



# Clinical Case Report Competition

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First Place Winner

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Nerve impingement within the adductor hiatus with links to proprioception of the affected limb

## **Abstract**

The objective of this case study was to determine if saphenous nerve impingement could be released through manual manipulation techniques, particularly focused on the adductor hiatus. Patient is a 25-year-old active woman with a four month history of intermittent referral pain and neurological symptoms effecting the anterior medial left knee and calf. The saphenous nerve and various orthopedic tests including nerve tension test were assessed. These tests included manual muscle test, and a gait analysis. Manual modalities were done by a variety of general Swedish Massage Techniques, including deep longitudinal strokes and molding of tissues. Myofascial techniques were also incorporated, such as direct shearing and muscle squeezing of underlying tissues. Over the course of ten treatments, significant changes were observed. Specific homecare of nerve flossing was also administered. The goals for this study were alleviation of referral pain, neurological symptoms, improve tissue health and limb proprioception. The results indicate a decrease in fascial restriction of the left medial thigh, elimination of pain and neurological symptoms, and increased muscle tone to the adductor group. Patient commented on noticeable changes in proprioceptive awareness and improved gait by the end of the study.

*Keywords* nerve impingement, saphenous, massage, myofascial, proprioception

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## **Introduction**

This is a nine week pilot study that investigates nerve impingement within the adductor hiatus, with links to proprioception of the affected limb. The nerve that runs through the adductor hiatus is the saphenous nerve. The literature so far is showing that saphenous nerve pain is frequently overlooked as a cause of medial knee discomfort (Settergren, 2012), and that it is not widely appreciated how important the saphenous nerve is in providing sensory input to the medial ankle (Clendenen, 2013). The saphenous nerve is the longest, largest branch of the femoral nerve originating from L2-3 and descends laterally to pass through the adductor hiatus to the medial aspect of the foot. From the femoral triangle, this nerve travels in the adductor canal medially to adductor magnus muscle and under the Sartorius muscle. As the femoral vessels pass through the adductor hiatus, the saphenous nerve gives off the subcutaneous infrapatellar branch (Figure 1). This branch wraps around the sartorius muscle to innervate the skin of the anterior and medial side of the knee and the patellar ligament. Continuing distally, the saphenous nerve pierces the fascia between the tendons of the Sartorius muscle and gracilis muscle giving off the medial crural nerves that supply cutaneous innervation to the anterior and medial leg. The saphenous nerve then terminates at the ankle, medial side of the first metatarsal head, and the dorsum of the foot (Payne, 2013 & Clendenen, 2013) (Figure2). So far there have been few studies on manual manipulation of this condition, and due the anatomical pathway of this nerve it has two places in which it can be commonly impinged. The first being the adductor hiatus, and the second being where it pierces

through the fascia. These can be the result of surgical interventions, trauma, or can be idiopathic (Ahadi, 2010). Massage therapy is a more affordable, less invasive approach to decreasing symptoms with no down time. Other methods the patient has tried for relief have been physiotherapy and acupuncture. Both methods helped for a few days but had no lasting effects. Based on this studies assessment and the busy schedule of the patient, a variety of various massage, fascial, and vibratory techniques (Porr, 2013) are the safest, fastest, and most cost effective approach. The hypothesis for this study is to see if manual manipulation of the adductor hiatus is a realistic non-surgical alternative for eliminating impingement of the saphenous nerve. As well as, improve tissue health and the osteokinematics and conscience proprioception of the affected limb.

## **Methods**

### Patient presentation

A 25-year-old woman with a four month history of intermittent referral pain and neurological symptoms effecting the anterior medial left knee, down into the calf. Patient described these sensations as hot, tingling, numb, sharp, pinching and a six on the pain scale while working and warming up before activity. Patient reports feeling of being sore or stiff for one-to-two days post activity with symptoms referring into her low back and down to her mid-calf. Patient is a Registered Massage Therapist (RMT) working thirty-to-forty hours a week, plays soccer three-to-four days a week, and does on average five hours of exercise (hiking, stair running, yin yoga) throughout the week. The reported activities of daily living (ADL's) that were most affected were lateral movements, cutting and sudden stops. Patient also has a history of injury to her left lower extremity over the

past two years. These include; two grade two (Magee, 2008) ankle sprains, a grade two hip flexor tear, hemarthrosis of the knee, and a laterally dislocated patella. Days prior to initial treatment she was presenting with a hematoma on her left anterior distal tibia. Patient also admitted to kicking herself while running or walking.

### **Assessment**

- Author declares there is no patient conflict. Written consent for treatment to the left lower extremity as well as all associated musculature was obtained prior to the initiation of the first treatment and verbal consent was obtained prior to all treatments thereafter. All pictures taken by author.
- Patient came in with a diagnosis from her physiotherapist of nerve impingement of the saphenous nerve. A thorough unbiased assessment was then performed to rule out any differential diagnosis.
- Visual gait analysis confirmed that the patients' gait crosses midline resulting in an “egg beater” pattern (Porr, 2013).
- Verbal analog pain scale. Patient was asked to give a number between 0-10 with 0 being no pain, and 10 being intolerable, to assess pain and discomfort during tests and treatment.
- A nerve tension test was performed to the saphenous nerve, as outlined in (Porr, 2013).  
To place maximum tension on the saphenous nerve place patient side lying with the hip in extension and abduction then into knee flexion.
- Manual muscle test (MMT) of the adductor group were used to assess for weakness of the adductor magnus, and longus muscles. Patient is side lying on table, laying on

the side being tested. Patient then adducts leg, while resistance is applied (Magee, 2008).

- Straight leg raise (SLR) was performed and tests for nerve root impingement at L5-S1, or possible disc herniation (Magee, 2008).
- Myotome test for the lower extremities was used to test for muscle weakness supplied by a single nerve root. (Magee, 2008)
- Using a vinyl tape measure, a girth measurement was taken at the proximal and distal thigh, measurements were taken bilaterally.

### **Treatment plan**

Goals for treatment (Tx) are to decrease fascial restriction of the left medial thigh, decrease pain and neurological symptoms of pain and tingling, numbness and increase muscle tone of adductor group. Goals also include changing proprioceptive awareness to the left lower extremity and improving gait. The patient's expectations were similar and realistic. Patient wanted to achieve increased strength in her medial thigh, decreased pain in her calf, and decreased fascial adhesion in her left lower extremity. Treatment schedule was one seventy minute Tx twice per week for three weeks, followed by once per week for four weeks for a total of ten treatments.

## **Treatments**

**Tx1:** A full assessment was done

Fascial treatment (Rattray, 2000) of the left adductor group: (adductor brevis muscle, adductor minimus muscle, adductor longus muscle, and adductor magnus muscle [adductor group]). Anchoring one hand just distal to the origin of adductor magnus muscle and the other hand applying a direct shearing technique with a posteromedial force, working down from the origin to insertion. An indirect cross hand shear was then applied to the medial compartment of the thigh. Picking up/molding of the skin and underlying tissue was performed around the medial condyle of the femur, as well as where the saphenous nerve pierces the sartorius and gracilis muscle tendons.

General Swedish massage (GSM) (Rattray, 2000) techniques: longitudinal palmar stroking, forearm stroking, fingertip kneading, c-scooping to the femoral condyles, and wringing. Finished with a full leg longitudinal flushing strokes. This routine was applied to biceps femoris muscle, semimembranosus muscle, semitendinosus muscle (hamstrings), vastus medialis muscle, vastus intermedius muscle, vastus lateralis muscle, and rectus femoris muscle, also known as the quadriceps femoris group (quads) and adductors group, sartorius and gracilis muscles.

Bilateral work was done on the hips and buttocks including; compressions, palmar kneading, rocking, and bear claw on the greater trochanter. Attachment release was done on iliosacral ligaments and sacrotuberous ligaments.

**Tx2:**

Same facial Tx was done as in Tx 1 to the left adductor group. GSM routine was applied to the gluteals, quadratus lumborum (QL) muscle, and adductor muscle group. All GSM routines finished with full leg longitudinal flushing strokes and fine vibrations of medial thigh (Settergren, 2012). Dynamic release of QL, adductor group was performed along with contract-relax (Travell, 1993) of adductor group, iliotibial band (ITB) muscle. Tried doing pelvic shotgun at end of Tx however, left side adductor group were too weak, and the patient experienced discomfort.

**Tx3:**

Fascial Tx applied to left adductor muscle group. GSM routine applied to quad muscles and hamstring muscles. Attachment release was also done on adductor magnus muscle. Contract-relax was performed at the end of Tx on the adductor muscle group and ITB muscle, followed by active and passive range of motion (A/PROM) of the rectus femoris muscle, Sartorius muscle (hip flexors) and adductor muscle group.

**Tx4:**

Fascial Tx was applied to the adductors muscle group, popliteus muscle, gastrocnemius and soleus (calf) muscles. GSM routine was applied to ITB muscle, hamstrings muscle, adductors muscle, popliteus muscle, calf muscles. Muscle stripping (Travell, 1999) was done on, iliopsoas muscle. Attachment release was performed on the popliteus muscle.

Dynamic release was done on psoas muscle, and adductor muscle group, followed by A/PROM of the hip flexors.

**Tx5:**

Fascial Tx on adductor group and calf muscles. GSM routine was applied to quadriceps muscles, hamstring muscles, adductor group, calf muscles. Attachment release of popliteus muscle. Dynamic release of adductor muscles

**Tx6:** re-assessment was done

Deep flushing technique routine- Deep longitudinal strokes delivered at a moderate pace and pressure, meant to penetrate down into the muscle bellies, gradually lifting up to help the body flush out any lactic acid build up, to decrease any delayed onset muscle soreness (DOMS). GSM routine applied to hip flexor muscles, calf muscles, adductor muscle group, quad muscles, hamstring muscles

**Tx7:**

Bilaterally over glute muscles - compressions, rocking, bear claw or greater trochanter. Attachment release of iliosacral ligaments and piriformis muscle, followed by fine vibrations of the sacrum. Fascial Tx on adductor muscles group, hamstring muscles, quad muscles, calf muscles. Dynamic release of piriformis muscle, glute muscles.

**Tx8:**

Deep flushing routine done to both lower extremities. Fascial Tx on adductor muscle group, hamstring muscles, quad muscles, calf muscles. Bilaterally GSM routine of the

lower extremities. Attachment release of iliosacral ligament, adductor muscle group, hamstring muscles, calf muscles.

**Tx9:**

Fascial Tx on adductor muscle group, hamstring muscles, quad muscles, calf muscles, with C-bowing of achilles tendon. Bilaterally GSM routine on lower extremities. Attachment release applied to achilles tendon, quad muscles, adductor muscle group, and calf muscles. Antagonist contraction of the calves.

Tx10: Final assessments were done.

Fascial Tx on posterior compartment, C-bowing of achilles tendon. Bilaterally- GSM- hamstring muscles, calf muscles, popliteus muscle, iliopsoas muscle. A/PROM of the left hip flexors. Attachment release-hamstring muscle, calf muscles. Dynamic release of rectus femoris muscle, iliopsoas muscle.

**Homecare: Remedial Exercises** (For detailed homecare instructions see Appendix B)

Tx1- Nerve flossing 2x per day, standing proprioception- 30 sec. to 1 minute progression, Yin yoga 20 minutes two times a week.

Tx2- Additional self-massage with tennis ball or foam roller when needed

Tx3- Additional second nerve flossing technique added

Tx5- Additional proprioceptive running warm up

Tx10- Additional self-massage to tibialis posterior

**Hydrotherapy-** both done as needed

Heat, to sore tight muscles for 20 minutes at a time

Apply ice to hot, inflamed muscles 10 minutes on/10 minutes off.

## Results

Visual gait analysis confirmed that the patients' gait crosses midline resulting in an “egg beater” pattern, which suggests that the infrapatellar branch of the saphenous nerve is affected (Porr, 2013). This was evident when watching patient walk to Tx room.

Myotome test- Testing of the lower extremities of the right side were all negative as were the nerve roots for L4-S2 on the left. Nerve roots on the left side for L2-3 were noticeably weaker in comparison, however still functional and did not elicit any neurological symptoms.

Girth measurement in inches:

Tx2	Tx7	Tx10
Right proximal thigh- 26.2	Right proximal thigh- 26.5	Right proximal thigh- 27
Right distal thigh- 18	Right distal thigh- 18.5	Right distal thigh- 20.5
Left proximal thigh- 25.2	Left proximal thigh- 26	Left proximal thigh- 27
Left distal thigh- 17.2	Left distal thigh- 18.5	Left distal thigh- 20.5

Modifications were made to every Tx protocol depending on the tissue presentation of the patient on each day of Tx. Different fascial restrictions plus different portions of the nerve needed to be worked each time, however there was a basic protocol for each Tx that was adhered to.

Patient was on time for all appointments, and did homecare as instructed, except all home

care given for improving proprioception. She also did 45-60 minutes of yin yoga each time. During Tx 9 patient noted that nerve flossing was feeling less effective.

Written explanation of the trends with reference to the tables in Appendix C

Nerve tension test- Patient showed significant restrictions along the course of the nerve, which improved greatly as tissue adhesion decreased.

**Table 1 Saphenous Nerve Tension Test**

Treatment	1	2	3	4	5	6	7	8	9	10
Nerve Tension Test	+	+	+	+	+	+	-	-	-	-
Percentage%	20	20	30	60	80	90	100	100	100	100

MMT of the adductor muscles- Patient showed steady improvements throughout the course of Tx. On the first treatment, the muscle weakness was evident when compared bilaterally, it also showed visually as the patient was not able to lift her left leg off the table as high as the right side. By the last Tx the patients' strength had improved dramatically, being able to withstand full resistance as well as equal height off of the table.

**Table 3 Manual Muscle Test of the Adductors**

Treatment	1	2	3	4	5	6	7	8	9	10
MMT-Adductors	X	4	5	X	4.5	4.5	4.8	5	5	5

SLR- Pain elicited was felt in the posterior thigh indicating a dysfunction along the sciatic and tibial nerve. ROM continued to improve but never reached full ROM due to hamstring tightness.

**Table 2 Straight Leg Raise**

Treatment	1	2	3	4	5	6	7	8	9	10
SLR	+	+	+	+	+	+	-	-	-	-
Degrees	45	45	50	50	50	55	80	85	85	85

**Discussion and Conclusion**

What's fascinating about this case was how a sensory nerve can have such an effect on motor function, and what makes it intriguing is that this condition seems

to be fairly new to manual therapies. Techniques such as fine vibrations have been proven to work (Settergren, 2012) and were a major success in this case. This study shows that the Tx plan was appropriate for this condition, however the author suggests that she would have preferred to keep Txs to two times per week and insisted that the patient rest more during the nine weeks. There were only a couple of times that the Txs had to be more general rather than specific, as not to aggravate the nerve due to a deeper Tx that was previously done or due to the patient feeling better and pushing herself too soon. Due to the fascial nature of this condition, it was necessary to move into different tissues such as iliopsoas muscle and soleus muscle. Additional Txs would be needed, as well as proper homecare adherence to ascertain if proprioception continued to improve. Despite these small changes the outcome remains positive, as hypothesized that manual manipulations would work to decrease pain and neurological symptoms. The treatment plan also improved tissue health, thus decreasing the saphenous nerve impingement. The assessment half way through showed that treatments were working, the patient had decreased adhesions along the saphenous nerve, as well as decreased numbness and tingling and the feedback from the patient was that she was also expecting things to resolve by the conclusion of this study. A four month follow up has revealed that the patient is still symptom free and has had no re-injury to her left lower extremity, although she has started to graze (kick) the inside of her legs while running. It is the authors' belief and hope that this case study will help support other cases of similar nature in the future.

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## **Appendix A – musculoskeletal anatomy and physiology**

Figure 1. Saphenous nerve pathway (Dartmouth, 2014)

Figure 2. Saphenous nerve cutaneous innervation (Medscape, 2014)

## **Appendix B – Homecare**

**Saphenous nerve flossing #1** – Starting position, facing away from table (or thigh high platform) place dorsum of left foot on table with knee in slight flexion and hip in extension and abduction (Figure 3). Progressively increase amount of knee flexion while decreasing the amount of hip extension (dip down), trying to maintain a constant amount of tension while gliding the nerve along its anatomical path (Figure 4). To increase intensity and floss the femoral nerve, tilt head back and lift left arm into full flexion in time with dip. (Porr, 2013)

Figure 3. Starting Position

Figure 4. Ending Position

Picture- The leg on table is one being assessed

**Saphenous nerve flossing #2**- Starting position, stand with left foot up against a wall in abduction and knee locked, place the right leg out in front toes pointed straight (Figure 5). Lunge forward keeping all pressure on forward leg. Hold for 2-3 seconds and repeat. To increase intensity and floss the femoral nerve, tilt head back and fully abduct left arm in time with lunge (Figure 6). (Shepard, 2013)

Figure 5. Starting Position

Figure 6. Ending Position

Picture- The leg against the wall is the one being stretched

**Standing proprioception-** Stand on one leg for 30 seconds, trying not to wobble. Once this is achieved increase intensity by gradually increasing time to 1 minute. Next start back at 30 seconds and close eyes, working back up to one minute without wobbling. Next place a towel under foot that is being stood on and work back up to 1 minute.

**Yin yoga-** targets the connective tissues, such as the ligaments, bones, and joints of the body that normally are not exercised very much in a more active style of asana practice. A flow for the hips, focuses on three degrees of freedom combining different combinations of movement to stretch and relax all the deep rotators muscles within the hip, as and well as, the larger superficial flexors and extensors. A flow for the legs focuses more on releasing the fascial restriction within each of the four major muscle groups of the thigh.

**Self-massage-** (At the origin of adductor group) fingertip stroking, thumb kneading. Tibialis posterior- knuckle stroking, thumb kneading. Use foam roller or tennis ball to release fascial restrictions and stretch soft tissue, particularly adductors, hamstrings, calves, and quads.

**Proprioceptive running-** When at soccer doing warm up, use the lines on the field as a guide and run over top of them, making sure each leg stays on its respected side of the line. (Porr, 2013)

## Appendix C

**Saphenous Nerve Tension Test, Table 1 page 13:** The first row indicates the treatment number. The second row indicates whether a positive or negative test result was produced. The third row indicates the percentage of the range of motion before a positive test resulted.

Ex. The therapist was able to perform 20% of the motion required before provoking pain.

**Straight Leg Raise, Table 2 page 13:** The first row indicates the treatment number. The second row indicates whether a positive or negative test result was produced. The third row indicates the degrees of ROM before a positive test resulted.

Ex. The therapist was able to perform 45 degrees of hip flexion before provoking pain.

**Manual Muscle Test of the Adductors, Table 3 page 14:** The first row indicates the treatment number. The second row represents the grade given to a muscle based on its capability to do its action. X represents that the test was not performed that day.

Ex. A 1 4 represents a complete ROM against gravity with moderate resistance, and a 5 represents complete ROM against gravity with maximal resistance.