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Muscle Damage in Femoroacetabular Impingement (Fai): A Self-Joint Mobilization Technique

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ABSTRACT:

Background: Femoroacetabular impingement (FAI) is recognized as a common cause of hip pain in young, active adults. There are many different approaches used in the treatment of FAI. A literature review and case report were conducted to examine the evidence that nonsurgical intervention has demonstrated effectiveness in the management of FAI.

Methods: The literature search included the electronic databases of PubMed, CINAHL, PEDro, and the Cochrane Library. The database search process yielded 463 articles, 21 of which were reviewed in full text and 9 included in this review for meeting the criteria for inclusion. The articles reviewed included two randomized clinical trials, five systematic reviews, and two case reports. Case Description: The patient was a 27- year-old female who presented to physical therapy with anterior hip pain. At the initial evaluation, she reported pain with prolonged sitting and squatting activities. The intervention included a program of six self-joint mobilization techniques for a period of eight weeks. Outcomes: The self-joint mobilization program was used to improve hip range of motion (ROM), pain-free squat depth, and pain-free sitting duration. Outcome tools included the Lower Extremity Functional Scale (LEFS), Hip Outcome Score (HOS), and Nonarthritic Hip Score (NAHS).

Conclusion: The literature review provided consistent evidence that conservative care, including manual therapy, exercise, activity modification, and a home exercise program, can successfully decrease symptoms of FAI. The case report demonstrated that young adults with FAI may benefit from a self-joint mobilization program to improve mobility and to return to functional activities pain free. The literature review and case report both support the hypothesis that nonsurgical intervention is an effective method to manage FAI. Further research is required to investigate the use of a self-joint mobilization program in a larger population of patients with FAI.

Keywords: femoroacetabular impingement (FAI); hip pain; labral tear; conservative care; manual therapy; self-joint mobilization

INTRODUCTION

Femoroacetabular impingement (FAI) can be described as involving deformities or abnormalities in the shape of the proximal femur or acetabulum of the hip joint. There are three types of impingement based on the abnormality present: cam-type, pincer-type, and mixed. Cam-type deformity is the result of abnormalities of the proximal femur including widening of the femoral neck or aspherity of the femoral head. Pincer-type deformity is classified by abnormalities of the anterosuperior acetabular rim causing a deeper socket. The third type of deformity involves a combination of cam and pincer malformations (Enseki et al., 2014). The presence of any of these bony malformations in combination with repetitive motions of the hip into flexion, abduction, and internal rotation can lead to tissue damage within the joint due to the excessive force placed on the acetabular labrum.

The acetabular labrum extends from the rim of the acetabulum and deepens the hip joint socket. It acts as a shock absorber to decrease the everyday forces placed upon the body and provides joint lubrication. The labrum also forms a seal creating negative intra-articular pressure within the joint. The presence of bony impingement and repetitive motions of hip flexion, adduction, and internal rotation can lead to damage of the acetabular labrum and joint degeneration. The structural changes seen with FAI have been associated with early onset of hip osteoarthritis (Bedi et al., 2008).

In the last decade, there has been an increasing prevalence of hip pain in young, active adults. This increase may be attributed to more diagnoses resulting from recent advancements in imaging techniques. The rate for surgical intervention is also increasing, and each procedure can cost up to $12,000.00 (Wright, Hegedus, Taylor, Dischiavi, & Stubbs, 2016). In addition, there is not sufficient

evidence to support a conclusion that surgery is the optimal treatment approach for young adults with nonarthritic hip pain (Fairley et al., 2016).

The Clinical Practice Guidelines recommend that 8 to 12 weeks of conservative care should be considered to manage nonarthritic hip pain prior to surgical intervention (Enseki et al., 2014). Traditional management in physical therapy of FAI includes joint mobilizations; stretching of hip musculature; neuromuscular reeducation of lumbar and pelvic stabilizers; strengthening of hip extensors, abductors, and external rotators; and activity modification (Loudon & Reiman, 2014). Research has supported the use of these techniques in physical therapy to reduce symptoms in individuals with FAI, but there has been limited research on the effects of a treatment approach allowing patients to self- manage their symptoms. This case report considers the effects of a self-mobilization treatment program in a young adult with FAI to manage symptoms, improve functional movement, and avoid the need for future surgical intervention.

Case Description

The patient was seen in an outpatient physical therapy setting over a three-month period for treatment of hip pain. The patient provided verbal and written consent for this case report. The patient was a 27-year-old female with left hip pain that began three years prior to the physical therapy evaluation. She was uncertain of the cause, with no trauma or specific known mechanism of injury. The patient participated in collegiate-level track and field from 2007 to 2010, competing in high jump and pole vault. She did not report any hip pain during that time. She reported at the time of the evaluation that she went to the gym three times per week, and jogged one time per week.

During her initial visit, the patient reported pain with prolonged sitting (greater than 20 minutes), squatting, and putting on her shoes and socks. The patient's report of pain with sitting was a significant problem because she was in her third year of a graduate program that required up to eight hours of sitting for class or schoolwork per day. In addition, she spent two hours a day sitting in her car while commuting to and from school. She was limited in participating in her normal recreational and fitness activities due to pain with squatting activities. Her pain was described as sharp or aching in nature. The patient also reported intermittent popping and clicking in her hip.

She reported no low back pain or referred symptoms into the lower extremity. The patient did not receive any imaging or previous treatments for her hip pain. She reported previous use of nonsteroidal anti-inflammatory drugs (NSAIDs) with no relief of symptoms, and she discontinued the use about two years prior to the evaluation. She denied any significant past medical history that may have potentially contributed to her symptoms. The patient reported that she had no night pain or inability to find a position of comfort. She reported her goals with physical therapy were to improve the duration of pain-free sitting and to improve pain-free squat depth.

Systems Review

Vital signs were not noted at the time of the initial visit. Based on the location of pain, the patient's primary problem was believed to be related to the hip joint. Screening of the lumbar spine was performed to rule out a neurological dysfunction. The screening included myotome testing of L2-S1, reflex testing of L4 and S1, and sensory testing of L2-S2. No structural abnormalities or mobility impairments were identified when screening the knees, ankles, or feet. The patient was 175 centimeters (69 inches) tall, weighed 62 kilograms (137 pounds), and had a body mass index of 20.1. There were no significant findings within the cardiovascular, endocrinologic, integumentary, and gastrointestinal systems.

At the time of the initial evaluation, the patient completed the Lower Extremity Functional Score (LEFS), Hip Outcome Score (HOS), and Non-Arthritic Hip Score (NAHS) questionnaires. The validity, reliability, and minimally clinically important difference (MCID) for each questionnaire is presented in Table 1. These outcome measures are an important tool because they allow patients to make a self-assessment of their condition without the bias of a healthcare provider. The LEFS is used to evaluate the impairment of a patient with a lower-extremity musculoskeletal condition (Binkley, Stratford, Lott, & Riddle, 1999). The HOS includes two subscales for activities of daily living (ADL) and sports and was developed to assess patients with acetabular labral tears (Martin, Kelly, & Philippon, 2006). Finally, the NAHS is used for young, active patients with activity-limiting hip pain, including those with FAI. NAHS includes subscales for pain,

mechanical symptoms, physical function, and activity level (Christensen et al., 2003; Harris-Hayes et al., 2013).

Clinical Impression #1

The patient was a 27-year-old female presenting with pain in the left anterior hip.

She reported pain with squatting and prolonged sitting. It was hypothesized that this patient presented with nonarthritic hip pain due to her age, level of activity, location of pain, and aggravating factors. Possible diagnoses are listed in Table 2. The possible diagnoses included femoroacetabular impingement, labral tear, hip osteoarthritis, iliopsoas bursitis, slipped capital femoral epiphysis, referred pain from lumbar spine, iliopsoas tendinopathy, and hip adductor muscle strain. Further tests and measures were needed to rule in or rule out each of these relevant diagnoses.

Conservative care is recommended for at least eight weeks prior to surgical intervention in the management of nonarthritic hip pain, making this patient appropriate for physical therapy to manage her hip symptoms (Enseki et al., 2014). She was a good candidate for a case study because she did not have any other injuries or comorbidities as determined by the subjective evaluation and systems review, and she was motivated to restore her function.

Examination

Tests and Measures

The patient's lumbar spine range of motion was assessed to clear her from pathology. The patient was standing with feet shoulder width apart with knees extended and was asked to bend forward, bend backward, and bend sideways right and left. Each motion was assessed for available motion, observing for smooth spinal curvature, asymmetry, and pain. Then overpressure was applied in each direction assessing for pain and joint stiffness. The patient demonstrated full lumbar spine range of motion with no reproduction of symptoms. She was then positioned prone to assess posterior to anterior intervertebral motion of the lumbar spine. There was no hypomobility, hypermobility, or symptom reproduction noted in the lumbar spine or hip.

Active knee range of motion with overpressures was assessed to clear the knee joint from pathology. The patient was positioned supine and asked to bend and straighten the knee as much as possible. Overpressures were applied to look for any limitations in motion or reproduction of symptoms. The patient had full bilateral knee range of motion with no pain or symptom reproduction.

The patient's hip joint mobility was assessed by observing for end feel, resistance, and symptom reproduction. The results are in Table 3. The right hip was assessed first to allow for comparison. The patient was positioned supine with the hip in about 80 degrees of flexion and slight external rotation. A caudal force and a lateral force were applied with the hands as close to the joint line as possible to assess the glide of the femur on the acetabular surface. The posterior capsule was assessed with the involved lower extremity crossed over the uninvolved, with the foot flat on the plinth. An axial anterior- to-posterior force was applied through the femur toward the hip joint. The patient was then positioned prone to assess the anterior joint capsule. The hip was passively extended, and a posterior to anterior force was applied through the gluteal fold.

Normal hip range of motion and the appropriate landmarks are presented in Table 4. The patient's hip passive range of motion was measured and noted in Table 5. The goniometer was used for all range of motion measurements (Bovens et al., 1990). Patient reported pain with passive hip flexion and internal rotation.

Manual muscle testing was performed with the results in Table 6. Each manual muscle test was completed on the right hip followed by the left hip, and measurements were recorded. Gluteus maximus strength was tested in the prone position with the knee flexed to 90 degrees. The hip was passively extended, and the patient was asked to hold this position as the muscle was palpated for activation. Resistance was applied through the distal femur as the patient was asked to hold that position. Gluteus medius strength was tested in side-lying with the uninvolved side on the table. The patient was passively taken into hip abduction with neutral rotation with the knee extended. The muscle was palpated for appropriate activation, and the patient was asked to maintain this position, and resistance was applied distally. Hamstring strength was tested with the patient prone with neutral hip alignment. The patient was asked to bend the knee to 90 degrees of flexion, and the muscle was palpated for activation. The patient was asked to maintain that position as resistance was applied into knee extension. Quadriceps strength was tested with the patient sitting. The patient was asked to extend the knee as the

muscle was palpated. The patient was asked to maintain the knee slightly out of extension as resistance was applied into knee flexion.

Special tests were performed to rule in and rule out specific diagnoses. The tests were performed according to the guidelines and instructions in *Orthopedic Physical Examination Tests: An Evidence-Based Approach* (Cook & Hegedus, 2013). Each exam was performed on the right lower extremity followed by the left lower extremity to compare the uninvolved with the involved extremity. See Table 7 for purpose, reliability, and specifics on test instructions and results of special tests.

The patient performed a deep squat in standing with feet shoulder width apart. She demonstrated apprehension with this movement and reproduction of anterior hip pain. The patient was then instructed to only squat as deeply as possible without any pain. She demonstrated proper mechanics, maintained a neutral spine, did not show femoral adduction or internal rotation, did not show excessive anterior tibial translation, and maintained a neutral arch. The Hudl Technique App was used to objectively measure the hip flexion angle of 67 degrees and knee flexion angle of 108 degrees (Figure 1). Hudl Technique is a free app that provides video review and performance analysis tools to allow athletes, coaches, and clinicians to assess and improve biomechanics and performance.

Table 1

Hip Joint Mobility

Hip Joint Mobility	Right	Left
Caudal glide	Normal	Hypomobile
Lateral glide	Normal	Hypomobile
Posterior glide	Normal	Hypomobile
Anterior glide	Normal	Normal

Table 2

Hip Passive Range of Motion (PROM)

PROM (in degrees)	Right	Left
Flexion	115	92*
Extension	18	18
Abduction	25	15
Internal Rotation	42	32*
External Rotation	42	44

Note. *pain experienced at end range. Table

Table 3

Hip Manual Muscle Test (MMT)

Muscle	Right	Left
Gluteus maximus	5/5	4/5
Gluteus medius	4+/5	4+/5
Hamstrings	5/5	4/5
Quadriceps	5/5	5/5

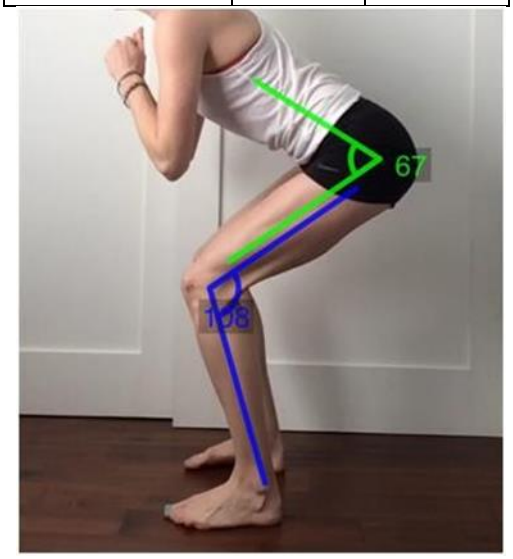

Figure 1. Pain free squat depth.

Table 4

Treatment Schedule

Weeks	Mobilization
1–2	1, 2
3–5	1, 3, 4
6–8	2, 5, 6

Note. The duration in all cases consisted of three sets of 30-second mobilizations with a 60-second hold.

Table 5

Outcome Tools Pre- and Posttreatment

Outcome Tool	Initial Evaluation	Discharge
LEFS	66/80 = 83%	71/80 = 89%
HOS: ADL scale	59/68 = 87%	62/68 = 91%
HOS: Sports scale	30/36 = 83%	32/36 = 89%
NAHS	67 × 1.25 = 84%	70 × 1.25 = 88%

Note. Abbreviations: LEFS, Lower Extremity Functional Score; HOS, Hip Outcome Score; ADL, Activities of daily living; NAHS, Non-Arthritic Hip Score.

Table 6

Left Hip Passive Range of Motion (PROM) Measurements Pre- and Posttreatment

PROM(in degrees)	Initial Evaluation	Discharge	Change (in degrees)
Flexion	92	110	+ 18
Abduction	15	25	+10
Internal Rotation	32	40	+8

Table 7
Squat Depth Pre- and Posttreatment

Squat Depth (in degrees)	Initial Evaluation	Discharge	Change (in degrees)
Hip Angle	113	131	+18
Knee Angle	72	92	+20

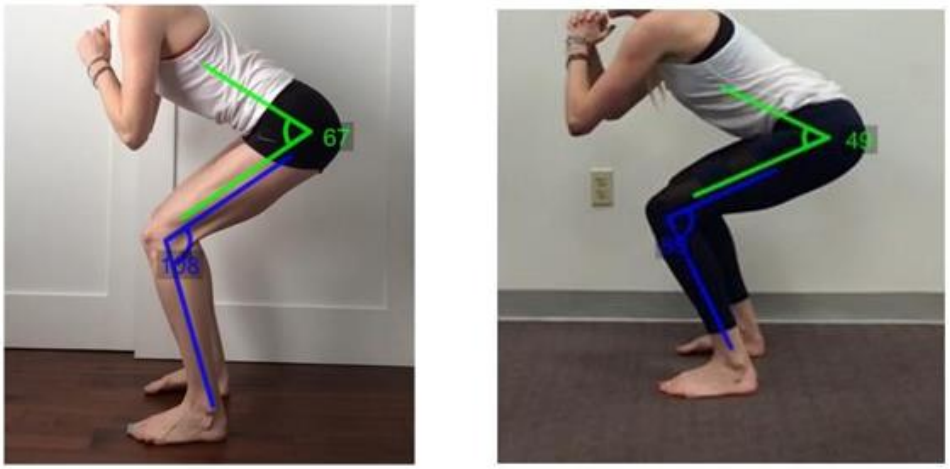

Figure 2. Pain-free squat depth pre- and posttreatment.

DISCUSSION

Femoroacetabular impingement (FAI) is the presence of bony abnormalities in the proximal femur or acetabulum that can lead to hip pain, dysfunction, labral tears, and early onset of hip osteoarthritis in young, active adults (Bedi et al., 2008). The purpose of this paper was to examine the use of a self-joint mobilization program in a 27-year-old female with FAI to manage symptoms, improve functional movement, and to avoid the need for future surgical intervention.

There are many different treatment approaches used in the management of FAI, including surgical and nonsurgical approaches, but it remains unclear what the most successful intervention is. Due to advancements in imaging techniques, there has been an increased prevalence and an increased rate for surgical intervention; however, there is no evidence to support this intervention as the most effective choice for young adults with nonarthritic hip pain (Wright et al., 2016). One article in the literature review suggested surgical intervention as the superior treatment technique, but one still has to consider the cost, complications, and failures associated with surgery. It can be concluded that nonsurgical intervention would be more cost-effective and involve fewer risks and therefore could be the more effective choice in many cases.

The Clinical Practice Guidelines recommend a period of 8 to 12 weeks of conservative care prior to surgical interventions (Enseki et al., 2014). Overall, research suggests physical therapy interventions in the management of FAI, including joint mobilizations; stretching of the lower

extremity musculature; neuromuscular reeducation of the lumbar and pelvic stabilizers; strengthening of hip extensors, abductors, and external rotators; and activity modification (Loudon & Reiman, 2014).

Previous research has shown physical therapy programs consisting of manual therapy to be beneficial for the treatment of FAI, but the effects of a self-managed manual therapy program are unclear. One report has suggested the use of self-hip mobilization incorporated into a home exercise program, but this report lacked a case study to show the effects (Reiman & Matheson, 2013). The case report presented in this paper has shown how a self-joint mobilization program was used to rehabilitate a 27- year-old female with a three-year history of left hip pain with clinical evidence of FAI and labral pathology. This report adds to the existing studies that showed favorable outcomes in patients with FAI undergoing manual therapy–based intervention (Hoeksma et al., 2004).

Limitations to the literature review's generalizability included inconsistent patient populations, various outcome measures, and free full text availability. The variability in treatment interventions, patient population, and outcome measures limited the ability to pool all of the data. The case report contained only one patient, limiting the ability to generalize the results to an entire patient population. In addition, the case report was not a randomized, controlled trial. Although the patient used in this study was able to properly learn and perform the mobilizations independently, it cannot be assumed that all patients will be able to do so. The patient in this case report did not receive any imaging to confirm the presence of a bony abnormality or labral pathology.

Future research needs to be conducted to determine the most effective treatment choice for FAI. Currently there are no studies that directly compare the effects of surgical and nonsurgical intervention techniques; therefore, no conclusion can be made regarding the efficacy of one intervention over the other. More research is also needed to specifically compare different manual therapy techniques as well as to assess the effectiveness of a self-guided joint mobilization program to aide in the management of FAI. Future studies need to include a larger population with FAI and would need to establish a protocol for selecting patients that may be appropriate for this treatment approach, depending largely upon their ability to properly learn and perform the suggested mobilizations independently.

In conclusion, the literature supports the use of nonsurgical intervention, specifically manual therapy, in the management of FAI. The effects of a self-managed manual therapy program remain unclear in the literature. The case report presented in this paper suggests that young adults with FAI may benefit from a self-joint mobilization program to improve mobility and to return to normal functional activities with reduced pain.

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