Introduction

This case study presents a 24 year old male soccer player with an Anterior Cruciate Ligament (ACL) tear in his left knee. The athlete is a defender/mid-fielder and has been involved in soccer since he was a young boy. The injury was suffered during an in-season game on natural grass. Following the injury, the athlete was evaluated on the playing field by the athletic trainer and later re-evaluated by the team physicians. The athlete was referred to receive the appropriate diagnostic tests.

Chief complaint

While jogging away from play, the athlete forcefully externally rotated his left knee on a planted ankle when he changed direction. According to Griffin, seventy percent of all ACL injuries occur in noncontact situations. The risk factors for non-contact ACL injuries fall into four distinct categories: environmental, anatomic, hormonal, and biomechanical.1 When the injury occurred, the athlete was first evaluated on the field by the team’s athletic trainer and then was re-evaluated off-field, by the same, where more tests were performed. Post-injury, the patient complained of left knee pain, and stated that he had felt a snap inside of his knee. The athlete was taken out of the game and did not return.

History of present complaint

Upon evaluation, the athlete experienced point tenderness over the lateral femoral condyle of the involved knee. The patient presented no obvious deformity or discoloration; however, moderate swelling was present over the affected area. The athlete experienced pain with active and passive knee flexion that he rated as a 6+ out of a possible 10 on the numeric pain scale. Furthermore, the strength of the quadriceps and hamstrings muscle groups were assessed by the athletic trainer and in a scale of 0 to 5, the athlete had a 3, able to move through the full range of motion but with no resistance. Neurovascular assessment of the affected limb was normal compared bilaterally.2

Results of physical examination

A battery of special tests for the knee were performed to arrive at a differential. The athletic trainer performed a valgus and varus stress test, Lachman’s test, McMurry’s, and a patella apprehension test. The Lachman’s and McMurry’s tests were inconclusive due to the amount of swelling and muscle guarding. The patella apprehension test and the varus tests were negative. However, the valgus test was positive, indicating possible pathology to the medial structures of the involved knee.

Medical History

Patient had no previous pathology to the involved knee or the uninvolved. However, a history of previous ankle inversions was noted. The ankle inversion injuries occurred to bilaterally; however, none of the injuries were serious. In addition, the athlete exhibited an abnormal gait pattern prior to injury, but was not addressed since he did not suffer from any pathology from it.

Diagnosis

Although a Lachman’s and McMurry’s tests were not able to be performed by the team physician and athletic trainer due to muscle guarding and swelling, an ACL tear with Medial Collateral Ligament (MCL) and Medial Meniscus damage was suspected. Following physician evaluation, the athlete was referred to receive an X-ray and a Magnetic Resonance Imaging (MRI). The X-ray taken came back negative but the MRI showed a torn ACL, MCL sprain, medial meniscal tear, and a bone contusion. Due to the
severity of the results of the MRI, the patient was referred for ACL reconstructive surgery by the team’s physician, along with meniscus repair.

**Treatment and rehabilitation protocol**

Subsequent to the evaluation of the injury, the athlete received cryotherapy modalities to decrease pain and swelling. Also, the athlete was given complete rest and was not allowed to return to play or practice with the team on the following day. Once the patient was referred for surgery, treatment to increase muscle strength, especially the quadriceps muscle group, and range of motion (ROM) exercises of the knee were performed. Returning full knee range of motion equal to the uninvolved knee prior to surgery decreases complications such as post-operative knee stiffness. Furthermore, decreasing swelling prior to surgery eases the return of normal range of motion. The rehabilitation protocol included quad sets, ROM exercises, and straight leg raises (SLR) exercises.

According to the surgical notes, the athlete was evaluated in the holding area and was also given a general anesthesia. Once under anesthesia, an anterior drawer test was performed, and was found to be minimally positive; however, the pivot shift test and Lachman’s were found to be positive.

When the surgery began, a parasagittal incision and a11-mm bone tendon-bone graft was harvested. The graft was prepared to fit through an 11-mm cannula. The surgeon then examined the medial compartment of the knee and found the medial lateral femoral condyle and medial meniscus normal, although there was some hemorrhage at the meniscocapsular junction. In the intercondylar notch, it was found that there was a complete tear of the ACL and the ACL stump had flipped anteriorly. The lateral compartment of the knee was also examined, and the lateral femoral condyle, lateral meniscus and the lateral plateau were normal. The ACL stump was debrided and a notchplasty was performed at the lateral femoral condyle.

Following further preparations, the graft was advanced from the created tibial tunnel to the created femoral tunnel such that the soft tissue laid posteriorly in the bone-tendon junction. The graft was then fixated in place using a 7 x 20 mm Bio-Absorbable RC HA screw from Dyonics.

The Lachman’s and pivot shift tests were performed again and they were negative for anterior translation of the tibia. Following this, the patient received sutures for the different incisions performed. Cast padding and an Ace bandage were applied to the injury in order to protect the site and apply compression to control swelling. A range of motion brace was placed on the knee and was locked at 0 degrees.

Following surgery, a rehabilitation protocol for ACL reconstruction surgery, provided by the team physician, was followed. For the first week ROM, SLR, and quad set exercises were continued, along with ankle pumps using theraband. Modalities used included electrical stimulation (e-stim) along with game ready. Range of Motion exercises included active range of motion (AROM) from 0 to 90 degrees. Furthermore, the athlete was weight bearing as tolerated with crutches and the brace was locked at 0 degrees. Russian e-stim was performed for 10 minutes at a 10 ms interbust interval and a 50 burst-per-second envelopes ratio.

From weeks 2-3, the previous week therapy was maintained, but AROM was increased to 120 degrees. Bicycle for ROM was introduced and administered with ½ arcs progressing to full ROM. Balance/propriception training was begun as well. Aggressive
patella and soft tissue mobs were performed to break up scar tissue and increase patella ROM, along with five minutes of friction massage. Strengthening exercises were increased to single leg press, along with mini squats from 0-30 degrees and wall slides from 0-30 degrees, each starting at 4 sets of 10 repetitions. Intensity and repetitions increments for the exercises followed patient tolerance and strength increase. Pulsed ultrasound was also introduced to promote tissue healing.

A continuation of the previous week’s rehabilitation techniques were encouraged for all ROM exercises, however an increase of 5 degrees per week were established for knee flexion, for the rest of the rehabilitation program until normal ROM was achieved. Extension ROM exercises were continued with a 5 lb weight attached at distal leg. For weeks 4-8 an isotonic program for hips, hamstring, and leg press was added to the strength program, with 4 sets of 10 repetitions, as well as Biofeedback for neuromuscular Vastus Medialis Oblique re-education, with intensity increasing as tolerated by patient. Proprioception exercises were progressed to trampoline single leg standing, as the athlete improved in proprioception. In addition, mini-squats were progressed to chair squats as the athlete’s strength increased. Aquatic pool running was also added to the program 8 weeks post-surgery for 15 minutes, as well as treadmill forward/backward walking. Aquatic pool running was chosen due to the inability of the athlete to fully bear weight on the involved leg.

A change in strengthening exercises began in weeks 9-12 post surgery. Isokinetic exercises at limited ROM (90-45 degrees) were begun at this stage. Furthermore, isotonic squats using the Smith Machine bar only was begun in addition to lunges. Stairmaster for 15 minutes, and single leg hopping, with 4 sets of 10 repetitions were also added to the rehabilitation protocol. In addition, the slide board was introduced to progress in proprioception.

At week 12, the athlete began slow forward and backward jogging on a level surface. Isotonic exercises were performed at terminal knee extension with low resistance and high repetition. Strength exercises performed were the same as previously mentioned, and continued with increments in resistance as tolerated by the athlete.

Low intensity plyometric exercises were introduced to the rehabilitation program approximately 6 months post surgery. The plyometrics exercises were performed 3 times per week and on the days performed no other strengthening exercise was done. Also, the athlete was introduced to a running program, and limited agility exercises. By the 8th month following surgery, the athlete was cleared to perform sport specific activities.

All throughout the rehabilitation program girth measurements were taken at the joint line and above patella to monitor swelling. All measurements were compared bilaterally to monitor the progress of motion about the knee joint. For ROM, a goniometer was used to establish the degrees of motion performed. All ROM measures were performed bilaterally.

**Criteria for return to play**

To return to play, the athlete had to perform sports specific activities without pain or discomfort, while maintaining proper technique. The athlete had to be able to perform a sprint at 100% intensity and be able to kick and dribble a soccer ball without pain. Furthermore, the athlete had to demonstrate full strength and endurance, measured with an isokinetic device and functional tests, compared to pre-injury documentation of the involved leg muscle groups.
Deviations from expectation

The athlete had no deviation from expectations with neither the operative procedures, nor the rehabilitation program. The athlete was a classic autograft ACL reconstruction patient, in terms of mechanism of injury and rehabilitation protocol timeline.
Abstract

Objective
To review the rehabilitation process for an athlete with an Anterior Cruciate Ligament Tear.

Background
The athlete is a defender/mid-fielder soccer player. The athlete suffered an ACL tear while participating in an away soccer game. The mechanism of injury was a forceful external rotation his left knee on a planted ankle. The injury was suffered during an in-season game over natural grass.

Differential diagnosis
ACL tear, MCL sprain, medial meniscal tear, and a bone contusion.

Treatment
Initial treatment included management of pain and inflammation using cryotherapy modalities. Because of the ACL tear, surgery was warranted in order for the athlete to return to play. An ACL reconstruction surgery rehabilitation protocol was implemented following surgery, provided by the team’s physician. Rehabilitation protocol provided by the physician included guidelines for the management of pain and inflammation, neuromuscular control, increase strength, improvement of cardiovascular endurance, and dynamic stability.

Uniqueness
Although common, the mechanism of injury lends to the uniqueness of this case study. The athlete was by himself lightly jogging, when he changed directions. This mechanism shows that one does not have to be performing stressful exercises of quick agile movements to receive an injury of this severity.

Conclusion
Following a successful operative procedure, the athlete, following the protocol set by his rehabilitation program, has been able to return to full participation. Following the termination of his rehabilitative program, the athlete has been able to return to play without any further problems to the surgically reconstructed ACL.

Key Words
ACL tear, meniscal tear, ACL reconstruction surgery, rehabilitation protocol

Word count 249
Figures

Figure 1. Normal ACL

Figure 2. MRI of ACL tear (square depicts missing ACL)
Figure 3. ACL arthroscopic picture

![ACL arthroscopic picture](image_url)
Reference
4. Operative Report
5. Rehabilitation protocol