Clinical Case Report Competition

Utopia Academy

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Second Place Winner

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Massage therapy and an active patient self-care program following a post-surgical anterior cruciate ligament reconstruction
Abstract

Introduction: The anterior cruciate ligament (ACL) is an important structure in maintaining knee stability. It is located within the knee joint, running at an oblique angle from the anteromedial aspect of the tibial intercondylar area to the lateral femoral condyle.\textsuperscript{1,2,3} The ACL functions to prevent knee extension, anterior displacement of the tibia and excessive internal rotation of the tibia in relation to the femur.\textsuperscript{1,2,3} ACL rupture is a common athletic injury that most often occurs in high demand sports. The purpose of this study is to determine the effectiveness of massage therapy, combined with a consistent active patient self-care program\textsuperscript{4}, as a means to improve patient rehabilitation following a surgical reconstruction of a ruptured ACL. The subject is a twenty-seven year old physically active female who sustained a complete rupture to her right ACL and right lateral meniscal tear while playing soccer.

Methods: In conjunction with a five-week, ten-session treatment protocol, orthopedic physical assessment tests, such as the Functional Numerical Pain Scale\textsuperscript{5}, the Kendall Key to Muscle Grading\textsuperscript{6}, joint circumference measurements\textsuperscript{5} and a Baseline goniometer\textsuperscript{2} were used to chart changes in pain, muscular strength, circumference and range of motion of the knee. Treatment techniques included Swedish, myofascial release, lymphatic drainage, muscle energy technique with proprioceptive neuromuscular facilitation (PNF) patterning and neuromuscular techniques including frictions, golgi tendon organ and trigger point release. The subject followed a daily active self-care program as part of her knee rehabilitation and completed the McGill Quality of Life Questionnaire\textsuperscript{7} at the beginning and at the completion of the ten-session treatment protocol.

Results: The subject’s pain level decreased from 7-8 to 2 on the Functional Numerical Pain Scale\textsuperscript{5}, and the subject regained full flexion and extension of the affected knee, which was measured and recorded using a Baseline 360-degree, plastic 8-inch goniometer.\textsuperscript{2} Muscle strength in both the quadriceps and tensor fasciae latae of the affected leg increased from Grade 8: Good to Grade 10: Normal according to the Kendall Key to Muscle Grading\textsuperscript{6}, and according to the McGill Quality of Life Questionnaire\textsuperscript{7} the subject’s score showed an increase by two points, from 5 to 7 out of 10. Although there was not a notable decrease in right knee circumference measurements overall, the subject experienced decreases during each individual treatment.

Conclusion: Massage therapy, combined with a consistent complementary self-care program, was determined to be effective in the treatment of a surgical ACL reconstruction by decreasing post-surgical swelling and pain.

KEYWORDS: Massage therapy, Anterior Cruciate Ligament (ACL) rehabilitation, ACL reconstruction, reconstructive knee surgery, knee pain, knee joint.
Introduction

The anterior cruciate ligament (ACL) is an important structure in maintaining knee stability. It is located within the knee joint, running at an oblique angle from the anteromedial aspect of the tibial intercondylar area to the lateral femoral condyle.\(^1,2,3\) The ACL functions to prevent knee extension, anterior displacement of the tibia and excessive internal rotation of the tibia in relation to the femur.\(^1,2,3\) ACL rupture is a common athletic injury that most often occurs in sports such as soccer, skiing, tennis, basketball and football.\(^2,8,9\)

The pathogenesis of an ACL rupture is often due to insufficient stability, when the ligaments within the knee joint fail to prevent posterior, lateral or rotational dislocation of the femur on the tibia.\(^2,8,9\) Under normal circumstances, this stability is maintained by the contractile and non-contractile structures within and around the knee joint.\(^8,10,11\) However, when excessive stress or force is applied to these structures, often in combination with forced internal rotation, a tear or full rupture may result.\(^4,10,11\) Often there is no direct contact to the knee and ACL rupture may occur as result of a blow to the lateral knee, forced hyperextension of the knee with internal rotation of the tibia, decelerating, pivoting or landing from a jump, or with a rapid change in direction.\(^2,8,9\)

In 2010 the prevalence of ACL injuries was estimated at approximately 200,000 per year in the United States, with almost half being surgically repaired each year.\(^3,8,9,10\)
Most ACL tears are experienced by women and occur from noncontact injuries with approximately fifty percent occurring in combination with damage to other ligaments within the knee, to the meniscus or to the articular cartilage. With approximately 100,000 ACL reconstruction surgeries performed each year in the United States, and surgical cost ranging from $4000 - $7000, often combined with countless hours spent in rehabilitation, the economic burden of ACL injuries and ruptures is quite significant.

The prognosis of a complete ACL tear and/or rupture is variable and the medical approach chosen by the patient is often determined by the original method of injury, the extent of knee instability and associated tissue damage, as well as the physical demands and chosen lifestyle of each particular patient. After a complete ACL tear, some patients are unable to resume their chosen sport when cutting or pivoting-type movements are involved, while others may have knee instability and/or pain with everyday activities, such as walking or climbing stairs. ACL tear and/or rupture is also linked with notable swelling, chronic pain and osteoarthritis in ten to ninety percent of patients ten to twenty, years post injury. Treatment may be either nonsurgical rehabilitation or a surgical procedure using a patellar, hamstring or quadriceps autograft or allograft, with both types of rehabilitation, surgical or nonsurgical, requiring assistance from a physical therapist in order to regain the functional use of the affected knee.
Although massage therapy is effective in promoting joint and tissue health following an injury, patient self-care is an essential element in an individual’s return to pain-free functional activity and/or sport.\textsuperscript{2,7,11} A patient who is willing and motivated becomes an active contributor in their own health and recovery process.\textsuperscript{2,7,11} An appropriate and effective self-care program will be based on the patient’s current physical ability, short- and long-term goals, and will include any considerations and/or recommendations given by the patient’s other healthcare professionals, such as the physician, surgeon or physiotherapist.\textsuperscript{2,7,11}

Massage therapy has been shown to be an effective orthopedic modality in the rehabilitation of both contractile and non-contractile tissue and/or joint injuries, however, in a literature review of both PubMed and EBSCO-Host for peer-reviewed studies on the effectiveness of massage in the rehabilitation of post-surgical ACL repair, no articles were found. The purpose of this case study is to determine the effectiveness of massage therapy, combined with an active patient self-care program, in restoring full knee flexion and extension, decreasing post-surgical swelling and pain and improving overall quality of life.

**Subject Profile**

The subject is a 27-year-old female flight attendant. The subject was actively involved in soccer, basketball, running and yoga five to six days per week, with no major injuries or surgeries prior to the ACL injury. In July of 2012 while playing soccer, the
subject sustained a complete rupture of the right ACL, combined with a partial tear to the lateral meniscus. The method of injury was a medially directed blow to the lateral aspect of her right knee while the foot was planted. The subject also sustained a bone contusion with no fracture. In February of 2013, the subject underwent a right knee ACL surgical reconstruction using a semitendinosus autograft with no repair to the lateral meniscus. Post-surgery, with approval from the operating surgeon, the subject began a physical therapy protocol where she attended appointments twice a week for the first three weeks, followed by one visit per week and gradually attending once every two weeks.

In May 2013, fourteen weeks post-operation, the subject had not returned to work or sport of any kind. As part of her physiotherapy rehabilitation, the patient was walking and riding a stationary bike up to three times per week and complained of consistent chronic pain with use of the affected knee. She experienced pain in the muscles surrounding the right hip with walking for periods longer than one hour in duration. The subject also complained of pain in the right knee joint with climbing and descending stairs, getting up from a seated position, and with getting into and out of a vehicle. The subject noted significant swelling around the knee and slightly reduced sensation in the areas of swelling below the knee. She experienced muscle tightness and pain in the quadriceps and hamstring muscles of the affected leg with limited range of motion in knee flexion and extension.
In order to determine the most effective course of action, functional long and short-term goals were discussed and established with the subject during the first treatment. The patient’s long-term goals are to return to work, and to return to sport and activity at her pre-ACL rupture level and intensity. Her short-term goals are to reduce swelling and regain full, pain-free range of motion of the affected knee, so as to engage in normal everyday activity without pain, hesitation or limitation.

**Methods**

**Assessment Tools & Protocol**

The subject’s pain level out of 10 was recorded at the beginning of each treatment session according to the Functional Numerical Pain Scale. Active range of motion in knee flexion and extension of the right knee was measured both pre- and post-treatment using a Baseline 360-degree, plastic 8-inch goniometer. Right knee circumference was measured both pre- and post-treatment using a soft tape measure at the joint line, 5cm above the joint line, 10cm above joint line and 15cm above joint line. Muscle strength of the quadriceps and tensor fasciae latae was measured using the Kendall Key to Muscle Grading prior to each treatment. The McGill Quality of Life Questionnaire was completed by the subject at the beginning of treatment session one and following session ten as a means of determining the individual’s personal assessment of their quality of life before and as a result of specific therapeutic massage treatment.
Treatment Details

The subject received ten therapeutic massage treatments for the duration of five weeks. Treatment sessions lasted an average of 75 - 120 minutes, allowing time for pre- and post-treatment assessment, re-evaluation and discussion of active self-care exercises.

Treatment Plan:

Intake and Assessment: 15 minutes

The following were charted in the therapist’s notes: subjective pain level according to the Functional Numerical Pain Scale,\(^5\) circumference measurements of the four noted locations on the affected leg,\(^5\) active range of motion of flexion and extension of the right knee using a Baseline goniometer,\(^2\) and manual muscle testing of the quadriceps and tensor fasciae latae muscles according to the Kendall Key to Muscle Grading.\(^6\)

Therapeutic Treatment - Prone: 30 minutes

An electric Thermaphore was placed over the hips and gluteal muscles for 10 minutes. Swedish techniques were used bilaterally on the gluteal, hamstring, gastrocnemius and soleus muscles. Neuromuscular techniques were used bilaterally on the gluteal and lateral rotator muscles of the pelvis where tender points or nodules were palpated within the muscle belly. These techniques were also used on the affected hamstring muscle group.
Therapeutic Treatment - Supine: 30 minutes

An electric Thermaphore was placed over the anterior hips and iliopsoas muscles for 10 minutes. Nodal pumping was used to the inguinal lymph nodes followed by lymphatic drainage techniques on the anterior thigh. Swedish and neuromuscular techniques were used on the iliotibial band (ITB) and vastus lateralis muscles when tender points or nodules were palpated within the muscle belly. Muscle energy techniques (MET) using isometric contraction and ice massage to the vastus medialis oblique (VMO) and adductor muscles.

Reassessment: 15 minutes

The patient continued the MET ice massage techniques for 10 minutes at the end of treatment. Circumference measurements of the four noted locations on the affected leg were recorded and charted (see Figure 3). Active range of motion of flexion and extension of the affected knee using a Baseline goniometer were recorded and charted by the therapist (see Figures 1 and 2, respectively). Self-care exercises were reviewed, with additions made as indicated.

**Active Self-Care Program:**

The active self-care program was based on the instructed exercises given by the patient’s physical therapist with the addition of specific strengthening and stretching exercises and hydrotherapy practices given by the massage practitioner.
The active self-care strengthening exercises were performed bilaterally, two to three times per week at a slow pace and included the following exercises: active leg raise with a level pelvis lying supine: each leg independently for 3 sets of 10 repetitions; clamshells: lying supine with knees bend and feet together, bringing one knee toward the other, maintaining a 3 finger width apart, hold 5 seconds for 3 sets of 10 repetitions; active pain-free knee flexion and extension: start seated and progression to standing, 10 times each, 3 times per day; single bent-knee lifts: seated, 3 sets of 10 repetitions; wall sit-squats: begin standing, 3 sets of 10 repetitions, gradually increasing knee flexion; seated ball squeezes: 3 sets of 10 repetitions; standing calf raises: 3 sets of 10-20 repetitions; side step-ups on stairs: for 5 minutes, starting with eyes open and progressing to having eyes closed.\textsuperscript{2,7,11}

Bilateral stretching exercises were given by the practitioner to be performed daily, held for 45 - 60 seconds each, and included the following: figure 4 while supine, standing hip flexor lunge (with knee on floor as needed) and standing calf stretch.\textsuperscript{2,7,11}

Additional techniques of the self-care program, given by the practitioner, included: self-mobilizations of the affected patella in superior, inferior, lateral and medial directions, slowly, 3 times per day; right side inguinal pumping 5 times to the inguinal lymph nodes followed by lymphatic drainage techniques for 2 minutes to the right anterior thigh while supine; isometric contraction with ice massage to affected VMO (the last 2 weeks of treatment) while seated for 10 to 15 minutes, 2 to 3 times per week; foam roller, bilateral, to ITB, gluteal and hamstring muscles.\textsuperscript{2,7,11}
Given the subject’s motivation and desire to return to activity and sport, the subject was encouraged to participate in a variety of cardiovascular exercises 2 - 3 times per week for approximately 30 minutes. These included bike riding, swimming, walking and/or Hatha Yoga, which should be modified according to ability and functional limitation.

**Results**

At the completion of this case study treatment series, the subject had regained full pain-free range of motion in both knee flexion and extension (see Figure 1 and Figure 2, respectively), with her subjective pain being reduced from an initial 7-8 to a 2 on the Functional Numerical Pain Scale (see Table 1). The leg circumference measurements demonstrated a slight decrease (see Figure 3) from initial to final measurement in each treatment session, and muscle strength in both the quadriceps and TFL muscles showed improvement from an initial grading of Grade 8: Good to a final measurement of Grade 10: Normal for both muscles tested, according to the Kendall Key to Muscle Grading. The subject’s Quality of Life score showed an increase by two points, from an initial score of 5/10 to a final score of 7/10.
FIGURE 1  Pre- and post massage measurements of right knee flexion using a Baseline goniometer.

![Changes in Degrees of Right Knee Flexion](image)

FIGURE 2  Pre- and post massage measurements of right knee extension using a Baseline goniometer.

![Changes in Degrees of Right Knee Extension](image)

FIGURE 3  Pre- and post-massage circumference measurements of right knee at joint line and 5cm above joint line.

![Pre- and Post-Massage Circumference Measurements of Right Knee](image)
Discussion

Massage therapy was effective in restoring full knee flexion and extension in the subject’s affected knee and proved valuable in reducing the subject’s reported pain from 7-8 to 2 according to the Functional Numerical Pain Scale. With visible knee swelling, a slight decrease was observed in leg circumference measurements from pre- to post-treatment indicating the effectiveness of the techniques utilized. It is possible that a more specific approach of Manual Lymphatic Drainage Techniques (MLDT), which has shown to be effective in sport injury rehabilitation, would have resulted in greater reduction.

Over the course of the 5 weeks, both the quadriceps and TFL muscles showed improvement in strength, from an initial grading of Grade 8: Good to a final measurement of Grade 10: Normal for both indicating the effectiveness of massage therapy as a means of promoting healing to affected muscle tissue. With notable muscle atrophy to the vastus medialis muscle (VMO), this protocol, combined with the active self-care program appears to be successful in strengthening and neurologically encouraging the stimulation and firing of the atrophied VMO and adductor muscles. The subject noted feeling the active firing of VMO during her self-care exercises and while performing cardiovascular exercise after the fifth treatment session. Having achieved her short-term goals during the 5-week period and being able to engaging in activities of daily living with significantly less pain, the subject’s Quality of Life scores were improved by 2 points.
A large part of the success of this case study was the willingness and consistency of the participant to complete her active self-care program, which was based largely on the physiotherapy rehabilitation provided for patients of post-operative ACL repair.\textsuperscript{2,7,11} Other studies\textsuperscript{15-20} have shown the effectiveness of physical therapy in the rehabilitation of a post-surgical ACL reconstruction, however, what this case study clearly demonstrates, is the effectiveness of massage therapy as a complement therapy for patients undergoing post-surgical rehabilitation. This is important and useful information for all healthcare practitioners in understanding the significant impact of massage therapy, by way of decreasing pain and increasing range of motion, thus improving quality of life and reducing the amount of money spent on rehabilitation.

Though the effects of this case study prove to be profound for the subject involved, and provide valuable evidence revealing the effectiveness of massage therapy in the rehabilitation of a post-operative ACL reconstruction, this study is limited by its very nature. As a case study, it is restricted by its small sample size, it lacks access to advanced or computerized methods of testing and assessment, and does not have a control group to measure the results against. Making adjustments to the massage protocol used, either by way of order or techniques used may prove more beneficial in promoting subject recovery. Timing may be another consideration and a question to consider might be whether there is an optimal time to begin rehabilitation post-surgery. With the common nature of surgical ACL repairs taking place in our current healthcare system, a larger body of subjects would be beneficial for further research in establishing
the many benefits of massage therapy as a complementary method of care in the rehabilitation process.

**Conclusion**

The results of this case study demonstrate the effectiveness of massage therapy as a complementary method of care and rehabilitation for post-operative ACL reconstruction. This study was effective in decreasing pain, restoring full range of motion of the affected knee, improving muscular strength and the quality of life of the subject involved.
Appendix

TABLE 1 Functional Numerical Pain Scale

<table>
<thead>
<tr>
<th>Score</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No pain</td>
</tr>
<tr>
<td>1–3</td>
<td>Pain that does not require change in activity</td>
</tr>
<tr>
<td>4–6</td>
<td>Pain that does require change in activity</td>
</tr>
<tr>
<td>7–9</td>
<td>Pain that fully prohibits one or more activities</td>
</tr>
<tr>
<td>10</td>
<td>Pain that is unbearable</td>
</tr>
</tbody>
</table>

TABLE 2 The Kendall Key to Muscle Grading

<table>
<thead>
<tr>
<th>Test</th>
<th>Function of Muscle</th>
<th>Muscle Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Movement</td>
<td>No contraction seen or felt</td>
<td>Zero 0</td>
</tr>
<tr>
<td></td>
<td>Tendon becomes prominent, or feeble contraction is</td>
<td>Trace 1</td>
</tr>
<tr>
<td>Supported in the Horizontal Plane</td>
<td>felt, but no visible movement</td>
<td></td>
</tr>
<tr>
<td>Movement through partial range of motion</td>
<td>Poor - 1</td>
<td></td>
</tr>
<tr>
<td>Movement through complete range of motion</td>
<td>Poor 2</td>
<td></td>
</tr>
<tr>
<td>Holds against slight pressure in test position</td>
<td>Poor + 3</td>
<td></td>
</tr>
<tr>
<td>Tests in the Antigravity Position</td>
<td>Moves through partial range of motion against gravity</td>
<td>Poor + 3</td>
</tr>
<tr>
<td></td>
<td>Gradual release from test position</td>
<td>Fair - 4</td>
</tr>
<tr>
<td></td>
<td>Holds test position (no added resistance)</td>
<td>Fair 5</td>
</tr>
<tr>
<td></td>
<td>Holds test position against slight pressure</td>
<td>Fair + 6</td>
</tr>
<tr>
<td></td>
<td>Holds test position against slight-to-moderate pressure</td>
<td>Good - 7</td>
</tr>
<tr>
<td></td>
<td>Holds test position against moderate pressure</td>
<td>Good 8</td>
</tr>
<tr>
<td></td>
<td>Holds test position against moderate-to-strong pressure</td>
<td>Good + 9</td>
</tr>
<tr>
<td></td>
<td>Holds test position against strong pressure</td>
<td>Normal 10</td>
</tr>
</tbody>
</table>

FIGURE 4 Left: Knees pre-treatment session 1  Right: Knees post-treatment session
FIGURE 5  McGill Quality of Life Questionnaire

PART A: Physical Symptoms or Physical Problems

1. Over the past two (2) days, our bladder/urinary symptoms has been ______________________________
   (circle one):
   no problem 0 1 2 3 4 5 6 7 8 9 10 tremendous problems
   on problem 0 1 2 3 4 5 6 7 8 9 10 tremendous problems

2. Over the past two (2) days, another bladder/urinary symptoms has been ______________________________
   (circle one): no problem 0 1 2 3 4 5 6 7 8 9 10 tremendous problems

3. Over the past two (2) days, a bowel/bladder symptoms has been ______________________________
   (circle one): no problem 0 1 2 3 4 5 6 7 8 9 10 tremendous problems

Please continue on the next page...

PART B:

4. Over the past two (2) days I have felt: physically very good ____________
   physically well ____________
   physically poor ____________
   physically terrible ____________
   1 2 3 4 5 6 7 8 9 10

5. Over the past two (2) days, I have been depressed:
   not at all ____________
   1 2 3 4 5 6 7 8 9 10 extremely

6. Over the past two (2) days, I have been anxious or nervous:
   not at all ____________
   1 2 3 4 5 6 7 8 9 10 extremely

7. Over the past two (2) days, how much of the time did you feel sad?
   never ____________
   1 2 3 4 5 6 7 8 9 10 always

8. Over the past two (2) days, when I thought of the future, I was:
   not afraid ____________
   1 2 3 4 5 6 7 8 9 10 terrified

9. Over the past two (2) days, my life has been:
   totally meaningless and without purpose ____________
   very purposeful and meaningful ____________
   1 2 3 4 5 6 7 8 9 10

10. Over the past two (2) days, when I thought about my whole life, I felt that I achieved my goals I have:
    not at all ____________
    made no progress/gotten nowhere ____________
    made some progress/better ____________
    made much progress/gotten better ____________
    1 2 3 4 5 6 7 8 9 10

Please continue on the next page...
Part D

Please list or describe the things which had the greatest effect on your quality of life in the past two (2) days. Please tell us whether each thing you list made your quality of life better or worse during this time. If you need more space, please continue on the back of this page.

Thank you very much for your help.

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References


