

# A REVIEW OF HIP ARTHROSCOPY AND ITS ROLE IN THE MANAGEMENT OF ADULT HIP PAIN

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## INTRODUCTION

Intra-articular hip pathology has recently received increased attention in the literature. Hip arthroscopy was first introduced by Burman in 1931.<sup>1</sup> Acetabular labral tears were first described in 1957 and 1959, and were identified through an open approach after irreducible traumatic hip dislocations.<sup>2,3</sup> The first arthroscopic description of an acetabular labral tear was in 1986.<sup>4</sup> More recently hip arthroscopy has become a minimally invasive diagnostic and therapeutic tool. The indications for hip arthroscopy have expanded, and its usefulness continues to be better defined in the literature.

## ANATOMY

The hip joint is a ball and socket joint consisting of the femoral head and acetabulum. This articulation provides multiple planes of movement and is highly congruent. Articular cartilage, consisting of type II collagen, covers the majority of the femoral head. The acetabulum peripherally consists of articular cartilage while the central floor is non-articular and filled with a fatty layer termed the pulvinar. The ligamentum teres arises from both the transverse acetabular ligament and the central non-articular layer of the acetabulum and attaches to the central femoral head. It may play a role in stabilizing the hip joint.<sup>5</sup>

The acetabular labrum is a fibrocartilaginous structure that runs circumferentially around the periphery of the acetabulum (Figures 1 and 2). Inferiorly, the transverse acetabular ligament connects the anterior and posterior portions of the labrum. The labrum is attached to the acetabular articular cartilage via a thin transition zone of calcified cartilage layer on the articular side.<sup>6</sup> The non-articular side of the labrum is directly attached to bone.<sup>6</sup> Only the peripheral one-third or less of the labrum has a rich blood supply, and this is provided by

branches from the obturator, superior gluteal and inferior gluteal arteries.<sup>6,7</sup> The central two-thirds of the labrum is avascular.<sup>6,7</sup> Pain fibers have been identified within the labrum and are most concentrated anteriorly and anterosuperiorly.<sup>8</sup> The labrum also appears to provide a stabilizing force for the hip joint by increasing the acetabular volume by 33% and helping to create a negative intra-articular pressure.<sup>6,9</sup>

Three major ligaments surround the hip joint capsule. The iliofemoral ligament of Bigelow lies anteriorly, and has an inverted Y-shape.<sup>10,11</sup> This ligament tightens with hip extension.<sup>10</sup> The inferior aspect of the iliofemoral ligament blends distally with the pubofemoral ligament, which covers the inferior and medial aspect of the hip joint capsule.<sup>10,11</sup> This ligament tightens with hip extension and abduction.<sup>10</sup> The ischiofemoral ligament lies posteriorly and its fibers spiral upward to blend with the zona orbicularis, a band that courses circumferentially around the femoral neck.<sup>10,11</sup> The ischiofemoral ligament also tightens with extension which explains why some degree of hip flexion increases capsular laxity and allows for better exposure during arthroscopic procedures.<sup>10</sup>

## HISTORY AND PHYSICAL EXAMINATION FOR HIP DISORDERS

Determining the etiology of hip pain can be very elusive. Both extra-articular and intra-articular hip structures can give rise to pain, creating a challenge for many practitioners. The term "hip" is often not well defined and is used to identify the groin, lateral trochanteric region, lateral, medial or anterior thigh, as well as the posterior pelvis, buttock and lower back.

The history for patients with intra-articular hip pathology can range from an acute twisting or falling episode to the insidious onset of pain that increases over months to years. Athletes participating in sports that involve repetitive hyperextension and external rotation (soccer, skating, hockey, tennis, golf) seem to be at a higher risk for developing intra-articular hip disorders.<sup>12</sup> The typical pain referral pattern is anterior groin or medial thigh pain following an L3 dermatomal pattern. Patients will occasionally complain of lateral and posterior hip or pelvic pain. Byrd has described the classic "C" sign where the patient places their index finger over

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Figure 1. Normal Anterior Acetabular Labrum

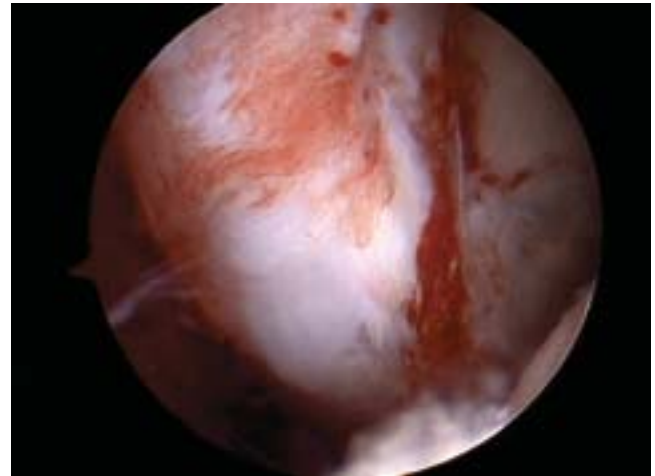


Figure 2. Normal Posterior Acetabular Labrum

the anterior aspect of the hip and thumb over the posterior trochanteric region to indicate the location of their pain.<sup>13</sup> Pain is typically worse with twisting activities and ascending or descending stairs or inclines.<sup>14</sup> Patients may also complain of painful catching in the hip, particularly when going from positions of flexion to extension such as with rising from a seated position.<sup>14</sup>

Physical examination begins with gait evaluation. Patients with intra-articular pathology may stand with the hip flexed and walk with an antalgic gait with a shortened stance phase and shortened stride length. Palpation typically does not elicit tenderness with an intra-articular lesion. Range of motion is next evaluated and includes a side-to-side evaluation of internal and external hip rotation, hip abduction and adduction, flexion, and presence of a hip flexion contracture as indicated by the Thomas test.<sup>5</sup>

Pain with supine log-rolling of the hip is the most specific test for intra-articular pathology.<sup>13</sup> A more sensitive measure of intra-articular pathology is recreation of pain with the impingement test, which involves forced flexion, adduction, internal rotation, and axial loading of the hip.<sup>13,15</sup> This may be present in patients with both anterolateral labral tears and femoroacetabular impingement.<sup>13,15</sup> Forced external rotation with an axial load and hip flexion can cause pain in patients with posterior labral pathology.<sup>12</sup> Pain may also be elicited with a resisted straight-leg raise. Moving the hip from full flexion, external rotation, and abduction to a position of extension, internal rotation and adduction can recreate pain and snapping in patients with anterolateral labral tears and iliopsoas snapping hip.<sup>16</sup> Any of the above provocative maneuvers can recreate mechanical symptoms in addition to pain, which can indicate labral, chondral or ligamentum teres pathology, loose bodies, or sometimes extra-articular pathology secondary to a snapping hip syndrome.

### DIFFERENTIAL DIAGNOSIS

There are other diagnoses to consider in the evaluation of patients with any of the above symptoms and physical findings. In the young athlete, musculotendinous strain, bony avulsion, stress or traumatic fracture, slipped capital femoral epiphysis, Legg-Calve-Perthes disease, developmental dysplasia, synovitis and septic arthritis are possible diagnoses.<sup>5,13</sup> Pain can be referred from genitourinary, intra-abdominal, and abdominal wall structures.<sup>5,13</sup> Back pain, sacroiliac disorders, radiculopathies and sciatica can mimic some of the above findings.<sup>5,13</sup> The snapping hip can be related to the iliopsoas tendon snapping over the brim of the pelvis or the iliotibial band over the greater trochanter.<sup>5,13</sup> Many of these above diagnoses may be differentiated based on additional history or physical examination findings, but may require certain imaging studies.<sup>5,13</sup>

### IMAGING

The first radiographic studies that should be obtained when evaluating patients presenting with hip pain are plain radiographs. Plain radiographs are useful to identify arthritic changes involving the hip joint, avascular necrosis, hip joint dysplasia, active and residua of Legg-Calve-Perthes disease, slipped capital femoral epiphysis, femoroacetabular impingement, ossified loose bodies and other pelvic and lower lumbar pathology. Practitioners evaluating these plain films should be familiar with techniques for identifying the above-mentioned disorders, which go beyond the scope of this article. Normal plain radiographs by no means rule out intra-articular pathology.

Magnetic resonance imaging (MRI) is the preferred radiographic method for diagnosing intra-articular hip joint pathology (Figure 3). Byrd has shown conventional MRI has high false negative rates (42 percent) but low

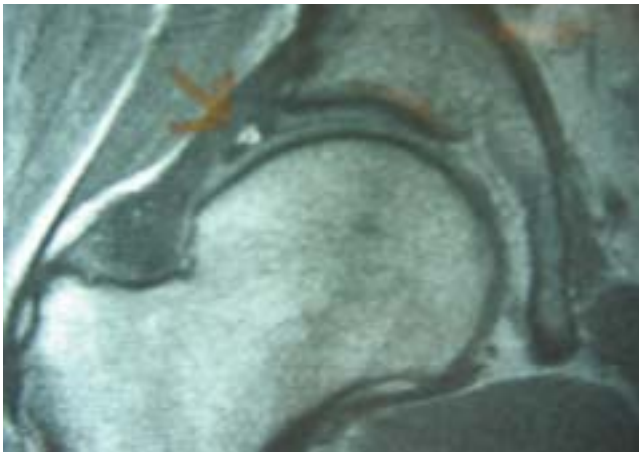


Figure 3. Anterosuperior Labral Tear

false positive rates (10 percent) when used to evaluate intra-articular hip pathology.<sup>14</sup> Indirect evidence of intra-articular pathology on conventional MRI includes the presence of an effusion, paralabral cysts, and subchondral cysts.<sup>14,17,18,19,20</sup> MRI arthrography is preferred over conventional MRI because of its greater than 90 percent sensitivity in diagnosing hip joint pathology.<sup>14,17,18</sup> Higher false positive results of up to 20 percent are noted with MRI arthrogram, however, when compared to conventional MRI.<sup>14</sup> Both MRI and MRI arthrography have been shown to have poor sensitivity and excellent specificity when evaluating cartilage lesions.<sup>14</sup> The use of MRI arthrography also allows for the addition of an intra-articular anesthetic injection, which we feel is the single most important diagnostic factor when evaluating candidates for hip arthroscopy. Byrd has found a positive response to this injection 90 percent accurate for detecting intra-articular pathology, consistent with our personal experience, also.<sup>14</sup> (C.M.L. unpublished data). It is imperative that patients can recreate their symptoms prior to the injection in order to evaluate whether or not symptoms are temporarily improved.

#### INDICATIONS FOR HIP ARTHROSCOPY

Hip arthroscopy is still in its infancy to some degree and longer-term outcomes and improved techniques should continue to better define the role for hip arthroscopy. Currently, common indications include symptomatic labral tears, loose bodies, ligamentum teres lesions, focal symptomatic chondral lesions and septic arthritis.<sup>5,13</sup>

The role for hip arthroscopy in the arthritic hip is being better defined and is following a pattern similar to that seen in the knee and other joints. The concept of femoroacetabular impingement is gaining popularity

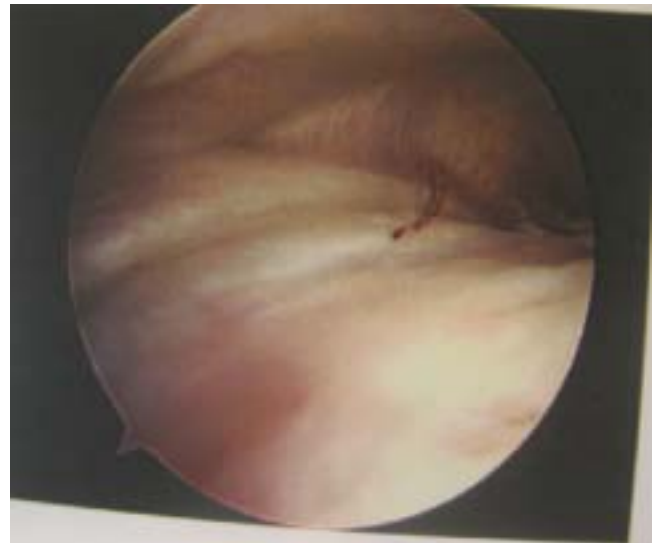


Figure 4. Labrum, Femoral Head and Neck and Viewed from the Peripheral Capsular Approach

and there may be a role for treating this arthroscopically in some cases.<sup>15,21</sup> There have been reports of arthroscopic treatment of pigmented villonodular synovitis, synovial chondromatosis and iliopsoas tendon release or lengthening for the snapping hip as well.<sup>5,22</sup> Other controversial roles for hip arthroscopy include avascular necrosis and hip instability.<sup>5,13,23</sup> Contraindications for hip arthroscopy include advanced osteoarthritis, avascular necrosis with collapse, an ankylosed joint, significant heterotopic ossification, or any other condition that prohibits entry into the hip joint.

#### HIP ARTHROSCOPY TECHNIQUE PRINCIPLES

Hip arthroscopy is performed with the use of traction in either the lateral, supine, or modified supine position under fluoroscopic guidance. There is a steep learning curve, but as the surgeon becomes more comfortable with the procedure and variations in anatomy, the hip joint and peripheral capsular structures should be well visualized with relative ease and safety. The structures that should be visualized in each case include the femoral head, acetabulum, pulvinar, ligamentum teres, anterior, superior, and posterior labrum, the zona orbicularis, standard medial plicae, femoral neck, peripheral femoral head-and-neck junction, peripheral labrum and occasionally the iliopsoas tendon attachment (Figure 4). The use of three small standard portals and occasionally accessory portals allows for visualization and treatment of the above structures and associated pathology. It is critical to know the anatomy adjacent to the standard portals and this is well described.<sup>24</sup>



Figure 5. Anterosuperior Labral Tear



Figure 6. Microfracture to Acetabular Defect

## HIP DISORDERS WITH A ROLE FOR HIP ARTHROSCOPY

### Labral Pathology

Multiple studies have documented successful treatment of labral tears arthroscopically (Figure 5).<sup>5,19,21,22,27,28,29</sup> Excellent outcomes are reported in 67 to 91 percent of individuals when treating labral tears.<sup>5,19,21,22,27,28,29</sup> When labral tears are associated with chondral or arthritic changes, results are less predictable.<sup>5,19,21,27</sup> Farjo reported that 46 percent of individuals found to have significant arthritic changes at the time of hip arthroscopy eventually underwent total hip arthroplasty (THA) within 14 months.<sup>19</sup> McCarthy has reported that the size of the chondral lesion is a predictor of outcome, and with diffuse degenerative joint disease 78 percent of patients had a poor result and 43 percent went on to THA.<sup>21,27</sup> Byrd has reported finding greatest improvement after arthroscopy in patients with loose bodies and labral tears.<sup>22</sup>

There is limited data regarding nonsurgical management of labral tears. Non-surgical treatment may be most effective when treating an acute labral tear. Reasons for this limited data may include patients infrequently presenting with acute labral tears, labral tears often going misdiagnosed for months to years, and some labral injuries becoming asymptomatic without ever confirming the presence of an intra-articular lesion.

There is some evidence that if diagnosed early, non-operative treatment of labral tears can be successful.<sup>25,26</sup> Ikeda et al found six of seven patients that presented with acute labral tears became asymptomatic with partial weight bearing.<sup>26</sup> Fitzgerald, however, found only seven of fifty-five patients with documented labral tears were successfully treated with partial weight bearing.<sup>16</sup> In our practice we have had success treating some pa-

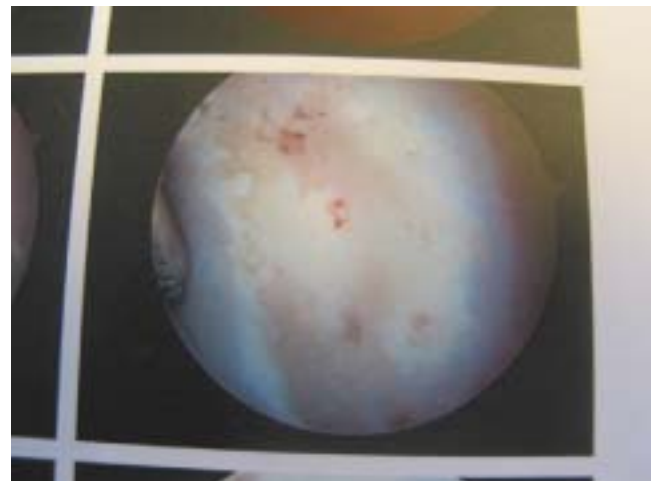


Figure 7. After Chondral Debridement and Microfracture

tients with acute labral tears with protected weight bearing. The majority, however, have had continued symptoms and eventually underwent hip arthroscopy. (C.M.L. unpublished data)

### Focal Articular Cartilage Injury

Although there is little in the literature with respect to chondral resurfacing procedures performed arthroscopically in the hip, McCarthy reported his experience with utilizing a microfracture technique.<sup>21,27</sup> Good to excellent results were achieved in 71 percent of patients with lesions less than one centimeter in diameter compared to 40 percent for lesions greater than one centimeter in size (Figures 6 and 7).<sup>21,27</sup> We currently await further reports on the utility of osteochondral autograft and allograft procedures performed open and arthroscopically in patients with focal chondral defects.

### Avascular Necrosis

Traditionally, avascular necrosis (AVN) of the hip has been treated with various techniques including core decompression, vascularized and nonvascularized fibular grafts, osteotomies, and ultimately joint reconstruction.<sup>30</sup> Byrd has reported a decrease in outcome measures after treating hip AVN arthroscopically.<sup>22</sup> McCarthy reported on a series of seven patients with hip AVN treated arthroscopically, and found it useful for accurate staging of AVN and treating patients with mechanical symptoms and pain secondary to loose bodies, synovitis, chondral flap tears and labral tears.<sup>31</sup> O’Leary also reported improved outcomes after arthroscopy in patients with hip AVN when mechanical symptoms were present.<sup>28</sup> We currently feel that hip arthroscopy is indicated for patients presenting with AVN when there is intra-articular evidence of loose bodies, labral tears, and chondral flaps in the absence of significant joint space narrowing and femoral head collapse. Hip arthroscopy can also be helpful for more accurate staging of AVN when contemplating various treatment options. We have found hip arthroscopy useful for staging at the same setting as core decompression for patients with hip AVN.

### Ligamentum Teres Lesions

Ligamentum teres lesions have been increasingly reported in the literature and have been reported to be the third most common finding during hip arthroscopy in athletes.<sup>14,22</sup> Typically, these patients present with deep anterior groin pain with or without mechanical symptoms.<sup>32</sup> Activities reported to be associated with these injuries include motor vehicle accidents, falls from a height, football, skiing, and hockey.<sup>32</sup> MRI has not been shown to be effective in diagnosing these lesions. MR arthrography is slightly better, with reported 29 percent sensitivity and 67 percent specificity for diagnosing these lesions.<sup>14,32</sup> The diagnosis of ligamentum teres lesions continues to be made based on history, clinical examination and arthroscopic evaluation. The treatment consists of simple debridement of the injured portion of the ligamentum teres with reported significant improvement in outcomes scores.<sup>32</sup>

### Femoroacetabular Impingement

There is an increasing awareness of the diagnosis of femoroacetabular impingement. It is typically identified in young individuals (16 to 40 years old) and may be a nondysplastic etiology of osteoarthritis.<sup>15</sup> Patients typically present with groin pain and a positive impingement test.<sup>15,33,34</sup> A positive impingement test is pain with flexion, internal rotation, and adduction of the hip joint



Figure 8. Normal Head Neck Offset in Patient Who Underwent Prior Proximal Hamstring Repair



Figure 9. Non-spherical Femoral Head, Short Anterior Head-neck Offset Seen in Femoroacetabular Impingement

with the patient in the supine position. There can be a combination of anatomic characteristics that result in femoroacetabular impingement. The typical features include increased anterior coverage of the femoral head from acetabular retroversion, a non-spherical femoral head, short anterior head-neck offset, retroversion of the femoral head, and a deep acetabulum (Figures 8 and 9).<sup>15,21,33,34</sup> This type of impingement has been divided into cam and pincer types. Cam impingement is the result of impingement of a non-spherical femoral head against the acetabular rim and labrum.<sup>15,33,34</sup> This typically leads to labral detachment and adjacent chondral abrasion.<sup>15,33,34</sup> Frog lateral radiographs typically reveal a prominence or “bump” on the anterolateral portion of



**Figure 10.** “Cross Over sign” indicative of Pincer type of femoral acetabular impingement

the femoral head neck junction. Normally the head is contained within a circle about the center of the femoral head. In cam impingement, the anterolateral portion of the femoral head lays lateral or outside of this circle. There may also be a pistol grip deformity as seen after slipped capital femoral epiphysis. Pincer impingement is the result of linear contact between the acetabulum and femoral head-neck junction.<sup>15,34</sup> In this second situation, the head-neck junction is often morphologically normal and impingement results from relative retroversion of the acetabulum or overcoverage of the anterior-superior acetabulum.<sup>15,34</sup> On a true antero-posterior radiograph, a line drawn along the anterior and posterior walls will reveal an overlap of the two lines superiorly called a “cross-over” sign which indicates relative acetabular retroversion or anterior overcoverage of the acetabulum (Figure 10). Pincer impingement can lead initially to anterior labral lesions followed by posterior inferior chondral lesions if impingement persists.<sup>15,34</sup>

Initial surgical management of femoroacetabular impingement has focused on removal of the anterior-superior acetabular prominence and removal of any non-spherical portion of the femoral head.<sup>33,34</sup> Beck reported on results of surgical dislocation and offset creation in 19 patients with a mean age of 36 years.<sup>33</sup> At a mean follow-up of 4.7 years, 13 hips were rated excellent to good, and five eventually underwent THA.<sup>33</sup> Arthroscopic proximal femoral resurfacing has recently been presented in 25 patients and although early results have been promising there is no published series in the peer reviewed literature to date.<sup>21</sup> We have had limited experience with two patients undergoing proximal femoral resurfacing arthroscopically with good early results (C.M.L. unpublished data).

### Instability

The diagnosis of hip instability has recently received more attention, but there is little data regarding the specifics in diagnosing and treating this entity. It has been reported to be a potential source of disability in certain patients with unresolved hip pain.<sup>5,23</sup> The inherent stability of the hip joint makes this difficult to define. The labrum plays a role in stabilizing the hip joint, and labral deficiency could theoretically contribute to hip instability, as could the presence of capsular laxity in some individuals.<sup>5,23</sup> Patients with connective tissue disorders or generalized ligamentous laxity may present with symptoms of giving way or habitual subluxation or dislocation.<sup>5,23</sup>

This condition has primarily been described in elite athletes involved in sports requiring repetitive hip rotation with axial loading such as baseball, ballet, gymnastics, football, figure skating and golf.<sup>5,23</sup> Pelvic rotation and, in particular, external rotation has been reported to cause pain in these patients.<sup>5,23</sup> Thermal capsulorrhaphy in addition to labral debridement has resulted in improvement in symptoms in over 80 percent of individuals according to one author.<sup>5,23</sup> The diagnosis is typically made based on clinical suspicion and the presence of capsular laxity seen at the time of hip arthroscopy. Increased hip external rotation on examination or under anesthesia may indicate incompetence or relative laxity of the iliofemoral ligament. The introduction of a large amount of saline into the hip joint at the time of surgery (>50 cc) may also indicate relative laxity of the hip joint capsule. One must take into account the typical history and examination findings when making the diagnosis of hip instability. Unfortunately, there is little published in the literature regarding outcomes in a large series of patients and it remains unclear whether capsulorrhaphy in conjunction with labral debridement provides additional relief when compared to labral debridement alone.

### SUMMARY

The diagnosis and management of patients presenting with hip pain is often challenging. A thorough history and physical examination, imaging studies and selective injections can help define the source of pain in many of these individuals. As technology and technical skills continue to improve, the role for hip arthroscopy will continue to expand. Further well-designed studies will better refine the indications for hip arthroscopy in managing patients with hip pathology.

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