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The effects of massage therapy on motion restriction at the knee joint as a long-term result of arthroscopic partial media meniscectomy

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THE EFFECTS OF MASSAGE THERAPY ON MOTION RESTRICTION AT THE KNEE JOINT AS A LONG-TERM RESULT OF ARTHROSCOPIC PARTIAL MEDIAL MENISCECTOMY: A CASE STUDY

ABSTRACT

Objective: The objective of this case study was to demonstrate the effectiveness of massage therapy as a treatment for motion restriction at the knee joint resulting from a long-term arthroscopic partial medial meniscectomy. **Methodology:** The treatment plan consisted of seven massage therapy treatments of 40-50 minute duration over the course of four weeks as well as a homecare plan. Treatment of the knee joint and related soft tissue lesions and dysfunctions included hydrotherapy, Swedish massage, myofascial release techniques, joint mobilizations and active muscle stretches. The homecare plan combined hydrotherapy with stretches, muscle balancing and proprioception exercises. Active, passive and functional knee flexion was measured using a goniometer. Knee extension was measured following the Knee Extension Contracture or Heel Height Difference test (HHD). Changes in the capsular endfeel as well as patellar mobility were determined by joint play. Palpation results and effects on activities of daily living were also documented. **Results:** Overall, the treatments increased functional range of motion (functional squat) by 30 degrees of flexion or 42.9%. Active flexion of the affected knee improved by 15 degrees or 12.5% and passive flexion improved by 10 degrees or 7.7%. The difference in extension between the left and the right knee decreased by approximately 2.2 degrees or 62.9%. The endfeel for the affected knee improved from hard capsular to a softer quality with some creep. **Conclusion:** Massage therapy in combination with a specific homecare program lead to a substantial improvement in functional, active and passive range of motion at the hypomobile knee joint, as well as to increased capsular mobility and a decrease of dysfunction in the surrounding tissues. A long-term treatment plan focusing on joint mobilizations is recommended to further improve capsular mobility.

INTRODUCTION

The knee is a joint complex referring to the tibiofemoral and the patellafemoral joints, which share a common joint capsule. It is a synovial modified hinge joint with two degrees of freedom supported by ligaments and muscles as well as two interposed menisci (Kisner and Colby, 2007; Dixon, 2003; Magee, 2006).

The medial and lateral menisci are semilunar fibrocartilaginous disks, which are firmly attached to the anterior and posterior aspects of the tibial plateau but are free to move slightly inward and outward during normal knee activity. Their function is to increase the congruity between the convex surface of the femoral condyles and the relatively flat tibial plateau, thus allowing distribution of the axial loads over a larger surface area and significantly reducing the shock load on the joint cartilage (Fu et al, 2002; Rattray and Ludwig; 2000; Salter, 1999). They also aid in the lubrication of the joint and reduce friction during movement (Hertling and Kessler, 2006).

At the knee, medial rotation normally occurs with flexion, whereas lateral rotation occurs with extension. If lateral rotation is forced during flexion, or if medial rotation is forced during extension, abnormal stresses are applied to the menisci, which can result in a

tear. The patella slides inferiorly with knee flexion, and superiorly with knee extension (Hertling and Kessler, 2006).

A common cause of injury to the medial meniscus is taking weight on the partially flexed and laterally rotated knee joint. A fall or a blow to the lateral side of the knee can also result in excessive rotation leading to the medial meniscus being ground between the femoral and tibial joint surfaces (Hertling and Kessler, 2006; Salter, 1999).

A partial meniscectomy is the most common medical intervention for a meniscal tear where only the torn part of the meniscus is surgically excised. This can either be performed through an open arthrotomy or by arthroscopic surgery, through the arthroscope (Salter, 1999).

"Few reports have covered the long-term results of arthroscopic meniscectomy" (Higuchi et al, 2000, p. 166). Those studies that have looked at long-term results were largely focused on the potential development of osteoarthritis (Higuchi et al, 2000; Lee et al, 2002). However, a few studies also reported reduced range of motion and abnormalities in limb motion during activities such as climbing stairs or regular gait as a functional outcome (Durand et al, 1993). Loss of stability in the knee after meniscectomy was observed as well (Higuchi et al, 2000).

"One of the most common causes of gross restriction of knee motion is capsular tightness" (Hertling and Kessler, 2006, p. 495). Trauma, surgery, prolonged immobilization or progressive chronic joint diseases can all lead to fibrosis and subsequent loss of extensibility of the joint capsule. If the traumatic mechanism of injury is well defined, the fibrosis may be limited to an isolated portion of the joint capsule. More often however, the entire joint capsule is affected which results in a characteristic pattern of motion restriction where knee flexion is significantly more restricted than knee extension (Dixon, 2003; Hertling and Kessler, 2006). Such a condition has been termed 'relative capsular fibrosis' or 'arthrofibrosis' (Cosgarea et al, 1994; Hertling and Kessler, 2006; Shelbourne et al, 1996).

Relative capsular fibrosis is most commonly the result of "(1) resolution of an acute articular inflammatory process; (2) a chronic, low-grade articular inflammatory process; (3) immobilization of a joint" (Hertling and Kessler, 2006, p. 49).

Inflammatory conditions tend to lead to an actual increase in collagen content. Once they have reached a state of relative capsular fibrosis, inflammatory conditions tend to be more resistant to treatment efforts to increase range of motion. Clinically, the longer and more severe the inflammatory process in the joint (which usually also leads to a prolonged immobilization phase) the slower the rate of improvement in range of motion as response to treatment (Hertling and Kessler, 2006).

"Because the knee is the intermediate joint between the hip and the foot, problems in these two areas can interfere with knee function" (Kisner and Colby, 2007, p. 692). For example, hip flexor contracture or ankle instability can have a negative effect on functional motion at the knee joint.

CASE HISTORY

The subject was a female full-time student, fitness instructor, personal trainer and tri-athlete in her forties. She had injured her left knee repeatedly teaching high-impact aerobics classes; twice in 2000 and once in 2005, with each injury showing increased severity of pain and swelling. Aside from icing and rest for one week and one month respectively, the subject did not receive any

treatment. After the first two injuries she experienced recurrent pain for about a year with some instability when the muscles were fatigued. After the third injury the subject suffered from a constant aching pain at the knee, which radiated down the lateral leg for four months with some recurrent symptoms after that. The pain was more severe and throbbing at night. Range of motion was reduced due to pain and some instability was experienced. The swelling would also recur with heavy activity. The subject continued to work as a fitness instructor, teaching 10-12 classes per week. She ceased trail running in September 2006 and with this reduction in activity the pain gradually reduced.

In July 2007, the subject consulted an orthopaedic specialist and was diagnosed with a partial tear of the anterior cruciate ligament, a grade one sprain of the medial collateral ligament and a radial tear through the body of the medial meniscus, i.e. a sharp split from the medial towards the lateral rim of the meniscal body. In April 2008 the subject underwent an arthroscopic partial medial meniscectomy. She had been pain-free and experienced no instability since the surgery. Directly after the surgery she reported having full range of motion but over a period of about three to four weeks post-surgery, both knee flexion and extension started to become somewhat limited and have been reduced ever since.

The subject's chief concern was the persistent decreased range of motion of the left knee joint. Although she was functioning on a very high level, she felt limited in some of her daily activities, such as demonstrating proper squatting techniques for personal training as well as demonstrating the child's pose while teaching beginners yoga classes, a position that was not only limited but also painful for her to stay in for any length of time. The patient also experienced frequent muscle spasms in the left anterior thigh and posterior leg when the muscles were fatigued from training.

ASSESSMENT

Initially, the subject was assessed following the standard protocol of observation, palpation, motion assessment and inquiry about any neurological or referred pain. To confirm meniscal integrity, McMurray and Apley's Compression Tests were performed, and Lachman and Varus-Valgus Stress Tests were used to rule out ligamentous instability. The Q-angle was measured to assure normal patellar alignment.

The following assessment techniques were performed before and after every treatment. Active, passive and functional knee flexion (functional squat) was measured using a goniometer. Knee extension was measured following the Knee Extension Contracture or Heel Height Difference Test (HHD). Changes in the capsular endfeel as well as patellar mobility were determined by joint play. Palpation results and effects on activities of daily living were also documented. In addition, Ober's, Thomas and Rectus Femoris Contracture Tests were used to monitor iliotibial band and hip flexor contracture respectively.

Baseline Assessment Results

Palpation revealed pronounced hypertonicity of the iliopsoas bilaterally, hypertonicity and fascial adhesions of the left rectus femoris and the quadriceps group (especially at the attachment sites at the knee joint), bilateral tightness of the iliotibial bands and pronounced hypertonicity of the tibialis posterior and flexor hallicus longus on the left side.

The left knee exhibited a capsular pattern of restriction with a hard capsular endfeel.

Patellar mobility was limited laterally for both knees as well as superiorly and inferiorly for the left knee.

Test	Left knee	Right knee
Squat in degrees of flexion	70	
A-ROM in degrees of flexion	120	130
P-ROM in degrees of flexion	130	135
HHD in cm	3.5	
Thomas test	+	+
Rectus femoris contracture test	+	+
Ober's test	+	+

Table 1: Baseline assessment results for special tests and goniometer readings.

TREATMENT PLAN

The treatment plan consisted of seven massage therapy treatments of 40-50 minutes duration over the course of four weeks as well as a specific homecare plan. Each treatment generally followed the outline below.

The treatment began with the application of Swedish massage techniques to the right anterior leg and thigh while a hydrocollator was placed on the abdomen. The hydrocollator was then moved to the left anterior thigh and knee area and after a short Swedish abdominal massage, both iliopsoas muscles were treated with muscle stripping.

The hydrocollator was then placed on the right anterior thigh and knee area for about ten minutes. Myofascial release techniques, specifically cross-hand release, picking-up, bowing, and long lever techniques were performed on the left rectus femoris, vastus lateralis, medialis and intermedius with focus on the attachment sites at the knee, as well as on the left iliotibial band. Stripping of the left tensor fasciae latae muscle was followed by a general flushing of the treated areas.

Myofascial and Swedish techniques were also used on the left gastrocnemeus and muscle stripping was performed on the left tibialis posterior and flexor hallicus longus, followed by a general flushing of the area. Following the above, joint mobilizations (both sustained glides and oscillations) were performed on the left knee joint, specifically axial distractions, posterior and anterior glide, medial and lateral glide, lateral tibial spin, superior and inferior patellar glides. Finally, Swedish massage was applied to the posterior thighs and legs on both sides. The treatment was completed with a contract-relax active stretch for the quadriceps muscles on both sides.

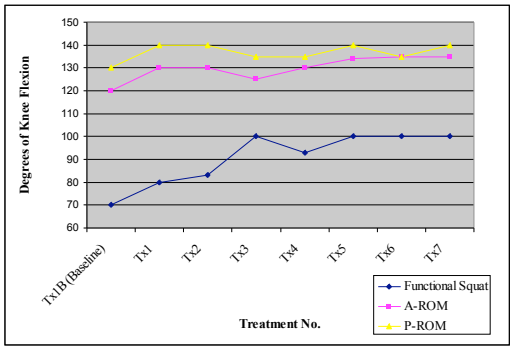
The first few treatments had a stronger focus on soft tissue techniques to break down fascial adhesions and decrease muscle hypertonicity. Joint play and low-grade oscillations were gradually introduced to the left knee joint. Over the course of the treatment series, as the condition of the soft tissue improved and the knee joint became more responsive, the focus shifted towards more extensive and corrective joint mobilizations.

The homecare plan combined the application of deep moist heat to the left knee and anterior thigh with stretches for the quadriceps group, iliopsoas and the posterior leg muscles, muscle balancing and proprioception exercises.

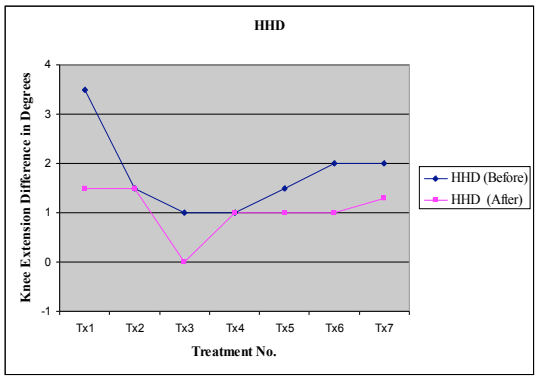
RESULTS

The overall increase in functional range of motion (functional squat) was 30 degrees of flexion or 42.9%. Active flexion of the affected (left) knee was improved by 15 degrees or 12.5% and passive flexion was

improved by 10 degrees or 7.7%. The difference in extension between the left and the right knee was decreased by approximately 2.2 degrees or 62.9%.



Graph 1. Baseline and post-treatment results for the left knee.



Graph 2. Knee extension difference comparing pre- and post-treatment data.

For all variables used to measure changes of range of motion at the knee, the first treatment produced the largest increase. Active, passive and functional range of motion all improved by 10 degrees, which equaled 8.3%, 7.7% and 14.3% respectively (see *Graph 1*). The knee extension difference decreased by approximately 2 degrees or 57.1% (see *Graph 2*). After that the three variables for knee flexion progressed almost consistently, but the amount of improvement diminished towards the second half of the treatment series. Although the overall tendency for the knee extension difference is to decrease, the progression is less consistent (see *Graph 2*).

The unaffected (right) knee also showed significant improvements. Overall, active flexion increased by 15 degrees or 11.5%, and passive flexion by 15 degrees or 11.1%.

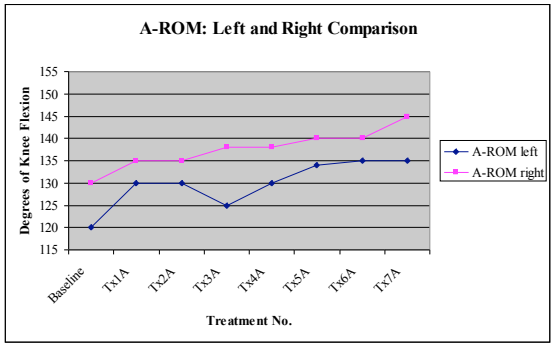
As *Graph 3* and *Graph 4* demonstrate, the progression of active and passive range of motion improvement was very similar for the left and the right knee joint so that the discrepancy of joint mobility between the right and the left knee stayed the same for active range of motion with ten degrees, and increased from five to ten degrees for passive range of motion.

Further data analysis revealed that for the left knee the increase in range of motion was noted mostly as a post-treatment effect, whereas mobility of the right knee improved more often in between treatments. These trends were especially noticeable regarding active range of motion. For the left knee active range of motion would often decrease between treatments.

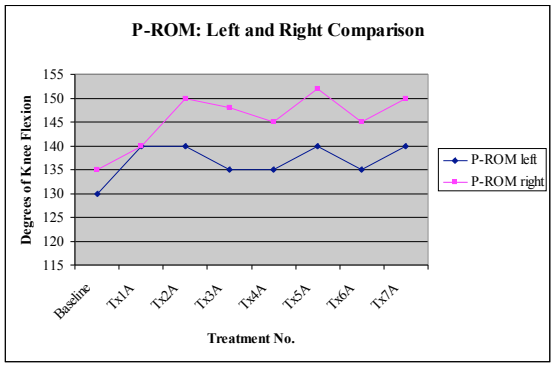
At the fourth treatment, the therapist noticed a change in the endfeel of the left knee joint. With joint play and mobilization, the endfeel had a slightly increased creep and was ‘bouncier’. This tendency continued throughout the remainder of the treatment series. Patellar mobility improved over the course of the treatment series, but was consistently restricted laterally.

Hypertonicity and fascial adhesions in the treated muscle groups decreased over the course of the treatment series particularly in the left rectus femoris, tibialis posterior and flexor hallicus longus and somewhat in both iliopsoas muscles. The Thomas and Rectus Femoris Contracture Test delivered positive results throughout the treatment series but demonstrated a tendency for improvement. The results for the Ober’s test also

demonstrated constant improvement, so that by the fifth treatment a negative outcome was noted.



Graph 3. Comparison of post-treatment results for active flexion of the right and the left knee.



Graph 4. Comparison of post-treatment results for passive flexion of the right and the left knee.

The subject did not experience any muscle spasms over the course of the treatment series. By the third treatment the patient reported that she could bend her left knee enough to hold a quadriceps stretch in a standing position, which she had not been able to do "in a long time". By the fifth treatment the patient was able to get into and hold the child's pose without any pain, which she had not been able to do without pain since the surgery. These functional improvements lasted for at least three more weeks after the termination of treatment.

DISCUSSION

The fact that a large portion of mobility improvement for the unaffected right knee occurred between treatments suggests that a homecare program combining stretches, muscle balancing and proprioception exercises can have a significant positive effect on the range of motion and function of a healthy knee joint.

Taking the effects on the unaffected knee into consideration, as well as the fact that the most dramatic improvements occurred during the first half of the treatment series, one can assume that the increase in mobility for the left knee is also largely due to soft tissue release and the decrease of muscle imbalances. A noticeable change in the capsular end feel towards a softer quality and some creep did not occur until the fourth treatment. These results demonstrate the effectiveness of joint play and mobilizations on the restricted knee capsule. The results also imply that improvement on a capsular level was just beginning at the time when the treatments were terminated. Given the chronicity of knee trauma for this subject, a significant degree of capsular fibrosis is to be assumed. An ongoing treatment should therefore focus on more extensive and corrective joint mobilizations in order to specifically target the capsular fibrosis. Future studies using similar cases should plan for weekly treatments lasting at least four to six months in order to expect significant and lasting results on a capsular level.

The data also showed that the left knee had a stronger tendency to regress between treatments, especially for active range of motion, which demonstrates the extent of chronic soft tissue adhesions affecting the chronically injured knee joint.

CONCLUSION

The results from this study demonstrate that massage therapy in combination with hydrotherapy and a detailed homecare program can lead to a substantial improvement in functional, active and passive range of motion at a hypomobile knee joint as a long-term result of arthroscopic partial medial meniscectomy. The applied treatment also resulted in increased capsular mobility and a decrease of dysfunction in the surrounding tissues.

The inclusion of the unaffected limb as well as related soft tissue dysfunctions in the treatment plan (such as hip flexor and iliotibial band contractures) have also contributed to the positive functional outcome of this study. This shows that viewing the lower limb as a functional and physiological unit and treating any dysfunctions in a comprehensive manner will provide positive results.

Follow-up studies should increase the timeline of the treatment plan to at least four to six months with a continuous and increasing focus on joint mobilization to further improve capsular mobility.

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