Interventions for femoroacetabular impingement

FEEDBACK FOLLOWING PRELIMINARY SEARCH
QUERY REF: Ortho-002
Received: 28.05.2013
Feedback to CSG: mid-July 2013 (due), 16th July 2013 (sent)

SEARCH METHODOLOGY

The content of this feedback report refers only to the most relevant material located under each of the evidence headings and is drawn predominantly from author abstracts or research recommendations within guidelines. The question is posed in the context of surgical and non-surgical interventions for patients presenting with femoroacetabular impingement. Further details of all the studies included in this report are shown in the appendix, sorted by report section and author name.

Criteria used (PICO):

Who? (population)
Patients presenting with femoroacetabular impingement.

What? (intervention/exposure/measure)
Surgical and non-surgical interventions

Comparison
Surgical and non-surgical interventions

What is measured? What are the outcomes?
Pain, function, arthritis (including radiographic changes on X-ray or MRI), cost

Location and setting
Hospital treatment; Worldwide

Exclusion Criteria
Non-English language articles; Letters; Comments; Editorials.

Databases Searched
DUETS; CINAHL; Cochrane Library; EMBASE; MEDLINE; ISRCTN Register; UK Clinical Research Network Study Portfolio; NIH records on ClinicalTrials.gov; Nederlands Trial Register; German Clinical Trials Register; Australian New Zealand Clinical Trials Registry; University Hospital Medical Information Network, Japan; Japan Medical Association Center for Clinical
Trials Register; Japan Pharmaceutical Information Center Clinical Trials Register (JAPIC); World Health Organization (WHO): International Clinical Trials Registry.

Types of Study
Intervention studies

Keywords searched
Search protocols were designed around the following terms: femoroacetabular impingement (e.g. see Appendix 1 for MEDLINE protocol)

Date limits
None

Summary of available evidence

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<thead>
<tr>
<th>EVIDENCE TYPE</th>
<th>INCLUDED IN FEEDBACK</th>
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<td>A Evidence Summaries</td>
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<td>B Systematic Reviews, Meta-analyses &amp; Economic Evaluations</td>
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<td>C Clinical Trial Registries (Current and Closed)</td>
<td>16</td>
</tr>
<tr>
<td>D Primary Research</td>
<td>22 studies (24 articles)</td>
</tr>
<tr>
<td>E Overviews and expert opinions</td>
<td>n/a</td>
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<tr>
<td>F Intellectual Property Office</td>
<td>n/a</td>
</tr>
</tbody>
</table>

RESULTS

A: Good Quality Evidence Summaries (including guidelines)

Three guidelines pertinent to this review were identified these addressed open (NICE, 2011a) and arthroscopic (NICE, 2011b) femoroacetabular surgery for femoroacetabular impingement (FAI), and post-operative guidelines following hip arthroscopy for FAI (Edelstein, Ranawat, Enseki, Yun & Draovitch, 2012). Both guidelines by NICE conclude there is ‘adequate’ short- and medium-term evidence for symptom relief from open and arthroscopic surgery whilst acknowledging these procedures have recognized complications. Furthermore, NICE highlights that only experienced surgeons should undertake open and arthroscopic femoroacetabular surgery.

The guideline for rehabilitation following hip arthroscopy outlines a four-phase approach based on functional and healing milestones; with program design and timetable determined by pre-operative health status and post-operative physical demands (Edelstein et al, 2012).
B: Systematic Reviews and Meta-analyses

See Appendix 2, Section B for details of systematic reviews and meta-analyses included in this section.

Twenty-five articles were identified: twenty four systematic reviews and one economic evaluation. However, one systematic review addressing hip arthroscopy for FAI could not be accessed to obtain the details required (Chattle, 2012).

Systematic Reviews


- General reviews of FAI (only treatment related aspects follow):
  - Samora, Ng & Ellis (2011) found both non-surgical and surgical options proffered for treating FAI. However, usually surgical management seems necessary to enable full return to activity. The lack of prospective long-term evidence was identified along with studies examining implications for FAI from early intervention.
  - Macfarlane & Haddad (2010) found a variety of surgical techniques used to treat FAI. Early interventions involved open surgery but less invasive arthroscopic techniques have evolved which show favourable short-medium term results. They suggest early treatment may help prevent progression to end stage hip OA.

- Surgical interventions for FAI:
  - In general
    - Athletes show a high return to pre-injury activity levels of sport following surgery for FAI (Alradwan, Philippon, Farrokhyar, Chu, Whelan, Bhandari & Ayeni, 2012).
    - Only level III & IV studies identified. All studies report reduced pain and improved hip function following surgery. However, the need for long term studies to assess survivorship, OA progression and FAI natural history was highlighted (Clohisy, St John & Schutz, 2010).
    - One level II, 2 level III and 20 level IV studies identified. All surgeries improved symptoms in most patients without advance OA or chondral damage. Surmise early evidence supports the use of labral refixation. Further, current evidence is insufficient to assess effect of surgery on OA progression (Ng, Arora, Best, Pan & Ellis, 2010).
    - and labral tears (Bedi, Chen, Robertson & Kelly, 2008). This systematic review identified no prospective studies and concluded the evidence base is limited. Furthermore, current evidence does not support the superiority of open surgical dislocation with osteoplasty (historical gold standard) over arthroscopic techniques.
  - Arthroscopy
    - Indications for arthroscopic management of FAI (Ayeni, Wong, Chien, Musahl, Kelly & Bhandari, 2012). These show great inconsistency, thus there is a need for consistent reporting of surgical indications and further research to determine best combination of clinical and radiological indicators.
    - Baldwin, Harrison, Namdari, Nelson & Hosalkar (2009) conclude that hip arthroscopy appears to be viable alternative to open surgery for FAI, but highlight there is insufficient evidence (particularly long term) to assess superiority.
Evidence base for hip arthroscopy in general (Longo, Franceschetti, Maffulli & Denaro, 2010). Whilst providing an alternative to traditional arthrotomy, it is unclear whether arthroscopy is superior to open surgery for managing FAI or labral lesions. The need for prospective studies to evaluate role of hip arthroscopy in clinical practice was highlighted.

Martin & Katz (2012) reviewed the diagnosis and arthroscopic management of FAI and labral tears and surmised that hip arthroscopy (labral repairs and osteoplasty) was effective in relieving hip pain, but identified the need for further research including RCTs to assess efficacy and long-term studies to ascertain whether OA risk is reduce. Furthermore, the advanced training required to undertake arthroscopy was also highlighted.

Evidence base for hip arthroscopy (all indications) concluded there was fair evidence for use in cases of FAI. However, higher quality trials (level I&II) are needed (Stevens, Legay, Glazebrook & Amirault, 2010).

Complications and reoperations during and following hip arthroscopy (all indications) (Harris et al., 2013). The evidence base comprises primarily of level IV studies (88%). Labral tear and FAI the most common diagnoses. Labral treatment and acetabuloplasty/femoral osteochrondroplasty most common interventions. Major complications rate is 0.58% and reoperation rate is 6.3% (usually conversion to THA).

Consistency of clinical and radiological outcomes reported following arthroscopic management of FAI (Hetaimish et al., 2013). A lack of consensus was identified regarding clinical and radiographic outcomes, with a significant range of outcomes reported. The review highlights the need for consistent outcome reporting.

**Arthroscopy versus open surgery**

Open dislocation, arthroscopy and combined approach (Botser, Smith, Nasser & Domb, 2011). This review found all 3 approaches resulted in consistent improvement in patient outcomes. Unfortunately, direct comparison was precluded due to the varied outcomes reported; consequently no approach was clearly shown to be superior to another. However, arthroscopic interventions were noted to have the quickest rehabilitation times and lowest complication rates.

Open surgery, arthroscopy and arthroscopy followed by mini-open surgery degradation (Papalia et al., 2012). These approaches were comparable regarding outcomes and return to sports. Debridement plus osteoplasty resulted in better outcomes than debridement alone. Labral refixation shows significant better outcomes than resection. Procedures are contraindicated in patients with severe OA or cartilage.

Current approaches to surgical management of FAI (Matsuda, Carlisle, Arthurs, Wierks & Philippon, 2011). Only level III or IV evidence was identified regarding open surgical dislocation, mini-open and arthroscopic interventions (the only prospective study was on arthroscopy). All 3 approaches were found effective and relatively safe, although open surgery had comparatively greater major complication rates. Open and mini-open approaches had comparable outcomes. Arthroscopic approaches had equal or better outcomes together with lower major complication rates when carried out by experienced surgeons.
Surgical dislocation of the hip

The indications for surgical dislocation of the hip are inconsistent and lack of consensus, thus, there is a need to develop standardized clinical and radiological criteria (Ayeni, et al., 2013b).

Labral repair versus labral resection

Clinical studies support routine labral repair in conjunction with acetabular rim trimming. However, little evidence is available regarding labral repair for patients with symptomatic labral damage associated with FAI. Furthermore, the current evidence does not support routine labral repair over labral resection (Zaltz, 2012).

Non-surgical management of FAI: The current evidence base is poor (Griffin & Wall, 2012: conference abstract), although physical therapy and activity modification appear beneficial initially. Further studies are required to evaluate the effectiveness of these interventions (Wall, Fernandez, Griffin & Foster, 2013).

Patient reported outcome instruments for FAI and labral hip pathology (Lodhia, Slobogean, Noonan & Gilbart, 2011). Three instruments show clinimetric evidence supporting use in this group of patients: Hip Outcome Score (HOS, shows greatest clinimetric evidence and), also Non-Arthritic Hip Score (NAHS) and 12-item modified WOMAC.

Economic Analysis

Cost-effectiveness of hip arthroscopy for FAI (Shearer, Kramer, Bozic & Feeley, 2012). This study suggests arthroscopy is cost-effective compared with other interventions currently used to treat FAI. Further research is needed to determine the impact on QoL, duration of symptomatic relief and need for subsequent THA.

C: Clinical Trial Registries

See Appendix 2, Section C for details of trials included in this section.

Sixteen on-going and recently completed studies were identified for inclusion in this evidence review. These included seven RCTs, eight prospective observational studies (of which 5 were had controls), three prospective cohort studies and one retrospective observational study.

Randomized controlled trial

- Arthroscopic hip surgery versus conservative management for FAI (C8 & C9 [feasibility study and pilot RCT]).
- Arthroscopic osteochondroplasty versus arthroscopic lavage for FAI (C4)
- Platelet rich plasma during hip arthroscopy for FAI (C15; placebo control)
- Naproxen following hip arthroscopy for FAI (C5; placebo control)
- Physical therapy versus usual care in patients with FAI (C6).
- Physiotherapist-supervised rehabilitation program versus no formal rehabilitation following hip arthroscopy for FAI (C7).
Prospective observational study

- Controlled studies
  - Prevalence of hip pathology (FAI & hip dysplasia) in collegiate athletes and controls (C1; case-control).
  - Biomechanics of hip joint in FAI (C2; case-control).
  - Natural history of cam deformity FAI (symptomatic and asymptomatic) and asymptomatic controls (C3).
  - Dynamic imaging of the hip for pre-operative planning (C12)
  - T1-rho imaging for assessment of cartilage damage of proteoglycan levels (C13)

- Cohort studies
  - Efficacy of anterior approach for blind intra-articular hip injections in patients undergoing hip arthroscopy for FAI (C11)
  - Prevalence of FAI in asymptomatic patients (C14)
  - Hip biomechanics in FAI (C16)

Retrospective observational study

- Relationship between hip impingement and hamstring tendon tear (C10).

<table>
<thead>
<tr>
<th>Ref</th>
<th>Trial Details</th>
<th>Study Period</th>
</tr>
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<tbody>
<tr>
<td>C1</td>
<td>Hip Pathomorphology in Collegiate Athletes and Controls University of Utah <a href="http://ClinicalTrials.gov/show/NCT01799200">link</a></td>
<td>2012-2018</td>
</tr>
<tr>
<td>C2</td>
<td>Biomechanical Assessment of Femoroacetabular Impingement University of Utah <a href="http://ClinicalTrials.gov/show/NCT01575964">link</a></td>
<td>2012-2016</td>
</tr>
<tr>
<td>C3</td>
<td>Hip Impingement - Understanding Cartilage Damage Ottawa Hospital Research Institute; Canadian Institutes of Health Research (CIHR) <a href="http://ClinicalTrials.gov/show/NCT01546493">link</a></td>
<td>2010-2015</td>
</tr>
<tr>
<td>C4</td>
<td>Femoroacetabular Impingement Randomized Controlled Trial McMaster University; American Orthopaedic Society for Sports Medicine <a href="http://ClinicalTrials.gov/show/NCT01623843">link</a></td>
<td>2012-2015</td>
</tr>
<tr>
<td>C5</td>
<td>Influence of Naproxen on Heterotropic Bone Formation Following Hip Arthroscopy University of Utah <a href="http://ClinicalTrials.gov/show/NCT01539447">link</a></td>
<td>2012-2015</td>
</tr>
<tr>
<td>C6</td>
<td>Conservative Management of Femoroacetabular Impingement High Point University <a href="http://ClinicalTrials.gov/show/NCT01814124">link</a></td>
<td>2013-2014</td>
</tr>
<tr>
<td>C7</td>
<td>Efficacy of a physiotherapy program for individuals following arthroscopic surgery for symptomatic femoroacetabular impingement: a randomised controlled trial University of Melbourne <a href="https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=363815">link</a></td>
<td>2013-2014</td>
</tr>
</tbody>
</table>
### C8
**Hip Arthroscopy Versus Conservative Management of Femoroacetabular Impingement**  
*University of Western Ontario, Canada*  
[http://ClinicalTrials.gov/show/NCT01621360](http://ClinicalTrials.gov/show/NCT01621360)  
2011-2014

### C9
**UK FASHIoN: Feasibility study of a trial of Arthroscopic Surgery for Hip Impingement compared with Non-operative care**  
*University Hospitals Coventry & Warwickshire (UK)*  
[http://www.controlled-trials.com/ISRCTN09754699](http://www.controlled-trials.com/ISRCTN09754699)  
2012-2013

### C10
**Is there a relationship between impingement in the hip and tearing of the hamstring tendon near the buttock?**  
*The Avenue Hospital, Windsor, Australia*  
2012-2012

### C11
**Non-guided hip injections are a safe and accurate method of treatment for patients undergoing hip arthroscopy due to Femeroacetabular Impingement (FAI)**  
*The Avenue Hospital, Windsor, Australia*  
2012-2012

### C12
**Dynamic Imaging of the Hip for Pre-operative Planning**  
*Ottawa Hospital Research Institute*  
[http://ClinicalTrials.gov/show/NCT00605969](http://ClinicalTrials.gov/show/NCT00605969)  
2007-2012

### C13
**Characterization of Proteoglycan Depletion in Femoroacetabular Impingement With T1Î¼ Magnetic Resonance Imaging (MRI)**  
*Ottawa Hospital Research Institute*  
[http://ClinicalTrials.gov/show/NCT01578694](http://ClinicalTrials.gov/show/NCT01578694)  
2007-2012

### C14
**Prevalence of Femoroacetabular Impingement in Asymptomatic Patients**  
*Ottawa Hospital Research Institute*  
[http://ClinicalTrials.gov/show/NCT00606047](http://ClinicalTrials.gov/show/NCT00606047)  
2007-2011

### C15
**PRP (Autologous Platelet rich plasma) may improve hip arthroscopy patients outcome.**  
*Millennium Institute of Sport and Health*  
2011-??

### C16
**Hip biomechanic in patients with femoroacetabular impingement**  
*Klinik für Orthopädie, CMSC Berlin*  
[https://drks-neu.uniklinik-freiburg.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00000338](https://drks-neu.uniklinik-freiburg.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00000338)  
2010-??

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**D: Primary Research**

See Appendix 2, Section D for details of studies included in this section.

A total of twenty two controlled and comparative studies (24 papers) were identified for inclusion in this evidence review: Five prospective RCTs (6 articles), 9 prospective comparative studies, 7 retrospective comparative studies (8 articles), and 1 further comparative study where it was unclear if the study was prospective or retrospective.
Prospective RCT

- **Arthroscopic versus open approaches**
  - Open versus arthroscopic procedures for cam-type FAI [cadavers used] concluded precision was comparable, but arthroscopy was less reliable (Mardones, et al., 2009).
  - Open versus arthroscopic osteoplasty for cam-type FAI [cadavers used] found the approaches to have comparable accuracy and precision and so surmised arthroscopic osteoplasty is a feasible alternative to open resection (Sussmann, et al., 2007).

- **Arthroscopic approaches**
  - Arthroscopic labral repair was shown to be superior to labral debridement in women with cam- or pincer-type FAI (Krych, Thompson, Knutson, Scoon & Coleman, 2013).
  - Arthroscopic treatment for FAI including platelet-rich plasma clot versus PRP spray versus saline (placebo) control found the application of PRP-clot to confer some post-operative advantages (Mardones, et al., 2012a, b).
  - Analgesia for arthroscopic hip surgery: lumbar plexus block induction versus lumbar and parasacral sciatic nerve block versus general anaesthesia with morphine. This study found all methods resulted in satisfactory analgesia but morphine increased risk of urinary retention and resulted in greater sedation (Volpato, et al., 2010).

Prospective comparative studies

- **Arthroscopic versus open approaches**
  - Arthroscopic osteoplasty with debridement or refixation versus open surgical dislocation with debridement or refixation in patients with FAI refractory to non-operative management (Bedi, Zaltz, De La Torre & Kelly, 2011). Whilst outcomes were comparable for anterior and anterosuperior cam and focal rim impingement, the open approach allowed greater posterosuperior correction and so may be preferred for FAI with extensive proximal femoral deformity.
  - Hip arthroscopy versus surgical hip dislocation for FAI (Zingg, et al., 2013). Arthroscopy resulted in faster recovery and better short-term outcomes, however, some overcorrection occurred and the reduced frequency of labrum refixation may negatively impact long-term outcomes.

- **Hip arthroscopy**
  - CAT-based navigation conferred no additional benefits over non-navigated hip arthroscopy for cam FAI (Brunner, Horisberger & Herzog, 2009).
  - Hip arthroscopy in under and over 25 year olds (Cooper, Basheer, Maheshwari, Regan & Madan, 2013). Both age groups showed comparable improvements thus arthroscopy appears beneficial for patients irrespective of age.
  - Hip arthroscopy in athletes versus non-athletes (Malviya, Stafford & Villar, 2012). Both groups showed comparable improvements thus arthroscopy seems beneficial for athletes and non-athletes.
  - US guided intra-articular hyaluronic acid injection followed by RM-arthrography versus conventional RM-arthrography (Martini, et al., 2012). Similar diagnostic value of RM-arthrography was attained irrespective of whether this was preceded by viscosupplementation with hyaluronic acid. Hence, enabling integration of diagnosis and treatment in one session.
Peripheral compartment starting point was shown to be superior to central compartment starting point for hip arthroscopy used to treat FAI (Rupp & Duggan, 2012).

Arthroscopic labral repair was found to be superior to arthroscopic labral resection in treating FAI with labral tears (Schilders, Dimitrakopoulou, Bismil, Marchant & Cooke, 2011).

Arthroscopic labral repair versus labral debridement for the treatment of FAI associated with labral pathology (Suri, Choate, Pawlak & Jones, 2012). Whilst short-term outcomes were similar, there was a trend towards greater failure rates in arthroscopic labral debridement.

**Retrospective comparative studies**

- **Arthroscopic versus open approaches**
  - Hip arthroscopy versus surgical hip dislocation result in comparable outcomes for cam-type FAI (Domb, Finley, Baise & Botser, 2012) or cam- and mixed-type FAI (Buchler, et al., 2013).
  - Partial arthroscopic labral resection versus partial arthroscopic labral resection with limited open osteochondroplasty for FAI found better outcomes were achieved with osteochondroplasty i.e. deformity also corrected (Nepple, Zebala & Clohisy, 2009).

- **Open approaches**
  - Open labral refixation was found to be superior to labral resection for FAI (Espinosa, Rothenfluh, Beck, Ganz & Leunig, 2006).

- **Arthroscopic approaches**
  - Arthroscopic labral refixation was found to be superior to arthroscopic excision/debridement for pincer- or combined FAI (Larson & Giveans, 2009; Larson, Giveans & Stone, 2012).
  - Arthroscopic labral refixation versus labral reconstruction for cam-pincer FAI (Matsuda & Burchette, 2013). Labral reconstruction with gracillis tendon autograph was shown to be effective and safe. Furthermore, outcomes may be similar despite those undergoing refixation often having more severe initial labral insufficiency.

- **NSAID versus no prophylaxis post-hip arthroscopy** (Randelli, et al., 2010). NSAIDs appear to be effective prophylactics in reducing heterotopic ossifications following hip arthroscopy.

**Unclear if prospective or retrospective observational studies**

- Hip arthroscopy versus modified Smith-Petersen approach without surgical dislocation for cam-FAI (Pierannunzii, Caforio & D'Imporzano, 2011). Short-term outcomes superior for hip arthroscopy, however, long-term outcomes may be similar.

A further one hundred and eighty five observational studies (case-series and case studies) were also identified from the literature search dating from 2001 (these have not been included in this report, as higher quality evidence is available).

Finally, a feasibility study addressing patient and surgeon opinions regarding an RCT comparing operative and non-operative treatment FAI may also be of interest (Palmer, et al., 2013).
Summary of evidence identified

Three guidelines, 25 secondary research articles (24 systematic reviews, 1 economic evaluation) and 22 primary research studies (5 RCTs, 9 prospective comparative studies, 7 retrospective comparative studies and 1 unclear comparative study) were identified for inclusion in this report. In addition 16 on-going or recently completed registered trials were also found (7 RCTs, 5 prospective controlled studies, 3 prospective cohort studies 1 retrospective observational study). Furthermore, the vast majority of studies identified during the evidence review process were cases series and case studies (n=185), but these have not been detailed in the main body of the report as they rank as low-level evidence.

The systematic reviews highlight the current paucity of high quality evidence regarding the treatment of FAI: irrespective of focus, the evidence-base identified comprised primarily of observational studies and expert opinions. This is consistent with the findings reported in this evidence review.

The primary and secondary research describes a variety of clinical presentations and interventions for the treatment of FAI, further analysis of which is beyond the scope of this report. However, it appears that in general the newer arthroscopic procedures have comparable outcomes to more traditional open surgical procedures, although for some presentations one approach i.e. arthroscopy or open surgery may be preferable or confer greater benefit compared to the other. The current lack of evidence precludes assessing superiority of arthroscopy, open surgery or combined approaches in treating FAI.

In the case of arthroscopic procedures, the current limited evidence base suggests arthroscopic labral repair/refixation is superior to both labral resection and debridement for treating FAI. Finally, there is a dearth of evidence regarding non-surgical interventions for treating FAI.

In summary, this report identifies the lack of high quality clinical trial evidence as a necessary research direction in establishing the effectiveness of surgical and/or non-surgical interventions in the treatment of femoroacetabular impingement.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADL</td>
<td>Activities of daily living</td>
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<td>AP</td>
<td>Anteroposterior</td>
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<td>CAT</td>
<td>Computed tomography</td>
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<tr>
<td>CI</td>
<td>Confidence interval</td>
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<td>FAI</td>
<td>Femoro-acetabular impingement</td>
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<tr>
<td>HA</td>
<td>Hyaluronic acid</td>
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<tr>
<td>HOOS</td>
<td>Hip dysfunction and osteoarthritis outcomes score</td>
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<td>HOS</td>
<td>Hip outcome score</td>
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<tr>
<td>ICER</td>
<td>Incremental cost-effectiveness ratio</td>
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<td>MHHS</td>
<td>Modified Harris hip score (MHHS)</td>
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<td>MRA</td>
<td>Magnetic resonance arthrography</td>
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<td>MRI</td>
<td>Magnetic resonance imaging</td>
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<tr>
<td>NAHS</td>
<td>Non-arthritic hip score</td>
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<tr>
<td>NSAID</td>
<td>Non-steroidal anti-inflammatory drugs</td>
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<td>OA</td>
<td>Osteoarthritis</td>
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<td>PRP</td>
<td>Platelet-Rich Plasma</td>
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<td>QALY</td>
<td>Quality-adjusted life-year</td>
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<td>QoL</td>
<td>Quality of Life</td>
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<tr>
<td>RCT</td>
<td>Randomized controlled trial</td>
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<td>ROM</td>
<td>Range of movement</td>
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<td>SF-12</td>
<td>Short Form 12</td>
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<td>THA</td>
<td>Total hip arthroplasty</td>
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<tr>
<td>US</td>
<td>Ultrasound</td>
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<tr>
<td>VAS</td>
<td>Visual analogue Score</td>
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References


APPENDIX 1: MEDLINE SEARCH PROTOCOL

1. Femoracetabular Impingement/
2. Hip/
3. Hip joint/
4. femoroacetabular.ti,ab.
5. (femoral adj1 acetabular).ti,ab.
6. (femora adj1 acetabular).ti,ab.
7. (femoro adj1 acetabular).ti,ab.
8. hip.ti,ab.
9. or/2-8
10. imping*.ti,ab.
11. 9 and 10
12. 1 or 11
## APPENDIX 2 - FULL TEXT

### SECTION A – EVIDENCE SUMMARIES (INCLUDING GUIDELINES)

<table>
<thead>
<tr>
<th>Title</th>
<th>Summary</th>
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<tbody>
<tr>
<td>Edelstein, Ranawat, Enseki, Yun and Draovitch, (2012)</td>
<td>This guideline addresses rehabilitation after hip arthroscopy for femoro-acetabular impingement and was developed based on a sliding scale of functional progression. An algorithm was devised to highlight how variations in osseous structure, inert tissue laxity and neuromuscular control affect recovery time (linear vs complex patients). Four phases were developed based on functional and healing milestones allowing patients to progress to the next level of activity, with pre-operative health status and post-operative physical demands directing program design and timetable. <strong>Phase I</strong>: goal to progressively regain 75% ROM and normalize gait. <strong>Phase II</strong>: main goal is to gain function and independence in daily activities without discomfort. To achieve uncompensated stomp up/down on 8&quot; box and adequate pelvic control during exercise (low demand). <strong>Phase III</strong>: goal to achieve pain free, non-compensated recreational activity and higher demand work functioning. Manual muscle testing (5/5) achieved for all hip girdle musculature and ability to dynamically control body weight in space. <strong>Phase IV</strong>: requires independence with home and gym protocols and to be asymptomatic and pain free afterwards.</td>
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<tr>
<td>NICE (2011a) IPG403: Open femoro–acetabular surgery for hip impingement syndrome</td>
<td>The interventional procedure guidance report from NICE providence guidance on the use of open femoro-acetabular surgery for hip impingement syndrome. A rapid review of the literature was undertaken; relevant evidence/studies were identified and assessed concerning efficacy and safety (see accompanying overview for details <a href="http://www.nice.org.uk/nicemedia/live/11181/55772/55772.pdf">http://www.nice.org.uk/nicemedia/live/11181/55772/55772.pdf</a> [accessed 03.07.2013]). The document considers the current evidence adequate with regards symptom relief in short- and medium-term and acknowledges the procedure has recognized complications. It concludes that only well-trained surgeons, highly experienced with this type of procedure, should undertake the procedure. Furthermore, the guideline highlights the establishment of a register for open femoro-acetabular surgery for hip impingement syndrome by the British Hip Society and urges all clinicians to submit patient details once open.</td>
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<tr>
<td>NICE (2011b) IPG408: Arthroscopic femoro–acetabular surgery for hip impingement syndrome</td>
<td>The interventional procedure guidance report from NICE providence guidance on the use of arthroscopic femoro-acetabular surgery for hip impingement syndrome. A rapid review of the literature was undertaken; relevant evidence/studies were identified and assessed concerning efficacy and safety (see accompanying overview for details <a href="http://www.nice.org.uk/nicemedia/live/11328/54753/54753.pdf">http://www.nice.org.uk/nicemedia/live/11328/54753/54753.pdf</a> [accessed 03.07.2013]). The document considers the current evidence adequate with regards symptom relief in short- and medium-term and acknowledges the procedure has recognized complications. It concludes that only surgeons with specialist expertise in arthroscopic hip surgery should undertake the procedure. Furthermore, the guideline highlights the establishment of a register for arthroscopic femoro-acetabular surgery for hip impingement syndrome by the British Hip Society and urges all clinicians to submit patient details once open.</td>
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### SECTION B – SYSTEMATIC REVIEWS & META-ANALYSES

Square brackets around the title of an article indicate that whilst the article’s abstract is available in English, the main body of the article is NOT in English.

<table>
<thead>
<tr>
<th>Title</th>
<th>Sample/Aim</th>
<th>Methodology/Comments</th>
<th>Summary</th>
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<tr>
<td>Alradwan, et al., (2012) Return to preinjury activity levels after surgical management of femoroacetabular impingement in athletes.</td>
<td>Systematic review to establish the current evidence base regarding surgical interventions for femoro-acetabular impingement in athletes.</td>
<td>Computerised search of: MEDLINE, EMBASE and Cochrane library from inception to November 2011. Clinical studies of athletes treated for FAI exclusively and a minimum of 6 months follow-up. Random-effects model used to calculate weighted proportions.</td>
<td>Nine studies met inclusion criteria. 72% agreement (95% CI 0%-94%) between the 2 reviewers for inclusion and quality assessment of studies. Total of 418 athletes were surgically treated for FAI. Rate of return to sport was 92% (95% CI, 87%-96%) and rate of return to previous level of competition was 88% (95% CI, 80%-94%). Concludes: surgical treatment for FAI resulted in a high return to pre-injury activity levels of sports.</td>
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<td>Ayeni, et al. (2013a) Sources and quality of literature addressing femoroacetabular impingement.</td>
<td>Systematic review to determine trends in FAI literature with emphasis on source and quality of publications.</td>
<td>Computerised search of: MEDLINE and EMBASE from 2005 to 2010.</td>
<td>Two hundred and ninety eight studies met inclusion criteria. Between 2005 and 2010 there was roughly a five-fold increase in publications. The majority of studies were from orthopaedic literature (197 studies, 66%) the rest from other medical specialities. Publications were primarily level 4 and 5 studies (248 articles): no level 1 studies were identified. Concludes: between 2005 and 2010 there was a dramatic increase in FAI-related publications, although there remains a paucity of high quality studies.</td>
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<td>Source</td>
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<td>Ayeni, et al., (2013b)</td>
<td>Surgical indications for treatment for femoroacetabular impingement with surgical hip dislocation.</td>
<td>Systematic review to identify indications for surgical dislocation of the hip for FAI. Computerised search of: MEDLINE and EMBASE from inception to September 2011. References of included papers were hand-searched for further relevant studies.</td>
<td>Fifteen studies, including a total of 822 patients, met inclusion criteria. A lack of consensus was identified regarding the clinical and radiographic indications for surgical hip dislocation to treat FAI. The most common clinical indications were symptoms such as hip pain (10 papers, 67%), positive impingement (9 papers, 60%), painful/reduced ROM (9 papers, 60%), activity-related groin pain (4 papers, 27%), and non-responsive to non-operative treatment (4 papers, 27%). The most common reported radiological indicators were various impingement findings (15 papers, 100%), a combination of radiographs and MRA (5 papers, 33%) or radiographs and MRI (3 papers, 20%). Concludes: an inconsistency between clinical and radiographic indications for surgical hip dislocation to treat FAI. Thus, there is a need to develop standardized clinical and radiological criteria for surgical treatment for FAI.</td>
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<tr>
<td>Ayeni, et al., (2012)</td>
<td>Surgical indications for arthroscopic management of femoroacetabular impingement.</td>
<td>Systematic review to identify indications for the arthroscopic management of FAI. Computerised search of: MEDLINE and EMBASE from 1980 to June 2011. References of included papers were hand-searched for further relevant studies. Clinical studies of patients treated for FAI and a minimum of 6 months follow-up with clinical outcome data reported.</td>
<td>Twenty studies were included in the review, including a total of 1368 patients. A lack of consensus was identified regarding the clinical and radiographic indications for the arthroscopic management of FAI. Indications varied from positive impingement sign (45%) and symptoms or pain for &gt;6 months (35%) to a series of positive special tests (25%). The most common reported radiological indicators included: results of CAT or MRI scans (60%), cam or pincer lesions on antero-posterior and/or lateral radiographs (50%), loss of sphericity of the femoral neck (30%), acetabular retroversion (30%), magnetic resonance arthrography (25%), reduction in head-neck offset (25%), an alpha angle &gt;50 (25%) and coxa profunda (25%). Concludes: great inconsistency among indications for arthroscopic management of FAI. The need for consistent reporting of surgical indications for arthroscopic management of FAI was highlighted, along with research to determine the best combination of clinical and radiological indicators.</td>
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<td>Baldwin, Harrison, Namdari, Nelson and Hosalkar (2009)</td>
<td>Outcomes of hip arthroscopy for treatment of femoroacetabular impingement: A systematic review.</td>
<td>Systematic review of FAI treated with hip arthroscopy and relief of symptoms and risk of degenerative changes. Computerised search of databases from 1950 to February 2008. Studies with FAI as a major or underlying diagnosis, with hip arthroscopy to treat FAI and pre- and post-operative outcomes reported.</td>
<td>In the short term hip arthroscopy results in favourable outcomes for FAI, although documented, reliable and prolonged relief is uncertain. Furthermore, the lack of long-term data precludes assessing implications regarding the natural history of FAI. Concludes: hip arthroscopy appears to be a viable alternative to open surgery for FAI, however, currently there is insufficient evidence to assess whether arthroscopy is superior to open surgery for FAI.</td>
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Systematic review to determine quality of literature regarding surgical treatment for labral tears and FAI including patient satisfaction and outcomes of open vs arthroscopic procedures.

Computerised search of databases from January 1980 to May 2008. Clinical studies (level I – IV) of patients with a labral tear and/or FAI as major diagnosis. Patients were excluded if they had severe pre-existing OA or acetabular dysplasia.

Nineteen articles reported post-operative outcomes, however, none use a prospective study design and only one article met criteria of a level III study.

Open surgical dislocation with osteoplasty and labral debridement is successful with good correlation between patient satisfaction and positive outcome scores. Studies suggest 65% - 85% are satisfied with outcome at 40 months (mean) post-surgery.

All series found increased failure rate in patients with extensive pre-existing OA.

Arthroscopic treatment of labral tears is effective: 67% to 100% of patients are satisfied with outcome.

Concludes: the evidence base for surgical interventions for labral tears and FAI is limited. The current evidence does not support open surgical dislocation with osteoplasty (historical gold standard) as superior to arthroscopic techniques.


Systematic review to evaluate and compare surgical approaches for FAI.

Computerised search of PubMed and related articles reference list. Level 1 – IV studies of patients treated for FAI. Exclusion of case reports and patients with acetabular dysplasia.

Twenty six articles fitted search criteria and reported clinical outcomes. Three surgical modalities were reported: open surgical dislocation, arthroscopic and combined approaches.

Outcomes were analysed for 1,462 hips in 1,409 patients.

Arthroscopy was the most published modality (62% patients). Labral repair was performed more frequently in open surgical dislocation (45%) and combined approach (41%) than in arthroscopy (23%).

Mean improvement in modified Harris hip score post-operatively was 26.4 for arthroscopy, 20.5 for open surgical dislocation and 12.3 for combined approach.

Return to sport by professional athletes was greater in arthroscopic intervention compare to open surgical dislocation.

Complication rates: 1.7% arthroscopy, 9.2% open surgical dislocation, 16% combined approach.

Concludes: all three modalities resulted in consistent improvement in patient outcomes. However, direct comparison was precluded due to the varied outcome measures used, thus no approach was clearly shown to be superior to another. However, arthroscopic interventions have lowest complication rates and quickest rehabilitation times.
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<tr>
<th>Author(s)</th>
<th>Paper Title</th>
<th>Study Description</th>
<th>Search Method</th>
<th>Inclusion Criteria</th>
<th>Results</th>
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<tr>
<td>Clohisy, St John and Schutz (2010)</td>
<td>Surgical treatment of femoroacetabular impingement: a systematic review of the literature.</td>
<td>Systematic review to examine the evidence base for hip impingement surgery including outcomes, complications and modifiable causes of failure.</td>
<td>Computerised search of: PubMed, EMBASE, CINAHL and the Cochrane Library from 1950 to December 2008. Studies reporting on the surgical treatment of FAI with a minimum of 2 years follow up.</td>
<td>Eleven studies met inclusion criteria: 9 level IV and 2 level III studies. Mean follow up time was 3.2 years (range 2-5.2 years). All studies reported reduced pain and improved hip function following surgery. Conversion to THA was reported in 0% to 26% of cases, whilst major complications occurred in 0% to 18% of procedures. Pain relief and improved function reported in 68%-96% of patients over short-term follow-up across all procedures. Long-term studies are need to assess survivorship, OA progression and FAI natural history.</td>
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<td>Griffin and Wall (2012)</td>
<td>Non-operative treatment of femoroacetabular impingement: Design of a fair comparator for a multi-center national randomized trial of arthroscopic surgery.</td>
<td>Systematic review to inform a feasibility and pilot study to compare arthroscopic surgery and non-operative treatment for FAI.</td>
<td>Computerised search of: PubMed, MEDLINE, EMBASE, CINAHL, AMED and Cochrane Library. Articles referring, describing or providing evidence related to non-operative treatments for FAI were included.</td>
<td>[Conference abstract] Forty-five studies met inclusion criteria: 41 were review/discussion base and included non-operative treatments including conservative treatment (n=28, 68%), activity modification (n=33, 80%), avoiding excessive hip movement and/or rest (n=15, 37%), physical therapy (n=18, 44%), detail on type of physical therapy (n=13, 72%), NSAIDs (n=29, 17%) and intra-articular steroid injections (n=4, 10%). 4 articles were primary research but were level IV evidence or below: 2 suggested favourable outcome with non-operative treatment, and one case-series reported poor outcome of non-operative compared to surgical treatment (but groups were not similarly matched). Concludes: current evidence base for non-operative management of FAI is poor.</td>
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<td>Harris, et al., (2013)</td>
<td>Complications and reoperations during and after hip arthroscopy: a systematic review of 92 studies and more than 6,000 patients.</td>
<td>Systematic review to determine prevalence of complications and reoperations during and post hip arthroscopy.</td>
<td>Multiple medical databases including MEDLINE Clinical outcome studies reporting presence or absence of complications and/or reoperations. Unable to access full article to obtain more detail</td>
<td>Ninety-two studies involving 6,134 patients were included in the review. 88% were level IV studies with short-term follow up (mean = 2.0 years). The 2 most common diagnoses were FAI and labral tear, and the 2 most common treatments were labral treatment and acetabuloplasty/femoral osteochondroplasty. Major and minor complication rates were 0.58% and 7.5% respectively. Iatrogenic chrondrolabral injury and temporary neuropraxia were the most common minor complications. Overall re-operation rate was 6.3% at a mean of 16 months, with THA the most common procedure. Conversion rate to THA was 2.9%. Concludes: Major complication rate was 0.58% after hip arthroscopy, with reoperative rate of 6.3% usually the result of conversion to THA. Minor complications and reoperation are directly related to learning curve of hip arthroscopy. As surgical indications evolve, patient selection should mean conversion to THA is minimized. Also, as minor complications are directly related to technical aspects of procedure, so should reduce with surgeon experience and improved instrumentation.</td>
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<td>Haviv, Burg, Velkes, Salai and Dudkiewicz (2011) Trends in femoroacetabular impingement research over 11 years.</td>
<td>Systematic review to assess the number of articles published in orthopaedic vs non-orthopaedic journals over 11 years, and to evaluate the quality of this evidence.</td>
<td>Two hundred and six papers were identified of which 72% were published in orthopaedic journals. The number of publications increased exponentially over this time period, with a notable increase in clinical trials. However, high-quality evidence was scarce. Concludes: the increase in data from both orthopaedic and non-orthopaedic disciplines is welcome, however, the lack of high-quality evidence for FAI treatment was highlighted.</td>
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<td>Hetaimish, et al. (2013) Consistency of reported outcomes after arthroscopic management of femoroacetabular impingement.</td>
<td>Systematic review to evaluate consistency of clinical and radiographic outcome reporting following arthroscopic management of FAI.</td>
<td>Twenty nine studies met inclusion criteria involving 2,816 patients. A lack of consensus was noted for clinical and radiographic outcomes after arthroscopic treatment of FAI. Reported clinical outcomes include: Harris Hip score (45%), the Non-Arthritic Hip Scale (28%), ROM (34%), pain scores (24%) and patient satisfaction (28%). The most commonly reported radiographic outcomes include the alpha angle (38%), head-neck offset (14%) and degenerative changes (21%). Concludes: A significant range of outcomes are reported after arthroscopic management for FAI. The need for consistent outcome reporting was highlighted.</td>
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<td>Lodhia, Slobogean, Noonan and Gilbart (2011) Patient-reported outcome instruments for femoroacetabular impingement and hip labral pathology: a systematic review of the clinimetric evidence.</td>
<td>Systematic review of patient-reported outcome instruments (content &amp; clinimetric evidence) to assess FAI and labral hip pathology.</td>
<td>Five articles met inclusion criteria and reported on 3 patient-reported outcomes: Hip Outcome Score, the Non-Arthritic Hip Score, and the 12-item modified Western Ontario and McMaster Universities Osteoarthritis Index. The Hip Outcome Score had the highest positive rating for internal consistency, construct validity, agreement, responsiveness, lack of floor/ceiling effect, and interpretability. The Non-Arthritic Hip Score showed evidence for validity and lack of floor/ceiling effect. The 12-item modified Western Ontario and McMaster Universities Osteoarthritis Index showed strong internal consistency and had intermediate construct validity. Concludes: Only 3 patient-related outcome measures show clinimetric evidence supporting use for patients with FAI and labral pathology, with the Hip Outcome Score showing greatest clinimetric evidence and most proven instrument for this group of patients. Finally, the need for further clinimetric evaluation of commonly used patient-reported outcome instruments for non-arthritic hip pathologies is highlighted.</td>
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| Longo, Franceschetti, Maffulli and Denaro (2010) | Systematic review to assess evidence base for hip arthroscopy. | Computerised search of: Pubmed, Ovid and Cochrane Reviews. Studies (excluding case reports) reporting outcome measures were included. | Twenty three articles met inclusion criteria. 
Areas of agreement: Hip arthroscopy provides an alternative for traditional arthrotomy. But, current evidence does not allow for definitive conclusion regarding its routine use. 
Areas of controversy: unclear whether arthroscopy is superior to open surgery for managing FAI or labral lesions. 
Growing points: this review provides potential areas for prospective studies to evaluate the role of arthroscopy in clinical practice. 
Areas for future research: the need for appropriately planned and powered studies to clarify the role of arthroscopy in hip pathology is highlighted. |
<p>| Macfarlane and Haddad (2010) | The diagnosis and management of femoro-acetabular impingement. | Systematic review to explore FAI, particularly its diagnosis and management. Computerised search of Pubmed. Articles regarding aetiology, pathophysiology, clinical features, diagnosis and treatment of FAI were included. | An increasing number of studies have been reported in the last 10 years. These recognise a range of clinical and radiological features. Promising results show a variety of surgical techniques may be employed in treating FAI. Whilst early interventions involved open surgery, less invasive and arthroscopic approaches have evolved which show favourable short-medium term outcomes. Concludes: greater awareness of diagnostic features and different treatment options for FAI allows the timely diagnosis and treatment of this condition. Early treatment may help prevent the progression to end-stage OA of the hip. |
| Martin and Katz (2012) | Labral tears and femoroacetabular impingement: Clinical features and arthroscopic management. | Computerised search of Pubmed. References of included papers were hand-searched for further relevant studies. | Hip arthroscopy enables labral repairs and osteoplasty to be performed to treat FAI. Both procedures appear effective in relieving hip pain, although RCTs are needed to assess their efficacy. Long-term studies are required to ascertain whether these procedures reduce the risk of OA. Concludes: Labral tears and FAI are common causes of hip and groin pain and disability. Successful treatment with arthroscopy requires advanced training. To date results are favourable but further research is required to fully document treatment outcomes. |
| Matsuda, Carlisle, Arthurs, Wierks and Philippon (2011) | Comparative systematic review of the open dislocation, mini-open, and arthroscopic surgeries for femoroacetabular impingement. | Systematic review to compare the current approaches to surgical management of symptomatic FAI. Computerised search of: Pubmed, EMBASE, Ovid and Cochrane Review. Studies reporting treatment outcomes with a minimum of 1 year follow-up. | Eighteen articles met the inclusion criteria, all level III or IV evidence: 6 concerned open surgical dislocation, 4 mini-open and 8 arthroscopic interventions. The only prospective studies involved arthroscopic surgery. All three types of procedure are effective in improving pain and function in short-mid term studies, whilst being relatively safe procedures. Open dislocation surgery, historical gold standard, has comparatively greater major complication rate mainly because of trochanteric osteotomy-related factors. The mini-open method shows comparable efficacy, although some studies identify a marked incidence of iatrogenic injury to the lateral femoral cutaneous nerve. Finally, the arthroscopic procedure showed equal or better outcomes than other methods, and lower major complication rates when carried out by experienced surgeons. |</p>
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<th>Study</th>
<th>Methodology</th>
<th>Findings</th>
<th>Conclusion</th>
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<tr>
<td>Ng, Arora, Best, Pan and Ellis (2010) Efficacy of surgery for femoroacetabular impingement: a systematic review.</td>
<td>Systematic review to assess the efficacy of surgery in treating FAI. Computerised search of: PubMed, MEDLINE, EMBASE and CINAHL. Studies, excluding single case reports and expert opinions, concerning arthroscopy or open surgical dislocation treatment for FAI.</td>
<td>Twenty three reports, all case studies involving 970 cases, were included in the review: one level II study, 2 level III studies and 20 level IV studies. All studies showed improved symptoms following surgery. However, up to 30% of patients may eventually need THA. Patients with Outerbridge grade III or IV cartilage damage observed intra-operatively or with pre-operative radiographs showing &gt;Tonnis grade I OA will have worse outcomes with treatment for FAI. Two studies compared labral refixation and labral debridement. Postoperative OA was reported in several studies with only a minority of patients showing progression of their OA. Concludes: Surgical treatment of FAI improves symptoms in most patients without advanced OA or chondral damage. Early evidence supports the use of labral refixation. There is insufficient evidence to assess whether surgical intervention delays progression of OA.</td>
<td>Conservatory/non-surgical treatment includes physical therapy, activity restriction, core strengthening, sensory-motor improvement and control, and NSAIDs. Surgical management if often necessary to enable full return to activity and includes procedures such as surgical dislocation of the hip, hip arthroscopy, periacetabular and rotational osteotomies, and combined arthroscopy and limited open exposure. Whilst there is an abundance of short-term evidence supporting surgical intervention, no long-term prospective data or natural history studies examines the implications of FAI and the effects of early intervention.</td>
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<td>Papalia, et al. (2012) Femoroacetabular impingement syndrome management: arthroscopy or open surgery?</td>
<td>Systematic review of clinical, functional and imaging outcomes after surgical management of FAI. Computerised search of: PubMed, MEDLINE, Ovid, Google Scholar and EMBASE.</td>
<td>Thirty one studies were included in the review: although there was great variation in study design and outcome assessment, and in general methodological quality was assessed as low. Arthroscopy, open surgery and arthroscopic surgery followed by mini-open surgery are comparable regarding functional results, biomechanics and return to sport. OA progression and conversion to THA depend on pre-operative status of OA and cartilage and type of management. Debridement plus osteoplasty result in better outcomes than debridement alone. Labral refixation shows significantly better outcomes than resection. Concludes: Open and minimally invasive procedures enable professional athletes to return to sports, both procedures are contraindicated in patients with severe OA or cartilage degeneration.</td>
<td>Conservatory/non-surgical treatment includes physical therapy, activity restriction, core strengthening, sensory-motor improvement and control, and NSAIDs. Surgical management if often necessary to enable full return to activity and includes procedures such as surgical dislocation of the hip, hip arthroscopy, periacetabular and rotational osteotomies, and combined arthroscopy and limited open exposure. Whilst there is an abundance of short-term evidence supporting surgical intervention, no long-term prospective data or natural history studies examines the implications of FAI and the effects of early intervention.</td>
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<td>Samora, Ng and Ellis (2011) Femoroacetabular impingement: a common cause of hip pain in young adults.</td>
<td>(Systematic?) review to explore FAI, particularly clinical presentation, physical examination findings, radiographic features and treatment. Computerised search of: PubMed. Studies directly involving the treatment of FAI, including review articles and expert opinion.</td>
<td>Conservative/non-surgical treatment includes physical therapy, activity restriction, core strengthening, sensory-motor improvement and control, and NSAIDs. Surgical management if often necessary to enable full return to activity and includes procedures such as surgical dislocation of the hip, hip arthroscopy, periacetabular and rotational osteotomies, and combined arthroscopy and limited open exposure. Whilst there is an abundance of short-term evidence supporting surgical intervention, no long-term prospective data or natural history studies examines the implications of FAI and the effects of early intervention.</td>
<td>Conservatory/non-surgical treatment includes physical therapy, activity restriction, core strengthening, sensory-motor improvement and control, and NSAIDs. Surgical management if often necessary to enable full return to activity and includes procedures such as surgical dislocation of the hip, hip arthroscopy, periacetabular and rotational osteotomies, and combined arthroscopy and limited open exposure. Whilst there is an abundance of short-term evidence supporting surgical intervention, no long-term prospective data or natural history studies examines the implications of FAI and the effects of early intervention.</td>
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<td>Shearer, Kramer, Bozic and Feeley (2012)</td>
<td>Economic evaluation to determine cost-effectiveness of hip arthroscopy in comparison to observation in patients with FAI.</td>
<td>Construction of Markov model including various health states for 36-year old patients with FAI using decision tree analysis software. Identified studies with Harris hip scores and complications post arthroscopy to estimate health state preferences and probabilities. Sensitivity analysis of 30 input variables.</td>
<td>The estimated incremental cost-effectiveness ratio (ICER) of hip arthroscopy was $21,700 per quality-adjusted life-years (QALYs) for patients with FAI without radiographic evidence of arthritis and $79,500/QALY for patients with FAI and preoperative arthritis. Using hip arthroscopy to alter the natural history of arthritis improved ICER to $19,200/QALY resulting in savings if THA was not performed until at least 16 years after arthroscopy. Concludes: The model suggests hip arthroscopy for patients with FAI without arthritis may result in favourable ICER compared with other interventions considered cost effective. The need for further studies of hip arthroscopy was highlighted to determine impact on QoL, duration of symptomatic relief and effect on need for subsequent THA.</td>
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<td>Stevens, Legay, Glazebrook and Amirault (2010)</td>
<td>Systematic review to determine level of evidence and grade of recommendation for hip arthroscopy.</td>
<td>Computerised search of: Pubmed and Cochrane databases. Studies focusing on efficacy of hip arthroscopy for all therapeutic indications.</td>
<td>Fair evidence exists to support use of hip arthroscopy for FAI (Grade B), whilst poor evidence exists to support recommendations for treating labral tears, extra-articular lesions, septic arthritis and loose bodies (Grade C(f)) and poor-quality conflicting evidence for treating mild to moderate hip OA (Grade C(c)). Concludes: Although fair evidence exists to support hip arthroscopy in the case of FAI, a majority of recognized indication currently lack an adequate evidence-base. The need for higher quality trials (Level I &amp; II) was highlighted.</td>
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<td>Wall, Fernandez, Griffin and Foster (2013)</td>
<td>Systematic review to examine the evidence base for nonoperative treatments for FAI.</td>
<td>Computerised search of: PubMed, MEDINE, EMBASE, CINAHL, AMED and Cochrane Library. All studies relating to nonoperative treatment for FAI.</td>
<td>Fifty-three articles met inclusion criteria, of which 48 were review and/or discussion based. Five articles reported primary research evaluating nonoperative treatment: 3 found positive outcomes. Thirty one (65%) reviews or discussions suggest a trial of conservation treatment was appropriate. Activity modification was the most commonly recommended treatment (n=39, 81%) followed by physical therapy (n=23, 48%). Concludes: The review suggests non-operative interventions of FAI in the first instance, in particular physical therapy and activity modification appears to confer benefit. However, there needs to be further studies to evaluate the effectiveness of these interventions.</td>
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Zaltz (2012) The biomechanical case for labral debridement. Systematic review to explore the role of labral repair. Computerised search. Articles focusing on labral formation, development, degeneration, biomechanics and clinical results of labral repair or resection. Unable to access full article for more detail

Fifty two studies were included in the review. Several clinical studies support routine labral repair in conjunction with acetabular rim trimming. Little evidence is available regarding labral repair for patients with symptomatic labral damage associated with FAI.

Concludes: The current evidence does not support the use of routine labral repair over labral debridement.

SECTION C – CLINICAL TRIALS REGISTRIES

<table>
<thead>
<tr>
<th>Title</th>
<th>Sponsors and Status</th>
<th>Summary</th>
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<tr>
<td>C1 Hip Pathomorphology in Collegiate Athletes and Controls</td>
<td>University of Utah 2012-2018 Ongoing</td>
<td>Prospective case-control study. To evaluate the prevalence of hip pathomorphology in athletes and normal age-matched controls. Participants: n = 10,000; age 18-30 years; FAI and acetabular dysplasia Outcomes: X-ray measurements of FAI; Asymptomatic FAI abnormalities Assessed: 5 years</td>
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<tr>
<td>C2 Biomechanical Assessment of Femoroacetabular Impingement</td>
<td>University of Utah 2012-2016 Ongoing</td>
<td>Prospective case-control study. To understand how FAI alters the biomechanics of the hip joint. Participants: n = 36; age 18-35 years; FAI Outcomes: kinematics, muscle activation patterns, soft tissue mechanics, radiographic and 3D measures</td>
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<td>Case</td>
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<tr>
<td>C3</td>
<td>Hip Impingement - Understanding Cartilage Damage</td>
<td>Ottawa Hospital Research Institute; Canadian Institutes of Health Research (CIHR)</td>
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<td>C4</td>
<td>Femoroacetabular Impingement Randomized Controlled Trial</td>
<td>McMaster University; American Orthopaedic Society for Sports Medicine</td>
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<tr>
<td>C5</td>
<td>Influence of Naproxen on Heterotropic Bone Formation Following Hip Arthroscopy</td>
<td>University of Utah</td>
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<td>C6</td>
<td>Conservative Management of Femoroacetabular Impingement</td>
<td>High Point University</td>
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<td>C7</td>
<td>Efficacy of a physiotherapy program for individuals following arthroscopic surgery for symptomatic femoroacetabular impingement: a randomised controlled trial</td>
<td>University of Melbourne</td>
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<td>C8</td>
<td>Hip Arthroscopy Versus Conservative Management of Femoroacetabular Impingement</td>
<td>University of Western Ontario, Canada</td>
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<td>C9</td>
<td>UK FASHIoN: Feasibility study of a trial of Arthroscopic Surgery for Hip Impingement compared with Non-operative care</td>
<td>University Hospitals Coventry &amp; Warwickshire (UK)</td>
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<tr>
<td>C10</td>
<td>Is there a relationship between impingement in the hip and tearing of the hamstring tendon near the buttock?</td>
<td>The Avenue Hospital, Windsor, Australia</td>
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| C11 | Non-guided hip injections are a safe and accurate method of treatment for patients undergoing hip arthroscopy due to Femoroacetabular Impingement (FAI).  
https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=362900 | The Avenue Hospital, Windsor, Australia  
2012-2012  
Complete | Prospective cohort study. To evaluate the efficacy of the anterior approach for blind intra-articular hip injections in patients undergoing hip arthroscopy for FAI.  
Participants: n = 40; age 18-50 years; FAI  
Outcomes: physical exam; RoM; mechanical symptoms; pain; full neuro-vascular status; possible side effects.  
Assessed: Baseline, 7 days and 12 weeks |
| C12 | Dynamic Imaging of the Hip for Pre-operative Planning  
http://ClinicalTrials.gov/show/NCT00605969 | Ottawa Hospital Research Institute  
2007-2012  
Ongoing | Prospective observational study. To develop a method for surgeons to visualize the hip joint before surgery in order to assist with pre-operative planning.  
Participants: n = 30; age 18-55 years; FAI and healthy volunteers.  
Outcomes: Motion analysis  
Assessed: Pre-op |
| C13 | Characterization of Proteoglycan Depletion in Femoroacetabular Impingement With T1ρ Magnetic Resonance Imaging (MRI)  
http://ClinicalTrials.gov/show/NCT01578694 | Ottawa Hospital Research Institute  
2007-2012 | Prospective observational study. To assess if T1ρ (T1-rho) imaging can accurately assess cartilage damage and levels of proteoglycan.  
Participants: n =26; age 18-40 years; FAI  
Outcomes: T1rho MRI  
Assessed: Pre-op (within 6 weeks prior to surgery) |
| C14 | Prevalence of Femoroacetabular Impingement in Asymptomatic Patients  
http://ClinicalTrials.gov/show/NCT00606047 | Ottawa Hospital Research Institute  
2007-2011 | Prospective cohort study. To investigate whether patients without hip pain have variations at the hip joint such as those seen in hip impingement syndrome.  
Participants: n = 200; Healthy volunteers  
Outcomes: MRI |
| C15 | PRP (Autologous Platelet rich plasma) may improve hip arthroscopy patients outcome.  
https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=347471 | Millennium Institute of Sport and Health  
2011-??  
Not yet recruiting? | RCT (placebo). To establish if platelet rich plasma improves surgical outcome in the short- and long-term.  
Participants: n = 100; age 16-50 years; FAI patients undergoing hip arthroscopy  
Outcomes: Surgical side effects; MAHORN questionnaire.  
Assessed: 1,3,6,12 months |
| C16 | Hip biomechanics in patients with femoroacetabular impingement  
https://drks-neu.uniklinik-freiburg.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00000338 | Klinik für Orthopädie, CMSC Berlin  
2010-??  
Ongoing? | Prospective observational single group, diagnostic study. To investigate preoperatively femoroacetabular contact areas which using current imaging techniques is not possible.  
Participants: n = 100; age 18-100 years; FAI  
Outcomes: 320-slice CT-system |
### SECTION D – PRIMARY RESEARCH

Square brackets around the title of an article indicate that whilst the article’s abstract is available in English, the main body of the article is NOT in English.

<table>
<thead>
<tr>
<th>Title</th>
<th>Sample</th>
<th>Methodology/ Comments</th>
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<td>Bedi, Zaltz, De La Torre and Kelly (2011) Radiographic comparison of surgical hip dislocation and hip arthroscopy for treatment of cam deformity in femoroacetabular impingement.</td>
<td>Prospective comparative study. 60 male patients &lt;40 years old with symptomatic FAI refractory to non-operative management. Matched treatment groups: 30 patients (15 left, 15 right hips) underwent arthroscopic cam and/or rim osteoplasty with labral debridement and/or refixation by arthroscopic surgeon; 30 patients (14 left, 16 right hips) underwent open surgical dislocation, cam and/or rim osteoplasty and labral debridement or refixation by hip preservation surgeon.</td>
<td>To compare efficacy of arthroscopic osteoplasty and open surgical dislocation in treating FAI. Outcomes: Anteroposterior (AP) pelvis and extended neck (Dunn) lateral radiographs; depth of resection, arc of resection, anterior femoral head-neck offset, AP and lateral angle. Time-points: Pre- and post-operatively.</td>
<td>Arthroscopic group: extended-neck lateral angle mean reduction = 17.2 (28.4%, p&lt;0.05); AP angle mean reduction = 12.6 (16.8%); anterior head-neck offset improved 5.0mm (111%, p&lt;0.05) and mean angle increased by 23.1. Open dislocation group: extended-neck lateral angle mean reduction = 21.2 (30.7%, p&lt;0.05); AP angle mean reduction = 20.1 (25.7%); anterior head-neck offset improved 6.56mm (108%, p&lt;0.05) and mean angle increased by 18.35. Concludes: Arthroscopy osteoplasty can restore head-neck offset and achieve similar depth, arc and proximal-distal resection compared to open surgical dislocation for anterior and anterosuperior cam and focal rim impingement deformity. However, the open technique may enable greater correction of posterosuperior loss of femoral offset and may be favoured for FAI with extensive proximal femoral deformity of AP radiographs.</td>
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<td>Brunner, Horisberger and Herzog (2009) Evaluation of a computed tomography-based navigation system prototype for hip arthroscopy in the treatment of femoroacetabular cam impingement.</td>
<td>Prospective comparative study. 50 patients treated by hip arthroscopy and arthroscopic offset restoration for cam FAI; 25 navigated; 25 non-navigated. Mean age = 42.9 years old</td>
<td>To investigate the impact of a new CAT-based navigation system on accuracy of arthroscopy offset correction in FAI. Outcomes: Alpha angle; RoM, VAS pain; non-arthritic hip score (NAHS). Time-points: Pre-operatively, 6 weeks post-operatively, mean follow up 26.7 months</td>
<td>Postoperative alpha angle of &lt;50° or reduction in alpha angle &gt;20° was considered successful offset restoration. Mean alpha angle was improved from 76.5° (range 57°-110°) to 54.2° (range 40°-84°). In both groups 6 patients (24%) showed insufficient offset correction. RoM, VAS pain and NAHS significantly improved in all subgroups. No significant differences between outcomes were found between patients with successful and insufficient alpha angle correction. Concludes: The present navigation system did not improve the rate of insufficient alpha angle correction (24%) after hip arthroscopy for cam FAI. Further, insufficient accurate reduction of the alpha angle does not appear to compromise early outcomes.</td>
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**Buchler, et al. (2013)**  
Arthroscopic versus open cam resection in the treatment of femoroacetabular impingement.

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<th>Outcomes</th>
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<td>Retrospective comparative study. 201 patients with cam- or mixed-type FAI between 2006 and 2009: 66 patients (49 female, mean age = 33.8 years) treated with hip arthroscopy; 135 patients (91 male, mean age = 31.2 years) treated with surgical hip dislocation.</td>
<td>To assess if osseous correction of the femoral neck for cam- or mixed-type FAI by arthroscopy is comparable to surgical dislocation. Outcomes: alpha and gamma angles; triangular index. Time-points: pre- and post-operatively. Mean follow up = 16.7 months (range 2-79 months)</td>
<td>In the hip arthroscopy group the mean alpha angle significantly improved from 60.7 pre-op to 47.8 post-op ($p&lt;0.001$) and the mean gamma angle improved from 47.3 to 44.5 ($p&lt;0.001$). Over time pre-op mean alpha angle increased from 56.3 (2006) to 67.5 (2009) and post-op mean alpha angle decreased from 51.2 (2006) to 47.5 (2009). Arthroscopic revision of intra-articular adhesions was performed in 4 patients (6.1%). In the surgical hip dislocation group, mean alpha angle significantly improved from 75.3 pre-op to 44.8 post-op ($p&lt;0.001$), and mean gamma angle improved from 65.1 to 52.2 ($p&lt;0.001$). Arthroscopic revision of intra-articular adhesions was performed in 16 patients (12%). 3 patients underwent revision for non-union of the greater trochanter (2.2%).</td>
<td>Osseous correction of cam-type FAI with hip arthroscopy is comparable to that achieved by surgical hip dislocation. Furthermore, there is a significant learning curve for hip arthroscopy with post-op correction improving with increased surgical experience.</td>
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**Cooper, Basheer, Maheshwari, Regan and Madan (2013)**  
Outcomes of hip arthroscopy. A prospective analysis and comparison between patients under 25 and over 25 years of age.

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<td>Prospective comparative study. 88 patients underwent 94 hip arthroscopies. Mean age = 24.3 years (range 11-57).</td>
<td>To compare hip arthroscopy for symptomatic intra-articular hip pathology in patients under and over the age of 25 years. Outcomes: modified Harris hip score (MHHS), non-arthritic hip score (NAHS), and hip dysfunction and osteoarthritis outcomes score (HOOS) Time-points: Baseline, 6 weeks, 6 &amp; 12 months, latest follow-up.</td>
<td>At baseline mean NAHS and HOOS subscale for pain and activities of daily living were worse in the over 25 group. Follow up range from 9-68 months, with 45 hips &gt;3 years. MHHS improved in both groups: mean difference of 16.22 in &lt;25s and 20.88 in &gt;25s. Similar improvements in NAHS and HOOS were also found. At latest follow up, no significant difference in outcomes between the under and over 25 groups was detected.</td>
<td>Comparable improvements in outcomes between patients aged under and over 25 were found, thus hip arthroscopy appears to be of potential benefit for patients with symptoms of FAI irrespective of age.</td>
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### Domb, Finley, Baise and Botser (2012)

**Osteoplasty for cam type impingement is more accurate when performed open than arthroscopic.**

| Conference abstract. Retrospective comparative study. 797 hip preservation surgeries for cam-type FAI: 17 open and 780 arthroscopically were reviewed. | To compare a single surgeon’s results of femoral neck osteoplasty using open surgical dislocation versus arthroscopic methods. Outcomes: alpha angle; head-neck offset Time-points: pre- and post-operatively 92 hips (83 patients) fitted strict inclusion criteria: 8 open surgical dislocation (osteoplasty using plastic spherical template and osteotome) and 84 arthroscopically (under fluoroscopy using 5.5mm burr). Mean age of patients was 22 years (range 14-30). Cam-lesions did not differ significantly between the two groups pre-operatively: mean alpha angle 60.6˚±14.9˚ and 72.3˚±12.4˚ and mean offset 5.4±3.0mm and 3.5±2.6mm, for open and arthroscopic groups respectively. Post-op, however, significant differences in both alpha angle (open 39.8˚±2.3˚ vs arthroscopic 49.3˚±11.9˚, p<0.0001) and femoral neck offset ratio (open 9.3±1.2mm vs arthroscopic 7.9±2.6mm, p<0.016). Concludes: Open surgical dislocation led to more successful osteoplasty and thus appears to remain the gold standard for surgical treatment of FAI. |


**Treatment of femoro-acetabular impingement: preliminary results of labral refixation.**

| Retrospective comparative study. Review of 52 patients (60 hips) with FAI who underwent arthrotomy and surgical dislocation of the hip: first 25 hips torn labrum was resected; subsequent 35 hips intact section of labrum was reattached. | To explore whether labral refixation after FAI treatment affects outcomes. Outcomes: Merle d’Aubigne clinical score; Tonnis arthrosis classification. Time-points: Pre-operatively, 1 and 2 years post-operatively There were significant improvements in clinical scores in for both groups, 1 year post-operatively (resection p<0.0003; refixation p<0.0001). However, the refixation group had superior clinical scores (p=0.0001). At two years post-op, 28% of hips that underwent resections had excellent result, 48% good result, 20% moderate result and 4% poor result. However, 80% of hips that underwent refixation showed excellent result, 15% good result and 6% moderate result: clinical scores were also superior to the resected group (p=0.01).
Radiographic signs of OA were more prevalent in the resected than refixed group at both 1 year (p=0.02) and 2 years (p=0.009) post-operatively. Concludes: Labral refixation results in earlier recovery and superior clinical and radiological outcomes compared to resection of a torn labrum. |

### Krych, Thompson, Knutson, Scoon and Coleman (2013)

**Arthroscopic labral repair versus selective labral debridement in female patients with femoroacetabular impingement: a prospective randomized study.**

<p>| Prospective RCT. 36 female patients undergoing arthroscopy for pincer- or cam-type FAI randomized at time of surgery to labral repair (n = 18, mean age = 38 years) or labral debridement (n = 18, mean age = 39 years). All patients underwent the same post-operative rehabilitation program. | To compare outcomes of arthroscopic labral repair and selective labral debridement in women undergoing arthroscopy for pincer-type or cam-type FAI. Outcomes: Hip Outcome Score (HOS), subjective measure Time-points: Pre-operatively and ≥1 year post-operatively Mean follow up = 32 months (range 12-48 months). HOS subscale for activities of daily living (ADL) and sports were significantly improved in both groups at follow up (p&lt;0.05). However, the post-operative HOS ADL subscale was significantly better in the repair (91.2, range 73-100) compared to the debridement group (80.9, range 28.6-100, p&lt;0.05), as was the post-operative HOS sport subscale (88.7, range 28.6-100 vs 76.3, range 28.6-100 respectively, p&lt;0.05). Furthermore, patient subjective outcome was significantly better in the labral repair group (p=0.46). Concludes: Arthroscopic labral repair of FAI in female patients resulted in superior hip function compared with labral debridement. Furthermore, more patients rated their hip function as normal or nearly normal following arthroscopic repair compared to debridement. |</p>
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<tr>
<th>Study</th>
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<th>Participants</th>
<th>Outcomes</th>
<th>Findings</th>
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<tr>
<td>Malviya, Stafford and Villar (2012) Is hip arthroscopy for femoroacetabular impingement only for athletes?</td>
<td>Prospective comparative study. 122 patients undergoing hip arthroscopy for FAI: 80 actively participated in sport; 44 did not.</td>
<td>To compare the outcomes of hip arthroscopy for FAI in athletes and non-athletes. Outcomes: modified Harris hip score (MHHS); non-arthritic hip score (NAHS); patient satisfaction (VAS); QoL. Time-points: pre-op, 6 weeks, 6 months and 1 year post-op</td>
<td>Significant improvements in MHHS, NAHS and QoL were found at 6 weeks, 6 months and 1 year after surgery ($p&lt;0.001$). At 6 weeks post-op MHHS and NAHS was significantly better for athletes compared to non-athletes ($p=0.01$ and $p=0.04$, respectively), however at 6 months and 1 year MHHS, NAHS and QoL scores were similar between groups. Concludes: arthroscopic management of FAI is not the sole domain of athletes, non-athletes show similar outcomes and do just as well.</td>
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<td>Larson, Giveans and Stone (2012) Arthroscopic debridement versus refixation of the acetabular labrum associated with femoroacetabular impingement: mean 3.5-year follow-up.</td>
<td>Retrospective comparative study. 94 hips with labral pincer- or combined type FAI with minimum of 2 years follow up. The first 44 hips underwent focal labral excision/debridement (mean age 32 years) (and deemed repairable by labral refxixation with current techniques); subsequent 50 hips underwent labral fixation (mean age=28 years).</td>
<td>To compare outcomes of arthroscopic labral fixation and focal labral excision/debridement for FAI. Outcomes: modified Harris Hip Score (MHHS); Short Form 12 (SF-12); VAS pain; bony resection. Time-points: pre- and post-operatively. Mean follow up = 42 months (range 24-72 months).</td>
<td>Pre-operatively mean outcome scores did not vary significantly between groups. At mean follow-up of 3.5 years subjective outcomes were significantly improved in both groups over pre-op scores, however, good to excellent results were noted in 68% of focal excision/debridement group and 92% of the refixation group ($p=0.004$). Furthermore, at the most recent follow up all scores were significantly better for the refixation compared to debridement group (MHHS $p = 0.001$; SF-12 $p = 0.041$; VAS pain $p = 0.004$). Concludes: Labral refixation results in better MHHS, SF-12 and VAS pain outcomes and a greater percentage of good-excellent results at follow up compare to labral excision/debridement. It was noted, however, that other factors may have influences these results.</td>
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<td>Larson and Giveans (2009) Arthroscopic debridement versus refixation of the acetabular labrum associated with femoroacetabular impingement.</td>
<td>Retrospective comparative study. Review of 75 patients with labral tears (deemed repairable by labral refixation with current techniques) who underwent labral debridement ($n=36$, mean age=31 years) and subsequently those who underwent labral refixation ($n=39$, mean age=27 years) for pincer- or combined pincer- and cam-type FAI with minimum 1 year follow up.</td>
<td>To compare outcomes of arthroscopic labral debridement and labral refixation. Outcomes: modified Harris hip score (MHHS); SF-12 and VAS for pain; alpha angle; Tonnis grade (OA) Time-points: pre- and post-operatively. Mean follow up: debridement group = 21.4 months; refixation group = 16.5 months.</td>
<td>Pre-operative outcome scores did not differ significantly between groups. A 1 year post-op outcome scores were significantly improved in both groups ($p&lt;0.01$), however, MHSS was significantly greater for refixation group (94.3) compared to debridement group (88.9, $p=0.29$). At latest follow-up, good to excellent results were observed in 66.7% of hips in debridement group compared to 89.7% in the refixation group ($p&lt;0.01$). Concludes: Labral refixation results in better MHHS outcomes and a greater percentage of good or excellent results compared with labral debridement (from an earlier cohort)</td>
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### Prospective RCT (placebo).
60 patients with confirmed FAI scheduled to undergo arthroscopy treatment including rim trimming, labral repair and femoral neck osteoplasty. Randomly assigned to receive PRP clot (PRP-c), PRP spray (PRP-s) or saline control (C) over the femoral neck osteoplasty at the end of procedure.

To investigate whether plasma rich protein (PRP) reduces postoperative pain, morphine requirements, oedema and ecchymosis in patients undergoing hip arthroplasty.

**Outcomes:** VAS pain; morphine use; oedema; ecchymosis

**Time-points:** 12, 24 hours and 7 days post operatively (pain); 0-12 and 12-24 hours post-op (morphine); pre-operatively, 7 and 14 days post-op (oedema); 7 and 14 days post-op (ecchymosis).

There were no differences between the groups for pain, morphine use or oedema at any time points ($p>0.05$).

66% of the control group had ecchymosis at 7 days and 56% at 14 days. In the PRP-s group 55% and 25% had ecchymosis at 7 and 14 days respectively. In the PRP-C group 22% and 0% had ecchymosis at 7 and 14 days respectively: which was significantly different from the control group ($p=0.025$).

Concludes: PRP clot may have some post-operative advantages for patients undergoing hip arthroscopy. Lower ecchymosis suggests an anti-inflammatory effect that may have implications for long-term outcomes.

### Mardones, et al. (2009)
Surgical correction of “cam-type” femoroacetabular impingement: a cadaveric comparison of open versus arthroscopic debridement.

### Prospective RCT?
5 fresh-frozen cadavers (10 hips) one side randomly assigned to open and the other arthroscopic procedure.

To compare open and arthroscopic surgical techniques for cam-type FAI.

**Outcomes:** head-neck union diameter; surgical time; position of osteotomy; length, width, and depth of final osteotomy.

In all hips partial resection of anterior-lateral femoral head-neck junction resulting in improved femoral head-neck offset was achieved.

Surgical time was significantly shorter in the open compared to the arthroscopic procedure ($p<0.05$).

Concludes: Surgical precision was comparable between the two procedures irrespective of measurement used. However, with the arthroscopic procedure there was a tendency to underestimate osteoplasty length and the positioning of the osteoplasty was less reliable as there was a tendency to place the osteoplasty more posterior and distal than intended.

### Martini, et al. (2012)
RM-arthrography of hip joint after intra-articular injection of hyaluronic acid (HA). Comparison with conventional RM-arthrography in a group of patients affected by femoro-acetabular impingement.

### Prospective comparative study
18 patients with indication for viscosupplementation and with bilateral symptoms and FAI: one hip underwent US guided intra-articular injection of 4ml HA and the contralateral hip conventional RM-arthrography.

To compare diagnostic results of RM-arthrography of the hip joint after intra-articular injection of hyaluronic acid (HA) and conventional RM-arthrography.

**Outcomes:** joint space; articular cartilage and acetabular lip.

No significant differences were observed between the two kinds of RM-arthrography.

Concludes: RM-arthrography made after viscosupplementation with HA has a diagnostic value similar to conventional RM-arthrography. This enables the integration of diagnosis and treatment in an integrated, single session.
<p>| Matsuda and Burchette (2013) Arthroscopic hip labral reconstruction with a gracilis autograft versus labral refixation: 2-year minimum outcomes. | Retrospective comparative study. 54 adults who underwent arthroscopic surgery for symptomatic cam-pincer FAI without advanced OA with both acetabular and femoral osteoplasties and at least 2 years follow up: 8 adults underwent labral reconstruction, mean age=34.6 (range 18-58); 46 underwent labral refixation mean age=37.5 years (18-73). To determine the clinical effectiveness of arthroscopic labral reconstruction using gracilis autograft compared to labral refixation for FAI. Outcomes: patient satisfaction; non-arthritic hip score Time-points: pre- and post-operatively. The mean NAHS improved by 50.5 points ($p=0.008$) in the labral reconstruction group and 22.5 points ($p&lt;0.05$) in the refixation group; however, the preop NAHS was significantly lower in the reconstruction compared to the refixation group ($p&lt;0.05$). A predictive model and linear regression showed a 15.0 (reconstruction) and 14.6 (refixation) point increase in postop NAHS. No major complications, revision surgeries or conversion arthroplasties occurred following labral reconstruction. Concludes: Arthroscopic hip labral reconstruction with gracillis tendon autograph is an effective and safe procedure. Patients undergoing reconstruction may not have outcomes inferior to those undergoing refixation despite having more severe initial labral insufficiency. |  |
|---|---|---|---|---|---|---|
| Nepple, Zebala and Clohisy (2009). Labral disease associated with femoroacetabular impingement: do we need to correct the structural deformity? | Retrospective comparative study. Consecutive cohorts: arthroscopic treatment of labrum and articular cartilage (23 hips) and hip arthroscopy with limited osteochondroplasty of the femoral head-neck junction (25 hips). Comparable age, labral disease, OA grade and chondromalacia. To compare clinical results of arthroscopic partial labral resection with arthroscopic partial labral resection augmented with limited open osteochondroplasty for treatment of symptomatic FAI. Outcomes: modified Harris hip score Time-points: pre- and post-op Follow up times was slightly longer in the arthroscopic only group. The modified Harris hip score showed a trend towards higher values in the augmented arthroscopic group: a 10 point improvement was more frequent in this group and also fewer patients required subsequent surgery. Concludes: these initial results suggest patients with cam FAI may have better outcomes when the impingement deformity is corrected. |  |
| Pierannunzii, Caforio and D'Imporzano (2011) Cam-type femoro-acetabular impingement: Hip arthroscopy vs. anterior open approach. | Conference abstract. Comparative study. 20 patients undergoing hip arthroscopy for cam-FAI and 20 who underwent a modified Smith-Petersen approach without surgical dislocation. Comparable age and sex. To compare cam-impingement treatment with anterior open approach and arthroscopic procedure. Outcomes: modified HHS; pain VAS; flexion range; satisfaction. Time-points: 6 weeks; 3 &amp; 6 months and 1 year post-op. Clinical outcome was significantly better for the arthroscopy group 6 weeks post-operatively, but differences became non-significant at 1 year for all measures bar flexion which remained greater in the arthroscopic group. In the open group: 1 patient developed bulky heterotopic ossifications and 1 lesion of the LFC nerve. In the arthroscopic group: abdominal extravasation of irrigation fluid and two haematomas occurred. Concludes: Hip arthroscopy is tissue sparing and can address intra-articular pathology, thus is the procedure of choice in managing cam-impingement, although long-term outcomes may be similar. |</p>
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<th>Results</th>
<th>Conclusion</th>
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<td>Randelli, et al. (2010). Heterotopic ossifications after arthroscopic management of femoroacetabular impingement: the role of NSAID prophylaxis.</td>
<td>Retrospective comparative study.</td>
<td>Review of 300 FAI hips managed with hip arthroscopy, divided into two groups: 285 hips which received NSAID prophylaxis; 15 hips no NSAIDs. To evaluate heterotopic ossification prevalence after hip arthroscopy for FAI and the association with NSAID prophylaxis. Outcomes: NSAID administration; roentgenograms (presence of heterotopic ossification around hip joint).</td>
<td>In total, 5 hips presented with heterotopic osseous (1.6% prevalence). All 5 patients were in the control i.e. non-NSAID group. No heterotopic ossification was observed in the group treated with NSAID. Consequently, heterotopic ossification rate was significantly greater (p&lt;0.001) in patients who did not receive NSAID after surgery. Concludes: arthroscopic interventions for FAI may result in heterotopic ossifications, however NSAIDs after arthroscopy appear to be an effective prophylaxis.</td>
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<td>Rupp and Duggan (2012) Peripheral versus central compartment starting point in hip arthroscopy for femoroacetabular impingement.</td>
<td>Prospective comparative study.</td>
<td>60 patients with FAI treated by hip arthroscopy: 30 patients had a peripheral starting point and 30 patients a central compartment starting point. To compare perioperative complications and traction times in FAI hip arthroscopy with either a peripheral or central compartment starting point. Outcomes: complications; traction times Time-points: intra- and post-operatively</td>
<td>The central compartment starting group experienced 8 minor and 3 moderate chondral injuries, 2 labral penetrations and 3 cases of post-operative paresthesias. The peripheral compartment starting group experienced 6 minor chondral injuries and 1 post-operative paresthesias. Traction times averaged 73 minutes in the central compartment starting group and 46 minutes in the peripheral compartment starting group. Concludes: a peripheral compartment starting point in hip arthroscopy should be considered for treating FAI as it results in reduced iatrogenic injury and traction times compared with central compartment starting point.</td>
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<td>Schilders, Dimitrakopoulou, Bismil, Marchant and Cooke (2011) Arthroscopic treatment of labral tears in femoroacetabular impingement: a comparative study of refixation and resection with a minimum two-year follow-up.</td>
<td>Retrospective comparative study.</td>
<td>96 patients (101 hips) with FAI and labral tears treated arthroscopically with: labral repair (n=69 hips) or labral resection (n=32 hips). To compare labral refixation and labral resection for the treatment of FAI. Outcomes: modified Harris hip score Time points: pre-operative and post-operative Mean follow up 2.44 years (range 2-4).</td>
<td>The mean modified Harris hip score improved from a preoperative score of 60.2 (range 24-85) to 93.6 (range 55-100) post-operatively in the labral repair group, and from 62.8 (range 29-96) to 88.8 (range 35-19) in the labral resection group. The mean modified Harris hip score in the labral repair group was 7.3 points greater than in the labral resection group (p=0.036, 95% CI 0.51-14.09). Labral detachments were more frequent in the labral repair group, whilst labral flap tears were more common in the resection group. No patients needed later hip replacement during the follow up period. Concludes: Patients with FAI but without advance degenerative changes in the hip may benefit from arthroscopic treatment. Where applicable, labral repair results in superior outcomes compared with labral resection.</td>
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<td>Suri, Choate, Pawlak and Jones (2012)</td>
<td>Arthroscopic repair versus debridement of labral tears in patients with femoroacetabular impingement: A prospective study. Conference abstract. Prospective comparative study. 83 patients (88 hips) undergoing arthroscopic treatment for FAI with associated labral pathology. Patients with labral tears suitable for repair, as determined intraoperatively, were compared to patients who underwent labral debridement. To compare outcomes of arthroscopic labral debridement and labral repair in patients with FAI. Outcomes: modified Harris Hip Score; SF-12; VAS pain. Time-points: pre-operatively and post-operatively. For both groups mean follow up = 13 months (range: 6 months – 2 years)</td>
<td>33 hips were excluded from final analysis. Of 55 hips, 37 underwent repair (mean age = 39.8 years) and 18 debridement (mean age = 45.5 years). The debridement group were observed to have a greater percentage of hips with advanced arthritis ($p=0.0089$). However, baseline demographics and pre-operative scores did not differ significantly between the two groups. Most recent follow up showed outcome scores significantly improved for both groups ($p&lt;0.01$), with no group differences detected at final follow up. Regression analysis using means at different time-points suggested a slight trend toward better outcomes in the labral repair group. The repair group had significantly higher SF-12 MCS scores at 6 weeks, 3 and 6 months (all $p&lt;0.05$), although this did not hold at final follow up ($p=0.2465$). Otherwise no significant differences were detected in outcome scores at any time. Good to excellent results were similar in both groups: debridement 15 hips (83.3%) and repair 33 hips (89.1%). An age &lt;30 years was the only factor predictive of good outcome ($p=0.003$). Advanced arthritis was not associated with poor outcome. There was a non-significant trend for higher failure rate with debridement ($p=0.056$). Concludes: Initial results suggest similar short-term outcomes for arthroscopy repair or debride ment for FAI with associated labral pathology. Trends towards greater failure rates in arthroscopic labral debridement may become significant with longer term follow ups.</td>
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<td>Sussmann, et al. (2007)</td>
<td>Arthroscopic versus open osteoplasty of the head-neck junction: a cadaveric investigation. Prospective RCT. 8 paired fresh-frozen cadaveric pelvises randomized to an open or arthroscopic osteoplasty on both anterior femoral head-neck junctions. To compare the precision and accuracy of arthroscopic and open osteoplasty. Outcomes: volume, depth, arc of resection. Time-points: pre- and post-operatively</td>
<td>No differences between techniques regarding volume, depth or overall arc of resection were detected. The arthroscopic group were closer to the predetermined start point and the open group closer to the end point. Concludes: confirms the ability to perform arthroscopic decompressions of the head-neck junction for isolated cam-type impingement with an accuracy and precision approaching those of open surgery, and thus is a feasible alternative to open resection.</td>
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<td><strong>Volpato, et al. (2010)</strong></td>
<td>Conference abstract. Prospective RCT (active control). 56 ASA I or II patients undergoing arthroscopic hip surgery randomly assigned to: lumbar plexus block before induction ((n=21)); lumbar and parasacral sciatic nerve block ((n=18)); general anaesthesia with 100 (\mu)g/kg morphine ((n=17)). Surgery was performed under general anaesthesia. Post-surgical analgesic regime was consistent across all groups. To compare three models of analgesia for arthroscopic hip surgery. Outcomes: Rest and dynamic pain scores; morphine consumption, urinary retention, sedation, nausea, pruritus Time-points: during 24h post-surgery. No statistical differences were noted between groups for rest and dynamic pain scores. Greater sedation levels were found in the morphine group compared to the lumbar plexus block group ((p&lt;0.05)). Additionally, urinary retention was greater in the morphine group compared to lumbar and parasacral sciatic block group ((p&lt;0.05)). Concludes: Satisfactory analgesia can be achieved using any of the three analgesia regimes studied after arthroscopic hip surgery. However, morphine increases the risk of urinary retention and results in greater sedation.</td>
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<td><strong>Zingg, Ulbrich, Buehler, Kalberer, Poutawera and Dora (2013)</strong></td>
<td>Prospective comparative study. 38 patients with verified isolated FAI allocated to either hip arthroscopy or surgical hip dislocation. To test the hypothesis that compared to surgical hip dislocation, hip arthroscopy results in faster recovery, better short-term outcomes and equivalent morphological corrections. Outcomes: demography, sport activity, hospital stay, complication, time off work, subjective hip value, WOMAC, HHS and hip abductor strength. Time-points: up to 1 year post-operatively Hip arthroscopy resulted in shorter hospital stay and time off work, less pain at 3 months and 1 year, greater subjective hip values at 6 weeks and 3 months, better WOMAC at 3 months, higher HHS and hip abductor strength, compared to surgical hip dislocation. Hip arthroscopy showed some overcorrection at the head-neck-junction compared to surgical hip dislocation. Further labral refixation was performed less frequently in the arthroscopy group. Concludes: Hip arthroscopy results in faster recovery and better short-term outcomes compared to surgical hip dislocation. However, some overcorrection of cam deformity and limited frequency of labrum refixation with arthroscopy may have a negative impact on long-term outcomes.</td>
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