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Use Of The Lower Extremity Functional Scale (LEFS) In A Patient After A First Metatarsophalangeal Joint Implant: A Case Report

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The patient signed an informed consent allowing the use of medical information and video footage for this report and received information on the institution's policies regarding the Health Insurance Portability and Accountability Act.

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Abstract

Background and Purpose. The LEFS was initially designed as a functional outcome measure for patients with lower-extremity orthopedic conditions.[1] While the LEFS has been used for a broad spectrum of lower-extremity pathologies, there is a paucity of research that investigates the use of LEFS in patients who have had a first MTP joint implant. The purpose of this case report was to investigate the use of LEFS in a patient with a right first MTP HemiCAP(®) joint implant.

Case Description. The patient was a 56 year-old male with bilateral pes planus. Conservative treatment for 9 years did not decrease symptoms associated with hallux rigidus, and the patient underwent surgery for a 1st MTP HemiCAP® arthrosurface implant.[2] A physical therapy (PT) evaluation revealed impairments of right great toe range of motion, strength and balance. PT intervention included balance exercises, toe and ankle stretching and strengthening, gait training, and joint mobilizations of the first MTP with outcomes measured by the LEFS.

Outcomes. The patient's LEFS score was 60/80 at initial evaluation and 73/100 at discharge, showing a clinically important difference.[1] He made significant gains in strength, range of motion and gait. His right single limb stance (SLS) balance improved from non-weight bearing to full weight bearing SLS for 45 seconds. He was able to return to his normal activities including golf.

Discussion. This case report suggested that the use of the LEFS outcome measure was beneficial when assessing a patient who had a 1st MTP HemiCAP® arthrosurface implant. Future research should investigate the use of the LEFS in larger populations of patients with foot and ankle pathologies.

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Background and Purpose

Arthritis is most frequently cited chronic disease in the United States[3,4] and hallux rigidus is the most common form of arthritis in the foot.[5] The gradual onset of pain and limitation of dorsiflexion at the MTP joint is characteristic of the degenerative arthritis of the first MTP, otherwise known as hallux rigidus, disease process.[5] Most often, patients with hallux rigidus have substantial articular erosion on the phalangeal side of the joint.[5] The debilitating nature of arthritis makes function difficult, and a variety of treatment option are available to help alleviate pain.

While hallux rigidus is generally treated with conservative measures such as shoe selection, orthotics and medication, surgical implants have been used with varying degrees of success.[5] First metatarsolphalangeal (MTP) total joint implants are uncommon; however, hemi implants have increased in popularity.[6] The HemiCAP(®) (Franklin, MA) implant resurfaces the metatarsal head while leaving the distal phalanx intact.[6] While early results of the HemiCAP(®) implant surgery have been promising, physical therapy outcome measures such as the LEFS have not been extensively studied in this population.[2] First MTP joint replacements have a tendency to fail over time due to the significant amount of force through the 1st MTP with each step.[7] HemiCAP DF(®), however, incorporates an anatomic, extended dorsal curve on the first metatarsal to improve dorsal roll-off while preventing osteophyte regrowth.[8] In a study of 27 great toes in 25 patients, Aslan et al (2012) found that the HemiCAP(®) resurfacing implant was successful in improving range of motion (ROM), function, and pain scores 37 weeks after surgery.[2]

Objective outcome measures such as the Lower Extremity Function Scale (LEFS) help clinicians assess PT interventions. The LEFS is a sensitive and reliable outcome measure that

has commonly been used in patients with lower extremity orthopedic conditions.[1] The 20 items on the LEFS were generated by a process of reviewing existing outcome measures as well as surveying clinicians and patients.[1] The LEFS is easy to administer and score and is applicable to a wide range of disability levels and conditions including the first MTP joint.[1]

While the LEFS has been used for a broad spectrum of lower-extremity pathologies, there is a paucity of research that investigates the use of LEFS in patients who have had a first MTP joint implant. Therefore, The purpose of this case report was to investigate the use of LEFS in a patient with first MTP HemiCAP(®) joint implant.

Case Description

The patient was a 56-year-old male sales consultant with a history of hallux rigidus in his right first MTP joint. He had a right first MTP joint arthrosurface implant on the proximal phalangeal side 9 weeks prior to his initial evaluation at an outpatient clinic. Upon being referred to PT by his surgeon to maximize surgical outcomes, the patient had decreased strength, AROM, gait discrepancies, increased pain, decreased function. Treatment for his hallux rigidus prior to surgery included bilateral foot orthotics and ant-inflammatory pain medications. The patient reported living in a house with one flight of stairs and participating in a full round of golf once a week prior to surgery. Ultimately, his impairments limited his ability to do his job and participate in his social activities.

Aside from his arthritis, the patient was in good health and was not taking any medications. He was independent with all activities of daily living (ADL) and instrumental activities of daily living (IADL), worked full time, but had limited participation in his normal social activities. The patient's primary goal for physical therapy was to walk, return to golf, and

make it through his normal activities including working and housework without any pain in his right foot.

At the patient's first outpatient physical therapy visit, he signed an informed consent allowing the use of medical information and video footage for this report and received information on the institution's policies regarding the Health Insurance Portability and Accountability Act. The patient's chief complaint was pain and stiffness in the right great toe and first MTP joint which he stated was causing him to limp. The patient reported that the pain was the worst the first fifteen minutes after getting up in the morning. He had moderate pain with walking on uneven surfaces, ascending, and descending stairs and mild pain with walking on even surfaces. During his first visit, the patient scored 60/80 on the LEFS, indicating he had trouble hopping, running, walking a mile, and participating in his usual hobbies, recreational or sporting activities. Despite his pain and limited function, the patient stated that his surgeon was pleased with his progress before beginning therapy.

A review of systems demonstrated normal findings for dermatomes in the lower extremities. Active movements of the left lower extremity and trunk were all within normal limits. The patient's height, weight, and body mass index were within normal limits as well. He appeared to be in good health and was knowledgeable about his foot condition.

Clinical Impression 1

The patient's medical diagnosis was provided on the script from his surgeon. However, differential diagnosis for the pain in the patient's right 1st MTP included gout, osteoarthritis, or degenerative arthritis. The focus of the examination was to further identify and measure his body function and structure impairments and activity limitations.

Following the subjective history and systems review, the patient's primary problem was difficulty walking. He was experiencing pain and discomfort with standing and walking, and he adopted gait abnormalities following surgery. Limited range of motion and strength contributed to his gait discrepancies. The patient's motivation to return to his prior level of function following his uncommon surgical procedure made him a good candidate for case report.

Examination

During the initial evaluation, several of the Tests and Measures categorized in the *Guide to Physical Therapist Practice* were performed.[9] Objective data collected from the initial examination are shown in Table 1.

In clinical practice, the universal goniometer is used to measure a patient's range of motion (ROM) in the foot and ankle.[10] Goniometry was used with this patient to help determine the treatment plan and to measure progress with ROM. Goniometry of the ankle and foot is moderately reliable when measurements are taken by different therapists, and a goniometer is generally accepted as a valid clinical tool.[10]

Manual muscle testing (MMT) is the most widely accepting method for evaluating a patient's strength.[11] Since the patient's strength may have been altered due to surgery or recently developed gait deviations, the strength of both ankles and first rays was tested. MMT has an excellent inter-rater reliability in trained examiners and has good internal and external validity.[11]

Translatoric traction and gliding joint play movements were used to evaluate the patient's joint function. Accessory movement in a joint is essential to the easy and painless performance of active movements in a joint.[12] Joint mobility can be measured reliably.[12]

Observational gait analysis helps to determine gait disorders and evaluate treatment.[13] Since treatment of gait was one of the reasons for the patient's PT referral, it was appropriate to

perform visual observational gait analysis. Visual observational gait analysis has moderate reliability between raters.[13]

In the last decade, there has been no universally accepted method for quantifying variation in foot posture in a clinical setting.[14] The patient's standing foot position was observed to help determine any possible factors contributing to his gait deviations. No data regarding reliability or validity was available.

The LEFS was chosen as an outcome measure because it applies to a wide range of lower-extremity musculoskeletal dysfunction.[1] Since the patient's goals were functional, using the LEFS to measure his functional status was most appropriate. The LEFS is reliable, and construct validity was supported by comparison with the 36-item Short Form Survey (SF-36).[1] Also, the sensitivity to change of the LEFS was superior to that of the SF-36.[1]

Clinical Impression 2

The patient's dominant symptom resulting from his right first MTP joint arthrosurface implant surgery was constant pain affecting his gait and functional mobility. Impairments of strength and range of motion of the great toe contributed to his difficulty walking. His PT diagnosis was consistent with *The Guide'*s preferred practice pattern 4H: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Joint Arthroplasty.[9] Because the patient was only being seen for physical therapy, there was no need for further referral or consultation. Additional testing to re-evaluate tests and measures was planned to take place every 8th visit and at discharge. Planned interventions focused on ROM, strength, balance, gait training, and pain relief modalities. Goals for the patient included walking without pain consistently, improving right great toe strengths to 5/5, improving right MTP active ROM to 10° flexion and 35° extension, and performing all ADL's without pain.

Interventions

The patient received 8 treatment sessions post-surgery. He was scheduled for two 45-60 minute treatment sessions per week. The patient continued therapy for 4 weeks, which was his anticipated length of care at the initial evaluation. He did not miss any treatment sessions.

Each treatment session was documented using an electronic medical system, and any changes in the plan of care were noted and explained at time of change. Communication with the patient's referring surgeon was accomplished by faxing copies of initial evaluation and discharge summary. There was no need to communicate with any other professionals, as the patient was only being seen by physical therapy.

At initial evaluation, the patient was educated on his current condition**.** He was educated on the impairments noted during the initial evaluation, and what his plan of care would include was explained. The importance of continued use of his orthotics with proper footwear to decrease pain and stress on the foot was emphasized, and the patient was instructed to use ice for pain following activity as needed.

Following initial evaluation, the patient was instructed in light therapeutic exercise for his home exercise program (HEP), such as gastrocnemius, soleus, and plantar stretches as well as heel and toe raises. Throughout the patient's episode of care, many other interventions were provided. Included was neuromuscular reeducation, range of motion exercises, soft tissue stretching, and strength and endurance exercises. Also, motor function training in the form of dynamic gait training was provided in addition to manual therapy techniques including massage, mobilization/manipulation, and passive range of motion. At the end of each treatment, a cold pack was used to help decrease inflammation and pain.[15] Consistently throughout treatments,

patient instruction regarding the patient's current condition, plan of care, and HEP was provided. A summary of interventions is provided in Table 2.

The patient warmed up for five minutes on a recumbent bike at the start of each treatment. According to Nakano et al., heating the tissue in this way provides an added benefit on stretch related gains of range of motion.[16] Gastrocnemius, soleus, and plantar stretches stayed consistent throughout the episode of care to help decrease tightness due to the patient's significant toe-out gait pattern. The kneeling hip flexor stretch was introduced after tightness in hip flexors was observed during gait training. The plantar stretch was indicated because of several muscles crossing the first MTP joint including the flexor hallucis longus and brevis, adductor hallucis, and abductor hallucis.

The application of a cold pack, soft tissue mobilization, marble pick up with right toes, and Wobbleboard exercises also stayed consistent. The exercise of marble pick up with toes was used to strengthen great toe flexor muscles and help to increase first ray active range of motion. The Wobbleboard and right single leg stance were used to help improve proprioceptive balance and to strengthen ankle muscles through muscle coactivation.[17] First MTP joint manipulation was discontinued after the 6th visit because the patient achieved his goal of active range of motion that was equal to the left side. As the patient's single leg balance improved, single leg stance practice progressed from the floor to an Airex pad to an Airex pad with ball toss.

Gait training started in the second week, and it continued through discharge. Gait training prioritized weight shift, equal step length and push off over level surfaces with the use of a mirror for visual feedback. Tandem walking was introduced once the patient was able to maintain balance within a narrow base of support. Tandem walking was used to improve proprioception and balance with a narrow base of support.

Dorsal and ventral glides of the first MTP joint were provided to stretch the joint capsule and increase the available range of motion of the joint.[12] Grade I mobilizations were provided for pain relief, and, according to Kaltenborn, takes place in the "slack zone" and ends before marked resistance.[12] Grade III mobilization was used because it is one of the most effective means of restoring joint play, per Kaltenborn.[12] Manual soft tissue mobilization was performed to help relax tight tendons and muscles crossing the joint, and a cold pack was applied after each treatment.

Outcomes

All tests and measures used at the initial evaluation were performed again at the patient's re-evaluation 8 weeks later. Results of tests and measures comparing the initial evaluation to the re-evaluation at discharge are shown in Table 1. The patient's LEFS score improved from 60/80 at initial evaluation to 73/100 at discharge, showing a clinically important difference.[1] The patient improved from 13 single leg heel raises before loss of height at the initial evaluation to 20 at discharge indicating a plantarflexor strength improvement of 4/5 to 5/5. While the patient was unable to tolerate single leg stance on the right at the initial evaluation due to discomfort, he was able to maintain 45 seconds at re-evaluation. He met 4 of his 6 goals for outpatient physical therapy and was able to return to his normal activities and recreational pursuits including golf.

Discussion

First MTP total joint implants are uncommon, but hemi implants have increased in popularity.[6] The HemiCAP prosthesis resurfaces only the metatarsal head and has shown promising surgical results. However, there is not a great deal of outcome data.

The LEFS is applicable to a wide range of disability levels and conditions, and it appears to be a good choice for documenting lower-extremity function.[1] The LEFS outcome measure

has been shown to be valid and reliable but has not been often used in assessing outcomes post MTP joint implants. Smith et al. found the LEFS outcome measure to be a reliable, valid, and responsive tool for the self-assessment of patients undergoing a total hip or totally knee arthroplasty.[20] Watson et al. found the LEFS to be reliable and moderately responsive to clinical change in patients with knee pain.[21] Results from these studies are similar to the results of this patient in that a clinically significant improvement was noted after 8 weeks.

This case report suggested that the use of the LEFS outcome measure was beneficial when assessing a patient who had a 1st MTP HemiCAP® arthrosurface implant. Future research should investigate the use of the LEFS in larger populations of patients with foot and ankle pathologies.

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Tables, Figures, and Appendices

Table 1: Data collected at Initial Evaluation and at Re-Assessment

Tests and Measures	Initial Evaluation Data	Re-assessment Data
Bilateral foot range of motion, goniometry:	R 1st MTP AROM: 5˚ flexion, 20° extension PROM: 10° flexion, 30° extension	R 1st MTP AROM: 10° flexion, 40° extension PROM: not tested (NT)
	L 1st MTP AROM: 10 flexion, 40 extension	NT
Bilateral ankle and foot strength:	Bilateral ankle dorsiflexion, inversion, and eversion strength: 5/5	Bilateral ankle dorsiflexion, inversion, and eversion strength: 5/5
	R ankle plantarflexion strength: 4/5. Patient able to complete 13 single leg heel raises before loss of height.	R ankle plantarflexion strength: 5/5. Patient able to complete 20 single leg heel raises without loss of height.
	L ankle plantarflexion: 5/5. Pt completed 20 single leg heel raises.	NT
	Flexor hallucis longus and brevis strengths: R: 4-/5 L: 5/5	Flexor hallucis longus and brevis strengths: R: 5/5 L: NT
	Extensor hallucis longus and brevis strength: R 4-/5 L 5/5	Extensor hallucis longus and brevis strength: R 4+/5 L: NT
Single leg stance	NT	R: 45 seconds L: NT

Bilateral foot joint mobility:	First ray mobility: R hypomobile L normal	Bilateral first ray mobility: Normal
	First MTP mobility: R hypomobile L normal.	Bilateral MTP mobility: Normal
	Bilateral first IP joints: normal	Bilateral first IP joints: normal
Observational gait assessment:	Antalgic Lacks proper heel strike and toe off on right Right lower extremity circumduction in swing phase Right medial heel whip.	Excessive posterior rotation of R pelvis in R terminal stance Decreased R toe off.
Foot posture:	Pes planus bilaterally	Pes planus bilaterally
Lower Extremity Functional Scale	60/80	73/80

Figure 1: Post-surgical X-ray

Figure 2: Medial View of Right Foot

Table 2: Interventions Performed Throughout Episode of Care

	Rx Day 1	Rx Day 2	Rx Day 3	Rx Day 4	Rx Day 5	Rx Day 6	Rx Day 7	Rx Day 8
Recumbent Bike	5 minutes	5 minutes	5 minutes	5 minutes	5 minutes	5 minutes	5 minutes	5 minutes
Heel raises	20 floor	30 floor	30 balance steps	30 balance steps	30 balance steps	20 single leg	25 single leg	30 single leg
Toe raises	20 floor	20 floor	30 balance steps	30 balance steps	30 balance steps	30 balance steps	30 balance steps	30 balance steps
Soleus Stretch	2 x 30 sec, bilaterally (B)	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B
Gastrocnemius stretch	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B
Kneeling Hip flexor stretch			2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B	2 x 30 sec, B
Plantar stretch	2 x 30 sec, right (R)	2 x 30 sec, R	2 x 30 sec, R	2 x 30 sec, R	2 x 30 sec, R	2 x 30 sec, R	2 x 30 sec, R	2 x 30 sec, R
Wobbleboard	2 min laterally (lat), 2 min anterior/posterior (A/P)	2 min lat, 2 min A/P	2 min lat, 2 min A/P	2 min lat, 2 min A/P	2 min lat, 2 min A/P	2 min lat, 2 min A/P	2 min lat, 2 min A/P	2 min lat, 2 min A/P
Right single leg Stance		3 x 30 sec, floor	3 x 30 sec, floor	3 x 30 sec, Airex	3 x 30 sec Airex	3 x 30 sec Airex	3 x 30 sec Airex with basketball toss	3 x 30 sec Airex with basketball toss
Marble pick up with R toes	4 min	4 min	4 min	4 min	4 min	4 min	4 min	4 min
Tandem walking				100 ft	100 ft	100 ft	100 ft	100 ft
Gait training		5 min	5 min	5 min	5 min	3 min	3 min	3 min
Backward walking		200 ft	200 ft	200 ft	200 ft	200 ft	200 ft	200 ft
First MTP joint mobilization	dorsal and plantar glides, grades I-II	dorsal and plantar glides, grades I-II	dorsal and plantar glides, grades I-II	dorsal and plantar glides, grades I-III	dorsal and plantar glides, grades II-III	dorsal and plantar glides, grades II-III		
Soft tissue mobilization	STM 1st ray, plantar and dorsal sides	STM 1st ray, plantar and dorsal sides	STM 1st ray, plantar and dorsal sides	STM 1st ray, plantar and dorsal sides	STM 1st ray, plantar and dorsal sides	STM 1st ray, plantar and dorsal sides	STM 1st ray, plantar and dorsal sides	STM 1st ray, plantar and dorsal sides
Cold pack	10 min, post Rx	10 min, post Rx	10 min, post Rx	10 min, post Rx	10 min, post Rx	10 min, post Rx	10 min, post Rx	10 min, post Rx

Appendix 1: Equipment used with the patient

1. An Airex Balance Pad (regular)
   Model Number AR-BB
   Manufacturer address: Industrie Nord 26
   CH-5643 Sins
   Switzerland
2. Two VersaSteps
   Item number: 80185
   Manufacturer address: Power Systems (PS), LLC
   5700 Casey Dr
   Knoxville, TN 37909
3. 20 in. Rocker Board with a maximum tilt angle of 16 degrees made by Perform Better
   SKU number: 6746
   Manufacturer address: 1600 Division Road
   West Warwick, RI 02893