NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of open femoro–acetabular surgery for hip impingement syndrome

Treating hip impingement syndrome with open femoro–acetabular surgery

Hip impingement syndrome is caused by unwanted contact between abnormally shaped parts of the head of the thigh bone and the hip socket. This results in limited hip movement and pain.

The aim of femoro–acetabular surgery is to improve range of movement and reduce pain. It is believed that it may also help prevent hip arthritis in later life. With the patient under general anaesthesia, the joint is opened and dislocated so that the surgeon can see both of the bones in the hip joint. The surgeon removes some of the cartilage or bone, with the aim of reshaping the joint surface.

Introduction

The National Institute for Health and Clinical Excellence (NICE) has prepared this overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in May 2011.

Procedure name

- Open femoro–acetabular surgery for hip impingement syndrome

Specialty societies

- British Hip Society.

Description

Indications and current treatment

Hip or femoro–acetabular impingement results from abnormally shaped (non-spherical) parts of the femoral head, the acetabulum, or both. The understanding of the pathophysiological mechanisms implicated is evolving, but it is believed that the condition results from (often unrecognised or subtle) injury – particularly during adolescence. Sporting activities involving weight training or loading are believed to be risk factors. Currently, it is believed that femoro–acetabular impingement is a common cause of 'groin pain syndrome' among elite athletes. Impingement is usually caused by jamming of an abnormally shaped femoral head into the acetabulum during forceful motion (especially during flexion) – often called the 'cam' lesion. Impingement can also be caused by contact between the acetabular rim and the femoral head–neck junction – often called the 'pincer' lesion.

Symptoms include restriction of movement, 'clicking' of the hip joint, and pain. Symptoms may occur or be exacerbated during hip flexion activities resulting from sporting activity, or after prolonged sitting. It is also believed that femoro–acetabular impingement leads to osteoarthritis later in life, although the epidemiological evidence for this association is limited. Diagnosis is typically based on history, clinical examination and (usually magnetic resonance) imaging. However, often the presence of impingement and its extent are confirmed endoscopically or through open surgery.

Appropriate management may begin with a trial of conservative measures, including activity modification to reduce excessive motion and loading on the hip. Non-steroidal anti-inflammatory drugs may be useful in patients with acute onset. In patients who are refractory to conservative treatment arthroscopic or open surgery to reshape the femoro–acetabular joint may be required.

Hip pain scores

There are two commonly employed methods for assessing hip function – the Harris hip score and the Merle d'Aubigné scale. The Harris hip score rates the hip based on the 4 criteria of pain, function, range of motion and deformity, scoring 0 to 100 points (higher scores better) with more weighting towards function and pain. The Merle d'Aubigné scale rates pain, walking, range of motion and clinical grade, scoring 4 to 18 points (higher scores better). 18 points is considered an excellent clinical grade, 15 to 17 points good, 13 or 14 points fair, and less than 13 points poor.

Additionally, the University of California, Los Angeles (UCLA) activity score assesses the involvement in and regularity of daily living and sporting activities scoring from 1 to 10 (higher scores better).

What the procedure involves

Open surgery for femoro–acetabular impingement aims to improve the range of movement of the hip joint and reduce femoral abutment against the acetabular rim. The hip joint is dislocated and the femoral head and acetabulum are exposed, using techniques which preserve the blood supply to the femoral head. The lesion(s) responsible for impingement are identified. Non-spherical sections of the femoral head are resected (aiming to establish a spherical surface) along with any prominent sections of the anterior femoral neck. Concomitant abnormalities of the acetabular rim are treated by resection osteoplasty and labral lesions are repaired. After the femoral and acetabular osteoplasties are completed the hip is relocated, and the range of motion and any residual impingement are evaluated. A period of physiotherapy rehabilitation is required after the procedure.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to open femoro–acetabular surgery for hip impingement syndrome. Searches were conducted of the following databases, covering the period from their commencement to 25 October 2010 and updated to 30 March 2011: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with hip impingement syndrome.
Intervention/test	Open femoro–acetabular surgery.
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on approximately 512 patients from 1 non-randomised controlled study[1], and 7 case series[2,3,4,5,6,7,8].

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on open femoro–acetabular surgery for hip impingement syndrome

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Espinosa N (2006)[1] **Non-randomised controlled study** Switzerland Recruitment period: 1999 to 2002 Study population: patients with femoro–acetabular impingement not responding to conservative treatment. Patients with persistent pain, mechanical symptoms, and radiographic structural abnormalities. n = **52 (60 hips - 25 resection. 35 refixation)** Age: 30 years Sex: 63% male Patient selection criteria: Patients with baseline and follow-up clinical and radiographic assessment, patients without open growth plates, age > 44 years, previous hip surgery, or professional athletes. Technique: Open surgery with dislocation in both groups with removal of any non-spheroidal portions of the femoral head, and acetabular rim resection as necessary. Labral resection vs refixation of the acetabular labrum after rim resection. Follow-up: **2 years (median)** Conflict of interest/source of funding: None	Number of patients analysed: **52 (60 hips – 25 resection, 35 refixation).** **Clinical outcomes** Group mean (and range) Merle d'Aubigné score (points) Labral resection / Labral refixation Baseline: 12 (8 to 13) / 12 (5 to 16) 1 year: 14 (14 to 18) / 17 (14 to 18) p = 0.0003 / < 0.0001 2 years: 15 (10 to 18) / 17 (13 to 18) p = 0.0009 / < 0.0001 Clinical status based on Merle d'Aubigné score at 2-year follow up Labral resection / Labral refixation Excellent: 28.0% (7/25) / 80.0% (28/35) Good: 48.0% (12/25) / 14.3% (5/35) Moderate: 20.0% (5/25) / 5.7% (2/35) Poor: 4.0% (1/25) / 0% (0/35) (p = 0.01 between groups) Group mean (and range) Merle d'Aubigné pain score (points) Labral resection / Labral refixation Baseline: 1.4 (0 to 2) / 1.5 (0 to 2) 1 year: 3.4 (0 to 6) / 5.5 (1 to 6) p = 0.005 / < 0.0001 2 years: 4.0 (0 to 6) / 5.6 (4 to 6) p = < 0.0001 / < 0.0001 Mean change in pain score at 2 years follow up Labral resection / Labral refixation Change from baseline: 59% / 73% (p = 0.0009 between groups, absolute figures not reported)	**Complications** Complications were not reported on.	**Follow-up issues**: Retrospective study. Only patients with full clinical data at follow-up included in analysis. No comparison made with those not included in analysis. **Study design issues**: Study with a historical cohort following change in surgical technique. No between-group comparison is made for postoperative group mean Merle d'Aubigné score, only comparison with baseline score **Study population issues**: There were no statistically significant differences between the two groups at baseline in terms of demographic characteristics, clinical and radiographic assessment of hip function, pain score, or extent of damage to cartilage. **Other issues**: Potentially some same patients as reported in Ganz (2001). No comparison to other active intervention, the study evaluates two different surgical protocols.

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Ganz R, (2001)[2] **Case series** Switzerland Recruitment period: 1992 to 1999 Population: n = **213 cases (hips)** Age: 34 years (mean) Sex: not reported Indications: anterior impingement resulting from anterior hypertrophy, idiopathic non-spherical femoral head or an insufficiently narrowed head-neck junction in 77% of cases (164/213). Technique: Incision, capsulotomy, and dislocation of the hip. Treatment consisted mainly of joint debridement and improvement of the anterior head-neck offset (not otherwise described). 24 patients underwent simultaneous intertrochanteric osteotomy (inconsistently reported in study text). Standard rehabilitation programme introduced at 8 weeks after surgery. Follow-up = **2 years minimum, 30 hips to 3+ years, maximum 7 years.** Disclosure of interest: not stated	**Procedure characteristics** Mean operation time from incision to hip dislocation ranged from 25 to 40 minutes. Mean length of stay following surgery was 5 days (range 3–9 days). Mean blood loss 300ml. **Functional outcomes** In hips treated without intertrochanteric osteotomy, abductor force usually reached M4 and in most cases was M5 at 4–6 weeks after self-training for abductor muscles. **Clinical outcomes** Most patients had improved motion of the hip, reported reduced pain, and no increased pain or stiffness was related to the intervention.	**Adverse outcomes** There was no clinical or radiological evidence of avascular necrosis, and no postoperative infections. **Operative complications** Partial neurapraxia of the sciatic nerve was found in 0.9% (2/213) of cases. Both cases resolved within 6 months. Heterotopic ossification was seen in 37% (79/213) of hips at 1 year follow-up 3% (7/213) of cases demonstrated ‘saddleback deformity’ (not otherwise described) of the subcutaneous fat due to insufficiency of sutures at the incision site.	**Study was included in original overview** **Follow-up issues**: Prospective follow-up **Study design issues**: No attempt to quantitatively analyse postoperative pain or hip movement, as these may be affected by the underlying disease and therapeutic approach employed. No details of method of case recruitment. **Study population issues**: No baseline characteristics given. A mixed selection of cases with different underlying disease. **Other issues**: No details of outcome evaluation by third parties.

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Peters C L (2010)[3] **Case series** USA Recruitment period: 2000 to 2008 Study population: Patients with femoroacetabular impingement, with anterior groin pain with flexion activities, and pain on impingement test rotation. Cam impingement n = 33, pincer impingement n = 6, combined n = 57. n = **94 (96 hips)** Age: 28 years Sex: 59% male Patient selection criteria: not reported Technique: patient in lateral position, lateral incision with a greater trochanteric flip osteotomy and z-shaped anterior capsulotomy. Femoral head was dislocated anteriorly. Debriding of excessive osseous-chondral tissue from the femoral head-neck junction and or the acetabular rim, with concurrent labral refixation where possible, and periacetabular osteotomy where necessary. Follow-up: **26 months mean** Conflict of interest/source of funding: none	Number of patients analysed: **94 (96 hips)** **Clinical outcomes** Group mean and range HHS Baseline: 67 (43 to 87) 26 months: 91 (48 to 100) p = < 0.0001 6.3% (6/96) of hips were defined as clinical failures with worsening HHS or requirement for athroplasty. **Radiographic evaluation** Tönnis grade based on presence of cysts, joint space narrowing, and femoral head deformity (low scores better) Grade 0: Baseline n = 29; 26 months n = 21 Grade 1: Baseline n = 44; 26 months n = 38 Grade 2: Baseline n = 23; 26 months n = 33 Grade 3: Baseline n = 0; 26 months n = 4 (Measurement of significance not reported).	**Complications** There were two complications related to the fixation of the great trochanter, one early failure due to cortical screw problem, and one malunion. Both were treated with revised fixation with full recovery and improvement in HHS. There were no nerve palsies, infections, osteonecrosis, or femoral neck fractures.	**Follow-up issues**: Retrospective analysis. No patients lost to follow up. **Study design issues**: The intervention varies between patients treated depending on degree of labral damage and structural abnormality found. Number of clinicians undertaking the procedure and experience is not reported. **Study population issues**: 18 patients had undergone previous hip procedures. **Other issues**: 5 of 6 patients who were clinical failures were treated within the first 30 patients of the cohort. There was no statistically significant association between clinical or radiographic outcome and severity of acetabular lesion at baseline. Authors state that the low complication rate is comparable to what has been reported for less invasive arthroscopic treatment of femoro–acetabular impingement.

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Graves M L (2009)[4] **Case series** USA Recruitment period: 2000 to 2003 Study population: clinical and radiographic findings of femoroacetabular impingement, failed 1 month of conservative management. Mean time since onset of symptoms = 42 months. 48 hips with cam impingement and 12 with additional deformity. n = **46 (48 hips)** Age: 33 years (mean) Sex: 54% male Patient selection criteria: patients without immature skeleton, or advanced osteoarthritis Technique: aim of surgery to restore impingement-free motion. Surgical dislocation and ostrochondroplasty of the head-neck junction. Other procedures varied on intraoperative findings. Acetabuloplasty to decrease overcoverage where necessary, damaged labrum debrided (no excision) and abrasion chondroplasty performed where necessary. Postoperative physical therapy. Follow-up: **38 months (mean)** Conflict of interest/source of funding: none	Number of patients analysed: **46 (48 hips) for clinical follow up.** **Clinical outcomes** Group mean ± standard deviation Merle d'Aubigné score Baseline: 13.0 (± 1.7) 38 months: 16.8 (± 1.3) p = < 0.001 **Radiographic evaluation** Restoration of normal hip offset was noted on X-ray in 100% (46/46) of patients postoperatively. 18.8% (9/48) of patients had Class 1 ossification, the remainder had no sign of heterotopic bone formation.	**Complications** 4.3% (2/46) of patients reported symptoms related to screw placement. Both resolved after removal of screw. There were no wound-healing complications, infections, thromboembolic disease, nerve palsy, femoral neck fracture, or a vascular necrosis.	**Follow-up issues**: Retrospective follow up. 16 patients not available for radiographic follow-up as undertaken in another state. **Study design issues**: The degree of intervention undertaken varied between patients. No independent outcome assessment. **Study population issues**: At baseline all hips had insufficient femoral head-neck offset on X-ray. **Other issues**: None

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Beaulé P E (2007)[5] **Case series** Canada Recruitment period: 2000 to 2003 Study population: persistent hip pain secondary to femoro–acetabular impingement. Labral tear n = 34 hips, calcification within labrum n = 3 hips. n = **34 (37 hips)** Age: 41 years (mean) Sex: 53% male Patient selection criteria: patients with hip pain made worse by long periods of sitting or activities of daily living for > 3 months, and with positive impingement sign on test. Computed tomography confirmed impingement. Technique: surgical dislocation, osteochondroplasty with high-speed burr. Delaminated cartilage debrided as necessary, detachment of labrum and removal of prominent acetabular rim with labral reattachment in 2 hips. Postoperative physical therapy. Follow-up: **3.1 years (mean)** Conflict of interest/source of funding: one author or member of family received benefits from manufacturer.	Number of patients analysed: **34 (37 hips)** **Clinical outcomes** No patient had undergone additional reconstructive hip surgery at 3.1 years follow up. 17.6% (6/34) of patients had no clinical improvement and/or worsening WOMAC score. Group mean ± standard deviation scores Baseline / 3.1 years / p = WOMAC score (points): 61.2 ± 20.0 / 81.4 ± 16.0 / < 0.001 UCLA activity scale (points): 4.8 ± 1.9 / 7.5 ± 2.4 / < 0.001 Short Form 12 survey (physical): 37.3 ± 10.4 / 45.6 ± 10.5 / < 0.001 Short Form 12 survey (mental): 46.4 ± 11.4 / 51.2 ± 11.3 / 0.031	**Complications** outcome — rate Failure of trochanteric fixation requiring reoperation — 1 out of 34 Grade IV heterotopic ossification requiring excision at 10 months — 1 out of 34 Painful internal fixation requiring screw removal (mean 8 months follow up) — 26.5% (9/34)	**Follow-up issues**: Retrospective follow up. **Study design issues**: All procedures undertaken by one author Patient accrual method not reported. **Study population issues**: One patient had undergone previous arthroscopy with partial excision of the labrum. **Other issues**: Authors state that there was no correlation between cartilage damage at baseline and clinical outcome.

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Peters C L (2006)[6] **Case series** USA Recruitment period: 2000 to 2003 Study population: patients with femoroacetabular impingement n = 25, Legg-Calvé Perthes disease n = 3, or slipped capital femoral epiphysis. Cam impingement n = 14, pincer impingement n = 1, mixed impingement n = 14. n = **29 (30 hips)** Age: 31 years (mean) Sex: 55% male Patient selection criteria: patients with anterior groin pain with flexion activities, and positive impingement test. Technique: surgical dislocation,and debridement. Any anterolateral chondrous overgrowth was debrided. Relative femoral neck lengthening and femoral neck reshaping in five patients. Follow-up: **not reported** Conflict of interest/source of funding: none.	Number of patients analysed: **29 (30 hips)** **Procedure characteristics** Mean blood loss was 318 ml and hospital length of stay 3 days. **Clinical outcomes** Group mean (range) points HHS: Baseline 70 (20 to 81); 1 year 88 (49 to 100); p = < 0.0001; Final follow up 87 (49 to 100); p = < 0.0001 13.3% (4/30) of hips were considered clinical failures due to pain or progressive arthosis. 3 of these hips underwent total hip arthroplasty at 3 months, 3 months, and 3 years follow-up respectively. **Radiographic evaluation** 73.3% (22/30) of hips demonstrated complete osseous union of the greater trochanter. There were no screw failures, and no osteonecrosis. Tönnis grade based on presence of cysts, joint space narrowing, and femoral head deformity (low scores better) Grade 0: Final follow up n = 10 Grade 1: Final follow up n = 15 Grade 2: Final follow up n = 3 Grade 3: Final follow up n = 2 (length of follow-up not reported). 1 hip demonstrated a 2-grade progression at final follow up.	**Complications** Adverse events were not reported on.	**Follow-up issues**: Prospective follow up. Mean or median length of follow-up is not reported. Protocol describes HHS score being assessed at baseline, 6 months, 1 year and then yearly for a minimum of 2 years. **Study design issues**: 1 surgeon undertook all procedures. The degree of intervention undertaken varied between patients, particularly with respect to cartilage debridement. No statistical comparison made between radiographic assessment at baseline and follow up. **Study population issues**: Mixed aetiology for treatment. Not all primary hip impingement. **Other issues**: Probably the same patients as reported in Peters (2010)

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Siebenrock K A (2003)[7] **Case series** Switzerland Study period: 1997 to 1999 Population: previous NSAID use = 9%, duration of symptoms = 17 months. n = **22 (29 hips)** Age: 29 years Sex: 66% male Indications: patients with femoro–acetabular impingement based on clinical symptoms, positive anterior impingement test and MRI findings of acetabular rim lesions Technique: incision, capsulotomy, and dislocation of the hip. All hips underwent peri-acetabular osteotomy. Selected cases had arthrotomy to improve low femoral head–neck offset. Follow-up = **30 months** Disclosure of interest: None	Number of patients analysed: **n=22 (29 hips)** **Functional outcomes** Anterior centre-edge angle: Baseline 36° (26–52°); 30 months 28° (16–46°); p 0.002 Merle d'Aubigne score: Baseline 14.0 points (12–16); 30 months 16.9 points (15–18); p < 0.006 There was an increase in average range of internal motion from baseline of 10° (p = 0.006), an increase in flexion of 7° (p = 0.014) and adduction of 8° (p = 0.017). **Clinical outcomes** The surgery resulted in a good or excellent status in 90% (26/29) of hips.	**Complications** Subsequent surgery was required in 12% (3/26) of hips, one procedure each for postoperative loss of reduction, correction of posteroinferior impingement, and recurrent anterior impingement.	**Study was included in original overview** **Follow-up issues**: Prospective study. **Study design issues**: No details provided of method of case accrual. No details provided of independent outcome assessment. **Study population issues**: **Other issues**: Probably same cases as in Ganz (2004)

Abbreviations used: HHS, Harris Hip score; OA, osteoarthritis; UCLA University of California, Los Angeles; WOMAC, western Ontario and McMaster universities osteoarthritis index.

Study details	Key efficacy findings	Key safety findings	Comments
Naal F P (2011)[8] **Case series** Switzerland Study period: 2003 to 2008 Population: mean BMI = 24.6 km/m^2, duration of symptoms = 8 months. n = **22 (30 hips)** Age: 20 years Sex: not reported Indications: patients with femoro–acetabular impingement based on clinical symptoms, positive anterior impingement test and magnetic resonance imaging. Technique: incision, capsulotomy, and dislocation of the hip. All hips underwent peri-acetabular osteotomy. Labral lesions were addressed, and osteochondroplasty performed. Follow-up = **45 months (mean)** Disclosure of interest: None	Number of patients analysed: **n = 22 (30 hips)** **Functional outcomes** Internal rotation (flexion): Baseline 6.0 ± 4.3°; 45 months 14.5 ± 6.2°; p 0.001 α angle: Baseline 69.3 ± 9.9°; 45 months 43.4 ± 4.6°; p < 0.0001 **Clinical outcomes** Tönnis grade remained unchanged in all but 1 hip which deteriorated from 0 to 1. 95.5% (21/22) of patients continued to compete in professional sport at 45 months follow up. 81.8% (18/22) of patients (7 with bilateral treatment) were satisfied or very satisfied with their hip surgery and would undergo it again. **Quality of life** Mean UCLA activity score was 7.6 ± 1.3 Short form-12 physical component score = 51.1 ± 8.0 Short form-12 mental component score = 54.3 ± 7.1	**Complications** There were no intraoperative or postoperative complications.	**Follow-up issues**: Prospective study. **Study design issues**: No details provided of method of case accrual. No details provided of independent outcome assessment. **Study population issues**: Professional sports people **Other issues**: No comparison to baseline for quality of life outcomes.

Efficacy

Clinical outcome

A non-randomised controlled study of 52 patients (60 hips) reported that there was a significantly better clinical status at 2-year follow-up for patients treated by open femoro–acetabular surgery with labral re-fixation than those treated by open femoro–acetabular surgery with labral resection ($p = 0.01$) (absolute figures not reported)[1]. Similarly group mean pain score improved more from baseline in the labral re-fixation group (73%) than in the labral resection group (59%) at 2-year follow-up ($p = 0.0009$) (absolute figures not reported).

A case series of 94 patients (96 hips) reported that group mean Harris hip score improved significantly from 67 points at baseline to 91 points at 26-month follow-up ($p < 0.0001$)[3]. A case series of 46 patients (48 hips) with femoro–acetabular impingement reported that group mean function score (Merle d'Aubigné scale) was significantly improved between baseline (13.0 points) and 38-month follow-up (16.8 points) ($p < 0.001$)[4].

A case series of 34 patients (37 hips) reported that group mean University of California, Los Angeles activity score improved significantly from 4.8 points at baseline to 7.5 points at 3.1-year follow-up after the procedure ($p < 0.001$)[6]. Additionally no patient had undergone further reconstructive hip surgery. A case series of 22 patients (29 hips) reported a significant improvement in hip function (Merle d'Aubigné scale) from 14 points at baseline to 16.9 points at 30-month follow-up[7].

Radiographic evaluation

The case series of 46 patients (48 hips) reported that restoration of normal hip offset was noted on X-ray in 100% (46/46) of patients postoperatively[4].

A case series of 29 patients (30 hips) reported that hip appearance (Tönnis grade) was grade 0 in 10 patients, grade 1 in 15 patients , grade 2 in 3 patients, and grade 3 in 2 patients following the procedure (length of follow-up not reported) and that only 1 patient had demonstrated a progression of 2 grades[6].

Safety

Neurological

A case series of 213 hips reported that partial neurapraxia of the sciatic nerve was found in 1% (2/213) of hips following the procedure both of which resolved by 6-month follow-up[2]. A case series of 46 patients (48 hips) states that there were no reports of nerve palsy in any patients (0/46) at 38-month follow up[4].

Avascular necrosis

The case series of 213 hips reported that there was no clinical or radiographic evidence of avascular necrosis in any hips (0/213) at a minimum 2-year follow up[2]. A case series of 94 patients (96 hips) reported that there was no osteonecrosis in any hip (0/94) at 26-month follow up[4].

Soft tissue ossification

Heterotopic ossification was reported in 37% (79/213) of hips in the case series of 213 hips at a minimum follow-up of two years. Clinical sequelae were not reported[2].

Other complications

The case series of 34 patients (37 hips) reported that painful internal fixation requiring screw removal occurred in 26% (9/340) of patients at a mean follow-up of 8 months following open femoroacetabular surgery for hip impingement[5].

Validity and generalisability of the studies

- No controlled data are available comparing the procedure with other interventions or against natural history.
- A range of outcome assessment scales are used; validation of these scales is often not reported.
- The intervention required is usually individualised to each patient, making comparison between studies difficult.
- Study quality is generally poor, with little prospective data collection in case series.

Existing assessments of this procedure

There were no published assessments from other organisations identified at the time of the literature search.

Related NICE guidance

Below is a list of NICE guidance related to this procedure. Appendix B gives details of the recommendations made in each piece of guidance listed.

Interventional procedures

- Arthroscopic femoro–acetabular surgery for hip impingement syndrome. NICE interventional procedures guidance 213 (2007). Available from www.nice.org.uk/guidance/IPG213

Specialist Advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and does not represent the view of the society.

Prof. D Griffin, Mr F Haddad, Mr D Pegg, Mr J Timperley, Mr R Villar (British Hip Society).

- Four of the Specialist Advisers classified the procedure as established practice and no longer new, and one as novel and of uncertain safety and efficacy.
- The main comparator to this procedure is conservative management, with hip replacement when symptoms deteriorated.
- Adverse events known from reports or experience include vascular insult to the femoral head (rare but serious), non-union of trochanteric fragment, trochanteric bursitis, nerve injury, infection, deep vein thrombosis, heterotopic ossification, accelerated osteoarthritis and postoperative pain.
- Theoretical adverse events might include fracture, postoperative dislocation, haemorrhage and haematoma.
- The key efficacy outcomes for this procedure include pain relief and delayed progression to osteoarthritis.
- One specialist advisor noted that there are no validated outcome measures generally accepted by the profession.
- One Specialist Adviser commented that they had limited exposure to open femoro–acetabular impingement (FAI) surgery because arthroscopic treatments have now largely taken over in their practice. Another pointed out that the open procedure will decrease as arthroscopy increasingly takes off for this condition.

- The observational evidence is strong with several observational reports showing a consistent estimate of effect.
- Specialist training is required including hospital visits, specialist courses, dry bones facilities, cadaver laboratory facilities and mentorship.
- There is presently discussion as to whether arthroscopic FAI surgery can adequately emulate open FAI surgery. It appears that it can do so in properly trained hands. However, it is likely that open FAI surgery will disappear as arthroscopic FAI surgery expands, so this question may eventually be irrelevant.

Patient Commentators' opinions

NICE's Patient and Public Involvement Programme was unable to gather patient commentary for this procedure.

Issues for consideration by IPAC

- Two of the studies included in Table 2 (Siebenbrock 2003, and Ganz 2001) were available in the original overview.
- The committee is also being asked to consider arthroscopic hip impingement treatment at the same meeting. There are no studies comparing the two different approaches.
- There is no other operative comparator to this procedure; it may be considered a stopgap before total hip arthroplasty, although a small proportion of patients in these series who were considered failures subsequently required arthroplasty during relatively short follow up.

References

1 Espinosa N, Rothenfluh DA, Beck M et al. (2006) Treatment of femoro–acetabular impingement: preliminary results of labral refixation. Journal of Bone and Joint Surgery – American Volume 88: 925–35.

2 Ganz R, Gill TJ, Gautier E et al. (2001) Surgical dislocation of the adult hip a technique with full access to the femoral head and acetabulum without the risk of avascular necrosis. Journal of Bone and Joint Surgery (British Volume) 83: 1119–24.

3 Peters CL, Schabel K, Anderson L et al. (2010) Open treatment of femoroacetabular impingement is associated with clinical improvement and low complication rate at short-term followup. Clinical Orthopaedics and Related Research 468: 504–10.

4 Graves ML and Mast JW. (2009) Femoroacetabular impingement: Do outcomes reliably improve with surgical dislocations? Clinical Orthopaedics and Related Research 467: 717–23.

5 Beaule PE, Le Duff MJ, and Zaragoza E. (2007) Quality of life following femoral head-neck osteochondroplasty for femoroacetabular impingement. Journal of Bone and Joint Surgery – American Volume 89: 773–9.

6 Peters CL and Erickson JA. (2006) Treatment of femoro–acetabular impingement with surgical dislocation and debridement in young adults. Journal of Bone and Joint Surgery – American Volume 88: 1735–41.

7 Siebenrock KA, Schoeniger R, and Ganz R. (2003) Anterior femoro–acetabular impingement due to acetabular retroversion. Treatment with periacetabular osteotomy. Journal of Bone and Joint Surgery – American Volume 85-A:278–86.

8 Naal FD, Miozzari HH, Wyss TF et al. (2011) Surgical hip dislocation for the treatment of femoroacetabular impingement in high-level athletes. American Journal of Sports Medicine 39: 544–50.

Appendix A: Additional papers on open femoro–acetabular surgery for hip impingement syndrome

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients / follow-up (FU)	Direction of conclusions	Reasons for non-inclusion in table 2
Anderson LA, Crofoot CD, Erickson J et al. (2010) Acetabular osteochondroplasty and simultaneous reorientation: background and validation of concept. Journal of Orthopedics 33 (5)	n = 5 FU = not reported	There were no intraoperative or postoperative complications in the series of 5 hips.	Larger studies are included in table 2
Bizzini M, Notzli HP, and Maffiuletti NA. (2007) Femoroacetabular impingement in professional ice hockey players: a case series of 5 athletes after open surgical decompression of the hip. American Journal of Sports Medicine 35 (11): 1955–9.	n = 5 FU = 2.7 years	Return to high-level ice hockey after open surgical decompression of the hip was possible in this series of 5 consecutive cases.	Larger studies are included in table 2
Botser IB, Smith TW Jr, Nasser R et al (2011) Open surgical dislocation versus arthroscopy for femoroacetabular impingement: a comparison of clinical outcomes. Arthroscopy 27 (2): 270–8.	n = 1409 FU = N/R	All 3 surgical approaches led to consistent improvements in patient outcomes. Because a wide variety of subjective hip questionnaires were used, direct comparisons could not be made in many cases, and none of the approaches could be clearly shown to be superior to the others. However, it seems that, overall, the arthroscopic method had the lowest complication and fastest rehabilitation rate.	The same studies summarised as included in table 2 with no pooling of data.
Eijer H, Podeszwa DA, Ganz, R. et al. (2006) Evaluation and treatment of young adults with femoro–acetabular impingement secondary to Perthes' disease. Hip International 16 (4): 273–80.	n = 11 FU = 33 months	At a mean follow-up of 33 months, half of all patients were pain-free and all had improvement in pain compared with preoperatively. Ten patients had an improved range of motion and two a slight decrease. No additional necrosis following the dislocation of the femoral head was seen.	Atypical indication Larger studies are included in table 2
Endo H, Noda T, Mitani S. et al. (2010) Operative treatment for pincer type femoroacetabular impingement: a case report. Acta Medica Okayama 64 (2): 149–54.	n = 1 FU = 8 months		Larger studies are included in table 2
May O, Matar WY, and Beaule PE. (2007) Treatment of failed arthroscopic acetabular labral debridement by femoral chondro-osteoplasty: a case series of five patients. Journal of Bone and Joint Surgery – British Volume 89	n = 5 FU = 16 months	At a mean follow-up of 16.3 months (12 to 24) all had symptomatic improvement.	Larger studies are included in table 2

(5): 595-8.			
Matsuda DK, Carlisle JC, Arthurs SC et al (2011) Comparative systematic review of the open dislocation, mini-open, and arthroscopic surgeries for femoroacetabular impingement. Arthroscopy 27 (2) 252–69.	n = 1200 FU = N/R	The arthroscopic method had surgical outcomes equal to or better than the other methods with a lower rate of major complications when performed by experienced surgeons.	The same studies summarised as included in table 2 with no pooling of data.
Ng VY, Arora N, Best TM et al. (2010) Efficacy of surgery for femoroacetabular impingement: a systematic review. American Journal of Sports Medicine 38 (11) 2337–45.	n = 970 FU = N/R	Surgical treatment for FAI reliably improves patient symptoms in the majority of patients without advanced osteoarthritis or chondral damage. Early evidence supports labral refixation. It is too soon to predict whether progression of osteoarthritis is delayed	The same studies summarised as included in table 2 with no pooling of data
Pan H, Kawanabe K, Akiyama H et al. (2008) Operative treatment of hip impingement caused by hypertrophy of the anterior inferior iliac spine. Journal of Bone and Joint Surgery – British Volume 90 (5): 677–9	n = 1 FU = 5 weeks	Resection of the hypertrophic anterior inferior iliac spine was performed which produced full painless restoration of function of the hip.	Atypical indication Larger studies are included in table 2
Pierannunzii L and d'Imporzano M. (2007) Treatment of femoroacetabular impingement: a modified resection osteoplasty technique through an anterior approach. Journal of Orthopedics 30 (2): 96–102	n = 8 FU = 1 year	The proposed technique although borne out only by short-term results appears to be a reliable procedure for the painful impinging hip.	Larger studies are included in table 2
Spencer S, Millis MB and Kim YJ. (2006) Early results of treatment of hip impingement syndrome in slipped capital femoral epiphysis and pistol grip deformity of the femoral head-neck junction using the surgical dislocation technique. Journal of Pediatric Orthopedics 26 (3): 281–285	n = 19 FU = 1 year	The surgical dislocation approach, combined with osteoplasty and/or bony realignment, is a safe efficacious treatment option for symptomatic pistol grip deformity. Outcomes are worse if there is preexisting cartilage damage	Larger studies are included in table 2
Yun HH, Shon WY, and Yun JY. (2009) Treatment of femoroacetabular impingement with surgical dislocation. Clinics in Orthopedic Surgery 1 (3): 146–54	n = 15 hips FU = 2.3 years	Radiographs and magnetic resonance arthrograms are important for making a proper diagnosis of femoro–acetabular impingement and planning treatment. A surgical dislocation can be used to treat femoro–acetabular impingement but further technical improvements will	Larger studies are included in table 2

		be needed for fixation of the greater trochanteric osteotomy site.	

Appendix B: Related NICE guidance for open femoro–acetabular surgery for hip impingement syndrome

Guidance	Recommendations
Interventional procedures	**Arthroscopic femoro–acetabular surgery for hip impingement syndrome. NICE interventional procedures guidance 213 (2007)** 'This guidance is currently under review and is expected to be updated in 2011. For more information, see www.nice.org.uk/guidance/IPG213 1.1 Current evidence on the safety and efficacy of arthroscopic femoro–acetabular surgery for hip impingement syndrome does not appear adequate for this procedure to be used without special arrangements for consent and for audit or research. 1.2 Clinicians wishing to use arthroscopic femoro–acetabular surgery for hip impingement syndrome should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's safety and efficacy in both the short and the long term, and provide them with clear written information. Use of the Institute's information for patients ('Understanding NICE guidance') is recommended (available from www.nice.org.uk/IPG213publicinfo). • Audit and review clinical outcomes of all patients having arthroscopic femoro–acetabular surgery for hip impingement syndrome 1.3 The procedure should only be performed by surgeons with specialist expertise in arthroscopic hip surgery 1.4 The natural history of hip impingement syndrome and the selection of patients for this procedure are uncertain; further research on these issues will be useful. The Institute may review the procedure upon publication of further evidence.

Appendix C: Literature search for open femoro–acetabular surgery for hip impingement syndrome

Databases	Date searched	Version/files	No. retrieved
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	25/10/2010		16
Database of Abstracts of Reviews of Effects – DARE (CRD website)	25/10/2010	NA	5
HTA database (CRD website)	25/10/2010	NA	4
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	25/10/2010		14
MEDLINE (Ovid)	25/10/2010	1950 to October Week 2 2010	531
MEDLINE In-Process (Ovid)	25/10/2010	October 22, 2010	47
EMBASE (Ovid)	25/10/2010	1980 to 2010 Week 42	680
CINAHL (NLH Search 2.0 or EBSCOhost)	25/10/2010	NA	112
BLIC (Dialog DataStar)	25/10/2010	NA	0

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1	(imping* or trap*).tw.
2	(hip or hips).tw.
3	hip/ or hip joint/
4	exp Femur/su [Surgery]
5	Acetabulum/su [Surgery]
6	Acetabul*.tw.
7	(femur* or femor*).tw.
8	6 or 7
9	surg*.tw.
10	8 and 9
11	2 or 3 or 4 or 5 or 10
12	debrid*.tw.
13	Debridement/

14	12 or 13
15	resec*.tw.
16	Correct*.tw.
17	14 or 15 or 16
18	surg*.tw.
19	17 or 18
20	1 and 11 and 19
21	(ganz m or ganz md).au.
22	20 or 21
23	animals/ not humans/
24	22 not 23