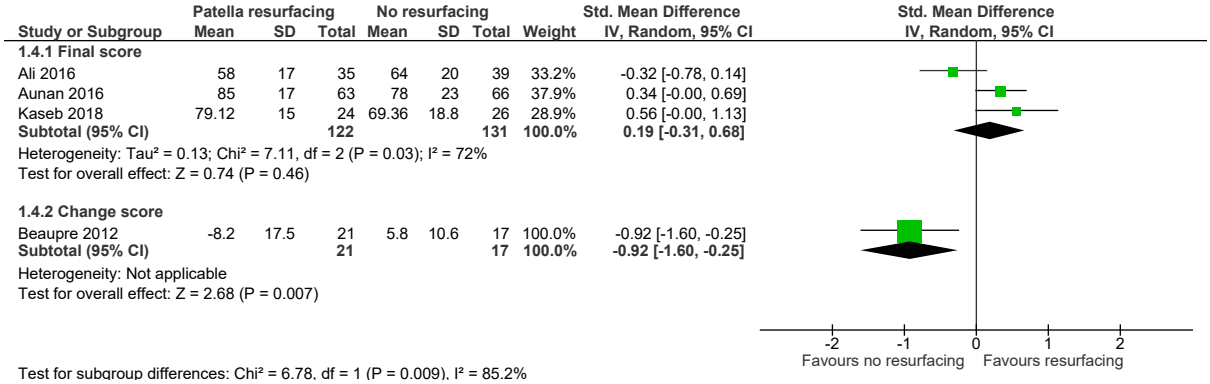

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Figure 6: PROMs, KOOS scale, Quality of life subscale

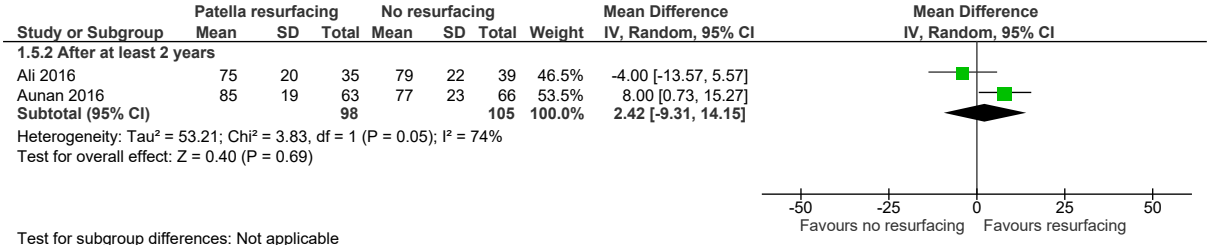

Figure 7: PROMs, KOOS scale, Symptoms subscale

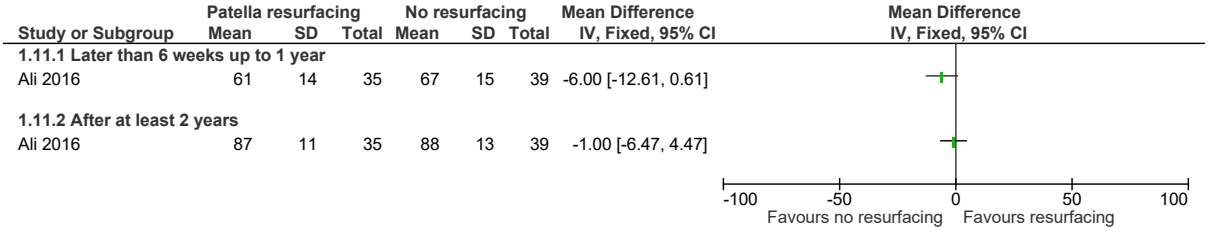

Figure 8: PROMs, KOOS scale, Pain subscale

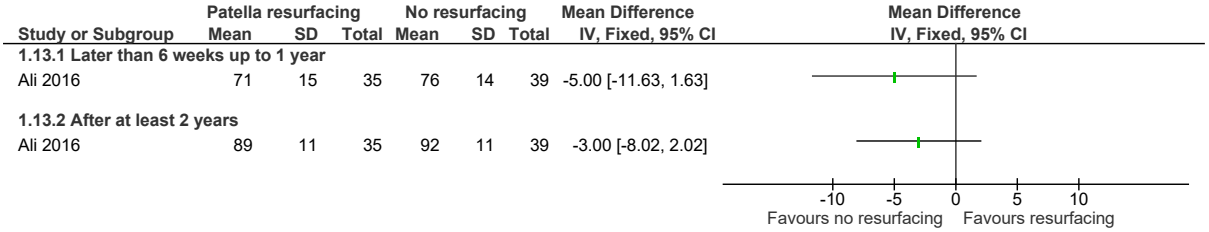

Figure 9: PROMs, Knee Society Scale, American Knee Society Score – Function subscale

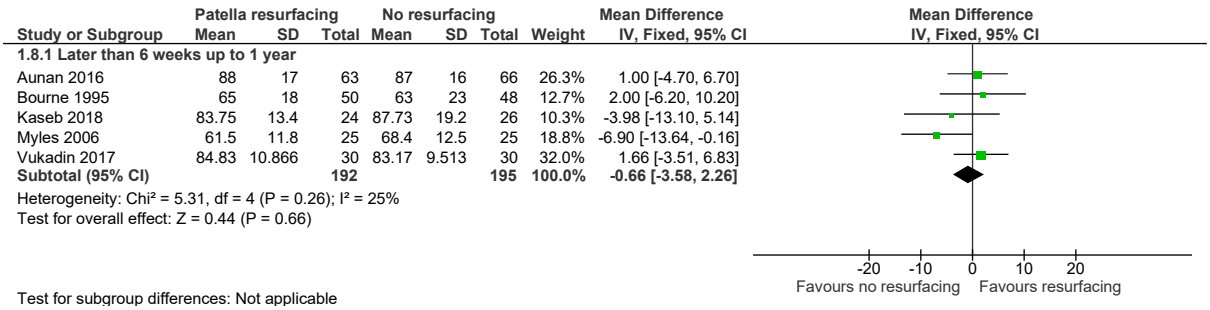

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Figure 10: PROMs, Knee Society Scale – Function subscale

Study or Subgroup	Patella resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
1.9.2 After at least 2 years								
Aunan 2016	83	21	63	83	21	66	4.9%	0.00 [-7.25, 7.25]
Bourne 1995	58.7	24.7	50	59.5	25.3	50	2.7%	-0.80 [-10.60, 9.00]
Campbell 2006	137.6	37.7	46	135.5	31.8	54	1.3%	2.10 [-11.71, 15.91]
Roberts 2015	65.6	28	67	59.8	26.3	47	2.5%	5.80 [-4.27, 15.87]
Smith 2008	14.4	19.3	73	18.6	19.5	86	7.0%	-4.20 [-10.25, 1.85]
Vukadin 2017	96.93	3.118	30	95.5	3.848	30	81.6%	1.43 [-0.34, 3.20]
Subtotal (95% CI)			**329**			**333**	**100.0%**	**1.03 [-0.57, 2.63]**

Heterogeneity: Chi² = 4.16, df = 5 (P = 0.53); I² = 0%
Test for overall effect: Z = 1.26 (P = 0.21)

Test for subgroup differences: Not applicable

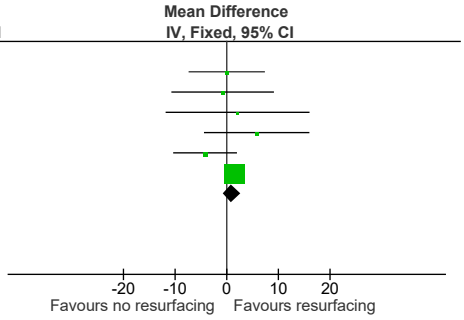

Figure 11: PROMs, Knee Society Scale – Clinical subscale

Study or Subgroup	Patella resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
1.16.1 Later than 6 weeks up to 1 year								
Aunan 2016	89	12	63	84	15	66	18.9%	5.00 [0.32, 9.68]
Bourne 1995	81	14	50	80	11	48	18.4%	1.00 [-3.97, 5.97]
Kaseb 2018	84.75	6.2	24	83.46	8.7	26	19.8%	1.29 [-2.87, 5.45]
Vukadin 2017	84.77	6.597	30	82.83	8.601	30	20.2%	1.94 [-1.94, 5.82]
Waikakul 2000	43	2.9	21	48.6	4.5	26	22.8%	-5.60 [-7.73, -3.47]
Subtotal (95% CI)			**188**			**196**	**100.0%**	**0.50 [-3.88, 4.88]**

Heterogeneity: Tau² = 20.79; Chi² = 27.27, df = 4 (P < 0.0001); I² = 85%
Test for overall effect: Z = 0.22 (P = 0.82)

1.16.3 After at least 2 years								
Aunan 2016	92	9	63	90	14	66	7.4%	2.00 [-2.04, 6.04]
Barrack 1997	59	40	38	62	39	40	0.5%	-3.00 [-20.54, 14.54]
Bourne 1995	86.9	12.8	50	85	13.5	50	5.0%	1.90 [-3.26, 7.06]
Campbell 2006	71.8	14.2	46	74.9	14	54	4.4%	-3.10 [-8.65, 2.45]
Roberts 2015	88	9	54	86.6	11.9	42	6.7%	1.40 [-2.93, 5.73]
Smith 2008	46.2	20.1	73	50	16.8	86	4.1%	-3.80 [-9.62, 2.02]
Vukadin 2017	92.27	2.447	30	92.2	2.265	30	23.9%	0.07 [-1.12, 1.26]
Waikakul 2000	76.6	2.5	21	77.2	2.6	26	21.6%	-0.60 [-2.06, 0.86]
Waters 2003 - RA	85.8	9.41	42	84.2	9.64	29	6.2%	1.60 [-2.92, 6.12]
Waters 2003 -OA	91.4	5.93	201	88.5	10.23	202	20.2%	2.90 [1.27, 4.53]
Subtotal (95% CI)			**618**			**625**	**100.0%**	**0.60 [-0.67, 1.87]**

Heterogeneity: Tau² = 1.37; Chi² = 16.04, df = 9 (P = 0.07); I² = 44%
Test for overall effect: Z = 0.93 (P = 0.35)

Test for subgroup differences: Chi² = 0.00, df = 1 (P = 0.97), I² = 0%

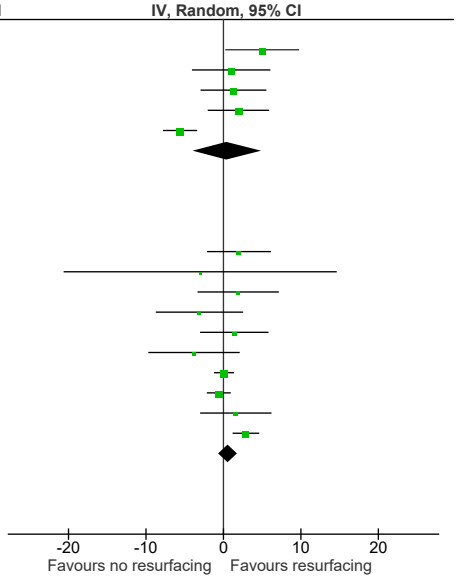

Figure 12: A Knee Society Score of excellent (score range of 80-100) and good (score range of 70-79)

Study or Subgroup	Patella resurfacing Events	Total	No resurfacing Events	Total	Risk Ratio M-H, Fixed, 95% CI
1.16.1 After at least 2 years					
Chawla 2019	45	50	48	50	0.94 [0.84, 1.04]

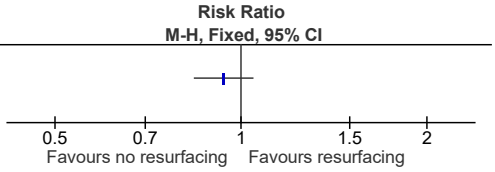

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Figure 13: PROMs, Oxford Knee score, WOMAC score, AKSS

Study or Subgroup	Patella resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Weight	Std. Mean Difference IV, Fixed, 95% CI
1.13.1 Later than 6 weeks up to 1 year								
Aunan 2016	43	6	63	41	7	66	6.4%	0.30 [-0.04, 0.65]
Johnston 2009	31.19	9.56	861	30.49	9.45	854	85.7%	0.07 [-0.02, 0.17]
Kaseb 2018	76.2	16.7	24	81.21	15.7	26	2.5%	-0.30 [-0.86, 0.25]
Myles 2006	80	12	25	77.4	11.8	25	2.5%	0.22 [-0.34, 0.77]
Vukadin 2017	40.57	2.622	30	40.2	2.172	30	3.0%	0.15 [-0.36, 0.66]
Subtotal (95% CI)			**1003**			**1001**	**100.0%**	**0.08 [-0.00, 0.17]**

Heterogeneity: Chi² = 3.74, df = 4 (P = 0.44); I² = 0%
Test for overall effect: Z = 1.90 (P = 0.06)

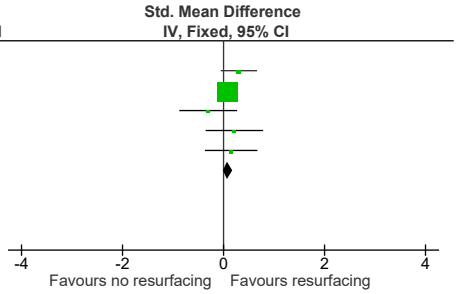

Figure 14: PROMs, Oxford Knee score, HSS score

Study or Subgroup	Patella resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Weight	Std. Mean Difference IV, Fixed, 95% CI
1.15.2 After at least 2 years								
Aunan 2016	43	6	63	42	7	66	12.6%	0.15 [-0.19, 0.50]
Feller 1996	85.7	7	18	88.6	5.2	18	3.4%	-0.46 [-1.12, 0.20]
Johnston 2009	33.6	11.3	418	33.5	10.8	380	78.1%	0.01 [-0.13, 0.15]
Vukadin 2017	45.27	2.348	30	45.2	2.024	30	5.9%	0.03 [-0.47, 0.54]
Subtotal (95% CI)			**529**			**494**	**100.0%**	**0.01 [-0.11, 0.14]**

Heterogeneity: Chi² = 2.59, df = 3 (P = 0.46); I² = 0%
Test for overall effect: Z = 0.20 (P = 0.84)

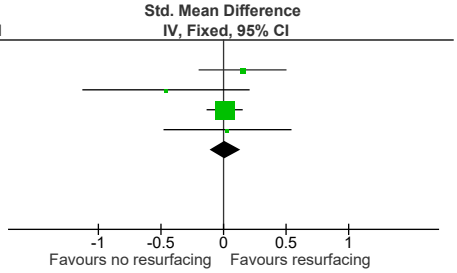

Figure 15: PROMs, Patellar score

Study or Subgroup	Patella resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Mean Difference IV, Fixed, 95% CI
1.28.1 After at least 2 years							
Feller 1996	25.6	4.8	18	27.8	3.9	18	-2.20 [-5.06, 0.66]

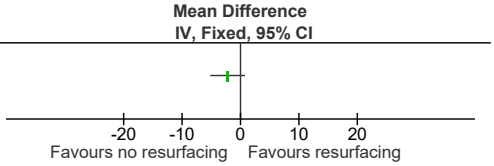

Figure 16: PROMs, WOMAC stiffness sub-scale, later than 6 weeks up to 1 year

Study or Subgroup	Patella resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Beaupre 2012	24.4	24.5	21	8.3	32.3	17	0.2%	16.10 [-2.49, 34.69]
Myles 2006	5.1	1.6	25	5.1	1.3	25	99.8%	0.00 [-0.81, 0.81]
Total (95% CI)			**46**			**42**	**100.0%**	**0.03 [-0.78, 0.84]**

Heterogeneity: Chi² = 2.88, df = 1 (P = 0.09); I² = 65%
Test for overall effect: Z = 0.07 (P = 0.94)

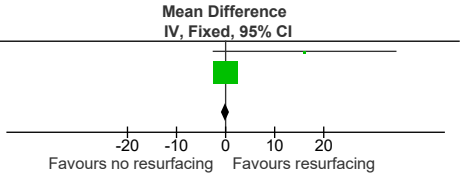

Figure 17: PROMs, WOMAC physical function sub-scale, later than 6 weeks up to 1 year

Study or Subgroup	Resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Beaupre 2012	24.1	16.6	21	19.5	16.9	17	24.3%	4.60 [-6.12, 15.32]
Myles 2006	47	11.4	25	48.7	10.5	25	75.7%	-1.70 [-7.78, 4.38]
Total (95% CI)			**46**			**42**	**100.0%**	**-0.17 [-5.45, 5.12]**

Heterogeneity: Chi² = 1.00, df = 1 (P = 0.32); I² = 0%
Test for overall effect: Z = 0.06 (P = 0.95)

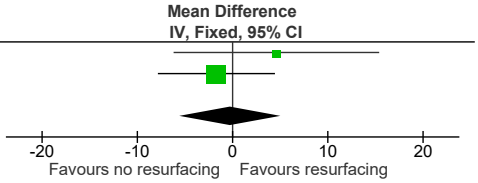

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Figure 18: PROMs, WOMAC pain sub-scale, later than 6 weeks up to 1 year

Study or Subgroup	Resurfacing Mean	SD	Total	No resurfacing Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Beaupre 2012	32.9	18.2	21	34.3	21.5	17	1.8%	-1.40 [-14.25, 11.45]
Myles 2006	15.5	3.6	25	16.6	2.5	25	98.2%	-1.10 [-2.82, 0.62]
Total (95% CI)			**46**			**42**	**100.0%**	**-1.11 [-2.81, 0.60]**

Heterogeneity: Chi² = 0.00, df = 1 (P = 0.96); I² = 0%
Test for overall effect: Z = 1.27 (P = 0.20)

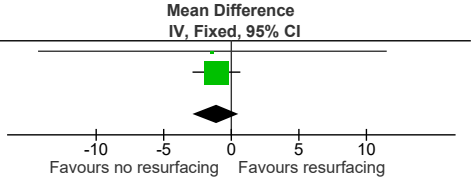

Figure 19: Minor revision

Study or Subgroup	Patella resurfacing Events	Total	No resurfacing Events	Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
1.36.1 After at least 2 years						
Barrack 1997	0	58	7	60	10.9%	0.13 [0.03, 0.58]
Beaupre 2012	1	21	2	17	4.6%	0.39 [0.04, 4.06]
Bourne 1995	2	50	9	50	16.2%	0.24 [0.07, 0.84]
Campbell 2006	1	46	2	54	4.8%	0.59 [0.06, 5.89]
Johnston 2009	2	841	0	830	3.3%	7.30 [0.46, 116.84]
Mayman 2003	2	50	5	50	10.8%	0.40 [0.09, 1.85]
Newman 2000	0	42	6	42	9.2%	0.12 [0.02, 0.62]
Roberts 2015	5	178	9	172	22.1%	0.53 [0.18, 1.55]
Wood 2002	0	92	12	128	18.2%	0.16 [0.05, 0.53]
Subtotal (95% CI)		**1378**		**1403**	**100.0%**	**0.30 [0.18, 0.49]**
Total events	13		52			

Heterogeneity: Chi² = 10.32, df = 8 (P = 0.24); I² = 22%
Test for overall effect: Z = 4.77 (P < 0.00001)

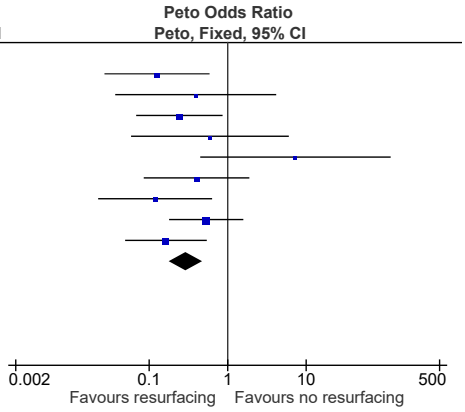

Figure 20: Major revision

Study or Subgroup	Patella resurfacing Events	Total	No resurfacing Events	Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
1.37.1 After at least 2 years						
Barrack 1997	5	58	0	60	6.4%	8.22 [1.38, 48.94]
Johnston 2009	26	841	39	830	83.3%	0.65 [0.40, 1.07]
Smith 2008	2	73	1	86	3.9%	2.33 [0.24, 22.91]
Wood 2002	5	92	0	128	6.4%	11.42 [1.90, 68.67]
Subtotal (95% CI)		**1064**		**1104**	**100.0%**	**0.97 [0.61, 1.52]**
Total events	38		40			

Heterogeneity: Chi² = 15.83, df = 3 (P = 0.001); I² = 81%
Test for overall effect: Z = 0.15 (P = 0.88)

Test for subgroup differences: Not applicable

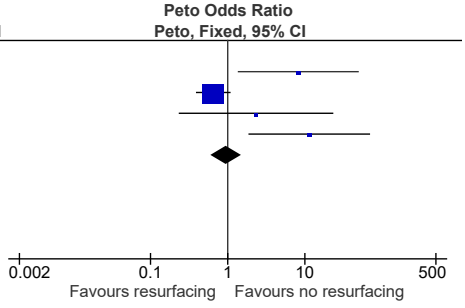

Figure 21: Superficial surgical site infection

Study or Subgroup	Favours resurfacing Events	Total	No resurfacing Events	Total	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
1.38.1 After at least 2 years						
Campbell 2006	3	46	2	54	61.5%	1.80 [0.30, 10.83]
Chawla 2019	1	50	1	50	25.6%	1.00 [0.06, 16.21]
Roberts 2015	1	178	0	172	12.9%	7.14 [0.14, 360.25]
Subtotal (95% CI)		**274**		**276**	**100.0%**	**1.85 [0.45, 7.57]**
Total events	5		3			

Heterogeneity: Chi² = 0.64, df = 2 (P = 0.72); I² = 0%
Test for overall effect: Z = 0.86 (P = 0.39)

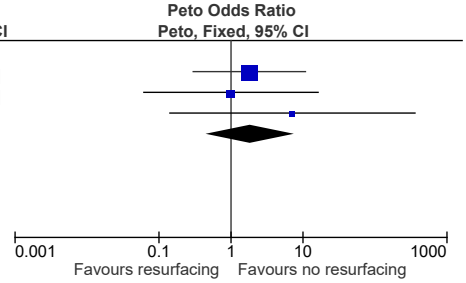

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Figure 22: Deep surgical site infection

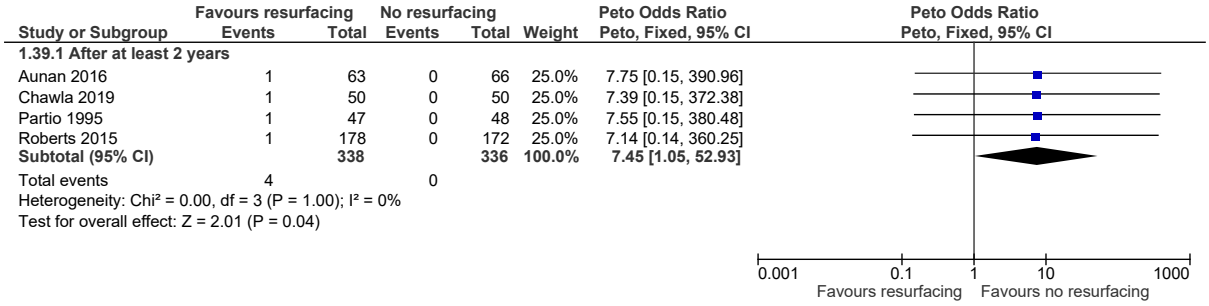


Figure 23: Reoperation

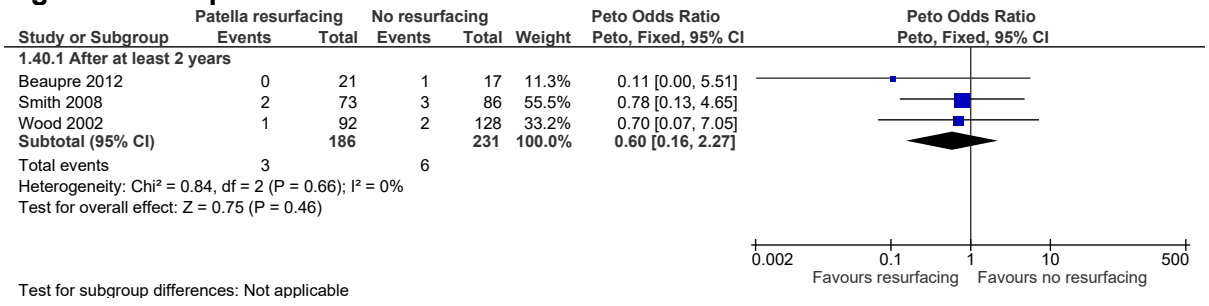


Figure 24: Length of stay

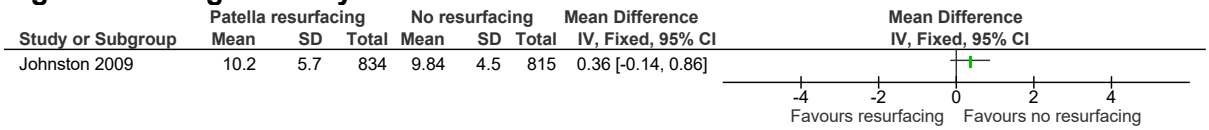


Figure 25: Major adverse events, (deep vein thrombosis)

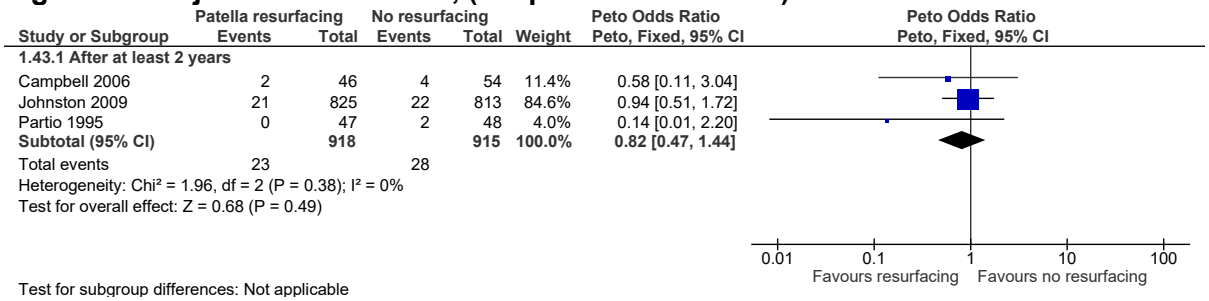
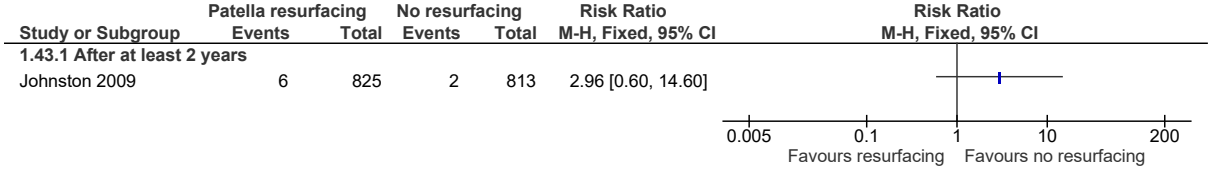


Figure 26: Major adverse events, (Myocardial Infarction)



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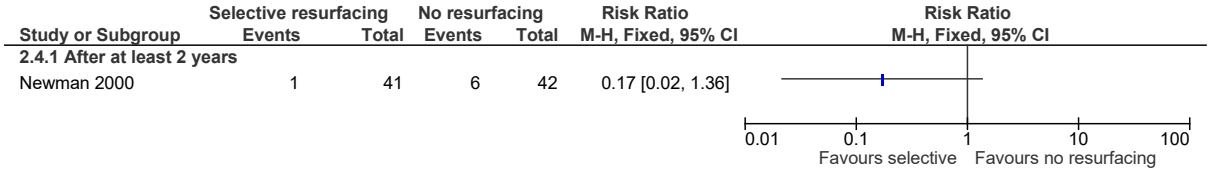
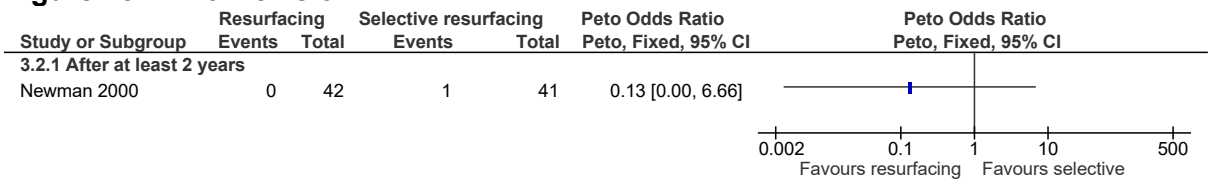
E.2 Selective patella resurfacing versus no patella resurfacing

Figure 27: Minor revision



E.3 Selective patella resurfacing versus patella resurfacing

Figure 28: Minor revision



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Appendix F: GRADE tables

Table 11: Clinical evidence profile: Patella resurfacing versus no patella resurfacing

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Patella resurfacing	Control	Relative (95% CI)	Absolute		
Quality of life (follow-up 3 months; measured with: EQ-5D; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	861	854	-	MD 0.01 higher (0.01 lower to 0.03 higher)	⊕⊕OO LOW	CRITICAL
Quality of life (follow-up 10 years; measured with: EQ-5D; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	861	854	-	MD 0.02 higher (0.02 lower to 0.06 higher)	⊕⊕OO LOW	CRITICAL
Quality of life (follow-up 3 months; measured with: SF-12 - mental subscale; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	861	854	-	MD 0.07 higher (0.95 lower to 1.09 higher)	⊕⊕OO LOW	CRITICAL
Quality of life (follow-up 10 years; measured with: SF-12 - mental subscale; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	440	416	-	MD 0.30 higher (1.17 lower to 1.77 higher)	⊕⊕OO LOW	CRITICAL
Quality of life (follow-up 3 months; measured with: SF-12 physical subscale; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	861	854	-	MD 0.74 higher (0.13 lower to 1.61 higher)	⊕⊕OO LOW	CRITICAL
Quality of life (follow-up 10 years; measured with: SF-12 physical subscale; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	861	854	-	MD 0.20 higher (1.31 lower to 1.71 higher)	⊕⊕OO LOW	CRITICAL

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Quality of life (follow-up 6 - 12 months; measured with: SF-36 scale, RAND-36 scale, KOOS - QoL subscale; range of scores: 0-100; Better indicated by higher values)												
4	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	143	148	-	SMD 0.05 lower (0.63 lower to 0.52 higher)	⊕OOO VERY LOW	CRITICAL
PROMs - Quality of life (follow-up 3 to 6 years; measured with: KOOS scale; range of scores: 0-100; Better indicated by higher values)												
2	randomised trials	very serious[1]	very serious[3]	no serious indirectness	serious[2]	none	98	105	-	MD 2.42 higher (9.31 lower to 14.15 higher)	⊕OOO VERY LOW	CRITICAL
PROMs - Symptoms (follow-up 3 months; measured with: KOOS scale; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	35	39	-	MD 6 lower (12.61 lower to 0.61 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Symptoms (follow-up 6 years; measured with: KOOS scale; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	35	39	-	MD 1 lower (6.47 lower to 4.47 higher)	⊕⊕⊕O MODERATE	CRITICAL
PROMs - Pain (follow-up 3 months; measured with: KOOS scale ; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	35	39	-	MD 5 lower (11.63 lower to 1.63 higher)	⊕OOO VERY LOW	CRITICAL
PROMs - Pain (follow-up 6 years; measured with: KOOS scale; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	35	39	-	MD 3 lower (8.02 lower to 2.02 higher)	⊕OOO VERY LOW	CRITICAL
PROMs - Function (follow-up 3 to 12 months; measured with: KSS score, AKSS; range of scores: 0-100; Better indicated by higher values)												
5	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	192	195	-	MD 0.66 lower (3.58 lower to 2.26 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Function (follow-up 2 to 7.8 years; measured with: KSS score; range of scores: 0-100; Better indicated by higher values)												
6	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	329	333	-	MD 1.03 higher (0.57 lower to 2.63 higher)	⊕⊕OO LOW	CRITICAL
PROMs – Clinical Score (follow-up 3 to 12 months; measured with: KSS score ; range of scores: 0-100; Better indicated by higher values)												

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5	randomised trials	very serious[1]	very serious[3]	no serious indirectness	serious[2]	none	188	196	-	MD 0.50 higher (3.88 lower to 4.88 higher)	⊕OOO VERY LOW	CRITICAL
PROMs – Clinical Score (follow-up 2 to 7.8 years; measured with: KSS score ; range of scores: 0-100; Better indicated by higher values)												
10	randomised trials	very serious[1]	serious[3]	no serious indirectness	no serious imprecision	none	618	625	-	MD 0.60 higher (0.67 lower to 187 higher)	⊕OOO VERY LOW	CRITICAL
PROMs - Knee score of excellent and good (follow-up 5 years; assessed with: Knee society score)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	45/50 (90%)	48/50 (96%)	RR 0.94 (0.84 to 1.04)	58 fewer per 1000 (from 154 fewer to 38 more)	⊕⊕OO LOW	CRITICAL
PROMs - Total score (follow-up 1 years; measured with: Oxford Knee Score, WOMAC score, AKSS; range of scores: 0-100; Better indicated by higher values)												
5	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	1003	1001	-	SMD 0.08 higher (0.00 lower to 0.17 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Total score (follow-up 2 to 5 years; measured with: Oxford Knee Score, HSS score; range of scores: 0-100; Better indicated by higher values)												
4	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	529	494	-	SMD 0.01 higher (0.11 lower to 0.14 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Knee score (follow-up 3 years; measured with: Patellar Score; range of scores: 0-40; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	18	18	-	MD 2.2 lower (5.06 lower to 0.66 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Stiffness score (follow-up 6-12 months; measured with: WOMAC scale; range of scores: 0-100; Better indicated by higher values)												
2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	46	42	-	MD 0.30 higher (0.78 lower to 0.84 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Physical function (follow-up 6-12 months; measured with: WOMAC scale; range of scores: 0-100; Better indicated by higher values)												
2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	46	42	-	MD 0.17 lower (5.45 lower to 5.12 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Pain (follow-up 6-12 months; measured with: WOMAC scale; range of scores: 0-100; Better indicated by higher values)												

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2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	46	42	-	MD 1.11 lower (2.81 lower to 0.60 higher)	⊕⊕OO LOW	CRITICAL
Minor revision (follow-up 10 years)												
9	randomised trials	serious[1]	serious[4]	no serious indirectness	no serious imprecision	none	13/1378 (0.94%)	52/1403 (3.7%)	Peto OR 0.30 (0.18 to 0.49)	30 fewer per 1000 (from 40 fewer to 20 fewer)	⊕⊕OO LOW	CRITICAL
Major revision, 10 years (follow-up 10 years)												
4	randomised trials	serious[1]	very serious[3]	no serious indirectness	very serious[2]	none	38/1064 (3.6%)	40/1104 (3.6%)	Peto OR 0.97 (0.61 to 1.52)	0 fewer per 1000 (from 20 fewer to 10 more)	⊕OOO VERY LOW	CRITICAL
Superficial surgical site infection (follow-up 10 years)												
3	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	5/274 (1.8%)	3/276 (1.1 %)	Peto OR 1.85 (0.45 to 7.57)	10 more per 1000 (from 10 fewer to 30 more)	⊕OOO VERY LOW	IMPORTANT
Deep surgical site infection 2 to 5 years (follow-up 2 to 7.8 years)												
4	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	4/288 (1.2%)	0/336 (0%)	Peto OR 7.45 (1.05 to 52.93)	10 more per 1000 (from 0 more to 30 more)	⊕OOO VERY LOW	IMPORTANT
Reoperation (follow-up 2 to 4 years)												
3	randomised trials	serious[1]	serious[4]	no serious indirectness	very serious[2]	none	3/186 (1.6%)	6/231 (2.6%)	Peto OR 0.60 (0.16 to 2.27)	10 fewer per 1000 (from 40 fewer to 20 more)	⊕OOO VERY LOW	IMPORTANT
Length of stay (Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	834	815	-	MD 0.36 higher (0.14 lower to 0.86 higher)	⊕⊕OO LOW	CRITICAL
Major adverse events (follow-up 10 years; assessed with: Deep vein thrombosis)												
3	randomised trials	very serious[1]	serious[4]	no serious indirectness	very serious[2]	none	23/918 (2.5%)	28/915 (3.1%)	Peto OR 0.82 (0.47 to 1.44)	10 fewer per 1000 (from 20 fewer to 10 more)	⊕OOO VERY LOW	IMPORTANT

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Major adverse events (follow-up 10 years; assessed with: Confirmed MI)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	6/825 (0.73%)	2/813 (0.25%)	RR 2.96 (0.6 to 14.6)	5 more per 1000 (from 1 fewer to 33 more)	⊕OOO VERY LOW	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[3] Heterogeneity unexplained by subgroup analysis.
[4] Downgraded by 1 or 2 increments because the number of zero events varies across arms.

Table 12: Clinical evidence profile: Selective patella resurfacing versus no patella resurfacing

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Selective patella resurfacing**	**No resurfacing**	**Relative (95% CI)**	**Absolute**		
Minor revision (follow-up 10 years)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	1/41 (2.4%)	6/42 (14.3%)	RR 0.17 (0.02 to 1.36)	119 fewer per 1000 (from 140 fewer to 51 more)	⊕⊕OO LOW	CRITICAL

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

Table 13: Clinical evidence profile: Selective patella resurfacing versus patella resurfacing

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Selective patella resurfacing**	**Patellar resurfacing**	**Relative (95% CI)**	**Absolute**		
Minor revision (follow-up 5 years)												

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1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	0/42 (0%)	1/41 (2.4%)	Peto OR 0.13 (0 to 6.66)	20 fewer per 1000 (from 90 fewer to 40 more)	⊕⊕OO LOW	CRITICAL

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

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Appendix G: Health economic evidence selection

Figure 29: Flow chart of health economic study selection for the guideline

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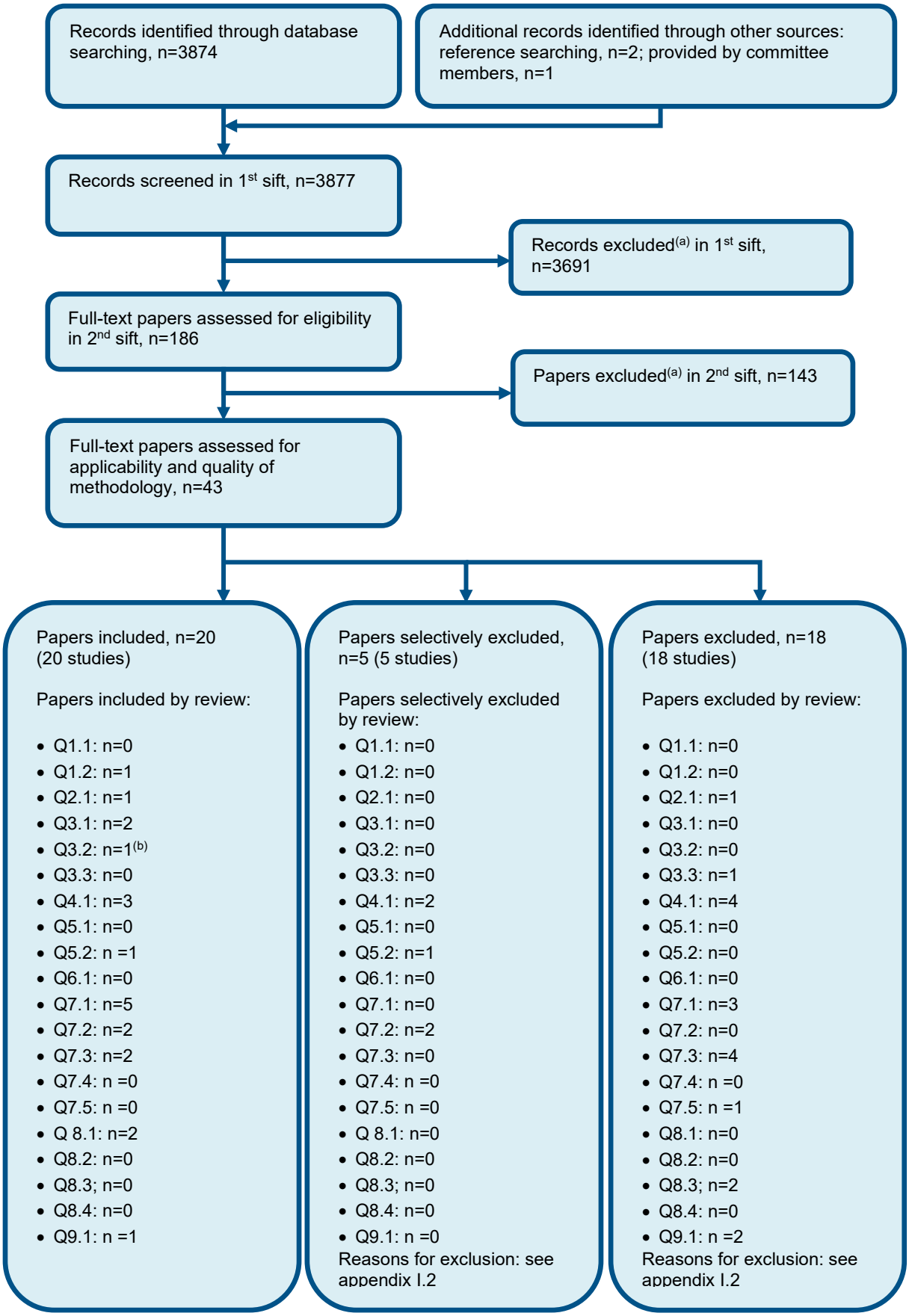

a) Non-relevant population, intervention, comparison, design or setting; non-English language
b) One study was applicable to both Q3.1 and Q3.2

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Appendix H: Health economic evidence tables

Study	Murray 2014[74]			
Study details	**Population & interventions**	**Costs**	**Health outcomes**	**Cost effectiveness**
Economic analysis: Cost utility analysis **Study design:** Within trial analysis (the KAT RCT) **Approach to analysis:** Analysis of individual level data for EQ-5D and resource use **Perspective:** UK NHS **Follow-up** 10 years **Discounting:** Costs: 3.5%; Outcomes: 3.5%	**Population:** Patients indicated for TKA **Patient characteristics:** N=1,715 Mean age: 70 years old (SD: 8) for both groups. Male: 45% resurfacing group and 44% non-resurfacing group **Intervention 1:** No patellar resurfacing **Intervention 2:** Patellar resurfacing	**Total cumulative costs 10 years after primary procedure (mean per patient):** Intervention 1: £8,889 Intervention 2: £8,785 Incremental (2−1): £-104 (95% CI: £-630 to £423; p=NR) **Currency & cost year:** 2011 GBP (£) **Cost components incorporated:** Costs associated with an inpatient stay for a primary knee replacement and the resource use over the first 10 years after the procedure.	**Cumulative QALYs 10 years after primary procedure (mean per patient):** Intervention 1: 5.110 Intervention 2: 5.297 Incremental (2−1): 0.187 (95% CI: -0.025 to 0.399; p=NR)	Patellar resurfacing dominated no resurfacing **Analysis of uncertainty:** Probabilistic sensitivity analysis showed that patellar resurfacing had a 95% probability of being cost effective at a celling ratio of £20,000 per QALY. The results were robust to changes in the time horizon, discount rates and costing methodology.
Data sources				
Health outcomes: All outcomes are measured from individual patients taking part in the RCT. Missing data points were imputed. **Quality-of-life weights:** EQ-5D measured from each participant at baseline, 3 months after the primary procedure and annually thereafter. **Cost sources:** NHS resource use was estimated from each individual's surgeon's form, readmission form, hospital care form and annual questionnaire. Additional data on hospitalisations was collected from HES and ISD. Unit costs were taken from NHS and governmental publications, for example, NHS Reference Costs and PSSRU. Costs and resources after discharge were estimated using inverse probability weighting.				
Comments				
Source of funding: Health Technology Assessment programme of the National Institute for Health Research, with additional industry funding for research support in clinical centres from: Howmedia Osteonics; Zimmer; J&J De Puy; Corin Medical; Smith & Nephew Healthcare Ltd.; Biomet Merck Ltd.; Wright Cremascoli**. Limitations:** 48% of patients did not respond at the 10 year follow-up. Missing data was imputed where necessary. Intervention effect is taken from a single RCT, albeit a large and well conducted one, as opposed to a systematic review. **Other:** The initial inpatient costs for patella				

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resurfacing were more expensive than for no resurfacing.

Overall applicability:[(a)] Directly applicable **Overall quality:**[(b)] Minor limitations

Abbreviations: CUA: cost–utility analysis; EQ-5D: Euroqol 5 dimensions (scale: 0.0 [death] to 1.0 [full health], negative values mean worse than death); HES: Hospital Episode Statisitcs; ICER: incremental cost-effectiveness ratio; ISD: Information Services Division; J&J; Johnson & Johnson; KAT: the Knee Arthroplasty Trial; NR: not reported; PSSRU: Personal Social Services Research Unit; QALYs: quality-adjusted life years; TKA: total knee arthroplasty.
(a) Directly applicable / Partially applicable / Not applicable
(b) Minor limitations / Potentially serious limitations / Very serious limitations

Study	**Weeks 2018**[110]			
Study details	**Population & interventions**	**Costs**	**Health outcomes**	**Cost effectiveness**
Economic analysis: Cost utility analysis **Study design:** Decision analytic model **Approach to analysis:** A Markov model of a hypothetical TKA cohort with 3 possible post-operative states: well, patellofemoral pain, or serious adverse event. **Perspective:** Canadian public healthcare payer **Time horizon:** 14 years **Discounting:** Costs: 5%; Outcomes: 5%	**Population:** Patients indicated for TKA **Cohort settings:** Start age: 67 Male: NR **Intervention 1:** No patellar resurfacing **Intervention 2:** Patellar resurfacing	**Total costs (mean per patient):** Intervention 1: £9,211 Intervention 2: £8,948 Incremental (2−1): Patellar resurfacing saves £263 (95% CI: NR; p=NR) **Currency & cost year:** 2015 US dollars ($) presented here as 2015 Great British pounds (£) **Cost components incorporated:** Implant costs, equipment, operating room costs, time in the operating room, length of hospital stay, laboratory and medical tests	**QALYs (mean per patient):** Intervention 1: 5.37 Intervention 2: 6.01 Incremental (2−1): Patellar resurfacing gives 0.64 extra QALYs (95% CI: NR; p=NR)	Patellar resurfacing dominated no resurfacing **Analysis of uncertainty:** A one-way sensitivity analysis varying the secondary resurfacing rate (0%-2%) was conducted. Results showed that when the rate was 0.5% or less for the non-resurfaced group, there was no difference in cost between the 2 procedures
Data sources				
Health outcomes: Adverse events, secondary resurfacing rates and annual cumulative revision rates were taken from the AOANJRR. Patella pain rates were taken from the literature **Quality-of-life weights:** QALYs derived from EQ-5D scores. The EQ-5D scores were obtained from different sources including a study using UK NJR data and a UK based RCT (KAT trial) **Cost sources:** Costs LHSC Case Costing Department, Ontario schedule of Benefits. Direct procedure costs were taken from the costing department at the Schulich School of Medicine and Dentistry, Western University in Canada.				
Comments				
Source of funding: Not specifically reported although it is declared 'one or more of the authors of this paper have disclosed potential or pertinent conflicts of interest' **Limitations:** It is a study with a Canadian perspective but much of the data is Australian and UK NJR data, and costs are presented in US dollars. Confidence intervals for total and incremental outcome and cost differences are not reported. Costs and outcomes were discounted at 5% instead				

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of 3.5%. Limited sensitivity analysis included a small one-way analysis and no probabilistic analysis.

Overall applicability:[a] Partially applicable **Overall quality:**[b] Potentially serious limitations

Abbreviations: AOANJRR: Australian Orthopaedic Association National Joint Replacement Registry; EQ-5D: Euroqol 5 dimensions (scale: 0.0 [death] to 1.0 [full health], negative values mean worse than death); ICER: incremental cost-effectiveness ratio; KAT: the Knee Arthroplasty Trial; LHSC: London Health Sciences Centre; NJR: National Joint Registry; NR: not reported; QALYs: quality-adjusted life years; RCT: randomised controlled trial; TKA: total knee arthroplasty.

(a) Directly applicable / Partially applicable / Not applicable

(b) Minor limitations / Potentially serious limitations / Very serious limitations

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Appendix I: Excluded studies

I.1 Excluded clinical studies

Table 14: Studies excluded from the clinical review

Study	Exclusion reason
Abd-el wahab 1998[1]	Inappropriate comparison
Abraham 1988[2]	Incorrect study design
Agarwala 2018[3]	Incorrect study design
Aglietti 2001[4]	Incorrect interventions.
Agrawal 2011[5]	Systematic review not suitable for inclusion. Included studies checked for this review.
Akhbari 2015[6]	Incorrect interventions.
Albrecht 2016[7]	Incorrect study design
Allan 2004[9]	Abstract
Arirachakaran 2015[10]	Systematic review not suitable for inclusion. Included studies checked for this review.
Arnout 2009[11]	Incorrect interventions
Badhe 2001[13]	Incorrect study design
Baker 2014[14]	Incorrect study design
Bao 2013[15]	Unavailable
Barrack 2000[18]	Incorrect study design
Barrack 2009[16]	Incorrect study design
Bernstein 1998[21]	Unavailable
Bernstein 1998[22]	Unavailable
Berti 2006[23]	Incorrect study design
Bhan 2006[24]	Inappropriate comparison
Bischoff 2014[25]	Conference abstract
Board 2003[26]	Editorial letter
Bourne 1998[27]	Conference abstract
Bourne 2004[28]	Incorrect study design
Boyd 1993[30]	Incorrect study design
Braakman 1995[31]	Incorrect study design
Burnett 2005[36]	Conference abstract
Calvisi 2009[37]	Systematic review not suitable for inclusion. Included studies checked for this review.
Campbell 1999[38]	Conference abstract
Chen 2013[41]	Systematic review not suitable for inclusion. Included studies checked for this review.
Chen 2013[42]	Incorrect study design
Chengqi 2018[43]	Not in English
Choi 2009[44]	Unavailable
Enis 1990[45]	Incorrect interventions
Epinette 2008[46]	Incorrect study design
Feng 2014[48]	Incorrect study design
Ferreira 2018[49]	Incorrect study design

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Study	Exclusion reason
Garneti 2008[50]	Incorrect study design
Grassi 2018[52]	Systematic review not suitable for inclusion. Included studies checked for this review.
Gross 2011[53]	Incorrect study design
He 2011[54]	Systematic review not suitable for inclusion. Included studies checked for this review.
Helmy 2008[55]	Incorrect study design
Hu 2013[56]	Incorrect study design
Ikejiani 2000[57]	Incorrect study design
Kai 2013[59]	Incorrect study design
Kajino 1997[60]	Incorrect interventions
Karachalios 1996[61]	Conference abstract
Keblish 1994[63]	Incorrect study design. Incorrect interventions
Khan 2012[64]	Incorrect study design
Kim 2015[65]	Incorrect study design
Kordelle 2003[66]	Not in English
Li 2011[67]	Systematic review not suitable for inclusion. Included studies checked for this review.
Longo 2018[68]	Systematic review not suitable for inclusion. Included studies checked for this review.
Lygre 2011[69]	Incorrect study design
Maradit-kremers 2017[70]	Incorrect study design
Meijer 2015[72]	Systematic review not suitable for inclusion. Included studies checked for this review.
Mole 1997[73]	Conference abstract
Nizard 2005[78]	Systematic review not suitable for inclusion. Included studies checked for this review.
Ogawa 2016[81]	Incorrect study design
Oh 2006[82]	Inappropriate comparison
O'Shea 2004[79]	Conference abstract
O'Shea 2006[80]	Conference abstract
Parvizi 2005[84]	Systematic review not suitable for inclusion. Included studies checked for this review.
Patel 2011[85]	Incorrect study design
Peng 2003[86]	Incorrect interventions
Pilling 2012[87]	Systematic review not suitable for inclusion. Included studies checked for this review.
Pollo 2000[88]	Incorrect study design
Schroeder-boersch 1998[91]	Unavailable
Seo 2011[92]	Incorrect study design
Shoji 1998[93]	Unavailable
Shoji 1998[94]	Unavailable
Soudry 1986[96]	Incorrect interventions
Swan 2010[97]	Incorrect study design
Tabutin 2005[98]	Incorrect study design
Tang 2018[99]	Systematic review not suitable for inclusion. Included studies checked for this review.
Tokgozoglu 1998[100]	Unavailable

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Study	Exclusion reason
Tokgozoglu 1998[101]	Unavailable
Tuson 1996[102]	Incorrect interventions.
Van Jonbergen 2014[103]	Incorrect interventions
Walter 2007[106]	Incorrect interventions
Wang 2017 [107]	Not in English
Weale 2000[109]	Abstract
Weeks 2018[110]	Incorrect study design
Woo 2006[111]	Unavailable
Wood 1997[114]	Inappropriate comparison.
Wood 2005[113]	Conference abstract
Zhang 2011[116]	Unavailable
Zhang 2011[117]	Unavailable
Zhang 2016[115]	Inappropriate comparison

I.2 Excluded health economic studies

Table 15: Studies excluded from the health economic review

Reference	Reason for exclusion
Breeman 2011[32]	This study was superseded by Murray 2014[74] which was an evaluation of the same trial but with a longer follow-up.

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Appendix J: Research recommendations

J.1 Selective resurfacing in knee replacement

Research question: In adults having elective knee replacement, what is the clinical and cost effectiveness of total knee replacement with patella resurfacing compared with selective resurfacing?

Why this is important:

Currently over 100,000 knee replacements are performed every year in the UK, costing around £550M. During the operation, the surgeon decides whether to replace the surface of the patella with a plastic button (patella resurfacing). The National Joint Registry records that approximately one third of patients have their patella resurfaced and two thirds do not. Some surgeons routinely resurface the patella in all patients and others never resurface the patella. A third group resurface the patella 'selectively' based on their experience and their assessment of the patient's condition, or based on their assessment during the operation.

Surgeons that resurface the patella state concerns that if the patella is not resurfaced, pain at the front of the knee can persist after surgery, increasing the likelihood of patient dissatisfaction, and also the need for future surgery to replace the kneecap at a later date, if people have pain. Further surgery is associated with an additional inpatient hospital stay, is painful, and exposes the patient to the risk of complications such as infection, as well as an additional cost to the NHS. Surgeons that do not resurface the patella refer to evidence that it does not affect the levels of post-operative pain and patient satisfaction, that it prolongs the surgical time, and that resurfacing risks causing significant injury to the knee cap and associated structures (for example fractures, tendon ruptures) which are often difficult to treat.

The NICE review found good quality evidence, in particular from a large UK RCT that there was no difference in PROMs between those who resurfaced the patella and those who did not, although there was a difference in QALYs in favour of resurfacing over the 10 year horizon. In the same trial, there was a large cost difference between the two strategies in favour of resurfacing (equivalent to approximately £30M/year if applied to all NHS cases) as less people in the resurfacing group required further surgery. Selective resurfacing might improve on this further, as the costs and risks of resurfacing the patella for people who don't need it might be reduced, whilst the risk of further surgery may be mitigated by only resurfacing those who do need it.

Criteria for selecting high-priority research recommendations:

PICO question	Population: People undergoing total knee replacement Intervention(s): Selective patella resurfacing (to be defined by NIHR, researchers, or treating clinicians) Comparison: Patella resurfacing for all people undergoing TKR Outcome(s): 1) Validated participant-reported measures of knee function and/or pain (PROMs) at 12-24 months, 5 and 10 years 2) Adverse events, including fracture, revision, need for further surgery, VTE, infection 3) Costs and Resource use
Importance to patients or the population	Improved knee-related outcomes and reduced complications
Relevance to NICE guidance	The NICE panel were unable to draw conclusions on whether or not to recommend selective resurfacing

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Relevance to the NHS	Given the financial impact of the findings of the KAT trial (equivalent of up to £30M a year savings) the financial impact is likely to be large.
National priorities	The James Lind Alliance Top 10 included: What are the best techniques to control longer-term chronic pain and improve long-term function following hip and knee replacement?
Current evidence base	There has been extensive research comparing resurfacing for all patients compared to not resurfacing, but no evidence on a selective resurfacing strategy.
Equality	There is no reason to think there will be any equality issues or disability groups that will be differentially influenced by this research.
Study design	A pragmatic multi-centre RCT in the UK with a 10 year horizon and support from routine datasets such as NJR for long term outcomes.
Feasibility	Given that a similar trial has been performed in the UK previously, it is likely to be feasible. An internal pilot would be recommended
Other comments	
Importance	• High: the research is essential to inform future updates of key recommendations in the guideline.

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