Study: Foot Power™ Advanced Foot Rehabilitation System

Abstract

This study was born out of the necessity to improve outcomes in foot rehabilitation. Traditional methods of foot and ankle rehabilitation are often outdated, limited in scope, and rarely produce superior results in terms of strength restoration, pain reduction, and functional recovery. Many patients continue to experience weakness, chronic pain, or even nerve impairment despite prolonged conventional therapy.

As a clinician with a background (40 years) in kinesiology, I encountered these limitations repeatedly while treating patients with a wide spectrum of foot conditions which created gait abnormalities and recognized the need for a more effective solution. I began developing a progressive, biomechanically precise rehabilitative device. The design process began with addressing plantar flexion, the foundational movement of the foot, and later evolved to replicate inversion, eversion and dorsiflexion with correct biomechanics.

After 35 iterations and refinements over 10 years, the result was Foot Power™—a novel, highly efficient rehabilitation tool specifically engineered to restore foot strength, improve function thus reducing pain and accelerate recovery. This study investigates the clinical application of Foot Power™ across common foot diagnoses, measuring its impact on pain, strength, range of motion, and overall functional balance outcomes in diagnosis grouped populations.

Introduction

The human foot is a structurally complex system that serves as the foundation for all upright activity. Its integrity is crucial for balance, gait, and athletic performance. When impaired by injury or pathology, foot dysfunction often leads to prolonged weakness, persistent pain, compensatory movement patterns, and, in some cases, neurological compromise.

Current rehabilitation protocols often emphasize passive modalities, stretching, trying to pick up marbles, grip a towel, or generic resistance band training. While these approaches may offer partial relief, they frequently fail to produce consistent, lasting strength and function. Many patients are left with unresolved deficits that limit activity and increase the risk of recurrent injury.

With over four decades of clinical experience in chiropractic and kinesiology-based care, I recognized the gap between conventional rehabilitation and the functional demands of daily life. This motivated the creation of a progressive rehabilitation device designed specifically for the biomechanics of the foot.

The Foot Power device emerged through a rigorous cycle of prototyping, with 35 versions developed and tested. The final model provides controlled, progressive resistance for toe flexion, plantar flexion, inversion, eversion and dorsiflexion—movements critical to restoring balance, strength, and stability. This study explores the clinical utility of Foot Power ™ as a primary rehabilitation tool, with outcomes measured in groups stratified by diagnosis.

Methods

Study Design

Type: Prospective, observational clinical study

Population: Patients diagnosed with common foot disorders including plantar fasciitis, capsulitis, hallux Valgus, metatarsalgia, Peripheral Neuropathy and other foot/ankle conditions.

Sample Size: Approximately 1023+ cases, grouped by diagnosis

Diagnosis Groups

1. Plantar Fasciitis (PF)
2. Peripheral Neuropathy (PN)
3. Metatarsalgia (Met)

These three diagnosis represented the bulk of the patients treated during this study. (797) In fact it is common for a person who has Peripheral Neuropathy to also have plantar fasciitis and metatarsalgia due to the weakening of the musculature from nerve damage.

4. Medial Tibial Tendon Syndrome (MTTS), We started seeing more of these patients of late as we became known for helping them. (23) In most of these cases we used an orthotic device to unload the tendon so it could recover. Most patients already had a custom orthotics made but were still having significant pain and weakness issues.

5. Hammertoes (Ham), Patient did not come to us because they had hammertoes but they came for concomitant diagnoses. (36)

6. Capsulitis (Cap), (47) Many of these patients came to us thinking they had other diagnoses.

7. Hallux Valgus (HV), (120) Patient did not come to us because they had hallux valgus but they came for concomitant diagnoses.

Intervention

All patients underwent a Foot Power ™ rehabilitation protocol, consisting of progressive resistance exercises targeting toe flexion, plantar flexion, inversion, and eversion. In the case that the patients pain was very severe 8-10/10, they were tested for their individual tolerance to the movements. If they tolerated the movement they started. If not they were treated with a variety of methods including Kinesiotaping, until such time that they could tolerate applying pressure to the foot during the Foot Power™ operation. This was typically 2 weeks.

Sessions: We started Foot Power™ rehab at a frequency of three times per week. The rehab time depended on the severity of the condition. If the patient never walks or exercises they typically had significantly less control over their foot function. The sessions were limited at first to

approximately 10-12 repetitions on each foot repeated twice. We utilized our light resistance setting. Larger people or extremely athletic people were started on our medium resistance.

Everyone gets evaluated on light resistance so we can see how restricted their movement is. It's one thing to talk about movement its another to observe the actual motion.

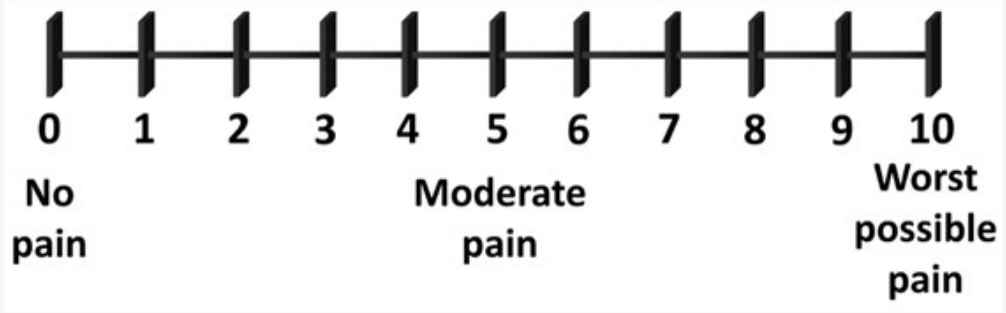
Duration: Depending on the case 6-12 weeks.

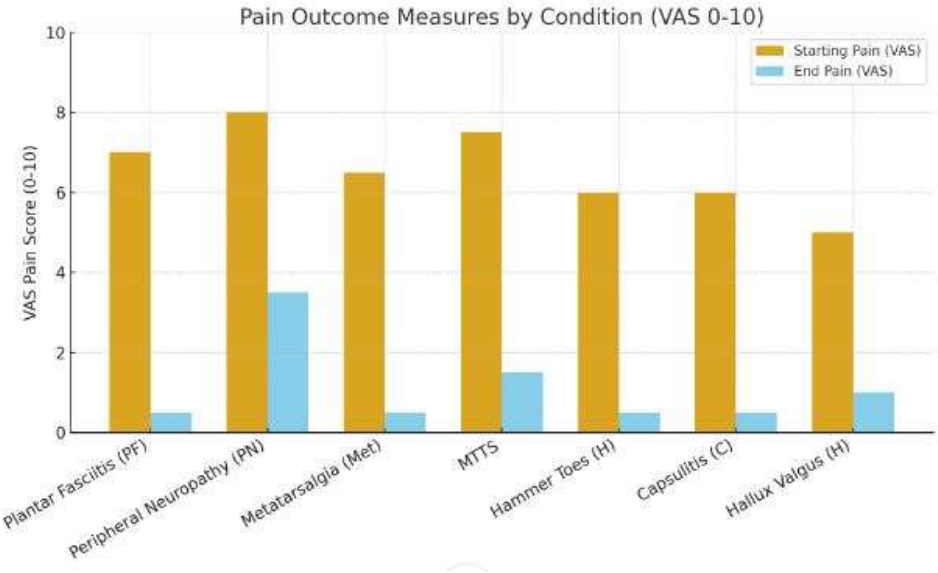
Data Analysis

Results will be tracked by diagnosis group (not individual patients). Data will be summarized as average changes in ROM, pain, strength, function and balance. Comparative analysis will evaluate which diagnoses respond most favorably to Foot Power intervention.

Outcome Measures

1. Pain – Visual Analog Scale (VAS)





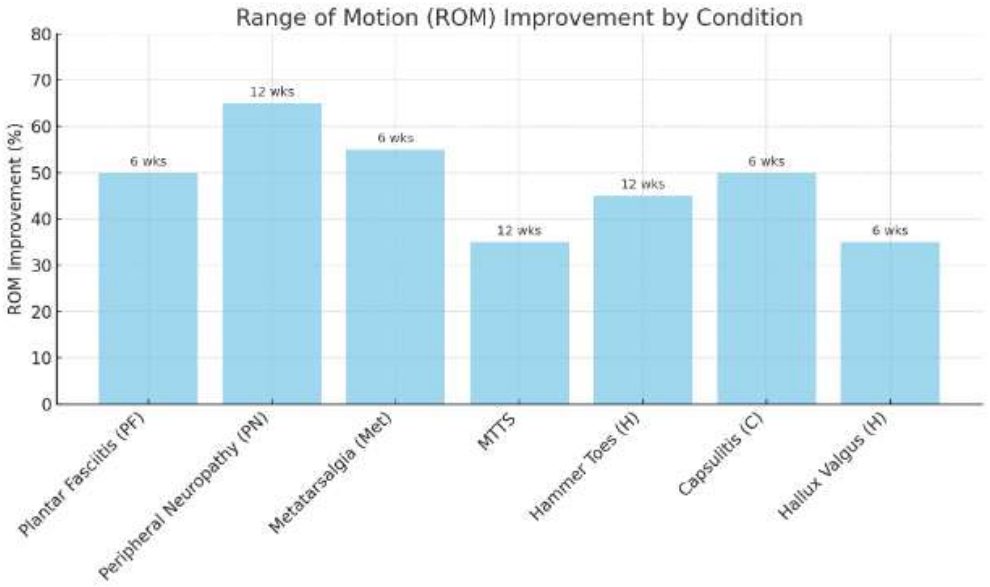
Starting Level of Pain in YELLOW				End in BLUE
Plantar Fasciitis	(PF)	Starting level averaged	7/10	0-1
Peripheral Neuropathy	(PN)	Starting level averaged	7-8/10	3-4
Metatarsalgia	(Met)	Starting level averaged	6-7/10	0-1
Medial Tibial Tendon syndrome	(MTTS)	Starting level averaged	7-8/10	0-3
Hammer Toes	(HT)	Starting level averaged	5/10	0-1
Capsulitis	(C)	Starting level averaged	6-7/10	0-1
Hallux Valgus	(HV)	Starting level averaged	4-5/10	0-2

2. **Range of Motion** (ROM) tests for the foot and ankle include:

- **Dorsiflexion:** (20-30 degrees) This measures the ability to move the foot upwards towards the shin. It's often assessed with the knee bent and straight to differentiate between ankle joint limitation and calf muscle tightness.
- **Plantarflexion:** (50 degrees) This measures the ability to point the foot downwards, away from the shin.
- **Inversion:** (30 degrees) This assesses the movement of the sole of the foot inwards, towards the midline of the body.
- **Eversion:** (20 degrees) This assesses the movement of the sole of the foot outwards, away from the midline of the body.
- **Toe Flexion :** MTP, Metatarsal Phalangeal Joint (30-50 degrees) These tests measure the ability to bend and straighten the toes.
- **Foot Abduction:** (10 degrees)Movement f the entire foot outward away from the midline.
- **Foot Adduction:** (20 degrees) Movement of the entire foot inward toward the midline.

ROM

Results show the percentage of range of motion improvement after treatment. Length of treatment varied depending on the severity of their condition. All patients that had a more rigid foot showed less ROM improvement than others in all categories.



Range of Motion in Percentage of Improvement			
Plantar Fasciitis	(PF)	6 weeks rehab	50%
Peripheral Neuropathy	(PN)	12 weeks rehab	65%
Metatarsalgia	(Met)	6 weeks rehab	55%
Medial Tibial Tendon Syndrome	(MTTS)	12 weeks rehab	35%
Hammer Toes	(HT)	12 weeks rehab	45%
Capsulitis	(C)	6 weeks rehab	50%
Hallux Valgus	(HV)	6 weeks rehab	35%

4. Strength

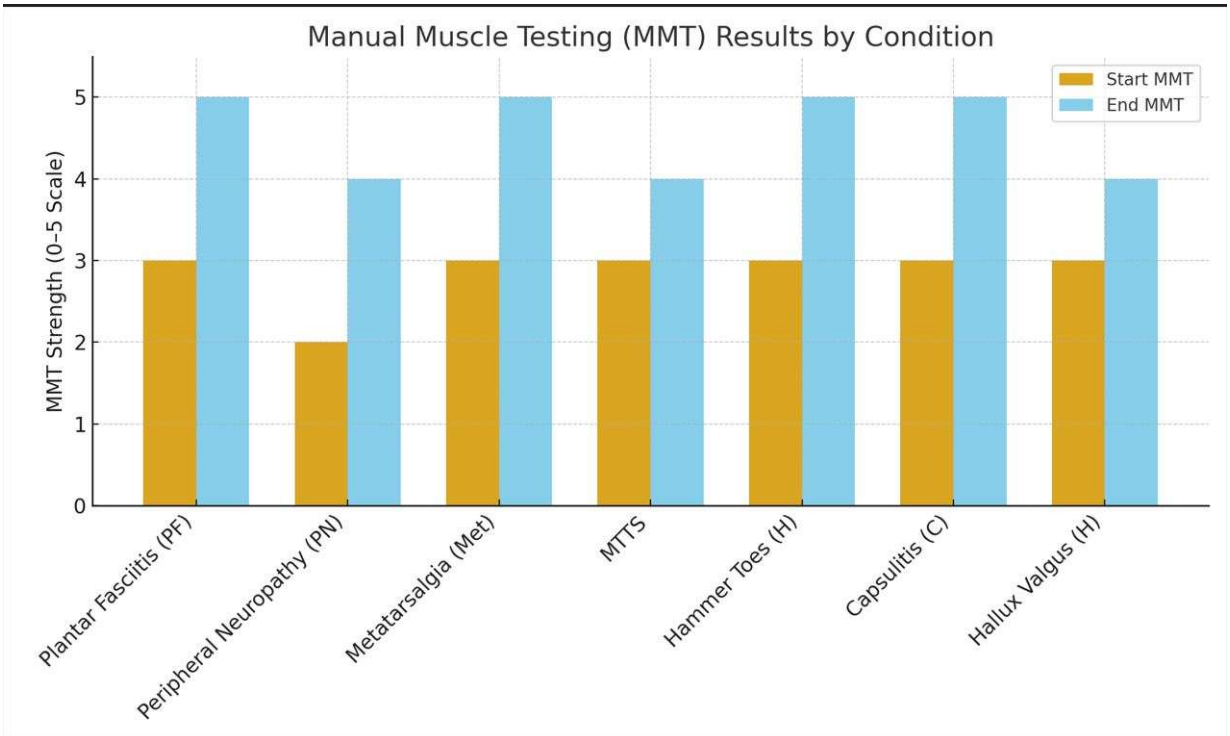
The scale ranges from 0-5 where 0 means paralysis and 5 means strong under significant load. The more significantly weak they were the lower the end results

achieved. All patients who came in with grade 0/5 or grade 1/5 strength were considered paralyzed and in most cases stayed that way. Very few progressed to level 3. Most grade 2 patients achieved a level 4 strength. Almost all grade 3 strength cases achieved a level 5/5 after training as long as they gave their rehab a good effort.

I personally tested: tibialis anterior, tibialis posterior, peroneus longus, brevis, tertius, extensor hallucis longus, and flexor hallucis longus.

Manual Muscle Testing (MMT) Rating Scale

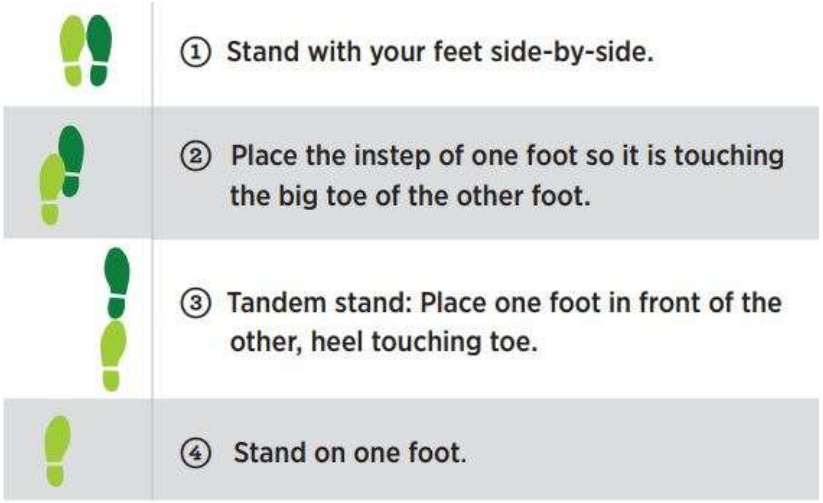
Grade	Description
0/5 – Zero	No visible or palpable muscle contraction.
1/5 – Trace	Palpable or observable contraction, but no joint movement.
2/5 – Poor	Full ROM in gravity-eliminated position (no resistance against gravity).
3/5 – Fair	Full ROM against gravity, but cannot tolerate resistance.
4/5 – Good	Full ROM against gravity, tolerates moderate resistance (less than normal).
5/5 – Normal	Full ROM against gravity, with maximal resistance (normal strength).



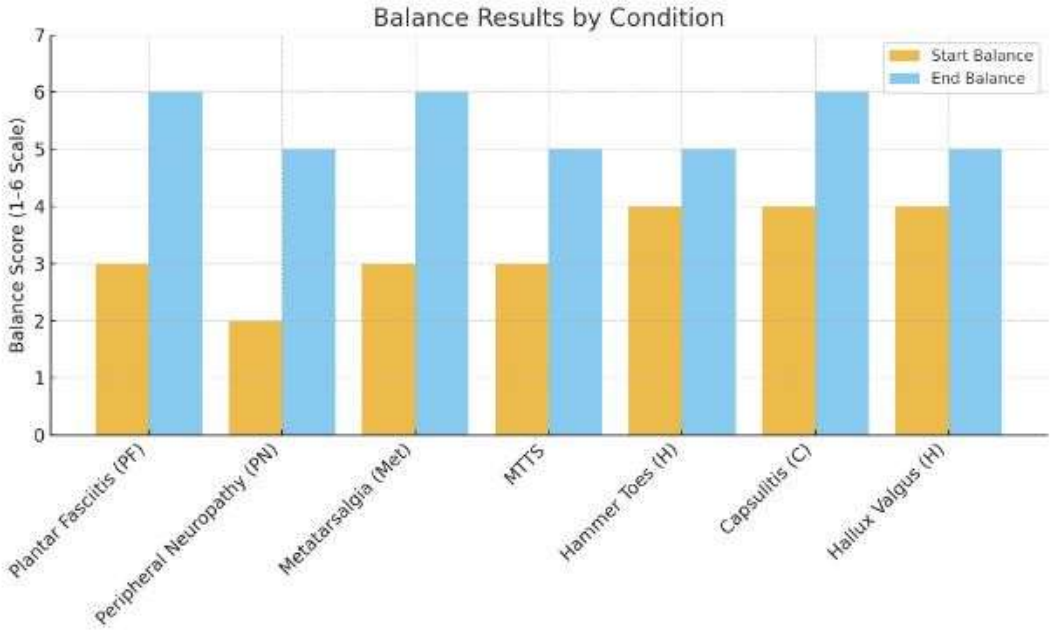
Grade of Manual Muscle Test: Yellow to START				After rehab in BLUE
Plantar Fasciitis	(PF)	Starting level averaged	3/5	5/5
Peripheral Neuropathy	(PN)	Starting level averaged	2-3/5	4/5
Metatarsalgia	(Met)	Starting level averaged	3/5	5/5
Medial Tibial Tendon Syndrome	(MTTS)	Starting level averaged	3/5	4/5
Hammer Toes	(HT)	Starting level averaged	3/5	5/5
Capsulitis	(C)	Starting level averaged	3/5	5/5
Hallux Valgus	(HV)	Starting level averaged	3/5	4/5

Balance Testing

While we used the 4 step balance test as a starter, we found that the information was not specific enough for our purpose. So we added a couple of tests to expand the information: Most patients pass the first two steps of the evaluation. Most could not tandem stand. But that does not give us specific enough information . So we added some steps. We asked the patient to go up onto their toes and hold for 30 seconds. During that time we observed for stability, the ability to actually use their calves and for the integrity of the lateral stabilizers (peroneal group). Almost everyone over the age of 50 was seen to have weakness in their peroneal group. Thus the derivative that as we age we stop moving sideways , unless we are involved in an activity that does (dancing, tennis etc.) What you don't use you lose. Then we asked them to go up on their heels and observed. Then we asked the patient to balance on one foot, then the other for 30 seconds. Almost ALL lacked stability and strength. Some more noticeable than others. Where there is nerve damage the results were significantly worse. We then observed them walking and completed our balance notes. This gave us specific functional information about the following muscles: Gastrocnemius, Soleus, Tibialis Anterior and posterior, extensor and flexor hallucis longus and the Peroneus group. We simultaneously observed their foot type. Normal arch, Flat Foot (pes planus), High Arch (Cavus foot), Abducted forefoot, etc. This led us to another conclusion. There's an assumption that flat feet are weak. That High arches must be stronger. Well, some of the fastest men in the world have flat feet ! A lot of the high arch people have significant symptomatology and in fact are prone to neurologic disease. So we used our powers of observation and specific muscle testing to better understand the individual patient. We are using a scale from 0-6. Where six is strong balance under all conditions.



Grade	Description
1 – Poor	Requires maximal assistance to maintain balance.
2 – Fair-Poor	Requires moderate assistance to maintain balance.
3 – Fair	Maintains balance with minimal assistance or support.
4 – Fair-Good	Maintains balance without support but may need supervision.
5 – Good	Maintains balance independently without support, no sway.
6 – Normal	Maintains balance independently under all conditions, full stability.



Balance Testing: Yellow at START and BLUE at completed rehab			
Plantar Fasciitis	(PF)	**3 to start**	6 completed rehab
Peripheral Neuropathy	(PN)	**2 to start**	5 completed rehab
Metatarsalgia	(Met)	**3 to start**	6 completed rehab
Medial Tibial Tendon Syndrome	(MTTS)	**3 to start**	5 completed rehab
Hammer Toes	(HT)	**4 at start**	5 completed rehab
Capsulitis	(C)	**4 at start**	6 completed rehab
Hallux Valgus	(HV)	**4 at start**	5 completed rehab

Results

- ROM Gains: Mean changes in degrees of motion were observed throughout all diagnosis groups.
- Pain Reduction: Significant reduction in VAS scores were observed in all diagnosis groups.
- Strength Gains: Everyone in the study felt and we could see the increases in their strength.
- Balance Improvement: 4/7 grouped participants experienced improved balance and were observed at a level 5/6 functional improvement by diagnosis and 3/7 were seen to improve to 6/6 at the end of their rehab.

Graphs and tables present group data.

Discussion

The preliminary hypothesis is that Foot Power ™ will outperform conventional rehabilitation methods by providing progressive, biomechanically correct resistance training. This is expected to yield:

- Improved Circulation in Diabetic and Neuropathy patients
- Faster pain reduction
- Improved functional balance recovery
- Superior restoration of strength and ROM
- Reduced recurrence of chronic foot conditions
-The ability to do it at home with lowered costs of rehabilitation

Limitations

Foot Power ™ is not able to work on paralyzed or patients who have been wheel chair bound for 4 months or longer. The human body atrophies at a rate of 1% per day after a month of immobility. So after 4 months they are unable to use their musculature and are not good candidates for this therapy. That said, there are always exceptions but rare. I therefore stopped accepting wheel chair bound patients. And none are included in this study.

Patients using walkers are the next category, that are more difficult due to their weakened condition. With this category of patient we actually use the walker as a stabilizing mechanism and they do respond just much slower since they are extremely weak and may have concomitant health issues. Your office needs to be set up for them. The walkers will catch and create safety issues on carpet edges, thresholds and uneven surfaces. Changing the rear legs of the walker to the ski like fitting really helps. In total only 27 patients using walkers are included in this study.

Patients using a cane or other patients whose balance is poor to unstable , should be using a stabilizing hand grip. In our office we use a bar mounted securely on the wall so they can hold on and not be at risk of falling. Foot Power™ is a weightbearing device which is why it is so helpful to strengthening our walking mechanism.

Where there was a musculature with a grade 0 or 1 there has been no significant change in strength. In other words if it was paralyzed before initiating Foot Power it remained paralyzed. This usually applied to Tibialis Anterior and Extensor and Flexor Hallucis Longus which are typical of nerve damage either in the lower leg or the lumbar spine. Grade 2 and above always showed improvement.

Conclusion

The Foot Power ™ rehabilitation device represents a modern, biomechanically correct approach to foot rehabilitation. Unlike traditional methods, it provides progressive, targeted resistance for key foot, ankle and calf movements. This study seeks to establish Foot Power ™ as a new standard of care for foot rehabilitation, with the potential to restore strength, balance, reduce pain, and improve long-term outcomes across a wide range of diagnoses. And it can be done at home.

NOTE: It was found that the most important human motion to strengthen was the toe and plantar flexion mechanism. 98% of the participants experienced significant improvement with plantar flexion which was the primary and starting movements that were performed. They did not move onto stronger resistance or eversion / inversion until they were stable in plantar flexion.

NOTE: In Peripheral Neuropathy there is great benefit in using Foot Power as part of a comprehensive approach. In my study while we used Foot Power on all Peripheral Neuropathy cases. They also received other treatment. The great majority of the Neuropathy patients achieved pain reduction during their 12 week therapy down to 0-2. I listed a level 3 pain in this category because that is what the patients reported after implementing Foot Power. They could feel the improvement and pain reduction immediately after using foot power. Which has me believing that not all the pain from Neuropathy is coming from the nerves. But rather the cascade effect from nerve damage to dysfunctional muscles to imbalances in the entire structure with subsequent Plantar Fasciitis, capsulitis, etc.…

As an added benefit, utilization of this therapeutic device will reduce the cost to treat these conditions. It will make it easier for the public to continue treatment which will represent a huge boost in compliance, effectiveness, prevent recurrence from chronic foot issues while reducing the risks of falling as we age. Approximately 14 million of our population over 65 are falling every year. Imagine if we could change that statistic just by utilizing Foot Power.