MCL sprain in young athlete: a case report

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MCL SPRAIN IN YOUNG ATHLETE: A CASE REPORT

By

Anna Johnson

A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine

University of North Dakota

in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

Grand Forks, North Dakota

May

2013
This Scholarly Project, submitted by Anna Johnson in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)

(Chairperson, Physical Therapy)
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Department Physical Therapy

Degree Doctor of Physical Therapy

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Signature _________________________

Date _________________________
TABLE OF CONTENTS

LIST OF TABLES...........................................................................................................................................v
ACKNOWLEDGEMENTS..........................................................................................................................vi
ABSTRACT .....................................................................................................................................................vii

CHAPTER

I. BACKGROUND AND PURPOSE.......................................................................................... 1

II. CASE DESCRIPTION......................................................................................................................... 4

   Examination, Evaluation and Diagnosis .............................................................................. 5
   Prognosis and Plan of Care .................................................................................................. 10

III. INTERVENTION ......................................................................................................................... 12

IV. OUTCOMES ................................................................................................................................. 18

V. DISCUSSION ................................................................................................................................. 19

   Reflective Practice .............................................................................................................. 19
   Conclusion ........................................................................................................................... 21

REFERENCES.............................................................................................................................................22
LIST OF TABLES

1. Test Results at First Visit ................................................................................................................ 6
2. Valgus Stress Test ............................................................................................................................... 7
3. Varus Stress Test ................................................................................................................................. 7
4. Lachman’s Test ..................................................................................................................................... 7
5. Posterior Drawer Test ......................................................................................................................... 7
6. McMurray’s Test .................................................................................................................................. 8
7. Apley’s Compression Test for Medial Meniscus ............................................................................. 8
8. Apley’s Distraction Test ...................................................................................................................... 8
9. ROM .................................................................................................................................................. 9
10. Strength ........................................................................................................................................... 9
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ABSTRACT

Background and Purpose: This is a case report that looks at the examination, evaluation, and treatment of a medial collateral ligament (MCL) sprain in a high school football player.

Case Description: The patient presented with pain in his left knee one day after playing in a high school football game. It was found that he had a grade II MCL sprain with possible medial meniscal involvement.

Outcomes: The patient was able to fully return to his sport by the end of 8 treatment sessions over the course of 5 weeks. He met all of the goals set by the therapist and himself.

Discussion: The amount of time between injury and return to sport was relatively short since he was able to return to the same season of the sport. The treatment techniques used may be correlated to his ability to return to the sport. More research should be done in the area of specific interventions for treating the MCL and surrounding tissues.

Key Words: Medial collateral ligament (MCL), knee.
CHAPTER I

BACKGROUND AND PURPOSE

Sprain of the medial collateral ligament (MCL) is one of the most common injuries to the knee.\(^1\) In particular, it is the most common severe injury in football players.\(^2\)\(^-\)\(^5\) Although this is a common injury, little research has been done on the subject of specific interventions to help in the rehabilitation process. This study will provide insight into the presentation, examination, and rehabilitation of a patient with a sprained MCL.

Robinson et al\(^6\) describe the medial side of the knee as being divided into anterior, medial, and posterior sections. According to this study, the anterior portion of the knee, which contains the capsular ligaments, is considered the least important. The medial portion consists of the superior and deep MCL which aid in stability against valgus stress. The posterior portion of the medial side of the knee contains the posterior oblique ligament, oblique popliteal ligament, attachment of the semimembranosus muscle, and the posteromedial meniscus. This posterior area aids in resisting anteromedial torsion (twisting). In the knee, a valgus stress is a force to the lateral side of the knee that results in an added stress to the medial portion of the knee.

MCL injuries most often occur by a force to the lateral side of the knee while the foot is planted on the ground.\(^7\) It can be seen that this injury would be likely to
happen in the sport of football since tackles are usually oriented toward the opponent’s legs; blocking can also result in extra force on the legs. Another way this injury occurs is by a valgus and medial twisting action of the leg. Once again, this occurs when the foot is planted on the ground but is not related to contact from another person. Examples of this include skiing and other pivoting and cutting sports such as soccer or basketball.

There are three grades of MCL sprains.\(^7,8\) A grade I sprain is defined as the MCL having a microscopic tear but does not result in an instability or laxity of the knee during a valgus stress test. Grade II sprains are incomplete tears of the MCL that result in 5 to 15 degrees of instability when a valgus force is applied to the knee at 30 degrees of knee flexion. A complete tear of the MCL is considered a grade III sprain. This results in more than 15 degrees of instability when a valgus force is applied at 30 degrees of knee flexion.

The MCL has an ability to heal that results in little or no valgus laxity.\(^18\)\(^-\)\(^19\) Therefore, surgery is not likely with grade I and II MCL injuries. Interventions that are typically performed early involve controlling pain and swelling with various techniques, protective bracing, and range of motion exercises. Later in the progression of treatment interventions such as leg strengthening, endurance training, and sport-specific exercises are incorporated. For treatment of a grade III MCL sprain, the rehabilitation process will take longer and may require surgery.\(^17\)\(^-\)\(^27\)

The patient in this report came to physical therapy (PT) complaining of pain and bruising on the medial side of his left knee. The student physical therapist and
clinical instructor felt competent with their ability to treat him and that they had adequate equipment to help him succeed. Therefore, the patient started therapy on this date. The injury was found to be a grade II medial collateral ligament sprain with possible medial meniscal involvement. The patient had a good prognosis since he was young, willing to comply with the therapists’ instructions, and this type of injury often does well on healing with little laxity.

Research has shown that conservative treatment is the treatment of choice for grade I and II sprains. This treatment may include but is not limited to initial limited weight-bearing, strengthening, patellar mobilization, proprioceptive training, and bracing.
CHAPTER II

CASE DESCRIPTION

This patient came to physical therapy one day following his high school football game. His chief complaint on this date was pain in his left medial knee. The patient reported that in the football game, he was tackled by an opponent from the outside; the opponent’s shoulder pad ran into the lateral side of the patient’s left knee. The patient stated he felt that his knee was hyper-extended and twisted during the tackle. He did not play for the rest of the game because of pain from the injury. That night, his knee was badly bruised and swollen, so he iced his knee as soon as he arrived home from the game. The next morning he saw the doctor. The doctor did not do any imaging because he felt that no ligaments were torn and sent orders for PT to evaluate and treat. The patient was a 15 year-old male who attended high school, played football (linebacker), and worked at a local fast food restaurant. He was slightly overweight. He stated that he had no prior knee injuries, and his past injuries included a sprain of the right ankle 1 year prior to the current injury and chronic bilateral shin pain. The patient came to PT with a neoprene knee sleeve on his left knee. On a pain scale of 0 to 10 with 0 being no pain and 10 being severe pain, he reported the pain in his left knee at 6.5/10 when he put pressure on it (standing or walking.) The patient had increased pain with knee flexion past 30°
and when descending stairs. His pain was decreased when his knee was in extension, and he denied any feeling of it giving out or locking up.

**Examination, Evaluation, and Diagnosis**

The patient came to PT with a slight limp because he tried to keep his left knee straight during ambulation. His posture was within normal limits (WNL) except that he had excessive pronation in both of his feet. Posture was observed in frontal, lateral, and posterior views while the patient was standing. PT observed slight swelling in the patient’s left medial knee and significant bruising in the same area. Several special tests were done on this patient in order to make a diagnosis. The reasons these specific tests were chosen were that the student PT had been taught these tests in school and they had relatively good sensitivity, specificity, and likelihood ratios. The tests and results are listed in the table below (Table 1.) The sensitivity, specificity, and positive and negative likelihoods are listed for each test in subsequent tables.
<table>
<thead>
<tr>
<th>Test</th>
<th>Result on right</th>
<th>Result on left</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valgus at 0°</td>
<td>Negative (-)</td>
<td>-</td>
<td>Pain on left.</td>
</tr>
<tr>
<td>Valgus at 30°</td>
<td>-</td>
<td>Positive (+)</td>
<td>Pain on left. Slight laxity in medial knee.</td>
</tr>
<tr>
<td>Varus at 0°</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Varus at 30°</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Lachman’s</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Posterior drawer</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>McMurray’s</td>
<td>-</td>
<td>+</td>
<td>Pain with lateral rotation of tibia.</td>
</tr>
<tr>
<td>Apley’s compression/</td>
<td>-</td>
<td>+</td>
<td>Pain with both compression and distraction.</td>
</tr>
<tr>
<td>distraction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in testing the knee at 0° of flexion and 30° in the valgus and varus tests is that at 30°, the anterior and posterior cruciate ligaments are not able to aid in the stabilization of the medial knee, so testing in 30° of flexion is more specific to the MCL.
Table 2. Valgus Stress Test\textsuperscript{29, 30}

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>+ Likelihood Ratio</th>
<th>- Likelihood Ratio</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Harilainen</td>
<td>86%</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td></td>
</tr>
<tr>
<td>Garvin</td>
<td>96%</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Varus Stress Test\textsuperscript{29}

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>+ Likelihood Ratio</th>
<th>- Likelihood Ratio</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Harilainen</td>
<td>25%</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Lachman’s Test\textsuperscript{31}

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>+ Likelihood Ratio</th>
<th>- Likelihood Ratio</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Magee</td>
<td>97%</td>
<td>97%</td>
<td>9.4</td>
<td>Not reported</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Posterior Drawer Test\textsuperscript{32}

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>+ Likelihood Ratio</th>
<th>- Likelihood Ratio</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubinstein</td>
<td>90%</td>
<td>97%</td>
<td>90</td>
<td>Not reported</td>
<td></td>
</tr>
</tbody>
</table>
The patient was tender with palpation on the left knee in the pes anserine area, MCL, medial joint space, and when the patella was pushed medially. The pes anserine consists of the sartorius, semitendinosus, and gracilis muscles, which all attach near the medial condyle of the tibia.
The following tables show the patient’s initial range of motion (ROM) and strength measurements.

<table>
<thead>
<tr>
<th>Table 9. ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>AROM right</td>
</tr>
<tr>
<td>0°-135°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 10. Strength (5/5 indicates normal strength)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Quadriceps</td>
</tr>
<tr>
<td>Hamstrings</td>
</tr>
</tbody>
</table>

The Lower Extremity Functional Scale (LEFS) contains 20 items that consist of a variety of functional tasks. The individual filling out the questionnaire grades how well he or she can accomplish the task by circling a number from 0 to 4. Zero (0) indicates extreme difficulty accomplishing the task listed and 4 indicates no difficulty accomplishing that task. The minimal clinically important difference (MCID) for this scale is 9 points. The MCID is the amount of change needed in order to detect a true change. Binkley et al found that the validity of the LEFS for physical function was 0.80 with \( p<0.05 \) and a CI of 95%. The patient filled out an LEFS form on his first visit and received a score of 38/80 where 80/80 indicates no disability.

The patient presented with a mild grade 2 left MCL sprain with possible medial meniscal involvement. We predicted that he would benefit from skilled
therapy consisting of ROM, kinesiotape, strengthening, education on protection of his knee, development of home exercise program (HEP), proprioceptive training, mobilizations, endurance exercises, and possible ultrasound to assist with return to prior level of function.

**Prognosis and Plan of Care**

PT would see the patient 2 to 3 times per week for 4 to 6 weeks and would continue to monitor if the patient would benefit from further diagnostics and a sports medicine consultation.

**Problem List:**

1. Increased pain
2. Bruising
3. Swelling
4. Decreased strength
5. Decreased ROM
6. Decreased balance

**Goals:**

Short-term goal: Following PT intervention, the patient would decrease pain to $\leq 5/10$ and achieve $\geq 4/5$ strength in the left hamstrings in order to improve tolerance to descending stairs, to be met in 2 weeks.

Long-term goal: Following PT intervention, the patient would have an increased LEFS score to 75/80 or higher, increase hamstring strength to 5/5, and decrease pain to $\leq 2/10$ in order to return to prior level of function, to be met in 6 weeks.
Throughout the treatment, re-evaluation was done to make sure the patient was making progress. His pain was assessed at every session as well as was ROM and patellar mobility until these measurements were equal bilaterally. The patient’s quadriceps and hamstring strength were tested at the first and last treatments. Valgus, McMurray’s, Apley’s, and LEFS tests were also performed at these times.
CHAPTER III
INTERVENTION

Many types of interventions were used throughout the patient’s rehabilitation process. The first treatment session consisted of education on the PRICE principle, education on participation in football, patellar mobilization, quad sets, hamstring sets, heel slides, and kinesiotaping which will all be explained further in the paragraphs to follow.

The PRICE acronym stands for protect, rest, ice, compress, and elevate the injured area. Protecting the area from further injury is important so the original injury can heal completely. The patient accomplished protecting his leg by wearing a neoprene sleeve on his left knee and decreasing the amount of time he spent standing and walking. Resting the injured body part is helpful to the healing process because less stress on the area in the early phases allows greater initial healing and discontinues aggravation to the injury. We instructed the patient to rest his knee by using the same precautions given for protecting his knee. Icing (cooling) the injured area helps to decrease inflammation and pain by inducing vasoconstriction to the area and slowing nerve conduction, which decreases the sensation of pain.41,42 I instructed the patient to ice the medial side of his knee approximately 3 times per day for a 3 days following the injury for 20 minutes at a time and then 1 time per day for the rest of that week. Compression helps to decrease swelling by pushing the excess fluid into the lymph nodes.42 The neoprene sleeve the patient wore not only
helped with protection, but also with compression. He was instructed to wear the sleeve until he could be fitted with a brace specific to providing extra support to the MCL. To help prevent more swelling in the area, elevation was used to aid in venous and lymphatic drainage. To elevate his leg, the patient was instructed to lie flat on his back with his left leg propped up on an object at approximately a 30-degree angle.

We educated the patient to avoid participation in football practices or games until we deemed it safe for him to return to those activities. Returning prematurely to playing football could decrease the speed of the healing process and put him at an increased risk of reinjuring his MCL because more stress would be placed on the compromised MCL, aggravating it, and not allowing the inflammation to decrease.

I did patellar mobilization on the patient’s left knee to correct the malalignment of the patella seen after the injury. It is not known if this malalignment was present before the injury or was a result of the injury. The patellar mobilization was done by pushing the patella medially while the knee was relaxed at approximately 20 degrees of flexion and resting on a towel roll. There was no set amount of time that the patella was held medially. Sometimes it was for 1 second, sometimes 5 seconds; but the overall use of patellar mobilization lasted 2 minutes per treatment session.

Quadriceps (quad) sets, hamstring sets, and heel slides were used to strengthen the lower extremity muscles. He did each exercise 15 times. The quad sets were done by having the patient lie supine with a towel roll under his left knee. We instructed him to contract his quadriceps by thinking of pulling his patella
toward his head, focusing especially on using his medial quad musculature.

Hamstring sets were done in the same position as the quad sets. The instruction for this exercise was to try to push his heel into the mat he was lying on. Heel slides were also done in a supine position. The patient was instructed to keep his heel on the mat while sliding his heel towards his buttocks and back to the original position. All 3 of these exercises were included in the patient’s home program.

Kinesiotape was used to decrease bruising and swelling. The technique needed for this is the fan cut. To make the tape into a fan cut, we cut off a 5-inch section of tape, rounded the edges, and cut four strips from one end but left 2 inches whole at one end of the tape. According to Kase, Kinesiotape “is used to reduce edema by directing fluid toward a less congested lymphatic pathway and lymph node. The elasticity and lifting effect of the tape decreases pressure, and may also create a massaging action during active motion.”

The treatments added in week 2 were ultrasound, soft-tissue mobilization, and the use of an aerodyne bike. The patient spent 10 minutes on the aerodyne bike to help strengthen the lower extremity muscles, maintain his aerobic capacity, and to get more comfortable with his knee repeatedly going into flexion. I used ultrasound to induce relaxation in the muscles surrounding the injury and reduce pain. The ultrasound was done for 8 minutes at 1 W/cm² to the medial knee area.

Soft-tissue mobilization was done to the medial knee and pes anserine area for 10 minutes. This was done in the technique of cross-fiber massage. To do this technique, a tool can be used or the therapist’s hand/fingers. Transverse forces are applied to the injured ligament, moving back and forth. The logic behind cross-fiber
massage is that the collagen that is healing in the ligament is not aligning correctly, so the extra force helps realign the collagen properly.\textsuperscript{45}

Also during the second week, the patient was referred to an orthopedic doctor for fitting of a Breg hinged brace that would provide support specifically to his MCL. At this time, we also allowed him to ride a stationary bike at football practice for 20 minutes per day.

A straight leg raise (SLR) exercise was added on the second treatment of week 2. This was done to strengthen his quadriceps, especially the vastus medialis oblique (VMO.) The patient was supine on the mat with his right knee flexed at approximately 90 degrees, and his right foot was still on the mat. He was instructed to keep his left leg straight and raise it up until it was aligned with the angle of his right leg. He did 15 repetitions this way. Next, he did 15 repetitions with his toes facing outwards. Externally rotating the leg helps to target the VMO and gain its greatest recruitment.\textsuperscript{46}

In week 3 of physical therapy the patient did short-arc quad contractions with hip adduction, wall squats with adduction, used a hydraulic stepper, and used an elliptical. Short-arc quad contractions with adduction were done to help strengthen the quadriceps. This exercise was done with the patient lying in supine, both knees flexed to approximately 90 degrees with the feet still on the mat, squeezing a 6-inch ball between his knees, and then extending his left knee. He did this exercise in 2 sets of 10 repetitions. The hip adduction portion of this exercise helps recruit the VMO.
Wall squats were done to help strengthen the patient’s lower extremities. He started with a 6-inch ball between his knees. I instructed him to keep his back against the wall and bend his knees until they were flexed to 90 degrees, and then to slowly return to full standing. He did this exercise 30 times.

The hydraulic stepper was used to help strengthen the patient’s lower extremities and to aide in aerobic capacity. The patient completed 5 minutes on the stepper, which was at a level 2 workload.

The patient spent 8 minutes on the elliptical at a workload of 4. I instructed him to go forwards for 4 minutes and backwards for 4 minutes. This was done to strengthen his lower extremity muscles as well as increase his aerobic capacity.

Leg extension and flexion on the NK table were done in the second treatment of week 3. NK is a brand of exercise equipment. The table used for these treatments allows flexion and extension of the knee with the ability to apply different amounts of weight to the motion. These exercises were done in order to strengthen his quads and hamstrings, aiding in the support of his knee joint. We instructed him to sit on the NK table and hook his ankle either in front or in back of the ankle support depending on if he was going to do extension or flexion exercises. (Hooking the ankle in front of the ankle support would be for the flexion exercise.) For both the flexion and extension exercises, the patient did 2 sets of 15 repetitions with 20 lbs of weight. After this therapy session, we allowed the patient to participate in the warm-ups at football practice.

Playing catch with single leg stance was added in week 4. To do this, the patient stood only on his left leg with slight flexion in his knee and played catch with
the PT. This was done to increase balance, proprioception, and strength in his left leg. The patient reported that his knee felt good in football warm-ups, so we allowed him to participate fully in football practice.

During the second treatment of week 4, retro-ambulation (walking backwards) on a treadmill was added to the patient’s therapy. He did this for 7 minutes at a 15% incline while walking 1.5 mph. This exercise was done to strengthen the patient’s lower extremities, especially the quadriceps muscles.

We tested the patient in sport-specific drills such as shuffling, cutting, jumping, and agility activities. He had no pain with these drills or activities. He reported that football practice had been going well and that he had minimal pain in his knee, so we allowed him to participate in a football game the next day. This was 4 weeks after his initial injury.

The patient had 1 treatment session the week after his football game and he reported no pain with playing football. I instructed him to continue wearing his brace while he played football and in the upcoming basketball season. He was also instructed to participate in a good offseason strength-training program to help prevent another injury from happening.

Throughout the patient’s therapy, he had a home exercise program that consisted of quad sets, hamstring sets, heel-slides, short-arc quads with adduction, and SLR. These were discontinued when the patient started participating in the warm-ups for football practice.
CHAPTER IV
OUTCOMES

The patient was seen 8 times within 5 weeks. All of his goals were met. By the time he was discharged, he had no pain in his left knee, had equal patellar mobility bilaterally, equal knee ROM bilaterally, 5/5 strength in his left leg flexors, and improved his LEFS score to 75/80. He also no longer had a positive valgus, McMurray’s, or Apley’s test. Through strengthening exercises, balance training, sport specific drills, and maintenance of aerobic endurance, the patient was able to get back to his prior level of function.

The patient was compliant with his HEP and with the amount he could participate in football. During treatment, he occasionally had pain with the NK table and hydraulic stepper, but only minimally. He was willing to try everything we asked him to, and made sure to tell us if he had any pain. The patient was very satisfied with his results. He was happy to be back playing football since that was his main goal.
CHAPTER V

DISCUSSION

The patient did well with treatment techniques that were incorporated throughout the physical therapy sessions. As previously stated, these techniques fit in with the guidelines displayed in Edson’s article.47 The finding that these techniques were effective helps with the future studies of MCL conservative rehabilitation by providing a case study in which to reference different treatments as well as the length of treatment until the patient returned to his sport. The length of time the patient spent in therapy is consistent with the average of when most athletes return to sport after a grade II MCL sprain.7

The limitations of this study include no imaging of the knee, so we cannot be sure of the degree of the sprain or the extent of the damage to the ligament, and that we could not study specific interventions because there were so many used in combination with each other. There is a need for further studies on specific rehabilitation techniques for MCL sprains.

Reflective Practice

If I were able to treat this patient again, I would have addressed the issue of instability in the knee joint in my problem list and goals. The examination procedure would have been the same because I feel like the tests we used showed his pathology well. For his treatment, I would have spent more time on agility and sport
specific exercises instead of just going over them quickly since he was doing more of those kinds of exercises in football practice. Spending more time on them would have allowed me to see if he was performing them with correct technique and body mechanics so that he would not increase the chance of causing further damage to his knee. I would like to see more evidence on the activity of the quadriceps muscles during retro-ambulation on a treadmill. It seemed to help our patient, but we cannot be sure since there were so many exercises utilized in one treatment session for the patient. I would also like to see research done on the interpretation on LEFS scores.

I do not have the exact costs of physical therapy treatment for this patient, so I will analyze what he had to pay from the prices listed on akrongeneral.org. The patient had 4 different types of billable services that included evaluation, therapeutic exercise, manual therapy, and ultrasound. The estimated cost per treatment session was $270, and if the patient’s family had to pay 25% of that, the average out of pocket cost per treatment session was $67. The total estimated cost for the 8 treatments was $2166, with the patient’s family paying $542 of that amount. Again, this is just an estimate because I did not have access to the exact costs or the insurance the patient had. I believe that the money spent was worth it for the patient and his family. They were very eager to have the patient return to playing football quickly but safely, so I think they were happy to pay for his therapy. The only way the cost could have been decreased was to have less treatment times, but I think that we did not overdo therapy.

This case gave me a good background on MCL sprains. I will feel more confident in the future when treating patients who have MCL sprains from what I
learned in treating this patient. I believe the customized brace was helpful in stabilizing the patient’s knee and will be helpful in adding to the sense of protection when the patient plays other sports as well as football. The exercises seemed to greatly benefit the patient in his recovery process. The knowledge gained from treating this patient will extend to my treatment of patients with similar diagnoses.

Conclusion

This case involved a 15 year-old football player who was sidelined by an injury to his medial collateral ligament. He was seen by a physical therapist 8 times over the course of 5 weeks and completed strengthening, balance, and agility exercises as well as received education about protecting his knees. He came in with pain, swelling, bruising, decreased pain, and decreased range of motion. At his last appointment, he had none of the complaints that he came in with initially. He was able to return to football the same season. The therapist and patient were pleased with his results.
REFERENCES


