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DIAGNOSIS AND REHABILITATION OF MULTIPLE HIP PATHOLOGIES  
IN A DIVISION I FOOTBALL PLAYER: A CASE STUDY

BY

KELSEY E SANDERS

A thesis submitted in partial fulfillment of the requirements for the

Master of Science

Major in Nutrition and Exercise Sciences

Specialization in Exercise Science

South Dakota State University

2019

DIAGNOSIS AND REHABILITATION OF MULTIPLE HIP PATHOLOGIES  
IN A DIVISION I FOOTBALL PLAYER: A CASE STUDY

This thesis is approved as a credible and independent investigation by a candidate for the Master of Science in Nutrition and Exercise Sciences and is acceptable for meeting the thesis requirements for this degree. Acceptance of this does not imply that the conclusions reached by the candidate are necessarily the conclusion of the major department.

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## ABSTRACT

DIAGNOSIS AND REHABILITATION OF MULTIPLE HIP PATHOLOGIES IN A  
DIVISION I FOOTBALL PLAYER: A CASE STUDY

KELSEY E SANDERS

2019

**Objective:** To present a diagnosis and rehabilitation plan for femoroacetabular impingement (FAI), labral tear, and sports hernia in a Division I college football player.

**Background:** A 21-year-old NCAA Division I college football player experienced a rare combination diagnosis of hip FAI, labral tear and sports hernia. Overlapping signs and symptoms proved difficult to conclude a diagnosis. The patient underwent three months of conservative treatment with no relief before electing to undergo surgery. **Differential**

**Diagnosis:** Hip flexor strain, osteitis pubis. **Treatment:** A combination of conservative treatment such as activity modification, anti-inflammatories, therapeutic modalities, injections, and rehabilitation were unsuccessful in relieving symptoms the patient experienced. A diagnosis was established through the use of x-rays and magnetic resonance imaging (MRI). Due to failed conservative treatment, surgery was completed by a regional hip specialist and sports hernia specialist. After the procedure, the patient completed six months of rehabilitation under the specifications underlined in the surgeon's protocol. **Uniqueness:** Though FAI and labral tears commonly occur together, sports hernias do not routinely occur in addition to both previously mentioned injuries. Present research does not show MRIs being successful in diagnosing a sports hernia, which was not the case with this patient. In addition, recurrent groin pain regularly associated with sports hernias was infrequently present with this patient. **Conclusion:**

The present case is an example of the difficulties found in diagnosing injuries with overlapping signs and symptoms as well as the importance of diagnostic imaging. Failed efforts with conservative treatment lead to surgical intervention. After six months of rehabilitation, the patient returned to all football related activities with no occurrence of previous signs and symptoms. **Key Words:** Femoroacetabular impingement, labral tear, sports hernia, hip, college football player

## Chapter 1

### Introduction

Given the contact nature of American football, there is a potential for a wide-variety of injuries in both the upper and lower extremities of the body. In a study utilizing the NCAA Injury Surveillance System, the authors found the top five injuries in fall and spring football practices consisted of knee internal derangement, ankle ligament sprain, upper leg muscle-tendon strain, concussion, and pelvis/hip muscle strain.<sup>1</sup> These injuries account for 45% for all injuries during this session type.<sup>1</sup> During fall practices, the most common type of pelvis/hip injury was a muscle-tendon strain and accounts for 1.9% of all injuries.<sup>1</sup> In the last few years there has been a growing interest in the relationship between femoroacetabular impingement (FAI) and sports hernias<sup>2</sup>; however, few of these studies also involve a labral tear. All three injuries have similarities in signs and symptoms, leading to the difficulty of diagnosing all injuries. This case report presents a look at the process for establishing a diagnosis and implementation of an intervention plan for all three conditions.

## Chapter 2

### Background

#### *Femoral Acetabular Impingement*

FAI occurs when an abnormal acetabulum and/or proximal femur repeatedly come in contact during terminal range of motion of the hip.<sup>3,4</sup> There are three forms of FAI and each is defined by the location of the osseous abnormality.<sup>3,4</sup> The most common form of isolated FAI is a cam impingement.<sup>3,4</sup> This form is defined by a loss of the normal contour found at the head-neck region of the femur; the lack of a spherical shape produces a shear force as the chondrolabral junction enters the acetabulum during hip flexion.<sup>3,4</sup> A pincer impingement is a result of acetabular over coverage, which pinches the labrum against the femoral neck during hip flexion and internal rotation.<sup>3,4</sup> The final type of FAI is a combination of cam and pincer impingements and is the most common form of FAI.<sup>3,4</sup> In most cases of combined impingement, one of the intra-articular conditions is more prevalent than the other.<sup>3,4</sup>

All three types of impingement can lead to damage of the hip labrum or acetabular cartilage.<sup>3,4</sup> Patients who suffer from any form of FAI typically experience hip or groin pain that increases in intensity with athletic activities or long periods of walking.<sup>4-6</sup> These individuals are more predisposed to developing hip osteoarthritis.<sup>4</sup> Diagnosis of FAI focuses heavily on patient history, physical examination, and radiographs.<sup>3,4</sup> Surgical interventions are becoming increasingly popular to correct anatomical deformities and alleviate patient symptoms.

### *Labral Tear*

The labrum is a fibrocartilaginous structure forming a labral suction seal around the acetabulum of the hip.<sup>7,8</sup> It contributes to enhancing hip stability by increasing acetabular volume, surface area, and stiffness. These components increase load transmission, reduce stress to articular cartilage, improve proprioception, and preserve the suction seal of the hip.<sup>8-14</sup> A tear to the labrum can be an acute injury or occur over time through FAI, capsular laxity, dysplasia, or degeneration.<sup>15-18</sup>

Diagnosis of hip labral tears has grown immensely in the last decade with the help of improved magnetic resonance imaging (MRI) capabilities and arthroscopic techniques.<sup>16,19</sup> Currently, labral tears are found in 22% to 55% of all patients who experience hip or groin pain, many of which are young and physically active.<sup>15,16,20-23</sup> Those who suffer from this injury report clinically significant pain, clicking, and functional limitations.<sup>7,9,16,24</sup> Surgical reconstruction and repair of the labrum have developed over the last 10 years.<sup>10,15,25,26</sup> Approximately 75-80% of patients who are diagnosed with a hip labral tear elect to undergo hip arthroscopy after conservative measures, such as rehabilitation and injections, have produced inadequate results.<sup>15,24</sup>

### *Sports Hernia*

A sports hernia, also known as athletic pubalgia, is caused by weakness or tear of the posterior portion of the inguinal wall without the presence of a clinically recognizable hernia.<sup>27-33</sup> Shearing forces across the pubic symphysis from movements like trunk hyperextension and thigh hyperabduction ultimately end in damage to local soft tissues<sup>27,34,35</sup>. These anatomical deformities are often accompanied by chronic groin

pain<sup>27-33</sup>. Sports hernias are commonly found in athletes who participate in sports with repetitive turning and twisting at speed.<sup>27</sup>

Presentation of this injury can be acute or chronic.<sup>27</sup> Patients typically experience unilateral, deep groin pain; however, some will experience bilateral pain.<sup>27-29,35-40</sup> A key finding is a cessation of pain with inactivity and a return of pain with activity.<sup>27,29,34,35,40-</sup>

<sup>42</sup> Pain may be aggravated by sudden movements, such as sneezing or coughing.<sup>27-</sup>

<sup>29,31,35,37,38,43,44</sup> Physical findings include local tenderness over the conjoined tendon, midinguinal region, and pubic tubercle with no detectable inguinal hernia.<sup>27-</sup>

<sup>29,31,32,34,36,38,40-42,45-49</sup> Pain with a resisted sit up and resisted hip adduction are also common findings.<sup>27,29,35,36,39,47</sup> Most imaging studies (x-rays and MRI) assist with ruling out other possible causes of pain but do not diagnose sports hernias directly.<sup>27,40</sup>

Treatment for sports hernias begins with conservative measures, such as core and pelvic strengthening, anti-inflammatories, and rest.<sup>27,34,36,48</sup> When nonsurgical methods have failed to improve symptoms after two months, surgical options should be explored.<sup>27,30-</sup>

<sup>32,34,49,50</sup> Surgical cases have been highly successful in both patient satisfaction and return to normal physical activities.<sup>27,29,30,32,35,36,38,40,42,43,47-49,51</sup>

## Chapter 3

### Case Report

The patient was a 21-year-old Caucasian male football player at the NCAA Division I level. He was a single, full-time college student. He was 188 cm tall, weighed 102 kg, and played linebacker. He first reported experiencing left hip pain in early November but did not recall a specific mechanism of injury. His first recollection of discomfort was during fall camp in August towards the end of practices. At that time, he experienced no functional deficits. As the season continued, he experienced a gradual increase in overall pain, as well as an earlier onset of discomfort with activity. When the injury was reported in November, he was experiencing an increase in pain during running, jumping, tackling, and various football related activities. Upon evaluation by the athletic training staff, the patient was referred to the team orthopedic physician for further evaluation.

#### *Weeks 1-2*

The following is a summarized evaluation from the initial appointment with the team orthopedic physician: pain was located over anterior aspect of the hip and anterior superior iliac spine (ASIS). Pain increased from a 0/10 while at rest to 3/10 with running, jumping, tackling, and other football activities. No mechanical symptoms. Mild discomfort on deep palpation over anterior aspect of the hip. No pain with internal rotation, external rotation, or circumduction. Negative impingement sign. Mild discomfort with deep hip flexion localized over anterior aspect of hip. Normal 5/5 strength with resisted hip flexion and extension. Negative straight leg raise test. Mild discomfort over hip flexor with resisted straight leg raise. Diagnosed as hip flexor strain.

Treatment plan was to modify activity, physical therapy, therapeutic modalities, and anti-inflammatory medications.

The intervention plan implemented addressed daily impairments and discomfort experienced by the patient. The daily treatment plan included cryotherapy and anti-inflammatory medications as pain increased and the patient participated in high volumes of physical activity. Activity modifications included reduced depth during squat and lunge exercises, along with reduced repetitions during football practice drills. During practice, to assist with hip flexion, the patient wore a groin spica wrap. Daily rehabilitation included hip range of motion (ROM) and strengthening exercises, which varied each day based on the patient's symptoms. Possible exercises, sets and repetitions included: 4-way TheraTube kicks (2x20 each), hip boxes (2xfatigue), monster walks (2x10), banded hip pulls with external rotation (2x15), donkey kicks (2x15), hip mobilizations (2x20), and osteitis pubis exercises (1x30" each). After conservative treatment and rehabilitation for approximately two weeks, the patient did not have a decrease in his overall discomfort.

#### *Weeks 3-4*

Summarized evaluation from follow-up appointment with team orthopedic physician: Pain over anterior inferior iliac spine (AIIS). Increased pain during running, jumping, and explosive-type football activities. Dull soreness at rest. No mechanical symptoms. Treatment included activity modification, rest, oral anti-inflammatory medications, and physical therapy. Normal gait. No palpable tenderness. No pain with log roll or hip ROM. Mild pain and discomfort with deep hip flexion localized to anterior aspect of hip; pain increased with resisted hip flexion. Negative impingement sign. No



pain with circumduction. Strength was 5/5 with resisted hip flexion and extension. X-rays revealed a small ossicle adjacent to AIIS, which was secondary to a small avulsion fracture off AIIS. X-rays also showed a mild cam lesion and mild osteitis pubis. Diagnosis consisted of hip flexor strain, which was the most consistent with findings from symptoms and x-rays. Treatment plan was to continue activity modifications, physical therapy, and medications. If no improvements, an MRI was the next step for further evaluation.

The physician visit confirmed the athletic training staff's initial diagnosis of a hip flexor strain. Minor adjustments were made to the patient's treatment plan. The most prominent change was a 50% decrease in the number of repetitions he participated in during practice. Incorporating the use of the HydroWorx underwater treadmill provided a means for continued activity and conditioning with decreased weight bearing status. Rehabilitation exercises continued to focus on maintaining full range of motion and strengthening the hip and abdominal regions. The patient continued to participate in games with little functional deficits or pain with the use of Toradol injections from the team orthopedic physician. He would also report having some good days and other days he would experience higher levels of hip muscle fatigue at the end of practice but did not notice any sharp pain.

#### *Weeks 5-8*

During this time, the football season ended, and the patient went home for a three-week break before the second semester began. No physical activity or exercise occurred during the break. After seven weeks of the patient experiencing little to no change in his condition, the team orthopedic physician scheduled an MRI arthrogram in December to

rule out a labral tear. He was referred to another medical doctor and underwent a left hip MRI arthrogram.

*Weeks 9-10*

The patient reported to the athletic training staff after the break stating he had good days and bad days with his hip. His chief complaint was an achy feeling during certain episodes of the day. Currently, the patient only experienced pain over the anterior portion of his hip with no groin or pelvic pain. The patient started to experience lower abdominal pain, particularly with physical activity. General pain became more prevalent during running, particularly when striding out. Sharp pain was not present during activity, but he still has the achy sensation. He began formal rehabilitation daily along with physical therapy one day per week. He continued to work out with activity modifications, which included linear running only and decreases in squat depth and weight. Exercises and treatment during the two physical therapy appointments during this time appear in Table 1. The interventions implemented during rehabilitation with athletic training staff continued based on daily impairments and discomfort experienced by the patient with the focus being on maintaining ROM and strengthening the hip and abdominal regions.

**Table 1. Team Physical Therapist's Rehabilitation Exercises for Weeks 9-10**

Exercise	Sets	Repetitions
Lateral hip glides	1	10 with 10 second holds
Hip distraction	1	10 with 10 second holds
Banded bridge march	1	20
Banded squat	2	10
Adductor ball squeeze	1	10 with 10 second holds
Banded monster walks		
Lateral	2	10 steps each
Backward		
Banded clams	1	60 seconds
Passive range of motion		
Flexion		
Abduction	1	10 each
Internal rotation		
External rotation		

The patient met with the team orthopedic physician to discuss the results of the MRI. The physician examination reported the following findings: no significant change in symptoms since the last visit. Continued diffuse pain along anterior pelvis and anterior aspect of the hip. Intermittent "sharp" pain over the anterior aspect of the hip. Dull achiness also reported involving his hip region. Pain was worse with running and explosive lifting or football activities. Painless internal and external rotation of the hip. Normal internal and external rotation without significant loss of ROM. Symmetric internal and external rotation. No pain with circumduction. Negative impingement sign. Mild pain with deep hip flexion localized to anterior groin region. Resisted hip flexion and extension was 5/5 in strength. Mild discomfort with resisted crunch. Negative straight leg raise as compared bilaterally. Full knee ROM. The MRI findings showed left hip femoroacetabular impingement with subtle/small labral tear, left hip flexor strain, core muscle injury, also known as sports hernia, and left gluteus medius/minimus tendinopathy. The standard care for hip pain includes activity modification, rest, oral anti-inflammatory medication, physical therapy, and guided injections. The team

orthopedic physician prescribed an x-ray guided intra-articular injection using ropivacaine to determine if FAI was the cause of pain. In the event of significant pain relief, the treatment plan would focus on the intra-articular pathology. If no significant pain relief, the treatment plan would concentrate on core muscle injury and other extra-articular structures. Referral to hip arthroscopy specialist was the next step if conservative management did not relieve symptoms.

In the days leading up to the injection, the patient experienced sharp pain when running at higher intensities in the underwater treadmill. Another medical doctor performed the injection of six mL of 0.5% ropivacaine directly into the left hip joint. The injection did not include a steroid medication at the request of the team orthopedic physician.

#### *Weeks 11-12*

One day following the hip injection, the patient experienced approximately 25% pain relief. Due to limited pain relief, the patient then received a cortisone injection to his pubic symphysis. The injection consisted of 0.5 mL of 0.5% ropivacaine and 0.5 mL of Kenalog, 40 mg/mL directly into the joint/pubis symphysis region of the abductor aponeurosis. The same medical doctor as the local hip injection performed this injection. One week after the pubic symphysis injection the patient met with the team orthopedic physician to discuss the result and future treatment options. The summary of the appointment with the team orthopedic physician is as follows: approximately 50% improvement pain relief after injection; however, this started to wear off. Continued diffuse pain along the anterior pelvis and anterior aspect of left hip/groin. Pain is worse with running and explosive lifting/football activities. Painless internal and external

rotation of the hip. Near normal internal and external rotation of the hip with mild decreased internal rotation. Symmetric internal and external rotation compared to contralateral hip. No pain with circumduction. Mild discomfort with impingement sign. Mild pain with deep hip flexion localized to anterior portion of groin. 5/5 strength with resisted hip flexion and extension. Mild discomfort with resisted crunch. Negative straight leg bilaterally. Full knee ROM. Due to failing to achieve significant relief with conservative, nonoperative management, referral to a regional expert is next recommendation. The team orthopedic physician and the hip specialist discussed the case and the hip specialist agreed to evaluate the patient.

The patient met with the physical therapist once during this time. The exercises and treatments implemented appear in Table 2. Rehabilitation exercises with athletic training staff continued to focus on maintaining full range of motion and strengthening the hip and abdominal regions.

**Table 2. Team Physical Therapist's Rehabilitation Exercises for Weeks 11-12**

Exercise	Sets	Repetitions
Lateral hip glides	1	10 with 10 second holds
Hip distraction	1	10 with 10 second holds
Banded monster walks		
Forward/backward	4	10 steps each
Lateral		
Banded bridge march with ball squeeze	1	10 each
Lunge matrix		
Overhead reach		
Overhead right reach	1	3 each
Overhead left reach		
Bridge with ball squeeze	1	10 with 10 second holds
Standing 4-way hip	2	15 each
Side plank with hip abduction	2	10 each
Front plank with hip extension	2	10 each

*Weeks 13-14*

The patient met with a regional hip specialist along with a sports hernia specialist.

The respective evaluation summaries were as follows:

The Hip specialist documented pain in left hip increased during mid-November this last year, specifically localized to anteriorly deep in the crease of his groin. His pain was worse with running and explosive lifting/football activities, as well as deep squats and rotational activities, such as getting in and out of a car. Patient experiences frequent popping episodes, which are occasionally painful. Mild, short-term improvements found with cortisone injection to pubic symphysis and IA injection into hip joint. In addition, activity modification, rest, oral anti-inflammatory medication, and physical therapy did not change his pain. No previous left hip injury or dislocation. Level pelvis with single limb stance. Good neuromuscular control with single leg squat. Internal rotation to 15 degrees, external rotation to 25 degrees, symmetric. Neutral coronal plan alignment

bilaterally. Negative log roll. Stinchfield's is positive. Hip flexion to 120 degrees without aggravation of anterior hip pain. Flexion, adduction, and internal rotation (FADIR) is mildly positive. Scour is negative. Circumduction is negative for pain and snapping. Resisted adduction is 5/5 for strength with no adductor pain. Resisted crunch is negative, but with tenderness over superior pubic rami on the left. Negative anterior apprehension test. No tenderness over pubic symphysis or superior pubic rami. No tenderness over lateral aspect of greater trochanter. Abductor tendons are non-tender. Abduction to 30 degrees with negative lateral impingement sign. Resisted abduction is 5/5 with no pain present. Mildly positive Ober's. Hip extension to 15 degrees. Low back, SI joint, piriformis, and ischial tuberosity are non-tender.

The sports hernia specialist documented pain has been present for several months. Labral tear is present with signs and symptoms consistent with possible sports hernia. Positive for activity change. Increase in pain on left side with resisted leg raise; consistent with sports hernia.

The surgeons collaborated to determine best treatment option. The patient chose to proceed with surgical intervention consisting of left hip arthroscopy, labral repair, acetabuloplasty, and femoroplasty to be performed by the hip specialist, and the sports hernia repair to be performed by the sports hernia specialist. The surgeons discussed details of the procedure and recovery period, all questions were answered, and the surgery was scheduled.

### *Surgery*

The patient underwent general anesthesia for the procedures. The first surgery performed was the repair of the sports hernia along the external oblique muscle. The 2 cm

long tear was sutured with Symbotex mesh along the length of the tear. Once the sports hernia procedure was complete, the hip scope began. Performing an interportal capsulotomy, the surgeon found a labroacetabular tear at the 3 o'clock position extending to the 12:30 o'clock position along with an osteochondral prominence at the femoral head and neck junction. The surgeon performed acetabuloplasty followed by the repair of the labrum tear and finished with the femoroplasty. No complications occurred during the procedure and the patient was kept overnight for extended recovery and observation.

*Intervention Phase I: Weeks 0-3*

The primary goal of Phase I is maximum protection of the surgical repairs. The patient attended rehabilitation five days each week. A collection of exercises was selected for each week with the focus being on restoring hip range of motion and isometric strengthening of muscles surrounding the hip joint and lower abdominals. Please see Table 3 for exercise list. Exercises were all within the restrictions of the surgeons' protocol. At the two-week post-operative date, the patient met with the team orthopedic physician for initial follow-up of the surgery. At the two-week mark, the patient completed a Modified Harris Hip Score outcome measure. The patient's pre-operative score was 81.4 (100 is highest possible score and the intended goal) and 55 at the two-week mark. A pain score of 1/10 at rest was reported prior to the surgery; pain of 2/10 at rest was reported 2 weeks post-operative. The patient adequately met the requirements of the protocol to progress to Phase II.



**Table 3. Phase I Rehabilitation Exercises**

Exercise	Sets	Repetitions
Passive range of motion		
Flexion		
Abduction	2	10
Internal rotation		
External rotation		
Glute sets with 5 second hold	2	15
Quad sets with 5 second hold	2	15
Hip isometrics		
Abduction		
Adduction	2	10
Knee flexion		
Internal rotation		
External rotation		
Heel slides	2	20
Ab draw-in	2	10
Prone lay	1	5 minutes
SL ball curls	2	20
Knee extensions (2# weight)	2	20
Standing abduction/adduction	2	15
Quadruped rocking	2	15

*Intervention Phase II: Weeks 3-6*

Phase II of the protocol called for progressive stretching and early strengthening. For each of the first two weeks, exercises focused on restoring full range of motion and lightly progressing strengthening of the hip and abdominals. During the third week, the patient reached full range of motion and muscle strengthening progressed. The third week included two separate workouts. One workout focused on muscle strength exercises and other focused on range of motion and neuromuscular control. Exercises from this phase appear in Table 4. During this phase, the patient began meeting with the team physical therapist once a week and completed the same exercises as with the athletic trainers. One follow-up appointment with the team orthopedic physician occurred along with the four-

week post-operative Modified Harris Hip Score. The outcome measure scored 78.1 and pain level at rest decreased to 1/10. The patient met all requirements of the protocol to move into Phase III.

**Table 4. Phase II Rehabilitation Exercises**

Exercise	Sets	Repetitions
Passive range of motion		
Flexion	2	10
Internal rotation		
Abduction		
SL ball curls	2	20
Prone hamstring curls with weight (4-5#)	2	20
Prone hip extensions (2# weight)	2	15
Quad set with SL raises	3	15
Side-lying abduction (2# weight)	3	10
Dead bugs	2	15
Ab draw in	2	15
Bridges	2	15
Donkey kicks	2	8
Standing abduction/adduction	2	15

*Intervention Phase III: Weeks 6-12*

Phase III included advanced strength and endurance training. The patient completed rehabilitation five days each week with one of those days being with the team physical therapist. Two days per week included exercises targeting strength of the major muscle groups of the hip and neuromuscular control. The other two days of rehabilitation focused solely on strengthening of the hip musculature. The patient went home prior to the start of summer football workouts and completed Week 11 of the rehabilitation plan. Exercises completed during this phase, along with home exercises based on equipment available to the patient, appear in Table 5. The three-month post-operative Modified Harris Hip Score improved to 95.7; however, the pain rating at rest remained at 1/10. No

physician appointments occurred during this phase. The patient met all requirements of the protocol to progress to Phase IV.

**Table 5. Phase III Rehabilitation Exercises**

Exercise	Sets	Repetitions
Passive external rotation	2	10
Banded dead bugs	2	15
Bridges on airex	2	15
Glute circuit	2	8
4-way hip	2	15
Step ups		
Forward	2	10
Lateral		
Rotational		
Bird dogs	3	10
Body weight squats	2	10
Hip boxes	3	8
SL bridge	2	15
Prone hamstring curls (5# weight)	2	20
Stool walks		
Forward	2	15 steps
Lateral		
Step downs	2	10
3-way calf raises	2	15
Ball squeezes	2	15
Standing rotation with body blade	2	30 seconds
Hip pulls	2	15
Cat/cow	2	15
SL balance	2	30 seconds
Cylinder step-overs	3	15
DL raises	3	15
Banded sit backs	2	15
Shuttle		
DL squats	2	15
SL squats		
SL RDL	3	15
Pelvic floor holds	2	10
Banded hip swings	3	30 seconds
Forward/backward		
Banded lateral walk outs	2	10
Lunge matrix	3 rotations	
4-way TheraTube kicks	2	20
Band resisted stool walks	2	15 steps

Banded SL bridge on airex	3	15
Osteitis pubis circuit	1	30 seconds each
Banded hip pulls	3	15
Clams	2	Fatigue
Wood choppers	2	15
Planks		
Front	2	30" each
Sides		
Banded Monster walks		
Forward/backward	4	10 steps
Lateral		
Storks	2	15
Banded rotations	2	15
DL raise holds	3	30"
Plank with SL extension	3	30"
Resisted march hold on airex	2	30" each
Reverse plank with SL flexion	2	30" each
Slide board mountain climbers	2	30"
Banded hip pulls with external rotation	3	15

---

*Intervention Phase IV: Weeks 12-20*

The focus of Phase IV was the return to sport program. For Weeks 12-13, the patient completed rehabilitation three days each week at home. The patient continued working with the team physical therapist once each week during this time. Equipment available to the patient dictated the exercises completed for each workout. The patient completed strengthening exercises each day. One workout incorporated neuromuscular control exercises and the other included agility exercises. The patient completed the six-month Modified Harris Hip Score with a score of 100 and a 0/10 for pain at rest. The patient attended two physician visits during this time. The first was just before the 15-week post-operative mark and was with his surgeon. At this time, the patient completed the remainder of the intervention program on campus with the team athletic trainers and

physical therapist. All exercises completed during this phase appear in Table 6. The second appointment was at 5-months post-operative with the team orthopedic physician who cleared the patient to progress into football activities.

**Table 6. Phase IV Rehabilitation Exercises**

Exercise	Sets	Repetitions
DL line hops		
Forward/backward	2	30"
Lateral		
Side plank clams	2	15
Side plank abduction with band	2	15
Power step ups	3	10
Glute bridge with march	2	20
4-point banded agility	3	3
Hip mobs	2	10
Hip traction	1	1'
Banded SL bridge on bosu	3	15
Lying hip rotations	2	15
Walking side lunge	3	5 each
Planks		
Front with SL extension	2	30" each
Reverse with SL flexion		
Osteitis pubis circuit	1	30" each
Lunge matrix	5 rotations	
Banded hip pulls with external rotation	3	15
Side planks with abduction	2	30"
Banded monster walks		
Forward/backward	4	10 steps
Lateral		
Storks	2	15
Banded glute circuit	1	Fatigue
SL ball curls	2	15
SL balance	3	30"
Cylinder step overs		
Forward	2	15
Lateral		
Bosu squats with band	3	15
DL raise holds	3	30"
Side plank with reach through	2	20
Bosu hops		
Forward	2	10

Lateral		
Pistol squats	3	10
Shuttle		
5 dot drill	3	5
Box jumps	2	5
Hip PNF	2	15
Ladders		
Pick 5 patterns	3x each	
Turf drills		
Box drill		
Forward weave	2x each	
Backpedal weave		
Planks with kickbacks	3	30"
Bunkies	1	30"
Shuttle		
2 up, 1 down squats	2	15
DL hops		
SL hops		
Rotational hops	2	10
SL bridge with whips	2	15
SL box jumps	2	8
Resisted backpedal	3	10 steps
Body blade rotations on physio ball	2	30"
Resisted lunges		
Forward	2	5
Reverse		
Banded lateral steps	2	10
Planks		
Side w/ abduction circles	2	30" each
Knee to elbow		
Side reach through		
Bosu ball airplanes	3	30"
Split squat jumps	3	15
Internal and external hip mobs	2	10
Skater jumps	2	10
Standing fire hydrants	2	Fatigue
Shuffle reaction drills	15'	

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### *Supplemental Interventions*

The underwater treadmill provided an avenue for activity progression and an alternative to high impact functional activities. In phase II and III, the patient utilized the underwater treadmill twice per week; workouts for each week were the same and progressed on a weekly basis. In Phase IV, the patient completed workouts periodically for low impact cardiovascular training. Exercises for each phase appear in Tables 7-9. All progressions occurred as tolerated by the patient.

**Table 7. Phase II HydroWorx Exercises**

Type	Description	Depth (Feet)	Treadmill Speed (MPH)	Left Jet (%)	Right Jet (%)	Time (Min)
Cardio	Walking	3	2.5	0	0	15
Cardio	Jogging	5	3	0	0	2
Cardio	Jogging	5	3.5	0	0	3
Cardio	Jogging	5	4	0	0	3

**Table 8. Phase III HydroWorx Exercises**

Type	Description	Depth (Feet)	Treadmill Speed (MPH)	Left Jet (%)	Right Jet (%)	Time (Min)
Warm-up	Jogging	5	4.5	0	0	3
Dynamic Motion	Side shuffle	4	2	0	0	2x30"
Dynamic Motion	Back pedal	4	2	0	0	1
Dynamic Motion	A-skip	5	2.5	0	0	1
Dynamic Motion	SL squat	4	0	0	0	2x10
Dynamic Motion	DL squat with hop	4	0	0	0	2x8
Dynamic Motion	DL squat with rotation	4	0	0	0	2x10
Cardio	Jogging	5	4.5	0	0	3
Cardio	Jogging	5	4.5	0	0	8
Cardio	Jogging	5	5	0	0	10
Cardio	Jogging	5	5	0	0	4
Cardio	Jogging	5	5.5	0	0	3
Cardio	Jogging	5	4.5	25	25	5
Cardio	Jogging	5	5	50	50	5
Cardio	Jogging	4	5	0	0	5
Cardio	Jogging	4	4.7	25	25	4
Cardio	Jogging	4	5	50	50	4
Cardio	Jogging	4	5.3	25	25	4
Sprint Work	30" rest between	4	6.5	100	0	30"
Sprint Work	30" rest between	4	7	100	0	30"
Sprint Work	30" rest between	4	8	100	0	20"
Cool Down	Walk	5	2.5	0	0	2



**Table 9. Phase IV HydroWorx Exercises**

Type	Description	Depth (Feet)	Treadmill Speed (MPH)	Left Jet (%)	Right Jet (%)	Time (Min)
Sprint Work	Sprint	4	7 on/5.5 off	100	0	15 min; 30 sec on, 1 min off
Cool Down	Walk	4	2	0	0	3

## Chapter 4

### Discussion

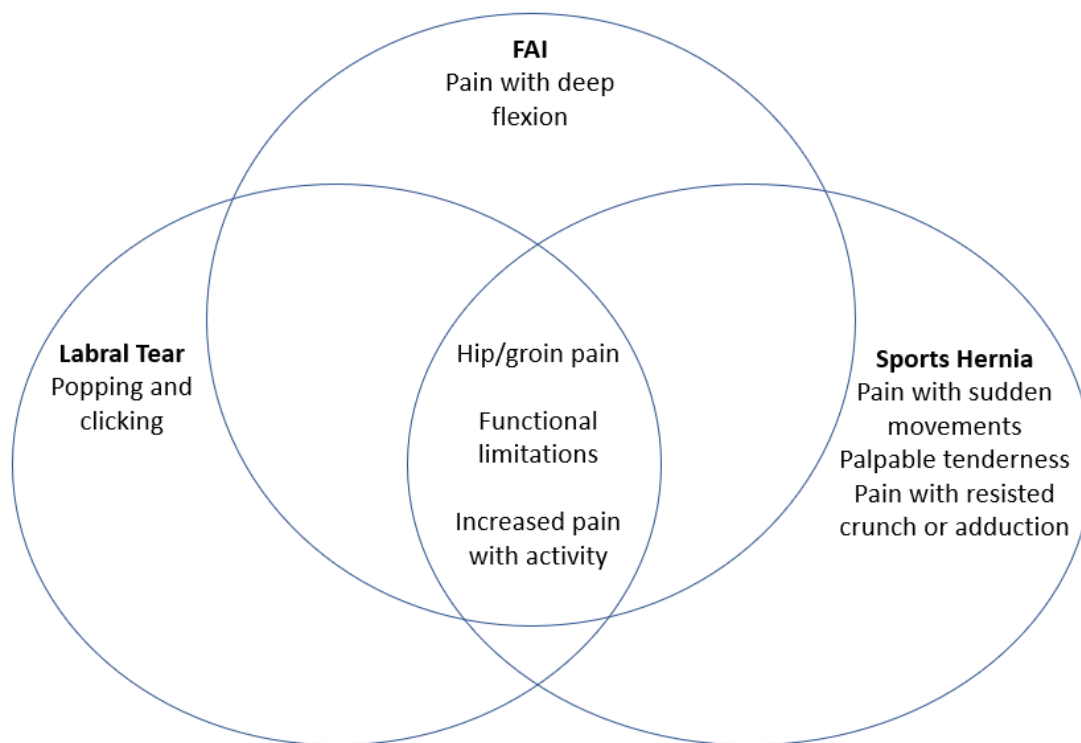
#### *Symptomology*

The patient displayed several signs and symptoms from the injuries he suffered. Chronic hip pain and functional limitations were the patient's chief complaint. These signs and symptoms can be present in all three of the patient's diagnosed injuries.<sup>4,6,24,27-29</sup> FAI and sports hernia also present with an increase in pain with activity, which the patient regularly experienced.<sup>4,6,27-33</sup> Other symptoms common with a sports hernia found in the patient include palpable tenderness, pain with resisted crunch, and lower abdominal pain during activity.<sup>27-33</sup> Notable symptom not found with this patient for a sports hernia include an increase in pain with sudden movements, such as sneezing or coughing, and pain with resisted leg adduction.<sup>27-33</sup> In addition to the other signs of FAI, pain with deep hip flexion is a key finding in both the literature and this case.<sup>4,6</sup> The symptoms the current patient experienced were not consistent on a daily basis.

#### *Diagnosis*

Diagnosis of the injuries was difficult due to the overlapping symptoms the patient experienced, which is common with chronic groin pain.<sup>27</sup> FAI relies on patient history, physical examination and radiographic studies.<sup>3,4</sup> The diagnostic finding of FAI through x-rays and MRI were consistent with previous research.<sup>3,4,6</sup> Both the labral tear and sports hernia were diagnosed through MRI for this patient. One deviation found in this case was the finding of a sports hernia through MRI, which the literature states is customarily not conclusive with this form of diagnostic testing.<sup>27</sup> In the current literature, MRI screening is effective for diagnosing of a hip labral tear.<sup>7,16,19</sup> Finding a conclusion

for diagnosis was difficult due to the number of overlapping signs and symptoms of the injuries exhibited by the patient.



**Figure 1. Signs and Symptoms Diagram.**

#### *Co-morbidities*

When looking through the research, it was discovered the presence of FAI, labral tear, and sports hernia are not commonly experienced together. FAI and labral tears are frequent co-morbidities due to the stress placed on a hip labrum from the physical abnormalities associated with FAI.<sup>3,4,6,16</sup> The mechanism for sports hernias frequently being trunk hyperextension and leg hyperabduction is opposite of the deep flexion associated with FAI and labral tears.<sup>4,6,27,34,35</sup> FAI occurs as chronic physical abnormalities whereas labral tears and sports hernias can both be from chronic or acute trauma.<sup>15-18</sup>

### *Modified Harris Hip Score*

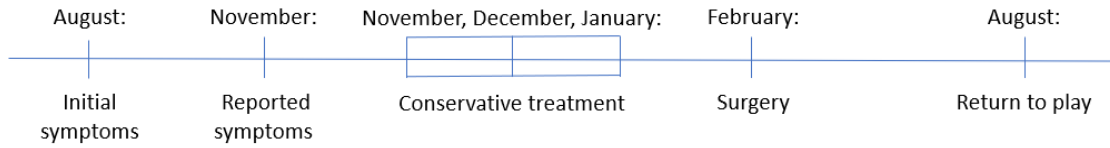
The Modified Harris Hip Score is a clinician-based outcome measure popularly used world-wide.<sup>52</sup> It can be used in both hip arthroplasty and hip arthroscopic procedures.<sup>52</sup> Currently, the Modified Harris Hip Score is one of the most commonly used patient-rated outcome measures in the presence of FAI.<sup>53,54</sup> This questionnaire was selected based on the ease of use by the patient and high usage rate throughout literature.

Utilization of the Modified Harris Hip Score occurred at five different time points in the intervention plan. The highest possible score for the outcome measure is a 100 and signifies no pain or functional limitations. A pre-operative score established a baseline to gauge improvements or setbacks and produced a score of 81.4. At the two-week post-operative mark, the patient completed the outcome measure with a score of 55. A drop in the score at this stage is due to the decrease in functional ability following surgery. The four-week post-operative mark reached 78.1 and the three-month milestone was 95.7. The final use of the Modified Harris Hip score was when the patient returned to full participation without restrictions at six months post-operative. At this time, the patient scored 100 and reached the goal of returning to activity with no pain or functional limitations.

### *Interventions*

Three months of conservative treatment consisting of activity modification, rehabilitation, anti-inflammatory medications, and injections resulted in no signs of improvement in the patient's symptoms. Research recommends surgical intervention as the next step when conservative treatment produces no results.<sup>5,6,10,27</sup> More specifically, research suggest a two month period of conservative treatment before surgical options are

discussed, particularly with sports hernias.<sup>27</sup> The surgery and proceeding rehabilitation elicited no complications or deviations from the protocol. The patient returned to full football activity at six months post-surgery and completed the season with no pain or functional limitations.



**Figure 2. Case Report Timeline.**

## Chapter 5

### Conclusion

Final diagnosis of each of the patient's injuries came two months after the initial report of symptoms to the athletic training staff and five months after his first recollection of symptoms. The patient attempted three months of conservative treatment with no decrease in impairments or functional limitations. At the recommendation of a regional hip specialist and sports hernia specialist, the patient underwent surgery to repair the FAI, torn labrum, and sports hernia. The timeframe for recovery and rehabilitation back to unrestricted participation was six months.

Presentation of signs and symptoms from several different possible injuries proved to make the final diagnosis of the patient's injuries difficult. Efficiently determining the correct diagnosis through patient history, physical examination, and diagnostic imaging is essential to provide the best possible outcomes for patients.

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# Appendix A

## Osteitis Pubis Exercises


### Exercise #1

- Arms crossed
- Shoulder blades just clear of table
- Athlete should be able to hold position for 30 sec.
- Exercise should be pain free




### Exercise #2

- Arms crossed
- Shoulder blades just clear of table
- Athletes squeezes knees together against resistance
- Performs exercise for 30 seconds or to fatigue
- Exercise should be pain free




### Exercise #3

- Arms crossed
- Supine position with hips @ 90degrees
- Knees flexed a little less than 90 degrees
- Use abdominals to curl buttocks off table
- Hold position for 30 sec. or to fatigue /discomfort




### Exercise #4

- Arms crossed
  - Supine position with hips @ 90 degrees
- Knees flexed a little less than 90 degrees
- Use abdominals to curl buttocks off table
- Provide resistance against knees
- Hold position for 30 sec. or to fatigue /discomfort




### Exercise #5

- Arms crossed
  - Supine position with hips @ 90 degrees
- Knees flexed a little less than 90 degrees
- Use abdominals to curl buttocks off table
- Provide isometric resistance against adductors
- Hold position for 30 sec. or to fatigue /discomfort



### Exercise #6

- Arms crossed
  - Supine position with hips @ 90 degrees
- Knees flexed a little less than 90 degrees
- Use abdominals to curl buttocks off table
- Provide isometric resistance against adductors, single leg.
- Hold position for 30 sec. or to fatigue /discomfort



### Exercise #7

- Arms crossed
  - Supine position with hips @ 90 degrees
- Knees flexed a little less than 90 degrees
- Hold arms straight up. Palms together
- Use abdominals to curl buttocks off table
- Provide isometric resistance to arms & legs, "push apart"
- Hold position for 30 sec. or to fatigue /discomfort



### Exercise #8

- Arms crossed
  - Supine position with hips @ 90 degrees
- Knees flexed a little less than 90 degrees
- Hold arms straight up. Palms together
- Use abdominals to curl buttocks off table
- Provide isometric resistance to opposite arm & leg, "push & pull"
- Hold position for 30 sec. or to fatigue /discomfort



## Appendix B

## Case Report Release Form

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**Case Report Release Form**

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Release of information for case report:

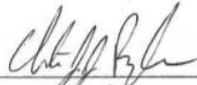
Date: 2-20-18

I, Christian Poseboom freely give my consent for the release of information regarding my medical history, injury, surgery, and rehabilitation for use in the following case report, which is being submitted to the *Journal of Athletic Training*:

Author(s): Kelsey Sanders

Title:

I understand that this information may be used in publication and that my name will remain confidential.

Signature: 

Witness: Kelsey Sanders