Physical Therapist Management of Persistent Pain and Dysfunction Following Arthrodesis of the First Metatarsophalangeal Joint: A Case Report

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Physical Therapist Management of Persistent Pain and Dysfunction Following Arthrodesis of the First Metatarsophalangeal Joint: A Case Study

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ABSTRACT

Background and Purpose. First metatarsophalangeal joint (MTJP) arthrodesis has been established as an effective intervention for intractable first ray pain and instability. There is a paucity of research that addresses post-surgical physical therapy treatment for this procedure despite commonly occurring post-surgical pain, weakness, and gait disturbances that often accompany it. The purpose of this case report is to describe the physical therapist management of a patient status-post first MTPJ arthrodesis with a focus on self-reported pain relief and functional ability outcomes. **Case Description.** The patient was a 46 year old male who underwent first MTPJ arthrodesis due to post-traumatic arthritic changes as a secondary complication of osteomyelitis. The patient's chief complaint was pain at the first metatarsal head extending down the first metatarsal shaft that had been present for 3 months post surgery. The pain was causing him difficulty with many activities of daily living (ADL's) and limiting him from returning to work as a facilities manager. The patient participated in a multi-modal physical therapy (PT) program 2-3x/week for 24 visits over the course of three months. The patient also received a custom semi-rigid orthotic in the latter part of his treatment regimen. **Outcomes.** At the end of 24 visits, the patient was able to complete all ADL's independently but required more time than prior to surgery to complete the tasks. He was able to return to work full time/light duty resume his running program which was a favorite hobby prior to surgery. **Discussion.** The patient in this case report appeared to benefit from a multi-modal PT program to decrease pain and increase functional ability status-post first MTPJ arthrodesis.

Key words: metatarsophalangeal, arthrodesis, activities of daily living, pain relief, functional ability, physical therapy.

INTRODUCTION

Fusion of the first metatarsophalangeal joint (MTPJ) has been supported by numerous surgeons as an effective method to treat intractable first ray pain and instability.[1,2] Some causative factors for intractable first ray pain may include rheumatic forefoot,[2,3] forefoot with severe non-rheumatic deformities but with instability and MTPJ incongruence,[2,3] hallux valgus,[2] primary hallux rigidus,[2,3] hallux rigidus secondary to Keller-Brandes procedure with enough residual phalanx,[3] failed previous surgery, [2,3] and finally post-traumatic, post-surgical, and neurological sequelae of the MTPJ.[3]

Hallux rigidus is a progressive dysfunction of the first MTPJ characterized by decreased range of motion (ROM) and degenerative changes of the joint.[4-11] However, because some degree of motion is usually available at the joint, the term hallux limitus[4] may be used to describe the condition. Regardless of the terminology, the pathology is one of progressive, degenerative joint changes secondary to biomechanical disturbances or local pathology.[4] Normal first MTPJ motion requires initial stability of the first metatarsal and subsequent plantarflexion of the first ray in the foot flat phase of gait. When instability of the first ray exists, plantarflexion ROM of the articular surfaces of the metatarsal head and phalanx are restricted resulting in abutment of the base of the proximal phalanx into the first metatarsal head, thereby creating the degenerative process.[4]

Hallux rigidus is often divided into stages based on the progression of joint destruction.[4,12] Regnauld[13] originally proposed a progressive 3 stage classification from developing arthrosis, established arthrosis, and then anklylosis. Subsequently a fourth stage was added and adapted by the American College of Foot and Ankle Surgeons[4] to address those cases where there was biomechanical imbalance without radiographic joint changes.[4,10]

Clinical symptoms that are commonly described when hallux rigidus is present may include pain and/or stiffness at the first MTPJ, increased pain with activity or particular shoe wear, and other remote musculoskeletal complaints such as hip, knee, ankle or back pain.[4] Associated clinical findings may include, but are not limited to, central metatarsalgia, interphalangeal joint (IPJ) plantar callous, IPJ hyperextension, hallux equinus, abnormal first MTPJ ROM, loss of joint space, osteophytosis with/without loose bodies, and less than 10 degrees ROM.[4] In addition to pain being a major limiting factor, patient complaints are often associated with the decreased or complete inability to perform physical tasks that require extension of the first MTPJ, i.e. stooping, squatting, and stair climbing.

First MTPJ arthrodesis is often the surgical procedure of choice for pain reduction of the first ray when other conservative or surgical procedures have been unsuccessful.[4,9,14-27] Although there is still controversy over whether MTPJ arthrodesis should be performed in the active population, Bouche & Adad [28] state that this procedure is the preferred joint destruction procedure in active patients and is a "definitive, predictable, and viable option."[28] Others agree that the definitive nature, medial column stabilizing effect, long term predictability, reliability and durability of the first MTPJ arthrodesis are a solid basis for recommendation of this procedure to athletes and others who expect to resume and maintain an active weight-bearing lifestyle.[4,12]

The goal of first MTPJ arthrodesis is to achieve a solid lever that will promote the push-off phase of the gait cycle and will concurrently modify the force that is transmitted to the metatarsal heads in patients with forefoot deformity.[3, 29-32] Consequently, functional ability is restored and the patient may resume his/her pre-morbid activity level.

In order to achieve the best results, the position of fusion is paramount and varying

degrees of post-operative angles of fusion can be illustrated in various published papers.[14, 33-36] However, most authors recommend the dorsiflexion angle to be between 10-20 degrees from the metatarsal axis.[27,31,36,37] The most frequently recommended valgus angle is between 5-25 degrees.[27,31,36,37] And lastly, a neutral angle of rotation is recommended where the toenail of the great toe is parallel to those of the lesser digits.[1,3]

Stabilization of the first ray can be done via differing methods of osteosynthesis and stabilizing devices.[38-41] These procedures can be divided into two categories: joint preservation procedures and joint destructive procedures. Arthrodesis of the first MTPJ falls into the latter category.

The first MTPJ may be exposed by either a dorsal or medial incision. Medial exostoses are removed, and the joint surface of the first metatarsal head is smoothed out. The joint surfaces are then prepared as dictated by specific procedure and use of hardware. After careful assessment, bone is often removed to reduce the length of the first ray such that it is no more than approximately 5 mm longer than the second. Remaining bone spurs adjacent to the area are also removed. After achieving satisfactorily fitting bony surfaces, the position of fusion is confirmed. The joint is then fixated. The stability of the fusion is re-checked and the wound is closed in layers.[1]

Post-operatively, surgeons may allow partial weight bearing in a post-operative walking boot or removable cast progressing toward protected full weight bearing (FWB) over the course of 3-4 weeks. At approximately 4 weeks post-op the patient may be allowed full weight bearing in a walking shoe as tolerated. Numerous authors support early weight bearing after first MTPJ arthrodesis[12,42] and may recommend physical therapy for edema and pain control, to address gait deficits, exercise to promote ROM of surrounding joints, and

assessment for need of orthotics.[14,43]

Shamus et al[50] reported good functional improvements in patients with hallux limitus with a specific protocol of sesamoid mobilization, flexor hallucis muscle strengthening, and gait training, and further hypothesized that similar measures would be of benefit following MTPJ arthrodesis.[50] Others note that after radiologic confirmation that the fusion site is stable and secure, strengthening of the foot, ankle, great toe flexors, can be initiated, as well as joint mobilization of the mortise, tarsals, metatarsals, and digits.[44,51]

Additional physical therapy interventions that are generally noted by other authors in the treatment of MTPJ arthrodesis include compression stockings, elevation of the limb, moist heat, cryotherapy, and gait training with assistive devices.[28,43,44] In the final stages of rehabilitation, patients are often assessed for the need for insoles, prescriptive shoes (generally stiff-soled with substantial lateral support),[28] and custom orthotics to assist with dispersing compressive forces and to aid in propulsion.[28]

Yu and Gorby[53] suggest custom orthotics may be necessary to assist in the balance and distribution of weight. Most often, a semi-rigid material is recommended with an appropriate layer of shock absorption.[43,53] Some authors report orthoses have been shown to yield greater long-term pain relief for hallux rigidus than anti-inflammatory medications alone[52] and work best with shoes with a deeper toe box, supportive arches, and carbon fiber reinforcement under the first ray to minimize MTPJ excursion.[52]

Brantingham and Wood[51] offer a chiropractic perspective on the treatment of hallux rigidus of a single patient where they recommend Grade IV mobilization of the first MTPJ along with a small amplitude high velocity thrust(with or without cavitation) that is repeated between 3 and 5 times. Although this was their primary focus of treatment and not an option

for our patient, they also employed manual techniques that were appropriate for our patient. These techniques included mortise distraction, subtalar mobilization, and axial elongation of the digits Their patient showed improvement on NPRS from 6/10 on initial assessment, to 1/10 at discharge after 4 treatments. This patient was also prescribed a home exercise program that included gentle dorsiflexion of the great toe, ankle alphabet, and bilateral weightbearing in plantarflexion(concentric strengthening of the toe flexors). These exercises were performed 2-3x/day. This particular patient was a high level tennis player, and as a result of his physical therapy treatment, was able to markedly increase his playing time.

Schuch et al[44] employed more traditional therapeutic interventions in their treatment of patients who were status post hallux valgus surgery. These patients were non-weight bearing for 4 weeks, then began physical therapy. Gait training was performed with emphasis on achieving heel strike at the lateral aspect of the heel, followed by weight bearing of the first metatarsal during mid to terminal stance, then emphasizing active push off by the great toe flexors. Selective strengthening of the peroneus longus muscle was also performed in an effort to pronate the midfoot so that first ray contact on the ground was optimal. Manual mobilizations were performed for all metatarsophalangeal joints including dorsal glides and oscillatory traction for pain relief. Lisfranc, transverse tarsal, and subtalar joints were also mobilized. Increasing accessory motion or joint play between all articular surfaces would promote more normal ROM and therefore result in decreased pain by altering noxious afferent input. In addition, concentric strengthening of the great toe flexors and extensors was included.

The participants received between 3 and 6 treatments based on individual findings, and all patients were instructed in a home exercise program to include marble pick ups,

application of cold packs, strengthening and gait training exercises as well. The results of this study suggested that post operative physical therapy and gait training may lead to improved function of the first ray after hallux valgus surgery.

Although the aforementioned cases did not have the same diagnosis as our patient, the general pattern of pain, limitation of movement, loss of strength, and loss of functional ability were similar. It is for this reason it was determined that many of the treatment techniques cited in these studies may be beneficial for our patient.

Post-operative physical therapy is a well-established method to restore function after surgical procedure of numerous musculoskeletal disorders, and its success has been documented in medical literature.[44-49] Despite this fact, referral of patients who have undergone first MTPJ arthrodesis has been a rare occurrence in my clinical experience. Schuch et al[44] have reported that there is minimal literature available describing the effects of physical therapy on the functional outcomes of forefoot surgeries, and even less literature relating specifically to arthrodesis of the first MTPJ which may be contributory. The purpose of this case report is to examine the success of traditional physical therapy interventions such as stretching, strengthening, balance and proprioception training, joint mobilization, and modalities and their effects on self-reported pain relief and functional ability status- post first MTPJ arthrodesis.

CASE DESCRIPTION

HISTORY

Chief complaints at time of initial evaluation. The patient was a 46 year old male who was referred for physical therapy after tripping on a cracked sidewalk and hitting his left foot while working as a facilities manager. The patient developed osteomyelitis and was

hospitalized and treated with a course of intravenous antibiotics for 17 days which was successful in healing the infection, but he eventually underwent first MTPJ arthrodesis due to post traumatic arthritic changes. The patient was immobilized in a walking boot for approximately 8 weeks and presented in clinic for initial evaluation. The patient's medical history was otherwise unremarkable and he was not taking any medications.

The patient's chief complaint was pain at the first metatarsal head which extended down the shaft of the first metatarsal. The patient was unable to work for the prior 3 months since surgery and had difficulties with many activities of daily living(ADL's) including rising up from a chair, ascending/descending stairs, standing or walking greater than 20 minutes, vacuuming and cleaning his house. In addition, prior to this injury, the patient was a marathon runner and expressed a great desire to return to this sport. The patient's goal for physical therapy was to return to work and all other ADL's without pain and return to running as his hobby. It was my clinical impression that this patient would benefit from physical therapy to address his pain, decrease in mobility, strength, and ability to work and perform other daily activities that were a combined result of his surgical procedure and subsequent period of immobilization.

EXAMINATION AND EVALUATION

On initial examination, the patient presented with the following:

Self-reported pain scale: The patient's pain was assessed using a numeric pain rating scale (NPRS) from 0-10; zero meaning "no pain", and 10 being "the worst imaginable pain." The NPRS has been shown to yield reliable measurements of pain in subjects with lower extremity musculoskeletal conditions.[54] The patient reported pain level of 5/10 at best and 7/10 at worst, however, the type, quality, and duration of pain were not recorded at time

of initial examination.

Passive range of motion (PROM) measurements: Measurements were taken with a standard goniometer in a seated position with the knee extended and were performed according to Hoppenfeld.[55] It has been noted in the literature that joint goniometry measurements with a standard full circle goiniometer is both reliable and valid.[56] Please refer to Table 1.

MMT : Break tests were performed in a seated position with the knee extended according to Kendall.[57] There is evidence in the literature of good reliability and validity regarding the use of MMT for patients with musculoskeletal deficits.[58] Please refer to Table 2.

Muscle length testing: The patient's lower extremity flexibility was assessed subjectively by the evaluating therapist as compared to the uninvolved, right side. All flexibility tests were performed according to Hoppenfeld.[55] Please refer to Table 3.

Gait analysis: Gait was assessed subjectively by the evaluating therapist. An antalgic gait pattern was noted with external rotation of entire left lower extremity, absence of midfoot pronation in midstance, absence of push off, as well as decreased stance time on the left. The patient also demonstrated severe left knee hyperextension in stance and push-off phases of gait.

Palpation: Palpation revealed tenderness of the 7.5 cm metatarsal incision, fusion site, and DIP joint of the left great toe. All other structures of the left foot/ankle were unremarkable.

Functional ability: The patient completed a Medical History Form (Appendix A), and the patient's job requirements were recorded on the Critical Demands of Your Job

(Appendix B) form, also standard to the treating facility. The latter form was used to indicate the level of function that the patient needed to achieve in order to return to his previous job at a full-time, full-duty level. In addition, the patient was unable to squat, carry household items, perform light to heavy housework, yard work, or other home maintenance duties. The patient was only able to ambulate 11-20 minutes before becoming painful, and was only able to ascend and descend stairs in a sideways manner.

IMPRESSION AND PLAN

Based on the initial examination data, the primary treating therapist determined that this patient was demonstrating the musculoskeletal pattern of impaired joint mobility, motor function, muscle performance, and range of motion associated with bony or soft tissue surgery as outlined by the Guide to Physical Therapist Practice(Musculoskeletal Pattern I).[59] Physical therapy was recommended at a frequency of 3x/week to include active range of motion, passive range of motion, soft tissue and joint mobilization, progressive resistive exercises of open and closed chain variation, stretching, proprioceptive exercises, gait training, cardiovascular conditioning, and modalities as necessary. Patient education and revision of home exercise program (HEP) was an ongoing component as well.

INTERVENTION

Initial treatment for this patient emphasized patient education on his surgical procedure and the involved anatomy. The primary treating therapist explained to the patient that his gait pattern and difficulty weight bearing on the left foot was due to weakness of the ankle and foot musculature, decreased ROM due to the arthrodesis itself, and shortening of musculature as a result of the 8 week immobilization period. Strengthening of the ankle was performed with 4-way Theraband exercises(dorsiflexion, plantarflexion, inversion and

eversion); 20 repetitions each. The patient was also provided with a written home exercise program including written and picture description (Appendix C). Strengthening, stretching, balance and proprioception exercises were progressed gradually to the patient's tolerance in the clinic. The patient's sessions generally lasted between 45-60 minutes beginning with a 10 minute stationery bike ride to counteract the effects of deconditioning, followed by lower extremity stretching to lengthen the hamstrings, gastrocsoleus complex, and toe extensors , various open and closed chain progressive resistive exercises (PRE's) were also included. Strengthening exercises of the foot and ankle were prescribed as described by Schuch et al[44] and Brantingham and Wood[51] and progressed incrementally provided that the patient demonstrated proper form, there was no difficulty at the previous level, and had no significant increase in pain with advancement of exercise level. Each stretching exercise was held for 30 seconds and performed 3-5 times each. It is well documented in the literature that 30-60 second duration for stretching daily is effective for increasing muscle flexibility.[60,61]

Step exercises were initiated in the parallel bars and progressed from bilateral upper extremity (UE) assist, to single UE assist, to fingertip support, and finally no UE support. Gait training walking forward, backward, sideways and grapevine variations on stable ground and on the treadmill were performed with verbal cueing to assist the patient in achieving heel strike, to minimize the aforementioned gait deviations, and also to promote proprioceptive awareness in dynamic situations. Lastly, anterior-posterior and rotational glides were performed according to Kaltenborn [62] on the metatarsals, tarsals, cuneiforms, and mortise joint in an effort to provide as much normal joint biomechanics of the foot and ankle as possible to compensate for the loss of motion due to the first MTPJ arthrodesis. Please refer to Table 4 for more specifics of his program.

The patient was seen for a total of 24 visits over the course of 3 months. However, the patient was seen 2-3x/week for the first 12 visits, followed by a month off, but continued to do his HEP daily. He then returned for an additional 12 visits. On the patient's 12th visit he informed the physical therapy staff that the orthopedic surgeon had discharged him from his care. On this particular day, the patient was being treated by a per diem therapist who did not feel as though the patient was ready for discharge because he was still unable to return to work, continued to demonstrate noticeable gait deviations, and was still having substantial pain and difficulty with many aspects of his daily functional activities that was not acceptable to him. He did, however, demonstrate minimal gains with regard to overall pain relief, passive DF of the left ankle, and left hamstring flexibility. The per diem therapist contacted a well-known orthotics and prosthetics practice in the area and spoke to an experienced orthotist about the possibility of an orthotic for this patient. Based on the description of the patient and his remaining limitations, the orthotist felt that a semi-rigid orthotic would be helpful for this patient and was willing to see him for a consult. The per diem therapist then called the worker's compensation adjustor to discuss the patient's current deficits and in addition, suggested that this patient be evaluated for an orthotic. The worker's compensation adjustor advised the physical therapist to write a letter to the orthopedic physician detailing the reasons for requesting additional physical therapy visits and an orthotic consult. The letter was drafted and sent the following day.

A month passed between when the letter was sent and receipt of a response from the physician, which explains the 30 day lapse in treatment. During this time, the worker's compensation adjustor was contacted weekly by the physical therapy facility for follow-up on the status of the physician response to the letter. Four weeks after the patient's 12th

physical therapy visit, the adjustor was called again and at this time she informed the treating facility that the patient had been evaluated for an orthotic, but had been sent to an orthotist who was recommended by the orthopedic surgeon. The physician had also approved an additional 12 visits of physical therapy. On day 4 of the second round of PT visits(day 16 in total), the patient reported having received his orthotic and reported that it was already assisting in relieving pressure off the first metatarsal head, and he had an overall decrease in pain in the left great toe. The patient went on to complete his remaining 8 physical therapy visits. Please refer to Table 5 for a summary of periodic re-examinations during the course of this patient's rehabilitation.

OUTCOMES AND DISCUSSION

At the completion of treatment, the patient demonstrated marked changes in pain relief. Pain was rated at 7/10 on initial examination at worst on the NPRS scale, and was a 3/10 at worst at discharge. There was also noticeable improvement in ankle DF PROM, hamstring flexibility, gait pattern, and most noteworthy in his functional level. He was able to return to work full time/light duty and was able to perform all ADL activities independently, although he did require more time than at his pre-surgical level. He was also able to return to running from .25 to .5 miles 2-3x per week. This patient was extremely compliant with his physical therapy program; with perfect attendance to all appointments and daily compliance to his prescribed HEP as well.

The treating therapists believe the combination of gastrocnemius and soleus stretches and Grade II-III joint mobilizations were primarily responsible for the increase in passive ankle DF from 2 degrees to 9 degrees throughout the course of treatment. These exercises were implemented on the first day and were performed on each visit thereafter. The patient

also reported that he stretched frequently at home and at work when he had breaks. Along with the expected normal healing process, we feel we can partially attribute the patient's increased tolerance to weight bearing and participation in ADL activities to the various open and closed chain strengthening and balance exercises. However, the fact that strength measurements of the left ankle were not re-assessed after the initial visit does not allow us to be certain. It is probable that these values were not re-assessed regularly due to the patient being treated by multiple therapists after being evaluated initially by the primary therapist. An assumption may have been made that the primary therapist would be re-measuring at regular intervals, therefore no other therapist took the responsibility to do so. Grade I-III joint mobilizations were initiated by the per diem therapist on day 5 and day 22 and were intended to be carried forward indefinitely to promote pain relief, increase in ROM, and a more normalized biomechanical pattern of the foot and ankle. There is no explanation in the written documentation as to why they were not continued, and begs the question of what their effect may have been on this patient's pain level, ability for weight bearing activities and length of stay. This patient was treated by multiple therapists which likely affected the continuity of the plan of care.

Lastly, the patient received his orthotic on day 16 of treatment. Unfortunately, the type of materials, custom posting and relief requirements were also not documented in the physical therapy chart. We do know that the orthotic was a semi-rigid insert which serves to cushion and protect the joint as well as provides support, control, and weight redistribution. Additionally, it is likely that this patient's orthotic had a supportive arch as this is a standard type of posting for the purpose of decreasing pronation, to ultimately reduce pressure on the MTPJ.[52] The treating therapists also observed a noteworthy decrease in left knee

hyperextension throughout the gait cycle due to the orthotic. In a normal gait cycle, lower limb stability is established by the coupling of ankle plantarflexion and knee extension during midstance. During the stance phase of gait, the soleus muscle restrains forward rotation of the tibia over the foot and helps to extend the knee joint without quadriceps contraction. In abnormal gait, this coupling may be disturbed.[61] We feel that the orthotic not only assisted in normalization of this coupling mechanism, but also assisted in the overall relief in pain that this patient experienced and attribute this to the reduction of overload on the first ray and dispersement of biomechanical forces that the orthotic appeared to provide. This may have also allowed for increased tolerance to weight bearing activities throughout the day.

In conclusion, this patient made noteworthy gains in ankle ROM, hamstring flexibility, pain relief, and functional activity throughout the 24 day course of his multi-modal physical therapy treatment program. The patient's dedication and investment in his own well-being were paramount, and were a large factor in the successful outcome of his rehabilitation. In addition, without the persistence, follow-up, and patient advocacy demonstrated by the per diem therapist and treating facility, this patient may have never received an orthotic device which appeared to be an important contributor to this patient's overall outcome and return to function.

The absence of some clinical measurements and detailed information about the orthotic device in the physical therapy chart were detriments in the ability to wholly support the apparent gains made by this patient. However, the need for more research in this area is evident. Future improvements in the treatment of first MTPJ arthrodesis may be made by looking at the effects of the following a) a more specific and controlled physical therapy

regimen after MTPJ arthrodesis, b) an orthotic for the purpose of decreasing first ray and MTPJ pain in patients who are still considering surgical correction, and c) to assess the efficacy of orthotic use alone after surgical procedure.

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Table 1. Passive Range of Motion (PROM) Measurements of Left Ankle and Great Toe on Initial Examination.

Ankle:	Left	Right
Plantarflexion	60°	60°
Dorsiflexion	2°	10°
Inversion	35°	40°
Eversion	25°	25°
Great toe:		
Proximal interphalangeal joint:		
Flexion	10°	20°
Extension	10° elevated from neutral	40°

* PROM measurements were performed according to Hoppenfeld[55]

Table 2. Manual Muscle Test (MMT) Measurements of Left Ankle and Great Toe on Initial Examination.

Ankle:	Left	Right
Plantarflexion	-4/5	5/5
Dorsiflexion	-4/5	5/5
Inversion	+3/5	5/5
Eversion	-4/5	5/5
Great toe:		
Metatarsophalangeal joint:		
Flexion	4/5	5/5
Extension	4/5	5/5

* MMT measurements were performed according to Kendall[56]

Table 3. Muscle Length Testing of Left Lower Extremity on Initial Examination.

	Left	Right
Hamstrings	moderate restriction	normal
Gastroc	moderate restriction	normal
Soleus	moderate restriction	normal

* All measurements were taken in supine. Gastroc measurement taken with knee extended, and soleus measurement taken with knee flexed approximately 30 degrees.

Table 4. Physical Therapy Treatments Occurring Over a 3 Month Period.

• Patient education: daily • Home exercise program • Stationery bicycle: 10 min. • Gastroc-soleus stretching: with toes elevated and supported on a wooden step approx. 3 inches high. 30 sec. Hold x 3 reps with knee extended, 30 sec. Hold x 3 reps with knee flexed • Hamstring stretching: supine with strap on foot pulling into straight leg raise position, 30 sec. Hold x 3 reps • Ankle Theraband exercises: plantarflexion, dorsiflexion, inversion, eversion with leg supported on treatment table, 30 reps each; resistance increased as tolerated • Cybex leg press machine: involved side and bilaterally, only 30 reps each; weight increased as tolerated • Cybex hamstring curl machine:prone; involved side and bilaterally, 30 reps each; weight increased as tolerated • Cybex 4-way hip	• Front and lateral step-ups on 6" step: 30 reps each • Forward lunges: in place beginning with one arm support on treatment table progressing to no upper extremity support, and to walking lunges 30x each • Balance board squats: 30 x ea with board turned to challenge anterior/posterior proprioception, then board turned to challenge medial/lateral proprioception • BAPS board: clockwise and counterclockwise 30 x each with size of hemisphere increasing as tolerated • Standing diamond arch exercise: patient standing with feet together keeping inner aspects of great toes and heels together and lifting arches up off floor, hold 3sec 30 reps • Gait training activities: walking forward, backward, lateral, and grapevine at varying speeds with verbal cueing to help patient minimize deviations, 30 ft. each • Treadmill walking: forward, backward, lateral, varying speeds 8 min. • Stairstepper: bilateral upper extremity support, forward and backward 3 min. each; adjusting flywheel tension as tolerated

machine: standing hip flexion, extension, abduction, and adduction 30x each; weight increased as tolerated • Cybex leg extension machine: seated with knees approximately 90 degrees flexion start position, involved side and bilaterally 30 reps each; weight increased as tolerated • Single limb balance: on floor and foam square, hold for 10sec. 10x each	• Joint mobilizations of the forefoot and great toe(performed on day 5 by per diem therapist): dorsal, volar and rotational glides of the distal interphalangeal joint of the great toe, dorsal glides of the cuneiforms and tarsals, Grade I-II • Joint mobilization of the talocrural joint (performed on day 22 by the per diem therapist): dorsal and volar glides, Grade II-III • Cryotherapy as needed by patient assessment

Table 5. Summary of Reassessment Values Taken Periodically Through Rehabilitation Over 3 Month Total Time Frame			
Initial Examination	12th visit	Return after 1 month off	24th visit
Subjective: Pain scale: 5/10 best, 7/10 worst	**Subjective;** Pain scale: 6/10 worst	**Subjective:** Patient had been evaluated for orthotic and back to work part-time 4 hrs./day doing security. Pain improving with time on feet.	**Subjective:** Patient wearing orthotic full time. Now working full time/light duty, and running short distances; approximately ¼ to ½ mile. Pain scale: 3/10 worst.
Passive range of motion(PROM): in degrees Great toe proximal interphalangeal (PIP) joint flexion=10 Great toe PIP extension=10 elevated from neutral Ankle dorsiflexion (DF)=2 Ankle plantarflexion (PF) =60 Ankle eversion (EV) =25 Ankle inversion (INV)=35	**PROM:** Great toe extension=10 Ankle DF=5 Ankle PF=60 Ankle EV=25 Ankle INV=35	**PROM:** Ankle DF=5 Ankle PF=60 Ankle EV=25 Ankle INV=35	**PROM:** Ankle DF=9 Ankle PF=60 Ankle EV=25 Ankle INV=35
Manual muscle testing(MMT): per Kendall Toe extension metatarsophalangeal (MTP) joints 2-5=4/5 Toe flexion MTP's 2-5=4/5 Ankle DF=4-/5 Ankle PF=4-/5 Ankle EV=4-/5 Ankle INV=3/5	**MMT:** not tested	**MMT:** not tested	**MMT:** not tested
Flexibility: Hamstrings=moderate restriction Gastrocnemius=moderate restriction Soleus=moderate restriction	**Flexibility:** Hamstrings=mild restriction Gastrocnemius=moderate restriction Soleus=moderate restriction	**Flexibility:** Hamstrings=mild restriction Gastrocnemius=moderate restriction Soleus=moderate restriction	**Flexibility:** Hamstrings=mild restriction Gastrocnemius=moderate restriction Soleus=moderate restriction
Palpation: Tenderness of 3" metatarsal incision, fusion site, and distal interphalangeal (DIP) joint	**Palpation:** C/o pain at 1st metatarsal head at stance & push-off phases of gait	**Palpation:** not performed	**Palpation:** not performed
Functional ability: Squat-unable Carry household items-unable Light/heavy housework-unable Yard work-unable Home maintenance -unable Ambulate-11-20 minutes then painful Ascend/descend stairs-sideways	**Functional ability:** Squat-unable Carry household items-unable Light/heavy housework-unable Yard work-unable Home maintenance -unable Ambulate-11-20 minutes then PF Ascend/descend stairs-sideways	**Functional ability:** Squat-1/3 then painful Carrying household items-independent requiring > time Light housework-independent without difficulty Heavy housework-unable Yard work-unable Home maintenance-unable Ambulate-31-40 minutes then needs a rest Ascend/descend stairs-sideways	**Functional ability:** Squat-independent requiring > time Carrying household items-independent up to 25# Light housework-independent without difficulty Heavy housework, yard work and home maintenance-independent requiring > time Ambulate-without deviation requiring> time Ascend/descend stairs-normal pattern requiring > time

APPENDIX A

PAST MEDICAL HISTORY FORM

Patient Name: _____ Date: _____

Are you presently working? ☐ Yes ☐ No

Date of next physician's visit: / /

Date of injury / onset: / / _____

Have you ever had these symptoms before? ☐ Yes ☐ No

Check which apply to your symptoms:

☐ Work related injury ☐ Recurrence of previous injury

☐ Motor vehicle accident ☐ Injury related to lifting ☐ Injury related to falling

☐ Cause unknown ☐ Athletic / recreational injury ☐ Other: _____

Have you had a related surgery? ☐ Yes ☐ No

Do you have, or have you had any of the following?

	Yes	No		Yes	No
Diabetes	☐	☐	Allergies to Aspirin	☐	☐
Chest Pain / Angina	☐	☐	Allergies to Heat	☐	☐
High Blood Pressure	☐	☐	Allergies / Poor tolerance to Cold	☐	☐
Heart Disease	☐	☐	Other Allergies	☐	☐
Heart Attack	☐	☐	Hernia	☐	☐
Heart Palpitations	☐	☐	Seizures	☐	☐
Pacemaker	☐	☐	Metal Implants	☐	☐
Headaches	☐	☐	Dizziness / Fainting	☐	☐
Kidney Problems	☐	☐	Recent Fractures	☐	☐
Are you pregnant?	☐	☐	Surgeries	☐	☐
Cancer	☐	☐	Skin Abnormalities	☐	☐
Osteoporosis	☐	☐	Sexual Dysfunction	☐	☐
Bowel / Bladder Abnormalities	☐	☐	Nausea / Vomiting	☐	☐
Urine Leakage	☐	☐	Ringing in your ears	☐	☐
Asthma / Breathing Difficulties	☐	☐	Rheumatoid Arthritis	☐	☐
Liver / Gallbladder Problems	☐	☐	Special Diet Guidelines	☐	☐
Smoking	☐	☐	Hypoglycemia	☐	☐
Stroke/CVA	☐	☐	Other:_____		

If yes on any of the above, please briefly explain and give approximated date:

Is there any other information regarding your past medical history that we should know about?

Are you presently taking Medication? ☐ Yes ☐ No
If yes, please list what medications and for what condition:

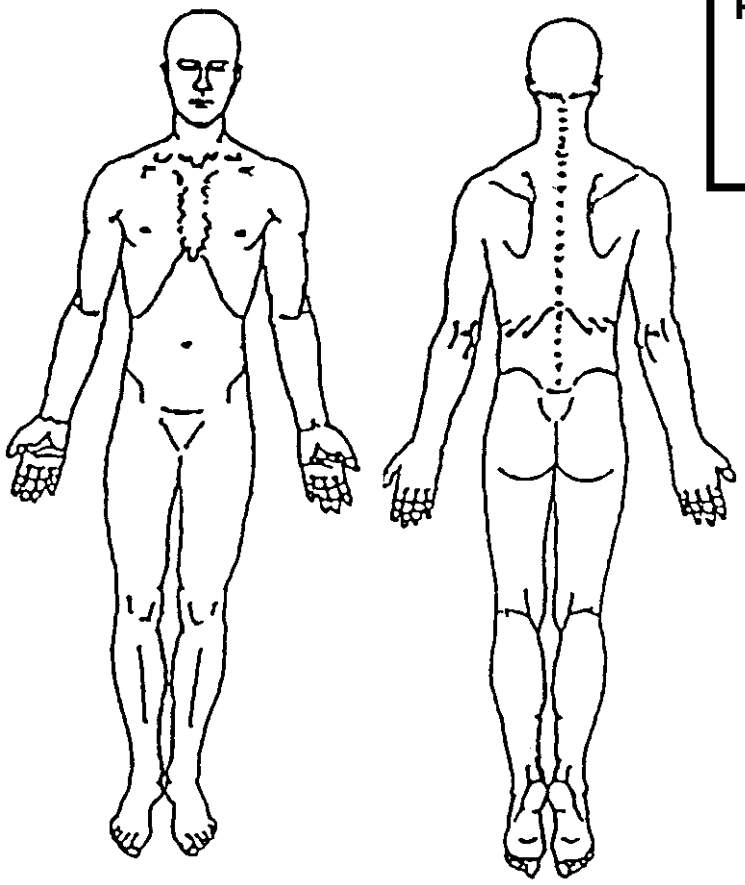
Do you participate in any sports, exercise programs, or activities on a regular basis?

☐ Yes ☐ No

KEY:

Numbness	**========**
Pins & Needles	**ooooooo**
Burning Pain	**xxxxxxxx**
Stabbing Pain	**/ / / / / / / /**

Please indicate below where your symptoms are located.



If you are having pain, please rate the intensity of your pain on a scale of 0 to 10, with 0 being no pain and 10 being the worst pain possible: _____.

Print Patient Name Phone Number

_____

Patient Signature Date

Therapist Signature Date

APPENDIX B

CRITICAL DEMANDS OF YOUR JOB

Name: _____ Account Number: _____

Job Title: _____ Employer: _____

How long had you been working in your position at the time of injury? _____

Years _____
Months _____
Days _____

Please complete the following questions to the best of your ability.

1) What types of tools, material and equipment do you handle? _____

2) What product do you make, repair, operate, etc.? _____

3) Answer the following as related to your job at the time of injury:

What is the heaviest item you ***lift?*** _____ How many times a day _____

The heaviest item you ***carry?*** _____ How many times a day _____

The heaviest item you ***push/pull?*** _____ How many times a day _____

What is the most *common* item you ***lift?*** _____ How many times a day _____

The most *common* item you ***carry?*** _____ How many times a day _____

The most *common* item you ***push/pull?*** _____ How many times a day _____

4) How often did you _____? Circle the number of hours (you may circle a small range)

Stand (do not include walking)	1	2	3	4	5	6	7 8
Sit (include driving)	1	2	3	4	5	6	7 8
Walk (at any pace)	1	2	3	4	5	6	7 8

Bend (at the waist)	1	2	3	4	5	6	7 8
Squat (knees bent)	1	2	3	4	5	6	7 8
Kneel (1 or 2 knees on the floor)	1	2	3	4	5	6	7 8
Balance (high places without rails)	1	2	3	4	5	6	7 8
Climb (ladders or stairs)	1	2	3	4	5	6	7 8
Reach (arms straight, front or up)	1	2	3	4	5	6	7 8
Grasp (tight hold)	1	2	3	4	5	6	7 8

PLEASE FAX TO **ATTENTION: ROB OYER** FAX NUMBER 813.681.1303

_____ SEDENTARY _____ D.O.T. JOB TITLE NUMBER

_____ LIGHT _____ D.O.T. JOB TITLE

_____ MEDIUM COMMENTS: _____ _____

_____ _____

_____ HEAVY _____ _____

_____ VERY HEAVY

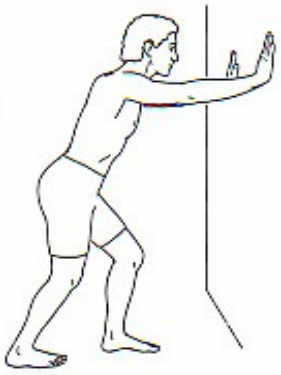
DATE _____ _____

APPENDIX C

Feb 17, 2010

ANKLE / FOOT - 13 Soleus Stretch

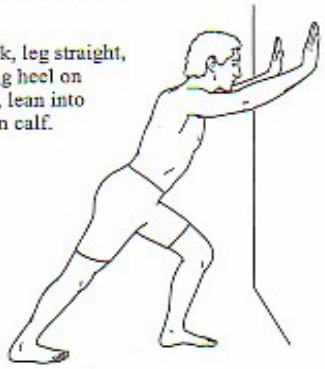
Stand with left foot back, both knees bent. Keeping heel on floor, turned slightly out, lean into wall until stretch is felt in lower calf.
Hold 30 seconds.



Repeat 3 times per set.
Do 1 sets per session.
Do 2 sessions per day.

ANKLE / FOOT - 14 Gastroc Stretch

Stand with left foot back, leg straight, forward leg bent. Keeping heel on floor, turned slightly out, lean into wall until stretch is felt in calf.
Hold 30 seconds.



Repeat 3 times per set.
Do 1 sets per session.
Do 2 sessions per day.

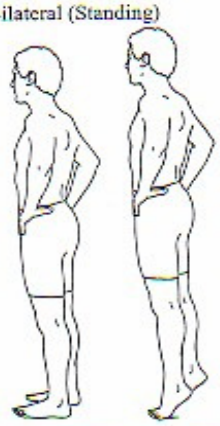
HIP / KNEE - 17 Strengthening: Straight Leg Raise (Phase 1)

Tighten muscles on front of left thigh, then lift leg 36 inches from surface, keeping knee locked.

Repeat 3 times per set. Do 1 sets per session.
Do 2 sessions per day.

ANKLE / FOOT - 20 Heel Raise: Bilateral (Standing)

Rise on balls of feet.



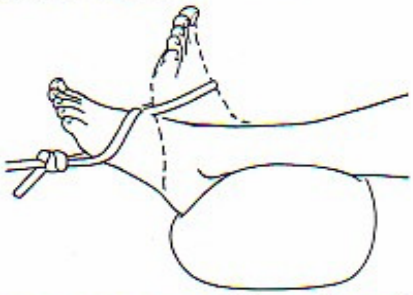
Repeat 30 times per set.
Do 1 sets per session.
Do 2 sessions per day.

ANKLE / FOOT - 22 Toe Raise (Standing)

Rock back on heels.

Repeat 30 times per set.
Do 1 sets per session.
Do 2 sessions per day.

ANKLE / FOOT - 5 Dorsiflexion: Resisted



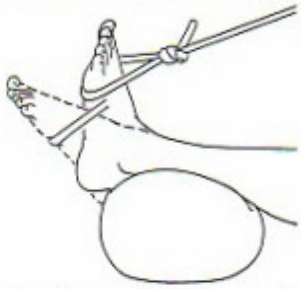
Facing anchor, tubing around left foot, pull toward face.

Repeat 30 times per set. Do 1 sets per session.
Do 2 sessions per day.

APPENDIX C (continued)

Feb 17, 2010

ANKLE / FOOT - 6 Plantar Flexion: Resisted



Anchor behind, tubing around left foot, press down.

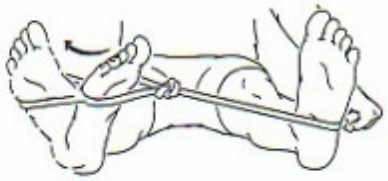
Repeat 30 times per set. Do _____ sets per session.
Do 2 sessions per day.

ANKLE / FOOT - 7 Inversion: Resisted

Cross legs with left leg underneath, foot in tubing loop. Hold tubing around other foot to resist and turn foot in.

Repeat 30 times per set. Do 1 sets per session.
Do 2 sessions per day.

ANKLE / FOOT - 8 Eversion: Resisted



With left foot in tubing loop, hold tubing around other foot to resist and turn foot out.

Repeat 30 times per set. Do 1 sets per session.
Do 2 sessions per day.

ANKLE / FOOT - 15 Balance: Unilateral

Attempt to balance on left leg, eyes open. Hold 15 seconds.

Repeat 15 times per set.
Do 1 sets per session.
Do 2 sessions per day.

X Perform exercise with eyes closed.

HIP / KNEE - 17 Strengthening: Straight Leg Raise (Phase 1)

Tighten muscles on front of left thigh, then lift leg 36 inches from surface, keeping knee locked.

Repeat 30 times per set. Do 1 sets per session.
Do 2 sessions per day.

HIP / KNEE - 21 Strengthening: Hip Abduction (Side-Lying)

Tighten muscles on front of left thigh, then lift leg 36 inches from surface, keeping knee locked.

Repeat 30 times per set. Do 1 sets per session.
Do 2 sessions per day.

APPENDIX C (continued)

G31
PATIENT EDUCATION
SCAR MASSAGE

After your surgery, it is important to massage the scar on a daily basis.

The massage loosens tight skin to eliminate adhesions on the scar incision site. It also increases skin and soft tissue mobility.

Scar massage should be done at least twice a day after the incision/wound is completely healed/closed.

Consult your physician before starting scar massage to determine which type of cream or lotion to use, IF ANY.

Make sure your hands are clean. Avoid using too much lotion or cream in wound crevices.

DIRECTIONS FOR SCAR MASSAGE

With the index and middle fingers, gently apply light pressure to the top of the scar and make small up and down movements heading toward the bottom.

Then take the two fingers and move them side to side working your way up and down the scar.

Finally, apply gentle pressure in small circular motions across the scar.