Evidence Based Review

Hip Arthroscopy:

An update of effectiveness, indications and diagnostic alternatives

Reviewer	**Sarah Clark**
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Important Note:

The purpose of this evidence based review is to update information on the effectiveness of, indications for, and diagnostic alternatives to Hip Arthroscopy. It is not intended to replace clinical judgement or to be used as a clinical protocol. A reasonable attempt has been made to find and appraise papers relevant to the focus of this review; however, it does not claim to be exhaustive.

The review was developed by staff of ACC's Evidence Based Healthcare Team. However, the content does not necessarily present the official view of ACC or represent ACC policy. The review is based upon information supplied up to the end of May 2007.

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Summary

The main indications for hip arthroscopy are loose bodies and labral lesions. The main contra-indication is severe osteoarthritis. Patient selection criteria relevant to ACC remain essentially unchanged from the 2003 EBH review, except when considering patients >55yrs. The view of authors of 9 review articles is that older age *per se* no longer seems to be a contra-indication for hip arthroscopy. There have also been some relevant new developments relating to hip arthroscopy:

- Hip arthroscopy can be a successful adjunct to the management of patients after traumatic hip dislocations.
- Early results show that Femoro-acetabular Impingement (FAI) predisposes patients to labral tears. FAI can be resolved with open surgery and perhaps with arthroscopy.
- Acetabular dysplasia appears not to be a contra-indication.
- New case series' describing 3.0-T Magnetic Resonance Imaging (MRI) and bone scintography imaging techniques suggest improved accuracy can be achieved in the diagnosis of intra-articular pathology.
- Complication rates are falling as surgeons become more experienced and develop safer procedures and equipment

Many surgeons remain sceptical of the role for hip arthroscopy because it is a difficult technique to master and because of the associated complications. Adhering to patient selection criteria is crucial for minimising complications, and detailed attention must be paid to several aspects of the procedure.

Background

Keyhole surgery of the hip became an attractive method for diagnosing and treating hip pain for the following reasons:

1. There were, and still are, limitations with the alternative diagnostic methods of provocative manoeuvres, MRI/Magnetic Resonance Arthrography (MRA), or intra-articular injection with anesthetic.
2. Non-operative treatment is likely to result in persistent symptoms and may lead to the progression of osteoarthritis[1].
3. Open surgeries, while being performed routinely and successfully, have potential risks associated with joint dislocation, infection, deep vein thrombosis, avascular necrosis, major nerve or vessel injury, heterotropic bone and muscle weakness. Open surgery also requires longer hospitalisation and recovery periods.

Hip arthroscopy was used minimally in the 1980's, but it brought awareness to many pathologies of the labrum, chondral surfaces and other tissues that were previously unrecognised and therefore untreated. It is now used with increasing frequency and rapid improvements in technique were seen by the late 1990s and early 2000s. Hip arthroscopy is more often used therapeutically than diagnostically. The large body of review literature describes it as a successful treatment for a variety of hip pathologies, but the most common indications are labral tears and loose bodies.

An EBH review of hip arthroscopy was completed in 2003. Since then the number of hip

arthroscopies purchased by ACC has increased each year, from just 3 in 2002 to 88 cases in 2006. The mean cost per claim has increased from ~$5,000 in 2002 to ~$6,400 in 2006. The mean cost of an arthrogram/MRI imaging per claim is ~$1,400. The current EBH review was carried out to determine whether there have been any changes in the indications for hip arthroscopy, and whether the diagnostic alternatives for intra-articular hip pain have changed or improved.

Objectives
To produce an updated evidenced based review of the literature on the efficacy of therapeutic hip arthroscopy, the indications for its use and to compare alternative diagnostic methods.

Methods

Criteria for selecting studies for this review
Types of studies: EBH reviews and/or guidelines, randomised controlled studies, case/control or series case reports since 2002. General review articles have been used as a source of expert opinion.
Types of participants/patients: Participants who have undergone hip arthroscopy.
Types of Interventions: Hip arthroscopy, Imaging techniques.
Types of outcome measures: A recognised scoring system such as the Modified Harris Hip Score (MHHS) was preferred, but descriptions of clinical and functional outcome after surgery was accepted. Diagnostic outcomes of imaging techniques were compared with the diagnosis at arthroscopy.

Criteria for excluding studies for this review
Arthroscopy for extra-articular pathologies, e.g. release of Iliopsoas tendon, trochanger bursectomy, piriformis syndrome
Case series involving 5 or less participants
Reports that had a particularly high risk of bias or confounding influence
Reports that did not report a follow-up period
Reports not written in English.

Search strategy

Database: CDSR (coch), ACP Journal Club (acp), DARE, CCTR, CINAHL (nursing), EMBASE (emef), Ovid MEDLINE(R) (medf)
Search Strategy:

1	(Arthroscop$ and hip).mp. (940)
2	Remove duplicates from 1 (648)
3	Limit 2 to english [Limit not valid in: DARE,CCTR; records were retained] (564)
4	Limit 3 to english language [Limit not valid in: CDSR,ACP Journal Club,DARE,CCTR; records were retained] (564)
5	Limit 4 to human [Limit not valid in: CDSR,ACP Journal Club,DARE,CCTR,CINAHL; records were retained] (548)
6	Limit 5 to humans [Limit not valid in: CDSR,ACP Journal Club,DARE,CCTR,CINAHL; records were retained] (548)
7	Limit 6 to yr="2001 - 2007" [Limit not valid in: DARE; records were retained]

(445)
8 7 not knee.ti. (425)
9 Exp arthroscopy/ (13566)
10 9 and 8 (297)
11 9 and 7 (310)
12 Hip$.sh. (114387)
13 11 and 12 (257)

Review Methodology

The studies relevant to this study were independently assessed by reviewing them for experimental design, population studied, interventions and outcomes. Papers describing arthroscopic treatments were assigned a design score according to the following SIGN[2] criteria. This assessment is not valid for papers describing diagnostic alternatives and so no score is provided for those papers. Evidence Tables are supplied at the end of this report (p28).

Table 1. SIGN criteria for classifying studies.

Score	Design
1++	High quality meta-analyses, systematic review of RCTs, or RCTs with a very low risk of bias
1+	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1-	Meta-analyses, systematic reviews of RCTs or RCTs with a high risk of bias
2++	High quality systematic reviews of case-control or cohort studies. High quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal
2+	Well conducted case control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal
2-	Case control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal.
3	Non-analytic studies
4	Expert opinion

Results

Description of studies

The vast majority of hip arthroscopy literature is comprised of low level reviews or papers about technique. Reported here is one systematic review of case study reports, and 30 case series. Several low level reviews are cited. No RCT's were found.

Limitations

A search was performed late in the review process to look for open surgical alternatives (open arthrotomy) to hip arthroscopy. The search was not extensive in terms of key word options but it covered all electronically available years for Medline and Embase, and from 1996 for Cinahl and Cochrane databases. Five papers were identified as relevant to this review and are cited.

Notes on the clinical trials reviewed

Size of studies

The number of patients included in case series reporting on arthroscopic treatment of various pathologies ranged from 6 to 101. The number of patients in studies reporting on complications was greater than 1000 in two studies.

Populations studied

Most studies were of consecutive series of patients for whom hip arthroscopy was the intervention. In most cases patients with particular diagnoses were selected from the series either prospectively or retrospectively, the latter being more common. Commonality between patient populations and ACC's claimant groups was limited and only three papers exclusively report on patients who had traumatic injuries[3 4 5]. Many of the other case series included some patients who obtained their injuries acutely or traumatically, but most patients had an insidious etiology of pathology. The age of patients ranged from 5 to 64 yrs. Six studies included patients aged over 55 years.

Period of Follow-up

The mean period of follow-up was variable, ranging from 1 year to 8 years. The most common follow up was about 2 years. Papers that did not report a follow-up period were excluded.

1 Summaries of papers reviewed

With the exception of the Krebs review[6], low level reviews and case series that describe arthrotomy are not summarised. Papers are grouped according to whether they describe arthroscopic treatments or whether they describe diagnostic alternatives.

1.1 Arthroscopic Treatments

Treatment of Labral Tears

1. In 2007, Robertson et al[7] published a systematic review of case study reports that reported on the outcomes for patients following arthroscopic debridement of labral tears. Only five studies met the author's selection criteria and of these, only one[8] can be classified as a new study because the other 4 were included in the original ACC EBH review of Hip arthroscopy in 2002. The selected studies included patients with symptomatic labral tears who had failed conservative management and received at least an average of 2 years follow-up following labral debridement. Robertson et al[7] found that at least 67%, and as high as 91%, of patients will be satisfied with their outcome at 3.5 years follow-up. Satisfied patients are likely to achieve good results by the MHHS. Nearly 50% of patients with mechanical symptoms may have complete resolution of their symptoms, and as high as 90% may have some reduction in the frequency of these symptoms. The review concluded that the literature supports the idea that patients with isolated labral tears, who lack associated intra-articular abnormality, can receive both symptomatic and functional improvement following arthroscopic labral debridement.

2. The Potter et al[8] study identified in Robertson's systematic review[7] was a retrospective study of 33 active soldiers. Only 19 of the original cohort are considered here because the results of 14 are confounded by them being under evaluation for workers' compensation. The patients had chronic hip pain that had failed to respond to at least 6 months of conservative treatment. They were subsequently treated with arthroscopic debridement of acetabular labral tears, and were followed up for a mean of 2 years 4 months. The mean MHHS was 84.1

(within the 'good' range) and 68% had good or excellent scores. Using a patient satisfaction rating, 84% said they were very, or somewhat, satisfied with the results of the procedure. The authors conclude that arthroscopic debridement yielded a high percentage of good results.

3. Burnett et al[9] did a retrospective study of 66 consecutive patients who had a labral tear confirmed with, and debrided during, hip arthroscopy. Patients were assessed by the MHHS both pre- and post-operatively. At the last follow-up (mean 16.4 months) the MHHS had improved from a mean of 62 points pre-operatively to a mean of 80 ($p<0.001$), and 89% (59/66) of patients continued to have improved hip function and diminished symptoms. The authors consider that arthroscopic debridement is an appropriate treatment for patients with a clinical diagnosis of labral tear when the specific etiology has been determined. Labral tears are frequently the manifestation of primary structural hip disease and so the potential impact of these diseases on surgical outcome should be considered.

4. Awan and Murray[10] did a retrospective study of arthrosopic surgery on a group of 22 patients for a range of hip pathologies. Their cohort of labral tear patients ($n=10$) was treated by debridement and were assessed pre- and post-operatively using a scoring system that allocated 25 points each for pain, mechanical symptoms, activity levels and sporting activities. This group showed the most significant improvement, having mean scores that improved from 64 to 90 ($p = 0.0001$). The authors consider that the main benefit of hip arthroscopy is in the treatment of labral tears and removal of loose bodies.

5. Yamamoto et al[11] did a retrospective study of outcomes from arthroscopic excision of a torn acetabular labrum in 10 patients with acetabular dysplasia. The Harris Hip Score improved from a mean score of 64.5 to 92.5 at the final follow-up, a mean of 8 years. However 3/10 patients did complain of mild or moderate dull pain after prolonged walking or sports activities. The authors consider these to be good clinical results, and note that rapid progression of osteo-arthritis was not observed up to 8 years after surgery.

6. Byrd & Jones[12] retrospectively assessed the outcome of hip arthroscopy for labral tears in 32 patients with acetabular dysplasia. The MHHS improved from 52 to 76 after a mean follow-up period of 27 months. The author considers that these results compare favourably with the general population.

The quality of evidence in the following 3 studies is particularly poor because they report on small groups, have no baseline score of the hip and only one uses a numerical scoring method to assess outcome. They have been included in this review because the patient group is comprised of athletes and sports people which are typical ACC claimants.

7. Guanche & Sikka[13] retrospectively report on their results after arthroscopic debridement of acetabular labral tears in a group of 8 high level runners. Patients were assessed using the Western Ontario and McMaster Universitites Osteoarthritis Index (WOMAC) survey at their follow-up examination (mean 14 months). The average score was 94 out of 100, and all patients were able to return to running at their pre-injury level.

8. Saw & Villar[14] reported on small cohort of 6 footballers who all had labral tears resected arthroscopically. Five returned to professional football at the highest level. Authors conclude that hip arthroscopy is an appropriate method of diagnosis and treatment and minimises the length of rehabilitation required.

9. McCarthy et al[15] report on a group of 10 elite athletes who all had labral tears treated arthroscopically. All returned to compete in their sport. The authors conclude that hip arthroscopy is a safe and reproducible method to diagnose and treat intra-articular disorders in athletes, which facilitates earlier return to their respective sport.

Removal of loose bodies

10. Krebs[6] published a review of the role of hip arthroscopy in the treatment of synovial disorders and loose bodies. The author considers that arthroscopic removal of symptomatic loose bodies from the hip has become an accepted treatment option, and the clearest indication for arthroscopic intervention in the hip.

11. Owens & Busconi[4] removed loose bodies from 11 patients who had suffered traumatic hip dislocations or fracture-dislocations but who did not require open surgery to manage the dislocation. At a mean follow up of 24 month, 5 cases had excellent results (no pain, no limp, full hip motion, normal radiographic findings), and 6 cases had good results (no pain, slight limp, >75% normal hip motion, minimal spurring and capsular calcification on radiography). Labral tears were also treated. The authors conclude that hip arthroscopy is a safe effective treatment option for patients who would otherwise be treated conservatively.

12. Mullis & Dahners[3] performed hip arthroscopy to remove loose bodies from 36 patients who had suffered traumatic hip dislocation or wall fracture, but who did not require open surgery to manage their injury. Thirty three of the 36 patients (92%) were found to have loose bodies. No clinical outcome data was presented. The authors conclude that hip arthroscopy may be indicated for loose body removal when open treatment is not otherwise necessary.

Treatment of Ligamentum Teres Ruptures

13. Byrd & Jones[5] did a retrospective study of patients with a traumatic rupture of the ligamentum teres (n=23). Disrupted ligament tissue was debrided arthroscopically. The average pre-operative MHHS was 47 and improved to 90 post-operatively ($p<0.001$). Most patients (96%) had a >20 point score improvement. No statistically significant difference was seen between patients who had associated pathologies e.g. labral tears. The authors conclude that arthroscopy can be quite effective in the management of traumatic ligamentum teres lesions.

Treatment of Sceptic Arthritis

14. Kim et al[16] reported on arthroscopic debridement and drainage in 10 patients with septic arthritis of the hip. All patients had excellent results, having a mean Harris Hip Score of 97.9 at the final follow-up which had a mean of 4 yrs 11 months. The authors conclude that arthroscopic treatment of septic arthritis is an excellent alternative to open surgery.

Treatment of Femoroacetabular Impingement (FAI)

15. Guanche & Bare 2006[17] reviewed the role of arthroscopy in the treatment of FAI. This procedure involves debridement of the impinging lesion on the femoral neck to restore head-neck offset; and treatment of significant labral lesions. A preliminary report was given on 10 patients with mean follow-up of 16 months. Those with no intra-articular cartilage degenerative disease (n=8) did substantially better than the 2 who had degenerative disease. The non-arthritic scoring method of McCarthy[18] averaged 75 pre-operatively and 95 at follow-up. The authors consider that if debridement of the impinging lesion and injured labrum is performed in the setting of normal femoral and acetabular articular surfaces, the results are promising.

16. Sampson[19] reviews FAI and treatment with open surgery and presents an arthroscopic equivalent to the open surgery. Early results from 90 patients are promising with impingement sign eliminated in nearly all patients, and most patients quite happy with their results. The authors conclude that arthroscopic treatment of FAI can be done safely and effectively with favourable early results.

Treatment of osteoarthritis

17. Byrd and Jones[20] retrospectively studied 9 hip arthroscopy patients who had osteoarthritis due to an inverted labrum. All had severe degeneration of the acetabulum cartilage, and 7 of 9 patients had severe degeneration of the femoral head. The torn inverted labrum was excised, and unstable chondral fragments were debrided. Three patients had subchondral bone microfractured and subsequently had the best outcomes. The median MHHS improved from 51 pre-operatively to only 56 post-operatively, and only 4/9 patients improved by more than 10 points. The authors conclude that the results of arthroscopic treatment of these patients were poor and the outcomes were no better than those previously reported for arthritis of all causes.

18. Walton et al[21] retrospectively assessed the outcome of arthroscopy on patients with (n=39) and without (n=31) chondral degeneration. Of those with chondral degeneration, 28/39 (72%) had a poor clinical result, whereas 27/31 patients without chondral degeneration had a good clinical result. The authors conclude that patients were significantly more likely to have a poor clinical outcome following therapeutic arthroscopy if a diagnosis of chondral degeneration was made when compared to other diagnoses ($p<0.0001$).

Treatment of pathologies in hips with Acetabular Dysplasia

19. Byrd & Jones[12] retrospectively studied the impact of hip dysplasia on the outcomes of hip arthroscopy on 48 patients. There were a range of hip pathologies encountered within this group (labral tears n=32, chondral damage n=25, disrupted ligamentum teres n=13, loose bodies n=8, and synovial disease n=4). The average improvement of the MHHS after surgery was 27 points ($p<0.001$), and 79% of patients showed at least a 10 point improvement. These results generally compared favourably with those previously published in a general population. The authors conclude that radiographic evidence of dysplasia is not a contraindication to arthroscopy, nor is it necessarily an indicator of poor outcome.

20. Yamamoto et al[11] did a retrospective study of outcomes from arthroscopic

excision of a torn acetabular labrum in 10 patients with acetabular dysplasia. The Harris Hip Score improved from a mean score of 64.5 to 92.5 at the final follow-up, a mean of 8 years. However 3/10 patients did complain of mild or moderate dull pain after prolonged walking or sports activities. The authors consider these to be good clinical results.

Treatment of children and adolescents

21. Kocher et al[22] studied the outcomes of hip arthroscopy on a group of 42 children and adolescents. This was a heterogeneous group with various hip disorders. Overall there was a significant improvement in MHHS from 53.1 to 82.9, $p<0.001$. Patients with labral tears, loose bodies & chondral flaps associated with perthes disease, developmental dysplasia and inflammatory arthritis all had statistically significant improvements in their MHHS after arthroscopic treatment. Patients with full thickness chondral loss or avascular necrosis did not improve. Complications of nerve palsy (n=3) and instrument breakage (n=1) were reported in 4/42 patients (9.5%). The authors conclude that hip arthroscopy in children and adolescents appears to be safe and efficacious for certain indications in the short term.

Complications of Hip arthroscopy

22. Clarke et al[23] reported that they had 15 complications (1.4%) recorded from 1054 hip arthroscopies. Complications included: transient neuropraxias which resolved within 6 hours; one vaginal tear; one trochanteric bursitis; excessive portal bleeding that resolved spontaneously after 2 days; portal hematomas that resolved spontaneously; instrument breakage; infection; arthrotomy. The authors conclude that with careful technique and proper equipment, arthroscopy of the hip can be done safely with adequate access through low-risk portals.

23. Sampson[24] reported on 38 (3.8%) complications recorded after 1001 hip arthroscopies done by the author and his associate (James M Glick). Complications included: neuropraxias (none in the last 10 years), intra-abdominal fluid extravasations, instrument breakage, scuffing of femoral head, avascular necrosis of femoral head. Most complications resulted in no permanent damage, and severe complications were only 0.5%, down from 15% for the first 60 cases and 6.2% in the next 500 cases. The author concludes that safe traction and experience has reduced the complication rate.

24. Lo et al[25] reported on complications experienced in their prospective study of 73 hips. Mild scope trauma to the femoral head occurred in 16.4% of patients, and 7% had transient sciatic nerve neuropraxia. Nerve damage was attributed to long traction times and there was no recurrence of this complication after a protocol of intermittent traction was introduced. The authors conclude that hip arthroscopy is a safe technique, providing an additional valuable too for hip surgery.

25. Kocher et al[22] did hip arthroscopy on 42 children and adolescents for the treatment of numerous pathologies. They reported complications of nerve palsy (n=3) and instrument breakage (n=1) in 4/42 patients (9.5%).

1.2 Diagnostic alternatives to arthroscopy

Diagnostic Manoeuvres

26. Suenaga et al[26] studied the diagnostic ability of the maximum flexion-rotation tests in determining the status of a labral tear in dysplastic hips, known to have either incomplete or complete detaching tears (n=59). Hip arthroscopy provided the definitive diagnosis. For the internal rotation test, 39% of patients experienced pain, and this correlated well with incomplete detaching tears in the posterosuperior portion of the acetabular labrum (70% positive predictive value). Whereas a negative internal rotation test was associated with a complete detaching tear (sensitivity 79%). Using the external rotation test, 27% of patients showed a positive result. However this test did not correlate with either the location or the grade of labral tears. The authors conclude that the maximum flexion internal rotation test is useful for assessing the magnitude of a labral tear in the posterosuperior portion of the acetabular labrum in dysplastic hips.

27. Mitchell et al[27] use the FABER test which involves combining the motions of hip flexion, abduction, and external rotation. The FABER test was 88% sensitive for intra-articular hip pathology but there was no correlation with a specific hip pathology.

Magnetic Resonance Imaging (MRI)

28. Sundberg et al[28] evaluated the ability of 3.0-T MRI to detect labral tears and chondral abnormalities compared with 1.5-T MRA in a group of 8 patients. All labral tears noted at 1.5-T MRA were also identified by 3.0-T MRI. Furthermore, 3.0-T MRI identified one additional surgically proven labral tear that was not diagnosed at 1.5-T MRA. 3.0-T MRI also demonstrated abnormalities in the articular cartilage of the femoral head and acetabulum. The authors consider that the results provide encouraging support for evaluation with 3.0-T MRI over 1.5-T MRA.

29. Mintz et al[29] evaluated the ability of optimized non-contrast MRI to identify tears of the acetabular labrum and defects in articular cartilage in 92 patients. The radiologists knew what pathology to look for, but were blinded to each others readings, initial MRI and surgical findings. They achieved accuracy of 95% and 93% for the diagnosis of 88 labral tears, and for femoral articular cartilage defects had agreement with initial MRI and surgical grading, within 1 grade, of 92% and 86%. The authors conclude that optimized non-contrast MRI of the hip can identify labral and chondral pathology. They suggest that hip arthroscopy may be preserved as a therapeutic tool, rather than being used as a diagnostic tool.

Magnetic Resonance Arthography (MRA)

30. Keeney et al[30] did a retrospective review of the MRA findings of 101 patients (102 hips) and compared them with the surgeon-documented intra-articular hip pathology. This is the largest published series of this type of study. In the diagnosis of acetabular labral tears a specificity of 44%, a sensitivity of 71%, and an accuracy of 68% for MRA findings was found. The positive predictive value was 93% and the negative predictive value was 13%. The authors conclude that although MRA is an excellent positive predictor in diagnosing acetabular labral tears and articular cartilage abnormalities, it has limited sensitivity resulting in a

high proportion of negative cases not being correctly identified. Consequently, a negative imaging study does not exclude important intra-articular pathology that can be identified and treated arthroscopically. They consider a careful patient history and physical examination to be very important.

31. Chan et al[31] prospectively studied the sensitivity and accuracy of MRA using radial reformatted images in localising acetabular labral tears in 17 patients who were symptomatic for labral tears. Surgical and imaging findings were correlated at arthroscopy. MRA was 100% sensitive and 94% accurate at identifying labral tears. Chan et al[31] also used MRA to localise the position of the labral tear with 100% sensitivity and 96% accuracy. The authors conclude that MRA using radial reformatted images with a true sagittal localizer may achieve superior success rates in diagnosing hip labral lesions and in guiding the arthroscopist in portal selections, thus rendering location of hip labral tears simple in surgery.

32. Mitchell et al[27] prospectively studied the diagnostic findings of MRA compared to hip arthroscopy in 25 patients. The sensitivity for all pathologies identified was low, with a relatively high number of false negatives. Sensitivity was 24% for labral tear, 31% for other labral abnormality, 6% for cartilage abnormalities, 4% for osteroarthritis. Furthermore, the pathology reported was frequently incorrect. The authors suggest that the relevance of MR imaging for indicating hip arthroscopy needs to be questioned in light of these results.

33. Byrd & Jones [32] did a retrospective non-blinded study to correlate the diagnostic accuracy of clinical assessment, 1.5-T MRI, MRA and intra-articular anesthetic injection against the definitive diagnosis of hip arthroscopy (n=40). The existence of hip abnormality was diagnosed clinically with 98% accuracy, but the nature of the abnormality was identified in only 32.5% of cases (with 92% accuracy). Intra-articular injection of anesthetic was 90% accurate for detecting presence of abnormality. MRI demonstrated a 42% false-negative and 10% false positive interpretation. MRA demonstrated an 8% false negative and 20% false positive interpretation. For labral pathology MRI was 25% sensitive; MRA was 66% sensitive. The authors conclude that MRA is much more sensitive than MRI, but the false positive interpretation rate doubles.

34. Schmid et al[33] retrospectively analyzed the MRA images of 40 patients suspected of having femoroacetabular impingement and/or labral abnormalities. Two readers interpreted the images for chondral lesions. Diagnosis by MRA was compared with notes taken at open surgery by two independent readers. Sensitivity was 79% and 50%, and specificity was 77% and 84%. There was poor agreement between the readers in the detection of cartilage lesions in all acetabular regions, and the extent of lesions was over-estimated when diagnosis was based on secondary signs of osteoarthritis. The authors consider that MRA is moderately sensitive in the detection of cartilage damage of the hip joint.

Bone Scintigraphy

35. Bruce et al[34] evaluated the predictive power of bone scintigraphy for diagnosis of acetabular labral tears. A group of 27 patients were diagnosed with labral tears using bone scintigraphy on the basis of them having distinctive focal uptake patterns. There were 2 false positives; these patients had osteo-chondral lesions of

the acetabulum. None of the patients that had other hip pathologies (n=30) manifested the distinctive focal pattern of uptake. The authors conclude that a bone scan that does not have this pattern of uptake carries a high negative predictive value for the absence of clinically significant labral pathology. The positive predictive value of the scintigraphic study is being evaluated prospectively.

2. Further Results and Discussion

The quality of the evidence describing hip arthroscopy as a therapeutic tool is poor according to the SIGN convention because it is limited to case series. There are 30 case series presented in this review. They all have limited follow-up periods, but apparently long term follow-up studies are underway[35]. There are no RCT's that directly compare hip arthroscopy to the two alternative treatment options: open arthrotomy or conservative treatment (non-surgical). This is partly due to the fact that one of the main pathologies which hip arthroscopy treats, acetabular labrum tears, went largely unrecognised and untreated prior to the development and use of hip arthroscopy, and so hip arthroscopy has become the gold standard for treating this condition.

In lieu of an RCT, the opinion in the literature says that a non-surgical approach to treating intra-articular pathology has an associated increased risk of progression to osteoarthritis[1]. Open surgery has traditionally had risks associated with surgical dislocation of the hip, such as avascular necrosis. These risks are somewhat diminished using the new dislocation technique, described in 2001 by Ganz et al[36], which provides full access to the joint without the risk of avascular necrosis. Consequently, there is more likelihood of an RCT being done in the future now that the opportunities for treating intra-articular hip pathology using open surgery have grown.

Treatment of Labral Tears

Labral tears are the most common pathology identified by hip arthroscopy[1]. Isolated labral tears are rare and occur in only 5 to 10% of cases. Rather, they are associated with femoral acetabular impingment (FAI), capsular laxity, degenerative changes and dysplasia (see Martin [37]and Geuvara[38]). Labral tears are routinely treated by debridement and the studies reported in the original EBH review in 2003 suggested that arthroscopic treatment of labral tears yielded good results. All 8 studies presented here continue to support this position[7-11] (see Table 2 for a summary of results). Good outcomes were achieved not only in patients with otherwise normal hip anatomy, but also in those with acetabular dysplasia[11 12].

One new question raised in the recent literature is whether labral tears in the peripheral one third of the labrum should be *repaired* rather than excised or debrided[39-42]. The acetabular labrum has important physiological functions such as enhancing joint stability, maintaining the sealing mechanism and decreasing cartilage consolidation, and the excision or removal of labral tears may alter these important functions. To avoid these potential negative consequences of labral debridement, Kelly et al[39] have reported their new technique of labral repair by way of suture anchor. Although they have no results to report yet, early results from open surgery indicate that outcomes of repairing labral tears may be significantly better than outcomes from labral debridement[40].

Table 2 Outcome after therapeutic arthroscopy for labral tears					
	Author	**Number of Patients**	**Average Follow-up Period**	**Assessment Method**	**Results**
This EBH Review	Potter et al; 2005	19	25.7 months	MHHS[a]	• 68% had good or excellent results on MHHS (scores >80) • 84% of patients very or somewhat satisfied
	Burnett et al; 2006	66	16.4 months	MHHS	• Mean MHHS improved from 62 to 80 points • 89% of patients had improved hip function and diminished symptoms
	Awan & Murray; 2006	10	18 months	A 100 point scoring questionaire	• The medial score improved from 64 to 90
	Yamamoto et al, 2005	10 (with dysplasia)	8 yrs	HHS[b]	• Mean score improved from 64.5 to 92.5 • 3 patients had mild or moderate dull pain after prolonged walking or sports activities
	Byrd & Jones 2003	32 (with dysplasia)	At least 1 yr	MHHS	• Mean score improved from 52 to 76
2003 EBH Review	Santori & Villar 2000	58	3.5 yrs	HHS[b]	• Mean score increased from 49.6 to 73.6 • 67% pleased with outcome
	Farjo et al 1999	28	-	-	• 71% without arthritis had good results • 46% overall had a good outcome
	O'Leary et al 2001	22	-	-	• 91% had a significant decrease in pain

[a] Modified Harris Hip Score (MHHS) range is 0 to 100: 90-100=excellent, 80-90=good, 70-80=fair, 70=poor

[b] Harris Hip Score (HHS); differs from MHHS by retaining points for 'range of motion and deformity', which is thought to be less relevant for assessment of Hip arthroscopy[12]

Removal of Loose Bodies

The vast majority of literature describing removal of loose bodies and treating synovitis dates to the 1990's and was reviewed in the EBH review of 2003. In that review, removal of loose bodies was considered to be one of the strongest indicators for hip arthroscopy.

Using our search strategy, only two case series and one review was found. Both case studies used hip arthroscopy to remove loose bodies from patients who had suffered traumatic hip dislocations. The dislocations themselves did not require open surgical management, but the presence of loose bodies was an indication for either open surgery or arthroscopy. Owens and Busconi[4] recommend waiting at least 3 weeks for the capsule to heal before performing arthroscopy and reported good or excellent results for all of their 11 patients. The focus of the other case study was on the high incidence of loose bodies in patients who suffered traumatic dislocations. They did not report clinical outcomes[3]. Both authors support the use of hip arthroscopy as a useful adjunct in management of hip trauma. The review article reinforced that loose bodies is a strong indicator for hip arthroscopy[6].

Treatment of Ligamentum Teres Ruptures

There is no evidence that the ligamentum teres has a significant role in stabilising the hip joint, but it contains vascular tissues that contribute to the blood supply of the femoral

head[5]. Lesions to the ligamentum teres are relatively rare (8% of hip arthroscopy patients are diagnosed with ligamentum teres pathology[43]) but can be a source of persistent hip pain. Rupture can be caused by violent trauma or simply from a twisting injury. There was only one new case series and it reported excellent outcomes after arthroscopic discriminant debridement of the ruptured portion in 23 patients who had traumatic injury[5]. This was a very difficult pathology to diagnose pre-surgery. None of the patients had their pathology diagnosed by MRI, and only 2 were diagnosed pre-surgery and this was achieved with MRA.

Treatment of Sceptic Arthritis

One case series was reviewed describing the use of arthroscopy to treat sceptic arthritis of the hip with debridement and drainage[16]. The excellent outcome for all 10 patients is consistent with the results reported in the 2003 EBH review. The accepted view is that arthroscopic treatment of sceptic arthritis is safe and effective, and avoids the post-operative pain, scaring and prolonged hospitalisation associated with open arthrotomy[44].

Treatment of FAI

FAI is a mechanical conflict between the femoral head-neck junction and the acetabular opening and rim. These deformities are known as cam and pincer impingements and appear to predispose patients to chondral and labral lesions (reviewed by Bare & Guanche[45]). There is a consensus in the literature that to adequately address the chondral and labral lesions associated with FAI, the underlying anatomic deformity must be addressed. Management of these deformities has been addressed using open surgical techniques since it was first recognised in 1999[36 40 46 47]. The learning curve is steep for these open surgery techniques and there is an associated risk of heterotopic ossification (37% incidence, but declining with experience[36]).

Of relevance to this report is that a number of recent reports describe arthroscopic techniques that enable both Cam and Pincer impingements to be resolved[17 19 48 49]. Whilst the preliminary data from arthroscopic resolution of FAI seems promising, the reports comprise only of brief paragraphs within review or technical papers[17 19]. There are no case series available at the present time. As with open surgery, success depends on the level of cartilage damage[17 47]. In conclusion, whilst early results look promising, the quality of the evidence for arthroscopic treatment of FAI is poor.

Treatment of Osteoarthritis

Only two new papers report specifically on the outcome of hip arthroscopy treatment for patients with osteoarthritis[20 21]. Both studies indicate that hip arthroscopy provides little or no benefit to these patients. Byrd and Jones[20] reported a median improvement using the MHHS scoring system of only 4 points, and Walton et al[21] reported that 72% of patients had a poor clinical outcome. These results are consistent with the results reported in the 2003 EBH review (see Table 3). The main support now for using hip arthroscopy in patients with osteoarthritis is as a diagnostic tool in staging the progression of the disease[44].

Table 3 Outcome after therapeutic arthroscopy for osteoarthritis					
	Author	**Number of Patients**	**Average Follow-up Period**	**Assessment Method**	**Results**
This EBH Review	Byrd & Jones 2002	9	Minimum 2 yrs	MHHS	Median score changed from 51 to 56
	Walton et al 2004	39	Minimum 4 months	Modified Farjo & Glick classification system	72% had a poor clinical outcome 61% of those with poor outcome progressed to hip arthroplasty surgery
2003 EBH Review	Helenius et al 2001	46	1 yr		74% reported no improvement in hip pain

Acetabular Dysplasia

Developmental acetabular dysplasia is defined by a shallow acetabular socket(ref 25 &55 within [50]). Whilst hip dysplasia is not a cause of hip pain in itself, it is a morphologic condition that may make the hip more vulnerable to an intra-articular lesion that may then become symptomatic. Of those that do experience hip pain, a high proportion (72%) have labral tears and chondral lesions of both the acetabulum and the femoral head [51 12].

The presence of dysplasia has been considered a relative contra-indication and a harbinger of poor results. However, the two papers reviewed here show that arthroscopic treatment of a range of pathologies is as effective in the dysplastic population as it is in the general population. Byrd & Jones[12] reported that 79% of patients improved by at least 10 MHHS points after surgery, and Yamamoto et al[11] reported a MHHS improvement from 64.5 to 92.5 at the final follow-up 8 years after surgery.

Treatment of children and adolescents

There was one case series that exclusively reported on the outcomes of hip arthroscopy on 42 children and adolescents[22]. The mean MHHS improved by 29 points after treatment of a range of pathologies, and so the authors thereby showed that outcomes are consistent with those for adults. The pathologies that improved after treatment were labral tears, perthes disease, labral tears associated with developmental dysplasia and inflammatory arthritis. Treatment of full chondral loss and avascular necrosis did not improve. The complication rate seemed quite high (9.5%) but all complications were transient.

Complications of Hip arthroscopy

The complications associated with hip arthroscopy are well documented and include both transient complications (transient neuropraxia, vaginal tear, trochanteric bursitis, excessive portal bleeding, portal hematomas, instrument breakage, infection, arthrotomy, intra-abdominal fluid extravasations), and serious longer term complications (scuffing of femoral head, avascular necrosis of femoral head, femoral neck fracture). The two recent reports by surgeons very experienced with hip arthroscopy, Clarke et al[23] and Sampson[24], show that complication rates are falling as surgeons become more experienced, and as techniques and equipment are optimized (see Table 4). Both authors emphasised the critical importance of a thorough patient history and clinical assessment in guiding patient selection to minimise complications.

Table 4 Summary of papers reporting specifically on complications as a result of hip arthroscopy			
Author/surgical team	**Number of patients**	**Percentage with Complications[a]**	**Comment**
Clarke et al 2003	1054	1.4%	Was 1.6% in 1999
Sampson 2005	1001	3.8% (0.5% serious [b])	Was 6.4% in 2001
Lo et al 2006	73	16.4% mild scope trauma to femoral head 7% transient sciatic nerve neuropraxia[c]	
Kocher et al 2005	42	9.5%	

[a] Complications include: transient neuropraxia, vaginal tear, trochanteric bursitis, excessive portal bleeding, portal hematomas, instrument breakage, infection, arthrotomy, intra-abdominal fluid extravasations, scuffing of femoral head, avascular necrosis of femoral head, femoral neck fracture

[b] Definition of serious complication: anything resulting in long term damage; included severe scuffing of the femoral head, avascular necrosis of the femoral head, femoral neck fracture.

[c] Nerve neuropraxia did not recur after intermittent traction used during surgery

Complications can be minimised or avoided by paying attention to the following[35]:

1. *Patient positioning*: supine position was used first, but other surgeons have adopted lateral position.
2. *Specialised equipment*: for lateral positioning; longer instruments for gaining access to the deep joint; flexible arthroscopes.
3. *Safe distraction of hip*: To avoid nerve damage, distraction force should be carefully controlled. Many modern distraction systems incorporate a tensiometer. The length of time under traction should be limited to one hour, and some surgeons use intermittent traction[52]. Careful positioning of counterpressure bar is required; some use wide groin bars with padding. Distraction force can be minimised by also using distension techniques, i.e. injecting air or fluid. Better distraction can be aided by attention to leg positioning.
4. *Gaining access without damaging labrum or femoral head*: Fluoroscopically guided wire insertion can be used. Distraction to 7 to 10 mm required.
5. *Portal selection*: To avoid major nerves, and blood vessels at least 2 portals are required – lateral, anterolateral. Often a third portal in the posterior position is used. Safest positions have been established and are widely reported.
6. *Achieving good visualization*: 70 degree arthroscopes are used; peripheral pathology best seen with 30 degree arthroscope; flexible arthroscopes now available.
7. *Recognizing the pathology*: a better understanding of the pathologies leads to recognition of what is normal variation, and what is pathology.

Diagnostic alternatives

The importance of patient selection in minimising the complication rate of hip arthroscopy makes pre-surgery diagnostic tools all the more important. The tools available to identify patients who can be treated arthroscopically are:

1. *Intra-articular injection of anesthetic*: 90% accurate[32] at confirming intra-articular lesions of the hip.
2. *A number of clinical tests that manoeuvre the hip joint*. These tests may reproduce pain and/or mechanical symptoms (clicking and catching), in hips with intra-

articular pathology. They include the Faber test (88% sensitive[27]), Scour Test, resisted straight leg raise, Impingement Tests (hip flexion, internal rotation and adduction; full hip extension and external rotation), the Log Roll Test, and the McCarthy sign[51]. See Martin et al for review[50].

3. *Magnetic Resonance Imaging (MRI)*
4. *Magnetic Resonance Arthrography (MRA).*

Whilst intra-articular injection and manoevres of the hip joint are useful in confirming the presence of an intra-articular pathology, neither of these approaches can differentiate between the numerous pathologies that cause hip pain. Imaging techniques provide the only non-surgical means of making a specific diagnosis, but even these techniques do not provide an entirely sensitive or specific diagnosis of hip pathology.

Background X-rays are of no use at all for detecting labral tears[32]. However, they can be useful to evaluate bony abnormalities that may contribute to labral tears, including FAI and hip dysplasia[50].

MRI commonly generates a high number of false negative readings[32 35]. However, the 2 MRI papers reviewed here describe developments or methodology in the technology that offers improved accuracy. Mintz[29], and others, prefer MRI to MRA because the latter is invasive and carries a risk of iatrogenic injury to adjacent neurovascular tissue when gadolinium, the MRA contrast solution, is injected into the hip joint. They have used an optimized non-contrast 1.5-T MRI protocol to achieve accuracy of 95% and 93% for the diagnosis of labral tears. This compares to 25% specificity for another recent MRI study that directly compared MRI to MRA[32].

These and previous studies used 1.5-T MRI. Importantly, higher resolution imaging which delineates cartilage interfaces in the hip joint can now be achieved with 3.0-T MRI. Only one new study has reported the application of 3.0-T MRI for diagnosing labral tears, but early results indicate improved accuracy[28]. The comparison was with 1.5-T MRA, and all labral tears noted at MRA were identified at 3.0-T MRI. Furthermore, 3.0-T MRI identified one additional surgically proven labral tear that was not identified by MRA[28].

The superiority of 1.5-T MRA imaging over MRI in evaluating intra-articular hip pathology is widely discussed in the literature and was generally borne out in the papers reviewed here. However, what becomes apparent after analysis of the 5 papers reported here is that there remains to be a huge variation in sensitivity and accuracy rates. At one end of the scale Chan et al[31] report 100% sensitivity, whereas Mitchell et al[27] report just 24%. Keeney et al[30], Byrd and Jones[32] and Schmid et al[33] fell in the middle reporting sensitivities of 71%, 66% and 50%-79% respectively. Accuracy rates were not calculated for all studies, but the variation of those that did report is significant: 68% by Keeney et al[30], and 94% by Chan et al[31]. Authors also do not agree on the weakness of MRA. Keeney et al[30] warn of a high proportion of false negatives, whereas Byrd & Jones[32] reported higher false-positives compared with MRI. Schmid et al[33] reported an over-estimation of cartilage lesions, and Mitchell et al[27] altogether questions the relevance of MR imaging for indicating hip arthroscopy.

One difficulty when comparing the results of many of these studies is that different combinations of coronal, sagittal and axial views are used in different studies, and there can be poor agreement between readers of images[33].

A potential pitfall in the correct identification of labral tears at MRI and MRA is that they have an appearance similar to that of a sulcus (a partial separation of the labrum from the boney acetabulum), which is now considered to be a normal anatomic variation of the acetabulum and can be seen at different locations[53]. Mistakes can be minimized with a better understanding of the prevalence and locations at which sulci and labral tears can be found[53 54]. Labral tears occur predominantly in the anterior or anterosuperior labral region of the acetabulum[9 54], whereas sulcus can be located postero-inferiorly[53 54] or anterosuperiorly [53]. Saddik at al[53] is of the view that the radiologist can be comfortable ignoring a cleft in the postero-inferior labrum in virtually all cases.

One new imaging report worth noting is that by Bruce et al[34] who use bone scintigraphy (bone scans) to diagnose labral tears and challenges the current opinion that bone scans can not diagnose labral tears[50]. The case series showed that a distinctive pattern is observed in patients with labral tears, but not in patients without labral tears[34].

The role of diagnostic arthroscopy

There were no recent studies that specifically set out to assess the role for diagnostic arthroscopy. Costa and Villar[35] reviewed the evolution and impact of hip arthroscopy and are of the opinion that its use purely for diagnostic purposes remains controversial because of the complications that do occur. There is some support for its use as a tool for staging osteoarthritis[44], but its overall role will continue to decline as imaging techniques become more powerful at providing accurate diagnoses of intra-articular hip pathology. In the meantime it has been suggested that diagnostic hip arthroscopy should be considered for pain persisting for 6 months or more.

3. Indications and Contra-indications

Indications for therapeutic hip arthroscopy

According to the evidence reviewed here, and the large body of expert opinion in review articles the following are indications for hip arthroscopy:

Loose bodies

Loose bodies are the clearest indication for hip arthroscopy because 1) the diagnosis of loose bodies is usually easy to determine, 2) retained intra-articular fragments have a well-established association with a poor prognosis, 3) arthroscopy is less invasive and less morbid than open arthrotomy.

Etiology includes:

- synovial chondromatosis
- osteochondritis dissecans
- degenerative arthritis
- traumatic hip dislocation

Labral tears

Labral tears are a well–recognised indication, although diagnosis is difficult. Symptoms include:

- persistent hip pain
- Mechanical symptoms (clicking, locking)

Etiology includes:

- FAI
- Development dysplasia of the hip
- Major trauma
- Twisting/rotational injury

Chondral lesions:
Chondral lesions occur in association with other pathologies including loose bodies, labral tears, degenerative arthritis, and are commonly found in patients with FAI. Chondral lesions are difficult to diagnose, and good outcome is directly correlated with less severe grades of cartilage lesion.

Impingement or rupture of ligamentum teres
Rupture of the ligamentum teres is a rare condition, but some of the best outcomes of hip arthroscopy are reported for this pathology. Diagnosing patients is often difficult.
Symptoms include:

- Mechanical symptoms (catching, popping, locking, giving way)
- Deep anterior groin pain

Etiology includes:

- Violent trauma including hip dislocation
- Twisting injury

Unresolved hip pain
An intra-articular cause of unresolved hip pain can be confirmed with anesthetic joint injection, and diagnostic manoevres as discusssed earlier in this review.

Septic arthritis of hip joint
Patients are often young and have sudden onset of painful limitation of range of motion of hip joint.

Contra-indications for therapeutic hip arthroscopy
Severe osteoarthritis is a major contra-indication for hip arthroscopy.

Other contra-indications are widely discussed in the literature and include:

- Concomitant medical illness that increases risk of surgery or anesthesia
- Joint ankylosis (joint is not distractible)
- Superficial infection
- Severe obesity
- Stable, non-progressing avascular necrosis

Treatment of the older patient
The 2003 EBH review of hip arthroscopy recommended that patients older than 55 years of age should be excluded from hip arthroscopy treatment. This recommendation seemed to be based on the routine practise of Byrd's group. The case series reviewed in this report included patients ranging in age from 5 to 64 years, and six studies included patients >55 yrs. Whilst none of these studies exclusively looked at the outcomes of hip arthroscopy on the older patient, Byrd & Jones presented an 'outcome v's age' analysis in their study of patients with dysplasia[12]. Although younger patients tended to do better,

the authors stated that this probably reflects the type of diagnoses seen in the younger population. Nine review articles published since 2002 were also referred to for the preparation of this report and none of them consider that older age is a contra-indication for hip arthroscopy. In conclusion, the general view when considering patient selection criteria, is that older age *per se* has limited relevance. Of more relevance is the condition of articular chondral surfaces and the diagnosis of hip pathology.

4. Conclusions

The quality of evidence supporting hip arthroscopy has not improved since the 2003 EBH review and remains poor by evidence-based healthcare standards. There are no RCT's and still no comparisons of outcomes with other therapeutic interventions. Any conclusions about the effectiveness of hip arthroscopy are still dependent on case series, most of which still have a relatively short follow-up period of around 1-2 years. The reporting of outcomes of hip arthroscopy has improved since the 2003 EBH, with many studies (70%) using a numerical scoring system such as the Modified Harris Hip Score.

It is widely accepted that the most effective application of hip arthroscopy is the removal of loose bodies, and the new case series data report good results for loose body removal after traumatic hip dislocations. Excellent results are also achieved after the treatment of ruptures to the ligamentum teres. Good results are reported for labral tear debridement in patients whether they have developmental dysplasia or not, and for treating sceptic arthritis. Early results suggest that the anatomic deformity in FAI can be resolved arthroscopically, but it is too early to conclude that this approach is effective.

Poor outcomes are achieved in patients with severe osteoarthritis, and in the treatment of other pathologies that have co-existing degradation of chondral tissue.

Patient selection criteria relevant to ACC remain essentially unchanged from the 2002 EBH review, except when considering patients >55yrs. The view of authors of 9 review articles is that older age *per se* no longer seems to be a contra-indication for hip arthroscopy. Selection criteria are:

- Hip pain is most likely attributable to an injury, and not to an anatomic deformity such as FAI.
- Hip pain has persisted for more than 6 months and has been unresponsive to conservative treatment (except in the case of sepsis).
- In most cases the patient has not received previous operative treatment for the hip involved.
- Patients >55 years are not necessarily contra-indicated, however it is particularly important to use highest resolution imaging techniques to determine the condition of chondral surfaces.
- Osteoarthritis, and other severe chondral damage, is not detectable by radiological techniques.
- Patient has none of the other contra-indications for hip arthroscopy (joint ankylosis, superficial infection, severe obesity, stable non-progressing avascular necrosis).

The intervention is proposed for:

- Removal of loose bodies
- Detection and treatment of labral tears, rupture to the ligamentum teres, chondral damage, or synovitis.
- Acute sepsis where the diagnosis has been made early and the organism is sensitive to antibiotic treatment.

Implications for practice

Hip arthroscopy remains a technically difficult procedure and has a very steep learning curve. Although complication rates are higher for less experienced surgeons, most complications are transient in nature. The incidence of complications declines as surgeons become more experienced. Patient selection is crucial to minimising complications - it is critically important to obtain a thorough patient history and carry out a thorough clinical assessment to guide patient selection.

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Evidence Based Healthcare Table Hip arthroscopy

Reference: Robertson WJ et al, 2006

Case Number: 1 **Reference Number:** 6

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A systematic review of the literature from January 1980 to September 2005 to determine the rate of patient satisfaction that can be expected following acetabular labral debridement.</td><td>Description:</td><td rowspan="5">Arthroscopic debridement of acetabular labral tears</td><td>Outcome Measures:
A subjective measure of patient satisfaction, results according to the MHHS, and resolution of mechanical symptoms.</td></tr>
<tr><td>Treatment Group
No. in Group: n/a

Mean Age: n/a

Control Group
No. in Group:

Mean Age:</td><td>Results:
1. patient satisfaction rate of approximately 67% at 3.5 years follow up.
2. good results by a MHHS in patients who are subjectively satisfied with their outcome.
3. a complete resolution of mechanical symptoms in nearly 50% of patients with this complaint.</td></tr>
<tr><td>Inclusions:
Studies in English; had a level I, II, III or IV study design; labral tear was major diagnosis; labrum received intervention; there was at least an average 2 year follow-up; patients with symptomatic labral tears who failed conservative management.</td></tr>
<tr><td>Exclusions:
Studies and patients with co-exisiting severe arthritis, or acetabular dysplasia; patients undergoing prior open surgical procedure of the ipsilateral hip. Patients claiming workers' compensation.</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
3
(Not 2++ because not a review of case-controlled studies)</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Potter BM et al, 2005

Case Number: 2 **Reference Number:** 7

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of consecutive patients (active soldiers) who underwent hip between 1998 and 2003.</td><td>Description:</td><td rowspan="5">Supine position arthroscopy.

Arthroscopic debridement of acetabular labral tears.</td><td>Outcome Measures:
Follow-up 13-55 months, mean=25.7 months. Assessment of the hip via MHHS and a ‘General Health Assessment’ via the Short Form-36. Short Form-36 measures 8 facets of general health. Scores were correlated with scores from ‘normal americans’.</td></tr>
<tr><td>Treatment Group
No. in Group: 33
(19 for this EBH review)
Mean Age: 34.6 yrs

Control Group
No. in Group:

Mean Age:</td><td>Results:
Group 1: 68% had good or excellent results on MHHS; 84% of patients were very or somewhat satisfied with the results.

Note; Those under evaluation for workers compensation were less satisfied with the outcome: 0% of the patients had good or excellent results. Only 50% were very or somewhat satisfied.</td></tr>
<tr><td>Inclusions:
Patients who underwent hip arthroscopy for the primary indication of acetabular labral tears. Patients had chronic hip pain that had failed to respond to at least 6 months of non-operative therapy.</td></tr>
<tr><td>Exclusions:
Patients not available for appropriate clinical follow-up post-operatively.
[**for purposes of this EBH, 14/33 are excluded because they were undergoing evaluation for workers’ compensation and therefore had conflicting interests]</td></tr>
<tr><td>Selection Notes:
The relevant cohort for this EBH review is effectively only 19. These patients, Group 1, (19/33; 58%) were not undergoing evaluation for workers’ compensation. Group 2 (14/33; 42%) were undergoing evaluation for workers’ compensation, possibly a negative indicator for success after hip arthroscopy; i.e. There was confounding influence at work in this group.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Burnett SJ et al, 2006

Case Number: 3 **Reference Number:** 8

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of consecutive patients who had a documented labral tear that had been confirmed with hip arthroscopy. Data was collected prospectively.</td><td>Description:</td><td rowspan="5">Arthroscopic debridement of unstable portions of the labrum.

Surgery done in the supine position.</td><td>Outcome Measures:

Follow-up at least for 12 months. Mean follow-up 16.4 months.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 38 No. in Group:

Mean Age: 66 Mean Age:</td><td>Results:
1 year follow-up: The MHHS improved from a mean of 62 points pre-operatively to a mean of 83 points (p<0.0001).

Most recent follow-up (mean 16.4 months): MHHS was 80; 89% had improved hip function and diminished symptoms.</td></tr>
<tr><td>Inclusions:
Patients with arthroscopically confirmed acetabular labral tear.</td></tr>
<tr><td>Exclusions:
Patients who required reconstructive or salvage procedures for the treatment of major structural abnormalities such as developmental dysplasia of the hip, prior Legg-Calve-Perthes disease, slipped capital femoral epiphysis or femoroactabular impingement.</td></tr>
<tr><td>Selection Notes:
All patients had failed a course of non-operative therapy before undergoing arthroscopy.
Onset of symptoms was classified as insidious (61%), acute (30%) or traumatic (9%).</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Awan N & Murray P, 2006 **Case Number:** 4 **Reference Number:** 9

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of a consecutive series of arthroscopies done over a 44-month period.</td><td>Description:
Arthroscopy revealed patients had a range of pathologies: Labral tear (n=10), mild OA (n=5), loose body (n=1), synovitis (n=2), Perthes' disase (n=1), normal (n=3).</td><td rowspan="5">Arthroscopic surgery in the supine position.

Debridement of labral tears.</td><td>Outcome Measures:
Follow-up assessments made at least 12 months, average was 18 months. .Assessment was via a non-validated questionnaire. Scores were allocated to a maximum of 100 points, 25 each for pain, mechanical symptoms, activity levels and sporting activities.</td></tr>
<tr><td>Treatment Group
No. in Group: 22 (n=10 with labral tear)

Mean Age: 31

Control Group
No. in Group:

Mean Age:</td><td>Results:
The medial score was improved from 67.7 to 84.

The most significant improvement was seen with the group of patients (n=10) who had mechanical symptoms with definite labral pathology confirmed and treated. Scores improved from 64 to 90 with a statistical significance of P=0.0001.</td></tr>
<tr><td>Inclusions:
Ongoing hip pain for more than 6 months.</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
Of the participants, 59% had mechanical symptoms of catching. Only 27% had a definite history of trauma.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Yamamoto et al 2005 **Case Number**: 5 and 20 **Reference Number:** 10

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">Case series</td><td>Description:
This group was selected from 419 hip arthroscopy operations from 1984 to 2000.</td><td rowspan="5">Hip arthroscopy in the supine position.

Arthroscopic partial limbectomy (i.e. excision of the torn labrum)</td><td>Outcome Measures:
Mean follow up was 8 years.
HHS pre- and post- operative.
And a subjective patient assessment of satisfaction.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 10 No. in Group:

Mean Age: 33.7 years Mean Age:</td><td>Results:
The HHS improved from a mean score of 64.5 to 92.5 after surgery.

All patients were satisfied with the result of surgery.
But 3/10 patients compained of mild or moderate dull pain after prolonged walking or sports activities.</td></tr>
<tr><td>Inclusions:
Incarceration of the torn labrum in the joint space of patients with pre- or early-osteoarthritis secondary to acetabular dysplasia.</td><td></td></tr>
<tr><td>Exclusions:
Patients with no incarceration of the torn labrum in the joint. This group received a different treatment.</td><td></td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Byrd & Jones 2003 **Case Number**: 6 and 19 **Reference Number:** 11

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="4">A prospective clinical case series.</td><td>Description:
Patients all had developmental dysplasia of the hip.</td><td rowspan="4">Hip arthroscopy. Treatments relevant to the range of pathologies.

Labral tears treated with debridement of damaged portion (n=32).

Chondroplasty – debridement of unstable articular surface (n=25).

Microfracture performed when indicated (n=8).

Disrupted ligamentum teres – disrupted fibres were debrided (n=13).

Loose bodies removed (n=8).

Synovial disease addressed (n=4).</td><td>Outcome Measures:
A minimum 1 year follow-up, average 27 months. Assessment via MHHS.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 48 No. in Group: n/a

Mean Age: 34 Mean Age: n/a</td><td>Results:
Average improvement of MHHS pre- to post-operative was 27 points (p<0.001). 79% of patients showed at least a 10 point improvement.

Dysplastic: 57 to 83 MHHS
Borderline dysplastic: 50 to 77 MHHS
Labral tears n=32. MHHS changed 52 to 76
Chondral damage n=25. MHHS changed 53 to 75

Results compare favourably with general population.</td></tr>
<tr><td>Inclusions:
Hip arthroscopy patients with evidence of dysplasia</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
Onset of symptoms was 11 traumatic (violent impact or hip dislocation), 16 acute (twisting, or other well-defined event precipitating onset of symptoms), 21 insidious (absence of injury or precipitating event, but a gradual onset of worsening symptoms).</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Guanche CA & Sikka RS, 2005

Case Number: 7 **Reference Number:** 12

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of patients who had increasing hip pain with running, without any history of macrotrauma.</td><td>Description:</td><td rowspan="5">All had arthroscopic debridement of labral tears.

6/8 also had chondral debridement.

3/8 also had ligamentum teres rupture.</td><td>Outcome Measures:
Follow-up ranged from 6-29 months, mean 14 months. Patients were given the WOMAC survey at their follow-up exam.</td></tr>
<tr><td>Treatment Group
No. in Group: 8

Mean Age: 36

Control Group
No. in Group:

Mean Age:</td><td>Results:
The average WOMAC score was 94 out of 100. All patients were able to return to running at their pre-injury level.</td></tr>
<tr><td>Inclusions:
High-level runners from a group of 162 patients who had hip arthroscopy.</td><td rowspan="2"></td></tr>
<tr><td>Exclusions:
Those who were not high-level runners.</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Saw & Villar, 2004

Case Number: 8 **Reference Number:** 13

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A case series of football players presenting with intractable hip pain.</td><td>Description:
Patients were top level football players</td><td rowspan="5">Hip arthroscopy with resection of all unstable labral and chondral tissues</td><td>Outcome Measures:
Clinical judgement of symptomatic improvement.
Return of patient to professional football or not.
Recovery time recorded.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 6 No. in Group:

Mean Age: not mentioned Mean Age:</td><td rowspan="3">Results:
Patient 4 had the most significant chondral damage and required a further operation to stabilise the flap. This patient did not return to professional football.

5 patients returned to professional football. Recovery time ranged from 8 weeks to 15 weeks.</td></tr>
<tr><td>Inclusions:
Professional football players who presented with intractable hip pain which was attributable to anterior acetabular labral tear with adjacent condral damage.</td></tr>
<tr><td>Exclusions:
Not described.</td></tr>
<tr><td>Selection Notes:
Injury was as a result of a rotational event.
Several patients had already undergone extensive periods of rehabilitation or groin surgery.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: McCarthy et al, 2003

Case Number: 9 **Reference Number:** 14

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of elite athletes who had arthroscopic surgery.</td><td>Description:</td><td rowspan="5">Hip arthroscopy in the lateral position.
Presumably debridement of labral tears, but not specifically mentioned.</td><td>Outcome Measures:
A result was considered successful if it allowed the patient to return to his or her preinjury level of competition in a painfree fashion with no additional surgical or conservative intervention other than standard rehabilitation.
Follow-up ranged from 4 months to 6 years, mean 18 months.</td></tr>
<tr><td>Treatment Group
No. in Group:

Mean Age:

Control Group
No. in Group:

Mean Age:</td><td>Results:
All patients had labral tears; some had co-existing pathologies e.g. loose bodies, chondral defects.

All 10 patients returned to compete in their sport.</td></tr>
<tr><td>Inclusions:
Elite athletes who had arthroscopic hip surgery.</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Krebs 2003

Case Number: 10 **Reference Number:** 15

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A review article</td><td>Description:</td><td rowspan="5"></td><td>Outcome Measures:</td></tr>
<tr><td>Treatment Group
No. in Group:

Mean Age:

Control Group
No. in Group:

Mean Age:</td><td rowspan="2">Results:
The role of hip arthroscopy in synovial disorders is mainly in diagnosis.

Treatment of symptomatic loose bodies within the hip or in the pericapsular region is the most widely reported and accepted application for hip arhroscopy.</td></tr>
<tr><td>Inclusions:
No description given</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
4</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Owens & Busconi 2006

Case Number: 11 **Reference Number:** 4

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">Retrospective study of hip arthroscopies performed on patients who had sustained hip dislocations.</td><td>Description:</td><td rowspan="5">Hip arthroscopy with removal of loose bodies and labral debridement.</td><td>Outcome Measures:
Assessment of pain, limp, hip motion, post-surgery radiographic findings.

Follow-up period was a mean of 24 months.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 11 No. in Group:

Mean Age: not mentioned Mean Age:</td><td rowspan="3">Results:
5 cases had excellent results (no pain, no limp, full hip motion, normal radiographic findings).

6 cases had good results (no pain, slight limp, >75% normal hip motion, minimal spurring and capsular calcification on radiography).</td></tr>
<tr><td>Inclusions:
Patients who had traumatic hip dislocations or fracture-dislocations.</td></tr>
<tr><td>Exclusions:
Patients who required open surgery to manage dislocations.</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Mullis & Dahners 2006

Case Number: 12 **Reference Number:** 3

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of patients with traumatic rupture of the ligamentum teres.</td><td>Description:</td><td rowspan="5">Lateral position hip arthroscopy and removal of loose bodies.

Standard AP pelvis x-rays and CT scans.</td><td>Outcome Measures:
Comparison made between radiographic data obtained pre-operatively and operative findings.</td></tr>
<tr><td>Treatment Group
No. in Group: 23

Mean Age: 28.3 yrs

Control Group
No. in Group:

Mean Age:</td><td>Results:
33 of 36 patients who were arthroscoped, were found to have loose bodies.

Loose bodies were found in 7 of 9 cases (78%) in which standard radiographic studies found no loose bodies and a concentric reduction.

Conclusions: Hip arthroscopy may be indicated for loose body removal when open treatment is not otherwise necessary. For removal of unrecognised loose bodies that might be responsible for eventual post-traumatic arthritis.</td></tr>
<tr><td>Inclusions:
Patients who had hip arthroscopy after traumatic hip dislocation or wall fracture</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
Dictated radiology and orthopaedic notes regarding the radiographic findings were available for all cases</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Byrd & Jones 2004

Case Number: 13 **Reference Number:** 5

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of patients with traumatic rupture of ligamentum teres.</td><td>Description:</td><td rowspan="5">Arthroscopic debridement of the disrupted portion of the ligamentum teres using shaver. Indiscrimiante debridement of healthy ligament is avoided.</td><td>Outcome Measures:
Mean follow-up 29.2 months
MHHS pre and post-operatively</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 23 No. in Group:

Mean Age: 28.3 yrs Mean Age:</td><td>Results:
The mean pre-operative score of 47 improved to 90 post-operatvely (p<0.001). 96% of patients improved their score by more than 20 points.</td></tr>
<tr><td>Inclusions:
Patients with traumatic rupture of the ligamentum teres and at least one year follow-up information.</td></tr>
<tr><td>Exclusions:
Atraumatic lesions of the ligamentum teres, associated with either degenerative disease or ligament hypertrophy.</td></tr>
<tr><td>Selection Notes:
15/23 ruptures were sustained violently. 8/23 ruptures were sustained after a twisting motion.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Kim et al 2003

Case Number: 14 **Reference Number:** 16

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of patients who had sceptic arthritis of the hip joint.</td><td>Description:

The duration of symptoms before arthroscopy was 2 to 5 days.</td><td rowspan="5">Supine position hip arthroscopy involving debridement and drainage.</td><td>Outcome Measures:

Follow-up mean of 4 yrs 11 months</td></tr>
<tr><td>Treatment Group
No. in Group: 10

Mean Age: 13

Control Group
No. in Group:

Mean Age:</td><td rowspan="3">Results:

All patients had excellent results, with mean harris hip score being 97.9.
Post-operative recovery was rapid, all patients showed a normal range of motion of the hip</td></tr>
<tr><td>Inclusions:
Patients with septic arthritis who were treated with hip arthroscopy</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
Age range was 2 yrs to 34 yrs.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Guanche & Bare 2006

Case Number: 15 **Reference Number:** 17

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A review, including a preliminary report of surgical results for 10 patients</td><td>Description:</td><td rowspan="5">Arthroscopic debridement of impingements on the femoral neck.</td><td>Outcome Measures:
A scoring system out of 100 called the McCarthy nonarthritic scoring system. Follow-up mean was 16 months.</td></tr>
<tr><td>Treatment Group
No. in Group:

Mean Age:

Control Group
No. in Group:

Mean Age:</td><td rowspan="3">Results:
8/10 had no degenerative disease and did substantially better than the 2 who had degenerative disease. Nonarthritic hip scores improved from 75 to 95.</td></tr>
<tr><td>Inclusions:
Patients with FAI</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
4</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Sampson TG, 2005

Case Number: 16 **Reference Number:** 19

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A review of arthroscopic treatment in patients with developmental dysplasia of the hip and femoroacetabular impingement. A method is reported for the arthroscopic resection of bone. Includes a preliminary report on arthroscopic treatment of 90 patients for FAI</td><td>Description:</td><td rowspan="5">Arthroscopic debridement of impingements on the femoral neck.</td><td>Outcome Measures:

Subjective</td></tr>
<tr><td>Treatment Group
No. in Group: 90

Mean Age:

Control Group
No. in Group:

Mean Age:</td><td>Results:
Nearly all patients had elimination of their impingement sign (pain on internal rotation and flexion of the hip) and were quite happy with their results. The early results seem similar to those reported in the open dislocation procedure.</td></tr>
<tr><td>Inclusions:
Patients with FAI</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
4</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Byrd & Jones 2002

Case Number: 17 **Reference Number:** 20

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of hjp arthroscopy patients who had secondary osteoarthritis due to an inverted labrum.</td><td>Description:</td><td rowspan="5">Hip arthroscopy in the supine position.

Arthroscopic excision of a torn inverted labrum and chondroplasty.

3/9 also underwent microfracture of the subchondral bone because they had relatively healthy surrounding articular surface.</td><td>Outcome Measures:

Minimum 2 year follow-up using MHHS.</td></tr>
<tr><td>Treatment Group
No. in Group: 9

Mean Age: 51 yrs

Control Group
No. in Group:

Mean Age:</td><td>Results:
The median preoperative hip score was 51, post-operative was 56.

Only 4/9 patients demonstrated improvement of at least 10 points.

This included the 3 patients who underwent microfracture with an average improvement of 36 points. These were the only patients who returned to more than simple activities of daily living.

Three patients went on to total hip arthroplasty during the follow-up period</td></tr>
<tr><td>Inclusions:
Hip arthroscopy patients who had secondary osteoarthritis due to an inverted labrum.</td></tr>
<tr><td>Exclusions:
Advanced radiographic disease, fixed or inadequate rotational motion of the hip, lack of reasonable expectations by the patient.</td></tr>
<tr><td>Selection Notes:
Arthroscopy revealed that the articular damage of the acetabulum to be grade IV in all cases. The femoral heads ranged from Grade IV to I.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Walton et al 2004

Case Number: 18 **Reference Number:** 21

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective case-controlled study of patients who underwent hip arthroscopy. They were assessed for evidence of chondral degeneration.</td><td>Description:

Mean age for whole group of 70 was 47 (range 22-87).</td><td rowspan="5">Patients with chondral degeneration were treated with debridement of unstable chondral fragments and hip washout. Co-pathologies were also treated, e.g. labral tear.</td><td>Outcome Measures:
Review was at a minimum of 4 months following surgery. Clinical outcome assessed using a modified Farjo and Glick classification system which classifies patient outcomes as good or poor depending on pain, mechanical symptoms, activities of daily living and ability to work and play sport.</td></tr>
<tr><td>Treatment Group
Those with osteoarthritis
No. in Group: 39

Mean Age:

Control Group
Those without osteoarthritis
No. in Group:31

Mean Age:</td><td>Results:
39/70 had evidence of chondral degeneration at arthroscopy.
• 28/39 had a poor clinical result. 17/28 progressed to hip arthroplasty surgery.
• 11/39 had a good clinical result.

31/70 patients had no evidence of chondral degeneration.
• 27/31 had a good clinical result.
• 4/31 had a poor clinical result

Confounders: age, coexisting pathologies.</td></tr>
<tr><td>Inclusions:
All patients who had undergone hip arthroscopy by one surgeon between 1996 and 2003</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
2-</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Kocher et al 2005

Case Number: 21 and 25 **Reference Number:** 22

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of young people who had hip arthroscopy.</td><td>Description:</td><td rowspan="5">Supine position hip arthroscopy.

Specific procedures included debridement of labral tear, shondroplasty of acetabulum or femoral head, removal of loose bodies, synovectomy, and general debridement for degenerative changes.</td><td>Outcome Measures:
Minimum follow-up of 1 year, mean 17.4 months.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 42 No. in Group:

Mean Age: 15.2 years Mean Age:</td><td rowspan="2">Results:
Overall a significant improvement in MHHS (53.1 to 82.9, p<0.001).

<u>Labral tears n=30</u>: 57.6 to 89.2; 26/30 had improved scores.
<u>Perthes disease n=8</u>: 49.5 to 80.1; all 8 patients improved scores.
<u>Labral Tears with developmental Dysplasia n=8</u>: 51.8 to 79.8; 6/8 had improved scores
<u>Inflammatory arthritis n=3</u>: 54.8 to 81.3; all improved
<u>Outerbridge grade 4 degenerative changes (full chondral loss) n=2:</u> scores did not improve.
<u>Avascular necrosis n=1</u>: no improvement

<u>Complications</u>: pudendal nerve palsy, instrument breakage; 4/42 = 9.5%</td></tr>
<tr><td>Inclusions:
Patients 18 years and younger who had hip arthroscopy between Jan 2001 and March 2004.</td></tr>
<tr><td>Exclusions:
Those with a follow-up of less than 1 year.</td></tr>
<tr><td>Selection Notes:
Two patients were lost to follow-up.
There were 54 hip arthroscopies in 42 patients.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Clarke et al 2003

Case Number: 22 **Reference Number:** 23

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of arthroscopies recorded prospectively from 1989 to 2001.</td><td>Description:
Complications in 1054 cases</td><td rowspan="5">Lateral position arthroscopy.

Arhtroscopic treatments for various pathologies.</td><td>Outcome Measures:
Follow-up was at 6 weeks.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 1054 No. in Group:

Mean Age: 37 Mean Age:</td><td rowspan="3">Results:
There were 15 complications (1.4%) in 1054 hip arthroscopies. They were: 3 sciatic neuropraxia, 1 femoral neurapraxia, 1 vaginal tear, 1 trochanteric bursitis, 2 portal bleeding, 2 portal hematoma, 2 instrument breakage, 2 arthrotomy, 1 infection.

If the non-accessible hips are included as complications, the rate is 4.2%</td></tr>
<tr><td>Inclusions:
Patients who had hip arthroscopy between 1989 and 2001 at the authors' institutions.</td></tr>
<tr><td>Exclusions:
The 'complications' data does not include 30 hips (2.8%) that could not be accessed.</td></tr>
<tr><td>Selection Notes:
Indications for arthroscopy were undiagnosed hip pain (41%), osteoarthritis (21%) labral tears (18%) removal of loose bodies (7%), and other conditions (13%).
The access was considered difficult in 18%.
There was no record kept of damage to the labrum or articular surface during surgery. The 18% that were difficult to access are most likely to suffer this type of injury, so 18% may represent an upper limit for this injury.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Sampson 2005

Case Number: 23 **Reference Number:** 24

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of complications in 1001 cases.</td><td>Description:
Patients operated on by since 1977.</td><td rowspan="5">All except 11 patients were done in the lateral position.</td><td>Outcome Measures:</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 1001 No. in Group:

Mean Age: not mentioned Mean Age:</td><td rowspan="3">Results:
38 complications (3.8%). None in the last 10 years.
Only 0.5% considered serious.
20 transient nerve injuries. High number of peroneal neuropraxias related to early developments and evolution of hip distractors for lateral approach. All neuropraxia occurred from prolonged traction times. None occurred in the last 10 years.
10 fluid extravasation into abdominical space and thigh. Occurred after longer operative times and in procedures using a pump.
3 instrument breakage
3 scuffing of femoral head
1 avascular necrosis of femoral head
1 femoral neck fracture</td></tr>
<tr><td>Inclusions:
All complications in cases done since 1977 by author and associate (James M Glick).</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Lo et al 2006

Case Number: 24 **Reference Number:** 25

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A prospective study to investigate complications of hip arthroscopy.</td><td>Description:</td><td rowspan="5">Hip arthroscopy in the supine position.</td><td>Outcome Measures:
Follow up mean 16 months, minimum 12 months
Number of complications due to surgery.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 73 No. in Group:

Mean Age: 43 Mean Age:</td><td rowspan="3">Results:
Average operation time 67 minutes
Average traction time 58 minutes

16.4% of patients had mild scope trauma to the femoral head, which did not affect their excellent outcomes.

7% had transient sciatic nerve neuropraxia and achieved complete recovery within 2 weeks of surgery (related to longer continuous traction times of 110 to 150 minutes; did not recur after intermittent traction used during surgery).</td></tr>
<tr><td>Inclusions:
Patients with severe intra-articular hip pain.</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
All patients had signs and symptoms of intra-articular pathology; had undergone failed conservative treatment prior to arthroscopy.</td><td>Methodological Score:
3</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Suenaga et al 2002

Case Number: 26 **Reference Number:** 26

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A study to determine the relationship between pain at flexion-rotation and the status of a labral tear in dysplastic hips.</td><td>Description:</td><td rowspan="5">Radiographic (x-ray) classification of hips.

Maximum flexion and internal rotation (MFIR) test.

Maximum flexion and external rotation (MFER) test.

Arthroscopic evaluation.</td><td>Outcome Measures:
Correlation of test results with arthroscopic findings.</td></tr>
<tr><td>Treatment Group
No. in Group: 59

Mean Age: 41

Control Group
No. in Group:

Mean Age:</td><td>Results:
All joints demonstrated incomplete or complete detaching tears of the acetabular labrum in one portion of the weight-bearing area.

39% experienced pain during MFIR test.
a) This correlated well with incomplete detaching tears in the posterosuperior portion of the actabular labrum (70% positive predictive value).
b) A complete detaching tear of the posterosuperior labrum was associated with a negative MFIR test result (sensitivity 79%).

27% showed a positive result for the MFER test. This test did not correlate with either the location or the grade of labral tears.

Conclusion: the MFIR test is useful for assessing the magnitude of a labral tear in the posterosuperior portion of the acetabular labrum in dysplastic hips.</td></tr>
<tr><td>Inclusions:
Patients with dysplastic osteoarthritis undergoing transposition osteotomy.</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Mitchell et al 2003

Case Number: 27 and 32 **Reference Number:** 27

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">Prospective study of consecutive hip arthroscopies.

Two radiologists were blinded to the clinical symptoms and surgical pathology and independently reviewed the imaging studies.</td><td>Description:</td><td rowspan="5">The FABER test done during clinical assessment.

Plain radiographs, ultrasound. All but one patient had MRA.

(the patient who didn't have MRA was diagnosed with ultrasound)

Hip arthroscopy in supine position.</td><td>Outcome Measures:
Correlation of MRA with surgical findings.</td></tr>
<tr><td>Treatment Group
No. in Group: 25

Mean Age: 30.9

Control Group
No. in Group:

Mean Age:</td><td>Results:
Plain radiographs normal in all patients.

<u>MRA</u>: 11/24 MRA were positive for hip pathology
Specificity: 100%
Sensitivity for labral tear: 24%
Sensitivity for labral abnormality: 31%
Sensitivity for cartilage abnormalities: 6%
Sensitivity for osteoarthritis: 4%

i.e. a relatively high number of false negatives. Furthermore the pathology reported was frequently incorrect (5/11= 45%).
FABER Test: 88% sensitive for intra-articular hip pathology.</td></tr>
<tr><td>Inclusions:
Hip arthroscopy patients enrolled consecutively, based on clinical suspicion of hip joint pathology.</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
Patients were enrolled sequentially over 4 months from 2 sports medicine centers. A single clinician took the history and performed the examination.</td><td>Methodological Score:

Risk of Bias; arthroscopy performed regardless of the MRA imaging findings.</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Sundberg et al 2006

Case Number: 28 **Reference Number:** 28

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">Prospective comparison of imaging of the acetabular labrum with 3.0-T MRI and 1.5-T MRA.

A description of blinding is given.

Preliminary experience.</td><td>Description:</td><td rowspan="5">3.0-T MRI
1.5-T MRA</td><td>Outcome Measures:
Correct diagnosis as judged by hip arthroscopy.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 8 No. in Group:

Mean Age: 38 Mean Age:</td><td rowspan="3">Results:
3.0T MRI identified all labral tears noted at 1.5-T MRA

3.0T MRI identified one additional surgically proved labral tear that was not diagnosed at 1.5-T MRA.

3.0T MRI demonstrated abnormalities in the articular cartilage of the femoral head and acetabulum.</td></tr>
<tr><td>Inclusions:
Patients with hip pain suspicious for labral disease. All patients underwent both 3.0-T MRI and 1.5-T MRA imaging.</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
3/8 patients did not undergo arthroscopy owing to resolution of their symptoms following MRI.</td><td>Methodological Score:

Confounders: inter-observer variation, and small group.</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Mintz et al 2005

Case Number: 29 **Reference Number:** 29

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">Retrospective review of MRI images of hip arthroscopy patients to evaluate ability of non-contrast MRI to identify tears of the acetabular labrum and defects in articular cartilage.

Two radiologists blinded to each other's readings, initial MRI and surgical findings</td><td>Description:</td><td rowspan="5">Analysis of MRI images by two experienced musculoskeletal MRI radiologists.

MRI scans were performed with a 1.5-T superconducting magnet using an optimised protocol.</td><td>Outcome Measures:
Correct identification of labral tears and articular cartilage damage present at surgery.</td></tr>
<tr><td>Treatment Group: Control Group:
No. in Group: 92 No. in Group:

Mean Age: Mean Age:</td><td>Results:
<u>Labral Tears</u>: each radiologist correctly identified 94% and 95% of the labral tears present at surgery respectively.
92% inter-observer agreement.

<u>Articular cartilage defect</u>: agreement with initial MRI and surgical grading of 92% and 86% within 1 grade.

A table was presented with sensitivity, specificity, positive predictive value, negative predictive value, accuracy.</td></tr>
<tr><td>Inclusions:
Patients who had MRI and subsequent arthroscopy of the hip from January 1997 to July 2000.</td></tr>
<tr><td>Exclusions:
Patients who did not have a comprehensive surgical record, including arthroscopic pictures of the acetabular labrum and articular cartilage of the femoral head.</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:

Risk of bias because radiologists knew to look for labral tears and chondral damage.</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Keeney et al 2004

Case Number: 30 **Reference Number:** 30

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective review of MRA findings and a comparison with surgeon documented intra-articular hip pathology.</td><td>Description:</td><td rowspan="5">MRA using 15 ml of 1:200 dilution of gado-diamide; 1.5-T magnet.</td><td>Outcome Measures:
Comparison of MRA with hip arthroscopy for labral pathology and articular damage.

Specificity, sensitivity, positive predictive value, negative predictive value reported.</td></tr>
<tr><td>Treatment Group
No. in Group: 101 patients; 102 hips
Mean Age: 37.6yrs

Control Group
No. in Group:

Mean Age:</td><td>Results:
Sensitivity: 71% (66/93 with labral tear were positive with MRA)
Specificity: 44% (4/9 with no labral tear were negative with MRA)
PPV: 93% (66/71 positive MRA’s were true positives)
NPV:13% (4/31 negative MRA’s were true negatives)

Accuracy not reported, but SJC calculated it to be 68%.

Results dependent on experience of individual radiologist.</td></tr>
<tr><td>Inclusions:
Patients who had hip arthroscopy between Sept 1999 and Aug 2003 to evaluate and treat persistent hip pain consistent with the clinical diagnosis of an acetabular labral tear.</td></tr>
<tr><td>Exclusions:
Patients having hip arthroscopy for other indications. Patients having simultaneous open surgery.</td></tr>
<tr><td>Selection Notes:
Clinical diagnosis of a labral tear was made on basis of anterior inguinal pain, positive provocative testing for acetabular labral tear (impingement test), absence of external tendon pathology, and minimal degenerative or dysplastic findings on plain radiographs.</td><td>Methodological Score:</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Chan et al 2005

Case Number: 31 **Reference Number:** 31

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A prospective case series to evaluate the sensitivity and accuracy of MRA in localizing labral tears.

Radiologists were informed that patients had hip pain but received no precise information on current clinical findings.</td><td>Description:</td><td rowspan="5">MRA using radial reformatted images with a true sagittal localizer.

Hip arthroscopy in the supine position.</td><td>Outcome Measures:
Surgical and imaging findings were correlated at arthroscopy.</td></tr>
<tr><td>Treatment Group
No. in Group: 17

Mean Age: 41

Control Group
No. in Group:

Mean Age:</td><td>Results:
<u>Identification of labral tear</u>:
Sensitivity 100%
Accuracy 94%

<u>Location of Labral Tear:</u>
Sensitivity 100%
Accuracy 96%</td></tr>
<tr><td>Inclusions:
Patients with unclear intra-articular hip pain, and suspected acetabular labral tear based on clinical signs.</td></tr>
<tr><td>Exclusions:
Patients with other pathologies identified by MRA.</td></tr>
<tr><td>Selection Notes:
30 patients were initially included in the study. 25 showed MRA evidence of labral tear, and of these, 17 patients underwent arthroscopic surgery. The other 8 patients could tolerate the hip pain and hesitated to have surgery.</td><td>Methodological Score:

Risk of selection bias towards patients with labral tear; limited sample.</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Byrd & Jones 2004, diagnostic accuracy

Case Number: 33 **Reference Number:** 32

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">A retrospective study of prospectively collected data to correlate the diagnostic accuracy of a range of methods.

Not blinded</td><td>Description:</td><td rowspan="5">Clinical assessment
x-rays
1.5-T MRI
MRA
Intra-articular anesthetic injection
Hip arthroscopy</td><td>Outcome Measures:
Comparison of diagnostic ability of all methods, measured against hip arthroscopy as the definitive diagnosis.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 40 No. in Group:

Mean Age: Mean Age:</td><td>Results:
<u>Clinical assessment</u>:
a) existence of hip abnormality with 98% accuracy.
b) nature of hip abnormality identified in 13/40 cases (32.5%), with 92% accuracy.
<u>Intra-articular injection of anesthetic</u>: 90% accurate (7.5% false negative, 2.5% false positive) for detecting presence of abnormality
<u>MRI</u>: 42% false negative; 10% false positive
<u>MRA:</u> 8% false negative; 20% false positive
Both MRI and MRA demonstrate poor reliability in assessing chondral damage.</td></tr>
<tr><td>Inclusions:
Patients selected for hip arthroscopy based on either intractable hip pain unresponsive to conservative measures, or imaging evidence of intra-articular abnormality amenable to arthroscopy.</td></tr>
<tr><td>Exclusions:
Patients who did not receive MRA. Therefore excluded the more obvious cases.</td></tr>
<tr><td>Selection Notes:
Patients selected between November 1999 and January 2002. This study encompassed less than a third of the 141 patients undergoing arthroscopy during this time period and represented the more difficult diagnostic cases. Sensitivity may have been better if the more obvious cases included.</td><td>Methodological Score:

Bias against accuracy of MRI because only selected patients who had MRA. They had MRA because couldn't diagnose with MRI images.</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Schmid et al 2003

Case Number: 34 **Reference Number:** 33

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="5">Retrospective analysis of MRA images obtained for diagnosis of articular carilage lesions. Comparison of diagnosis with surgical report.</td><td>Description:</td><td rowspan="5">MRA

Two readers independently interpreted the images for cartilage lesion location, depiction and characteristics.

Open surgery within 6 months of MRA</td><td>Outcome Measures:
Comparison of MRA diagnosis with the definitive diagnosis from open surgery.</td></tr>
<tr><td>Treatment Group Control Group
No. in Group: 40 (42 joints) No. in Group:

Mean Age: 37 Mean Age:</td><td>Results:
Sensitivity: 79%, 50%
Specificity: 77%, 84%
These data are for all five regions of hip joint, including femoral head, combined.

MRA is moderately sensitive in the detection of cartilage damage of the hip joint.

When the diagnosis is based on secondary signs of osteoarthritis, such as subchondral sclerosis, osteophytes, or cysts, the reader tends to overestimate the extent of cartilage damage.

There was poor agreement in the detection of cartilage lesions in all acetabular regions.</td></tr>
<tr><td>Inclusions:
Patients suspected of having femoroacetabular impingement and/or labral abnormalities who later underwent open surgery.</td></tr>
<tr><td>Exclusions:
Patients with severe cartilage damage
Patients with incomplete description of articular cartilage in surgery report</td></tr>
<tr><td>Selection Notes:</td><td>Methodological Score:</td></tr>
</table>

Evidence Based Healthcare Table Hip arthroscopy

Reference: Bruce et al 2004

Case Number: 35 **Reference Number:** 34

<table>
<tr><th>Design Description</th><th>Participants</th><th>Intervention</th><th>Outcomes</th></tr>
<tr><td rowspan="4">A retrospective study of patients who had a hip diagnosis made with arthroscopy and/or MRI, and then compared with the diagnosis made with bone scintigraphy, to evaluate the predictive power of scintigraphy.</td><td>Description:</td><td rowspan="4">Bone scintigraphy</td><td>Outcome Measures:
Presence or absence of scintigraphic patterns</td></tr>
<tr><td>Group 1 (scintigraphic diagnosis of labral tear)
No. in Group: 27

Mean Age:
subgrouops of 28 and 69

Group 2 (no labral tears; other hip pathologies)
No. in Group: 30

Mean Age: 52</td><td>Results:
Two patterns of uptake were found in group 1 patients:
1) a focal uptake in the superior aspect of the labrum.
2) a focal extension in an “eyebrow” pattern from the superior to the anteromedial aspect of the acetabular rim.
The pattern of uptake corresponds to the common sites of labral tears.

2/27 were false positives; they had osteo-chondral lesions of the acetabulum.

None of the group 2 patients manifested the focal pattern of uptake.</td></tr>
<tr><td>Inclusions:
All patients in group 1 and 2 had undergone arthroscopy and/or MRI and from these procedures a diagnosis was made. All patients also had bone scintigraphy.</td></tr>
<tr><td>Exclusions:</td></tr>
<tr><td>Selection Notes:
No description of attempts at blinding.</td><td>Methodological Score:

High risk of bias because incomplete description of methods.</td></tr>
</table>