Effect of Neuromuscular Electrical Stimulation Verses Electrical Stimulation On Gait Parameters in Subjects Having Plantar Fascitis

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Abstract

Objective:

1. To investigate the effect of neuromuscular electrical stimulation verses electrical stimulation on gait parameters in subjects having plantar fasciitis
2. To investigate the ratio of the effect in both males and females.
3. To compare the effect of neuromuscular electrical stimulation verses electrical stimulation on gait parameters in subjects having plantar fascitis

Method: Total 30 subjects were selected according to inclusion and exclusion criteria aged between 40 to 60 years. The outcome measures were foot and ankle ability measures scale, gait parameters - stride length, step length and cadence. The subjects were divided into two groups,group A was treated with Electrical Stimulation and group B with Neuromuscular Electrical Stimulation.

Result: The result was extremely significant within the group on foot and ankle ability measured scale and gait parameters post 4 weeks for Group A. The neuromuscular electrical stimulation on gait parameter in individual having plantar fasciitis there result was extremely significant (p=<0.0001) post 4 weeks for Group B. Between the group comparison: Post test there was significant difference between outcome variables in FAAM (p=<0.001) and gait parameters. Following are the p values which lead to analysis of improvement in stride length (0.0021), step length (0.0378) and cadence (p=<0.001). The result from the statistical analysis of present study support the null hypothesis is rejected which stated that there will be beneficial effect to the subject treated with neuromuscular stimulation than electrical stimulation

Conclusion: Based on the statistical results and interpretation it was concluded that Neuromuscular electrical stimulation showed reduction in pain and improvement in gait parameters in individual having plantar fasciitis. Both the groups showed significant results but, post intervention Neuromuscular electrical stimulation group showed extremely significant effect than the electrical stimulation group

Keywords: *Neuromuscular electrical stimulation, electrical stimulation, foot and ankle ability measures scale (FAAM), gait parameters.*

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Introduction

Plantar fasciitis is a non inflammatory degenerative syndrome of the plantar fascia resulting from frequent trauma at its origin on calcaneus[1]. This condition may not be characterized by inflammation rather than non-inflammatory degenerative changes in the plantar fascia.[2] The plantar aponeurosis is compound ligamentous

structure that that comprise of neurovascular and muscular components.[3,4] The plantar fascia originates and twine together with the superficial layer of intrinsic muscles that includes the abductor hallucis, flexor digitorumbrevis and abductor digitiminimi. In the second layer of intrinsic foot muscles, the quadrates plantae also shares its two heads of orogin with the plantar fascia on the inferiou surface of the calcaneus[4]

Plantar fasciitis is the most common cause of heal pain.[5,6]Prevalence of plantar fasciitis has found to be 10% of the general population over the course of lifetime[7]. The condition is bilateral in one third of cases[1]. Incidence reportedly peaks in people between age of 40-60 years[8]. The situation is thought to be multi-factorial in origin with factors such as obesity, decreased ankle joint range of motion, prolonged weight bearing and increase in age are suggested to be frequently involved.[9,10] In some cases the patients typically report an insidious onset of pain which usually burning, stabbing, dull aching or sharpe in nature and is localized under the plantar surface of the heal.[11] It is mainly experienced upon weight bearing after a period of rest. This pain is most noticeable in morning with first few step and is often described as 'first step pain'.[12]Some patients is having severe pain that it results in an antalgic gait.[1]

A few of the common interventions used for treatment of plantar fasciitis include calf muscle stretching, plantar fascia-specific stretching and foot orthosis. Therapeutic modalities, including phonophoresis, iontophoresis and electrical stimulation, have also been recommended as treatment interventions for plantar fasciitis. Although phonophoresis and iontophoresis are used to deliver localized anti-inflammatory medications, electrical stimulation has been proposed to enhance circulation of involved tissues to promote healing.[13,14]

Studies have reported that the neuromuscular electrical stimulation and exercise has been reduced pain and gait pattern of the subject. There is not much evidence documented on neuromuscular electrical stimulation for individual having plantar fasciitis. This research was conducted to examine the effect of neuromuscular electrical stimulation verses electrical stimulation on gait parameters in individual having plantar fasciitis.

Participants: 30 subjects diagnosed with plantar fasciitis, of age-group 40-60 yrs in Krishna college of physiotherapy had participated in this study. They were divided into two groups each group contain 15 subjects as per convenient sampling method. The pre-outcome measures were taken like foot ankle ability measure scale, gait parameters – stride length, step length, cadence. Pain assessment was done using the visual analogue scale (VAS) at rest and on activity. Specific exercise protocol was given to subjects which included neuromuscular electrical stimulation and electrical stimulation.

Method

Study Design: This study was Comparative study.

- **Subject Criteria:** Total 30 subjects were included, aged between 40 to 60 years,both males and female were diagnosed with plantar fasciitis selected in the study. The explanations about the study procedure were given. The outcome measures were foot and ankle ability measures scale, gait parameters- stride length, step length,cadence. The subjects who were not included in the study were Radiological Evidence Showing, Calcaneal spur, Any acute inflammation of ankle joint, Red flag to Physiotherapy,Prior surgery to distal tibia, fibula, ankle joint or rear foot region, Prior physiotherapy treatment for same complaint.
- **Outcome Measures:**
  - **Physical assessment[16]:** Gait parameters were taken to measure the following parameters- stride length, step length and cadence. For measures the length, foot prints were taken.
  - **Foot and ankle ability measures scale[2] (FAAM):** In this activities of daily living was assisted in 1- 5 numbering 1 has no difficulty and 5 has unable to do. In this 20 activities of daily living had taken to measure the score for the assessment.

Results

Data Analysis–within the group

Group A:

I. Foot and ankle ability measure scale (FAAM):

Table No. 1 Mean of group A foot and ankle ability measure

	Pre	Post	T values	P value
FAAM	58.26±3.515	33.4±1.957	23.470	<0.0001 (ES)

ES : Extremely Significant.

The pre interventional Foot and Ankle Ability Measures was 58.26±3.515 and post interventional was 37.3±3.889. The P value was <0.0001 which is statistically extremely significant (t=23.470) this shows improvement in Foot and Ankle Ability Measures.

Group B:

I. Foot and ankle ability measure scale (FAAM)

Table No. 2 Mean of group B foot and ankle ability measure

	Pre	Post	T values	P value
FAAM	56.4±4.595	28.7±2.374	25.190	<0.0001 (ES)

ES : Extremely Significant.

The pre interventional Foot and Ankle Ability Measures was 56.4±4.595 and post interventional was 28.7±2.374. The P value was <0.0001 which is statistically extremely significant (t=25.190) this shows improvement in Foot and Ankle Ability Measures.

Group A:

Table No. 3 Mean of group A gait parameters

Parameters	Stride length	Step Length	Cadence
Pre	52.8±2.569	27.33±1.633	77.06±2.492
Post	66.6±3.961	33.6±2.324	93.73±2.738
T value	13.410	16.883	20.316
P value	<0.0001 (ES)	<0.0001 (ES)	<0.0001 (ES)

ES: Extremely Significant

Group B:

Table No. 4 Mean of group B gait parameters

Parameters	Stride length	Step Length	Cadence
Pre	51.13±2.825	26.26±1.876	78.86±2.669
Post	71.66±4.220	35.4±2.197	99.13±2.200
T value	28.938	28.391	33.484
P value	<0.0001 (ES)	<0.0001 (ES)	<0.0001 (ES)

ES: Extremely Significant

- **Data analysis between the group:**

Foot and ankle ability measure scale (FAAM)

Table No. 5 mean of group A FAAM and group B FAAM

Parameters	Group A	Group B	T Value	P Value
FAAM	33.4±1.957	28.73±2.374	5.874	<0.0001 (ES)

ES: Extremely significant.

Statistically significant:

Physical assessment

Table No. 6 Mean of group A gait parameters and group B gait parameters

Parameters	Group A	Group B	T Value	P Value
Stride Length	66.6±3.961	28.73±2.374	5.874	0.0021(CVS)
Step Length	33,6±2.324	71.6±4.220	3.391	0.0378(CS)
Cadence	93.73±2.738	35.4±2,197	5.955	<0.0001 (ES)

CVS: Considered very significant, CS: Considered significant, ES: Extremely significant.

Statistically significant:

Discussion

The purpose of this study to investigate effect of neuromuscular electrical stimulation verses electrical stimulation on gait parameters in subjects having plantar fasciitis.

The objectives of this study were to investigate the effect of neuromuscular electrical stimulation verses electrical stimulation on gait parameters in subjects having plantar fasciitis, investigate the ratio of the effect in both males and females and compare the effect of neuromuscular electrical stimulation verses electrical stimulation on gait parameters in subjects having plantar fasciitis.

This project was done in six months of duration with sample size and age group 40-60 years. The subjects were taken randomly from Krishna college of physiotherapy. 30 subjects having plantar fasciitis were taken for the study and were divided into two groups. Group A was given electrical stimulation and group B was given neuromuscular electrical stimulation.

The following interpretations were noted:

1. According to score of foot and ankle ability measures scale subjects receiving Neuromuscular electrical stimulation showed improvement in score to subjects receiving electrical stimulation.
2. According to foot print for gait parameters like stride length, step length and cadence subjects receiving neuromuscular electrical stimulation showed marked improvement in foot print compared to subjects receiving electrical stimulation.

The average mean age of participants in Group A was 47.33±4.70 and Group B was 47.06±4.68, which showed there is a no significant difference in age of subjects in both groups (t = 0.1557 & p = 0.8774) which was done by unpaired t-test. The total number of participant included over 30 out of which 14 were males and 16 were females. Group A contained 7 males and 8 females and Group B had 8 males and 7 females.

30 subjects clinically diagnosed with plantar fasciitis and fulfilling inclusion and exclusion criteria with age between 40 to 60 years were included in this study. They were allotted into two groups, Group A and Group B each containing 15 subject.

Electrical stimulation was given in Group A and neuromuscular electrical stimulation was given in Group B. The outcome was measured with foot and ankle ability measure scale and gait parameters are stride length, step length and cadence.

In group A the pre interventional Foot and Ankle Ability Measures was 58.26±3.515 and post interventional was 37.3±3.889. The P value was <0.0001 which is statistically extremely significant (t=23.470) this shows improvement in Foot and Ankle Ability Measures.

The physical assessment of gait parameters pre intervention of stride length was 52.8±2.569 and post intervention was 66.6±3.961. The P value was <0.0001 which is statistically extremely significant (t=13.410) this shows improvement in stride length.

The physical assessment of gait parameters pre intervention of step length was 27.33±1.633 and post intervention was 33.6±2.324. The P value was <0.0001 which is statistically extremely significant (t=16.883) this shows improvement in step length.

The physical assessment of gait parameters pre intervention of stride length was 77.06±2.492 and post intervention 93.73±2.738 was. The P value was <0.0001 which is statistically extremely significant (t=20.316) this shows improvement in cadence.

In group B The pre interventional Foot and Ankle Ability Measures was 56.4±4.595 and post interventional was 28.7±2.374. The P value was <0.0001 which is statistically extremely significant (t=25.190) this shows improvement in Foot and Ankle Ability Measures.

The physical assessment of gait parameters pre intervention of stride length was 51.13±2.825 and post intervention was 71.66±4.220. The P value was <0.0001 which is statistically extremely significant (t=28.938) this shows improvement in stride length.

The physical assessment of gait parameters pre intervention of step length was 26.26±1.876 and post intervention was 35.4±2.197. The P value was <0.0001 which is statistically extremely significant (t=28.391) this shows improvement in step length.

The physical assessment of gait parameters pre intervention of cadence was 78.86±2.669 and post intervention was 99.13±2.200. The P value was <0.0001 which is statistically extremely significant (t=33.484) this shows improvement in step length.

Paired t-test was used to analyze the effect of neuromuscular electrical stimulation verses electrical stimulation on gait parameters in subjects having plantar fasciitis.

There result was extremely significant for group A and group B.

Between the group comparison the unpaired t-test was used to analyze group A and group B post treatment values and there was significant difference between outcome variables in in FAAM (p=<0.001) and gait parameters. Following are the p values which lead to analysis of improvement in stride length (0.0021), step length (0.0378) and cadence (p=<0.001).

Group A received electrical stimulation for plantar fascia. Group B received neuromuscular electrical stimulation for plantar fascia.

Paired t-test was used to analyze the effect of electrical stimulation on gait parameters in individual having plantar fascitis. There result was extremely significant on foot and ankle ability measured scale and gait parameters post 4 weeks for Group A. The neuromuscular electrical stimulation on gait parameter in individual having plantar fasciitis there result was extremely significant (<0.0001) post 4 weeks for Group B.

Between the group comparison: Post test there was significant difference between outcome variables in FAAM (p=<0.001) and gait parameters. Following are the p values which lead to analysis of improvement in stride length (0.0021), step length (0.0378) and cadence (p=<0.001).

The result from the statistical analysis of present study support the null hypothesis is rejected which stated that there will be beneficial effect to the subject treated with neuromuscular stimulation than electrical stimulation.

Conclusion

Based on the statistical results and interpretation it was concluded that Neuromuscular electrical stimulation showed significant reduction in pain and improvement in gait parameters in individual having plantar fasciitis.

Both the groups showed significant results but, post intervention Neuromuscular electrical stimulation group showed extremely significant effect than the electrical stimulation group

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Conflicts of Interest: The authors declare that there are no conflicts of interest concerning the content of the present study.

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Ethical Clearance: the institutional ethics committee has given permission to initiate the research project entitled Effect Of Neuromuscular Electrical Stimulation Verses Electrical Stimulation On Gait Parameters In Subjects Having Plantar Fascitis.

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