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Diagnosis and treatment of anterior hip pain in a physical therapy clinic

Femoroacetabular impingement (FAI), acetabular labrum tear, and osteoarthritis (OA) are all sources of intra articular hip pain localized to the anterior hip. Often times they coexist or one of the deformities natural history will lead to the other condition(s). The following paper investigates current literature on clinical differential diagnoses among these three conditions and appropriate physical therapy interventions for FAI and OA.

Femoroacetabular Impingement

Femoroacetabular impingement occurs in the presence of abnormal morphology at the femoroacetabular joint. The consequence is impingement with terminal motion.[1] There are three main forms: cam, pincer, and mixed. Cam refers to a non-spherical femoral head. The pincer deformity refers to over-coverage by the acetabulum. Mixed is the combination of both cam and pincer, and is found to be the most prevalent among the three.

Important cues that warrant a thorough clinical investigation of FAI include: participation in dance or sports that demand repeated extreme hip flexion and rotation; female; adolescent; deep groin pain that radiates anterolaterally (C-sign); mechanical clicking; pain with prolonged sitting (restaurant sign), deep flexion, prolonged walking, turning towards the affected side, and athletic activities like running up hill or biking.[1,2,3]

During the objective exam, there may be a statistically significant decrease in passive hip flexion and internal rotation at 90 degrees hip flexion with FAI.[1] The Flexion Adduction Internal Rotation test (FADIR) has the highest sensitivity (.94-.99) in detecting FAI. With flexion the cam or pincer deformity is thought to contact the labrum of the chondro-labral junction, limiting

internal rotation at the hip and producing a positive FADIR.[2] An additional special test is the flexion internal rotation test, where the hip is flexed to 90 and then internally rotated (with no added adduction). The sensitivity of this test is reported as .96 for detecting FAI.[4]

Acetabular Labrum Tear

The acetabular labrum is a fibrocartilaginous lining of the acetabular socket.[5] The labrum normally serves as a shock absorber, joint lubricator, pressure distributor, and a semi-stabilizer. Therefore, when there is a tear in the acetabular labrum, there are higher focal pressures, less joint lubrication, and a decrease in the joint stability. A tear in the acetabular labrum is associated with five possible etiologies: degeneration, hypermobility of the hip, FAI, dysplasia, and trauma. The majority of the tears seen in the United States are located in the anterior labrum.

In performing a differential diagnosis for an acetabular labrum tear, the initial interview and the patients' characteristics are vital first steps. Findings that may warrant further investigation of a labrum tear include: female; between 8-75 years old; anterior hip, groin pain or buttock pain; clicking and less commonly catching, locking, or giving way; a sensation of instability at the hip; pain increased with walking, pivoting, prolonged sitting, and impact activities.[5,6] Clicking is one of the more accurate indications of a labrum tear, with a sensitivity of 1 and a specificity of .85.[6]

However, as the labrum may tear in a number of locations, there is significant variability in the symptoms and signs. This makes diagnosis more difficult and decreases the sensitivity and specificity of objective tests. Studies have found the most reliable exam is the anterior hip-impingement test or the Flexion Adduction Internal Rotation test (FADIR).[5] In a recent cadaveric study of labrum strain in different positions of the hip, investigators found maximum posterior labrum strain with flexion alone.[7] The greatest strain of the anterior labrum was in flexion with

adduction. The research supported the anterior impingement test for identifying anterolateral labral tears, a common location for tears. The hyperextension-rotation test is effective in producing strain on the posterior labrum. The FABER, log-roll, resisted straight leg raise, and the apprehension test are less specific to a labrum tear, and therefore less appropriate for differential diagnosis.[5] Other studies have found that the patient may exhibit a slight decrease in hip ROM, with rotation being the most common movement limited.

Osteoarthritis

Osteoarthritis of the femoroacetabular joint is characterized by the degeneration of articular cartilage. Without articular cartilage to attenuate contact forces, the subchondral bone will be subjected to high contact pressures. Other changes that characterize osteoarthritis include shortening and lengthening of the joint capsule, osteophytes, bone spurs, sclerosis of the subchondral bone and cyst formation.[8]

As with a labral tear and FAI, the patient's characteristics and initial interview are important when performing a differential diagnosis for hip OA. Findings that warrant further investigation of osteoarthritis include: older than 50 years of age (likelihood of OA increases with age); developmental disorder like slipped capital femoral epiphysis (SCFE), Legg Calve Perthes (LCP) disease, or congenital hip dislocation; high intensity, impact activities; history of a proximal hip fracture; pain with weight bearing, with movement after period of prolonged inactivity, and hip flexion; and morning stiffness for less than an hour.[8] Weaker evidence implicates farming or an occupation that requires lifting heavy objects.

A handful of clinical prediction guidelines (CPG) have been formulated for identifying patients with hip OA. The American College of Rheumatology concluded after an extensive Level I study that OA should be assessed further if the patient reported hip pain and either:[9]

Cluster 1	**Cluster 2**
Hip internal rotation greater than or equal to 15 degrees	Hip internal rotation less than 15 degrees
Pain with internal rotation	Hip flexion less than 115 degrees
Morning stiffness for less than or equal to 1 hour	Older than 50
Older than 50	

The use of this CPG allowed for a sensitivity of 86% and specificity of 75%.

Another level I study by Birrell et al found that restricted internal rotation was the most commonly restricted motion in patients with OA.[10] However, any one restricted plane by at least 15 degrees when compared to the contralateral hip had a sensitivity of 1 and specificity of .54 for severe hip OA. The accuracy of this sign decreased with moderate OA. However, if all 3 planes are restricted the specificity increases to .98 and the sensitivity decreases to .33 for moderate hip OA.

In a level II study, a positive scour test with adduction had a sensitivity of .62 and specificity of .75 for osteoarthritis.[11] The sensitivity of pain with squatting and passive internal rotation less than or equal to 25 degrees had a sensitivity of .76. The tests that had the highest specificity (above .80) were constant pain, groin pain, squat causing posterior pain, pain with active hip extension, flexion, abduction or adduction.

Association among conditions

There is a distinct association among FAI, acetabular labrum tears, and osteoarthritis. With FAI, there is joint incongruity and decreased contact area between the proximal femur and the acetabulum. This decrease in contact area causes focal pressures on the labrum that exposes it to an increased risk of failure. Cam type FAI commonly causes damage to the anterosuperior acetabular cartilage and labrum as the abnormal femoral head makes contact with the

anterosuperior acetabulum and labrum. The pincer abnormality typically results in localized or peripheral damage, when the labrum is caught between the rim of the acetabulum and the femoral neck, resulting in degeneration of the labrum and the subchondral bone.[5] In one study a labral tear was seen on 57% of the study population diagnosed with FAI.[1]

There is an increased risk of articular and chondral damage in the presence of an acetabular labrum tears. One study found that 73% of patients with damage to the acetabular labrum also had chondral damage; and in 94% of the patients, the articular damage was in the zone of the labral lesion.[5] As the prevalence of chondral damage accompanying a labral tear appeared to increase with age, it is thought that the labral tear precedes the articular damage. However, there is an association between FAI and hip osteoarthritis, with or without a labrum tear.[12] One estimation has one third of patients with mild OA and FAI developing end–stage osteoarthritis in 10 years.[1]

Similarities in presentation

Similar findings among these three conditions may include: insidious onset; limited hip internal rotation; pain at the anterior hip; aggravated with squatting, pivoting, and prolonged sitting; positive FABER and FADIR tests. Patients with FAI and labrum tears may present with further similarities in the clinic like instability, clicking, and a younger age. One study found that the FABER test was positive for pain in 88% of patients with an intra-articular pathology, but no distinction between the different pathologies was possible.[13] Both the FADIR and the FABER test have excellent sensitivity, but poor specificity.[14] Any hip that is irritable, especially those that are irritated within the femoroacetabular joint, will be painful in this position. Therefore, these tests may be more useful in distinguishing intra-articular conditions from extra-artcular conditions.[4] Of

note, the FADIR has lower reliability, while the FABER and log roll have moderate and clinically significant reliability when performed by a PT or orthopedic surgeon.

Differences in presentation

The common differences among these three individual conditions are the following (recognizing there is some variability and exceptions to the rule):

Condition	**Osteoarthritis**	**FAI**	**Acetabular labrum tear**
Age	Older population (>50)	Younger population	Younger population
Onset	Insidious onset	Insidious	Insidious or acute
Morning stiffness	<1 hour	Not noted in the literature	Not noted in the literature
ROM limitations	Limited in multiple planes	Limited hip internal rotation and flexion	Minimal to no limitations
Pain with active hip extension	Present	Not noted in the literature	Not noted in the literature
Clicking	Not noted in the literature	Possibility of mechanical clicking	Clicking, 100% sensitivity
Instability	Not noted in the literature	Present	Present
Scour	May be positive	Not studied in literature	Not studied in literature

Physical Therapy Interventions

As FAI, labrum tears, and osteoarthritis are interrelated and often concomitant, interventions should primarily be driven by the patient's presentation. In general, physical therapy for the hip should address such issues as weakness, range of motion restrictions, malalignment, offending behaviors and patterns, decreased shock absorption, and poor neuromuscular control. When treating one condition, the intervention will likely benefit the other two conditions.

Osteoarthritis intervention:

The majority of research conducted thus far on physical therapy interventions is focused on management of hip osteoarthritis. Thus far the following interventions have been investigated: manual therapy, strengthening, stretching, aquatic therapy, foot orthoses, weight loss, durable medical equipment (DME) use, functional training, and patient education.

Manual Therapy

At this point, there is a lack of quality, unbiased evidence that supports the use of manual therapy (MT). Current findings allude to a cautious use of manual therapy in conjunction with other management methods and outcome measures. In a systematic review, the following clinically significant short term improvements in favor of manual therapy over exercise therapy were seen: decreased pain at rest and walking, decreased bodily pain subscale of the SF-36, decreased Harris Hip Score, and increased walking speed.[15] The intervention's positive effect was found to diminish at the 6-month follow up. There is a lack of evidence to determine the frequency and dosage for manual treatments; therefore, no conclusions can be drawn at this time. There have been a variety of mechanisms proposed for how MT has a positive effect including activation of pain inhibitory cortical system, hypoalgesia, endorphin release, increased blood flow resulting in a release of local pain mediators, placebo effect, and breaking adhesions.

In a randomized control trial comparing MT to exercise therapy for hip OA, MT had a larger effect on pain, stiffness, and range of motion when compared to exercise therapy. The intervention involved 2 sessions a week for a total of 9 sessions. The manual therapy incorporated stretching of shortened musculature at the hip, traction of the hip, and traction manipulation in the limited ranges.[16] However, with severe OA and decreased function, MT and exercise therapy were found to be equally effective.

Of note, for the number of studies showing a benefit from MT one will find the same number of studies showing no added benefit. For instance, in the EMPART study by French et al, the authors found no added benefit of MT with exercise when compared to exercise alone.[17] This MT protocol used non-manipulative techniques for up to 15 minutes at a time. This difference in findings may be attributable to the added manipulation intervention in the study be Hoeksma et al.[16,17]

Orthoses

There is limited research on the effect of custom made orthoses for management of hip osteoarthritis, and the evidence that exists is low quality. The aim of using orthoses is to improve the femoroacetabular joint congruency. In a study by Ohsawa et al, a heel lift was added to either the ipsilateral or contralateral leg depending on the effect that adduction and abduction had on the affected limb.[18] Meaning, if there was improved congruency with the hip in abduction, the raise was added to the contralateral leg. Joint congruency was assessed via radiographic imaging. With the addition of the lift, hip pain decreased but no change was seen in range of motion, function, or progression of OA. This was a non-randomized uncontrolled study of low quality.

A study by Gross et al found forefoot varus was associated with hip pain and total hip arthroplasty.[19] As the foot touches the ground, a forefoot varus will cause a larger ground reaction force driving the foot into pronation. Pronation can cause medial columnar collapse and internal rotation with adduction at the hip. This pulls the lateral hip musculature tight, driving the femoral head into the acetabulum. These findings suggest the importance of screening for forefoot varus, and when present, constructing a custom foot orthoses with a medial forefoot wedge to decrease the ground reaction force that is driving the hip into internal rotation and adduction.

Weight Loss

With increased weight, there will be increased force and pressure going through the weight bearing joints. Yet there is limited evidence showing an association between obesity and hip osteoarthritis.[8] There was no difference between the obese and non-obese populations in the prevalence of OA at the hip as assessed with radiographic imaging. However, there were higher rates of clinically diagnosed hip OA without an x-ray suggesting that the obese population suffer from more discomfort with the same severity of OA. One study showed that an intervention of weight loss and exercise resulted in improvements in the following areas: body mass (an average loss of 2.8 kg), WOMAC pain score, VAS pain, 6 Meter Walk Test (6MWT), and SF-36 pain scores. Improvements were seen at 3 months and 8 months when compared to baseline.[20]

Aquatic Therapy

Aquatic therapy should be recommended when land based exercise is not tolerated secondary to obesity or pain. Research has found only a small short-term effect for pain, stiffness, abductor strength, quality of life, and physical function when compared to no intervention.[8]

Stretching, strengthening, and neuromuscular control

Numerous studies have shown the efficacy of a stretching and strengthening program for management of hip OA as seen in lowered pain and improved function.[8] Range of motion interventions focused on daily, light stretching of the hip musculature for 15-30 seconds after heating. For strengthening of the hip musculature both free weights and exercise machines were found to be effective. The frequency of effective intervention ranged from 1 to 3 times a week for 30 minutes. However, after terminating the intervention, the benefits in improved function, less pain, and less medicine required decreased.

An umbrella interview in 2007 of systematic reviews identified only 6 systematic reviews that were high quality.[21] These papers identified low quality evidence in support of strengthening

hip musculature for pain reduction. In another study conducted in 2013, participants were seen during six to eight, 30-minute sessions over 8 weeks.[17] The interventions incorporated an individualized stretching and strengthening regime. The strengthening intervention used open kinetic chain, low-load exercises with progression to closed kinetic chain functional tasks. The muscles targeted included the gluteals, as they are often atrophied in patients with hip OA. Each subject was assigned a home exercise plan. The subjects were encouraged to partake in aerobic exercise 30 minutes, 5 days a week. Significant improvements in the WOMAC score, hip range of motion, and patient-perceived change occurred in the treatment group compared with the control group. In an RCT, a similar therapeutic intervention was used for increasing strength, proprioception, balance, and flexibility.[22] Improvements were seen in pain and function as measured by the WOMAC. The intervention involved a once a week group intervention and twice a week home exercise program.

Durable Medical Equipment

To reduce joint contact pressure and to decrease abductor muscle activation, a patient can be advised to use a cane on the contralateral side, and/or carrying loads on the ipsilateral side. One study assessing the efficacy of canes in patients with hip OA found decreased pain and improved function.[8] In another study using patients with varying severities of symptomatic hip OA, use of a cane after 4 weeks allowed for statistically significant improved gait velocity and double stance time compared to baseline. No change was seen in pain and function at this time.[23]

Patient Education

Patient education on arthritis has been found in numerous studies to reduce stiffness, fatigue, medical usage, and pain while improving function.[8] A meta-analysis showed a 20%

reduction in pain with patient education compared to NSAIDs alone. Patient education can target weight reduction, activity modification, exercise, and how to unload the hip.

Femoroacetabular Impingement

There is limited evidence assessing the efficacy of physical therapy for treating FAI, those papers available are primarily expert opinion based on experience and biomechanics. Sangal et al highlights that there is no evidence showing a benefit of one physical therapy intervention over another.[24] The recommended treatments found include the following:

Patient education/activity modification

In a study conducted by Emara et al in 2011, they examined the effect of a 4 stage conservative treatment with the Harris Hip Score and non-arthritic hip score assessing change.[25] All four stages primarily focused on activity modification alongside Diclofenac for the first 2-4 weeks and stretching the hip into external rotation and abduction. Activity modification focused on staying within the patient's "safe range of motion" and minimizing friction. Of the 37 patients studied, 27 had improvements in function and symptom, and 4 had no improvement and elected surgery. Of note, there was no change in the available range of motion. The authors found their results comparable to open or arthroscopic surgery. Loudon et al also recommends activity modification and suggests avoiding extremes of hip flexion and internal rotation, prolonged sitting, running, and biking.[3] Walking and swimming were offered as alternatives to exercise to decrease the stress at the joint. Running cadence should increase thereby decreasing forces on the hip.

Anterior-Posterior mobilizations of the hip

The recommendation for anterior posterior mobilizations of the hip is based on anecdotal evidence and should be used cautiously.[3] In order to improve posterior glide, the patient's leg should be flexed, adducted, and internally rotated. The physical therapist can then push the femur posterior-laterally from the distal femur. The patient can self mobilize by performing a quadruped rock-back.

Stretching, strengthening, and neuromuscular control

No studies were found assessing the benefit of a stretching and/or strengthening regime. Loudon et al recommends strengthening of the hip musculature, focusing on the gluteus medius and maximus, and stretching of tissues with decreased extensibility.[3] Furthermore, the authors recommend the possible use of a S.E.R.F. strap to decrease hip adduction and internal rotation.

Conclusions

The information presented in this review emphasizes the need for the cautious use of clinical tests when differentiating among femoroacetabular impingement, osteoarthritis, and acetabular labrum tears, while emphasizing the importance of a subjective interview and the patient's characteristics. Physical therapy interventions should be based on the patient's presentation with a thorough assessment of strength, range of motion, malalignment, offending behaviors and patterns, shock absorption, and neuromuscular control. The treatments discussed in this paper can be used by physical therapists to address limitations found, while recognizing the dearth of evidence available and therefore the need for outcome measures to assess a patient's progress.

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