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Comparison of immediate effect of integrated neuromuscular inhibition technique vs traditional therapy in individuals with heel pain: An interventional study

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Abstract

Heel pain is a common foot problem and harms the foot-specific and general health-related quality of life and shows a distant pattern of disability in different functional domains. The study consisted of a total of 52 participants. Individuals were divided into 2 groups: Control and Interventional group using the chit method (26 participants in Group A and 26 participants in Group B). Group A received Traditional therapy and Group B received an Integrated Neuromuscular Inhibition Technique. Both Group A and Group B showed a significant difference in Pre and Post VAS, and ROM respectively ($p=0.00$). When Group A and Group B were compared for VAS and ROM, the Control Group (Group A) showed a decrease in VAS significantly ($p=0.00$) but there was no significant difference between ROM between the Control and Intervention groups (Group A and Group B respectively) ($p=0.833$). Both INIT and Traditional approaches are effective in reducing Plantar Heel Pain and increase Ankle dorsiflexion range, however, the Traditional Approach may be a preferred treatment option.

Keywords: Heel pain, Init, traditional therapy, rom, ankle dorsiflexion

Introduction

Heel pain is a common foot problem and harms the foot-specific and general health-related quality of life and shows a distant pattern of disability in different functional domains^[1]. The patient usually complains of pain on posterior aspect of the calcaneus at insertion of Achilles. Common causes of heel pain includes: Plantar fasciitis, Heel spur, Heel bumps, Achilles tendinopathy, and Heel bursitis^[2]. Simons *et al.* have suggested that taut bands myofascial/muscle trigger points (TrPs) in the GastroSoleus (calf muscle) may be involved in the development of heel pain.

Trigger points are painful spots formed in taut band of muscles that become hyper-irritable, causing pain. These trigger points are developed as a result of trauma, overuse, mechanical pressure overload, psychological distress and poor posture^[3, 4]. The gastrocnemius muscle was found to be often affected by trigger points in which muscle is in shortened position, limit ankle dorsiflexion range and functional activities^[5].

The efficiency of the Integrated Neuromuscular Inhibition Technique (INIT) in the management of individuals with trigger points was reported in many trials. It was suggestive of a decrease in pain intensity and, an increase in function and range of motion due to the increased blood flow by intermittent pressure, tone reduction by Muscle Energy Technique (MET), and Muscle relaxation by Strain Counter Strain (SCS)^[6].

In a previous study, the Integrated Neuromuscular Inhibition Technique has been proven beneficial on the upper trapezius and piriformis trigger points^[7, 8]. There are lack of literature evidence available on whether this technique helps release TrPs in the gastrosoleus muscle which is one of the major factors responsible for heel pain. The purpose of this study is to find out the Comparison of Immediate effect of Integrated Neuromuscular Inhibition Technique vs. traditional therapy in individuals with heel pain.

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Materials and Methods

This study employs a comparative experimental design to investigate the effects of interventions on individuals experiencing unilateral heel pain, specifically focusing on those with active or latent trigger points in the gastrosoleus muscle. The sample population consists of 52 participants, selected through convenient sampling from the physiotherapy outpatient department of a government tertiary care hospital. Participants are divided into two groups, with 26 individuals in each group. The study duration spans approximately six months, during which data will be collected using various materials, including an Android smartphone with a clinometer app, a Visual Analogue Scale, and necessary clinical equipment such as a bed, plinth, and ice pack. The sample size was determined based on the prevalence of heel pain patients in the physiotherapy department, considering the total patient load within a month. Inclusion criteria encompass adults aged 18-60 years of both genders who exhibit active or latent trigger points in the gastrosoleus muscle with unilateral heel pain, individuals with bilateral heel pain also included, and those who were willing to participate by signing an

informed consent form. Exclusion criteria are stringent, ruling out individuals with Vascular conditions, Recent lower limb trauma, Spondyloarthropathy, History of acute ankle sprain, Neurological disorders (UMN/LMN lesion), Sensory loss over the lower limb, dermatological issues, anatomical abnormalities, over the lower limb or those unable to comprehend and follow verbal instructions.

Procedure

Study was conducted in the physiotherapy OPD of a tertiary care Hospital. Permission from the DRB and the Institutional Ethics Committee was sought. Participants were enrolled in the study depending on selection criteria and willingness to participate in the study. Informed consent was taken. Case Record Forms with demographic details were filled. The intensity of heel pain was noted by using a Visual analogue scale. A 10 cm horizontal line was drawn on the paper with one end indicating No pain at 0 and the other end indicating Most severe pain at 10cm. The patient was asked to mark the point between 0 to 10 according to the pain intensity they perceived.

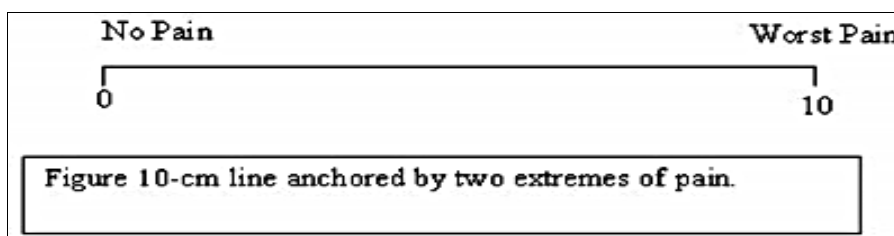


Fig 1: Visual Analogue Scale

Passive dorsiflexion ROM of ankle with symptomatic heel side was assessed by using smartphone application Clinometer. The application is available free of cost. To standardize the procedure of taking measurements of dorsiflexion a smartphone was kept along the lateral border of the foot. To measure gastrosoleus length patient was positioned in the supine position. The patient was asked to keep their feet in a neutral position. The therapist grasped the heel and passively dorsiflexed the feet until the end feel is felt. Smartphone app Clinometer was used to measure the angle by another therapist, which was not disclosed to 1st therapist.



Fig 2: Use of smartphone application Clinometer for assessing ankle ROM.

Individuals were divided into 2 groups: Control and Interventional group using chit method. (Group A received traditional therapy and Group B received Integrated Neuromuscular Inhibition Technique).

Interventional participants received -

Integrated Neuromuscular Inhibition Technique (INIT) which included:

Trigger point release: The participants in interventional group were placed in side-lying (relaxed position) with symptomatic leg up. The leg below was in knee flexion. The easiest way to treat gastrosoleus TrPs is using pincher grip between thumb and other four fingers. The applied pressure was maintained until the pain is reduced. Then, pressure was applied again until the patient report discomfort. This procedure was performed for 90seconds and was repeated for 3 times.



Fig 3: Use of INIT (Pincer Grip method) for Gastrosoleus TrP Release.

For MET (post isometric relaxation method) of Gastrosoleus muscle, patient was asked to lie supine. Starting with foot in neutral position. For soleus muscle knee was flexed by placing towel roll beneath the knee. The patient was asked to plantarflex the foot against the therapist's resistance, Isometric contraction was hold for 10 counts. Following the contraction, therapist had gone into new range of dorsiflexion to initiate local tissue stretch. Again, isometric contraction of soleus was performed and same procedure was repeated thrice.



Fig 4: Use of INIT- MET method for Soleus muscle Release.

- For gastrocnemius muscle, same procedure was performed with knee extended.



Fig 5: Use of INIT- MET method for Gastrocnemius muscle Release.

For Strain Counter Strain (SCS), in order to position gastrosoleus into shortened /relaxed position, patient was placed into prone with knee in flexion and foot in plantarflexion. Once the position of ease was achieved, it was maintained for 30 seconds and was repeated for 3 times.



Fig 6: Use of INIT- SCS method for Gastrosoleus muscle Release

Participants in control group were given traditional therapy.

Traditional therapy included: Active exercises which includes-

- Ankle toe movements.
- Ankle isometric exercises (dorsiflexor, plantar flexor, invertor, evertor). (10reps of each exercise bilaterally) and
- Calf muscle stretch. (30 seconds counts and 3reps).
- Cryotherapy for heel. (10 mins).

Intensity of heel pain was noted in both the groups post session by using VAS. Passive dorsiflexion ROM of ankle with symptomatic heel was assessed post session in both the group using Clinometer application. Data was collected and analyzed.

Data Analysis and Result

The data was entered using Microsoft Office Excel 2013 and data analysis was done using SPSS software version 24. Data was then tested for normality. ROM didn't pass the normality, so non-parametric-was done. Wilcoxon W test for intragroup and Mann Whitney U test was used for intergroup comparison. As VAS is Likert scale, non-parametric - Wilcoxon W test was performed.

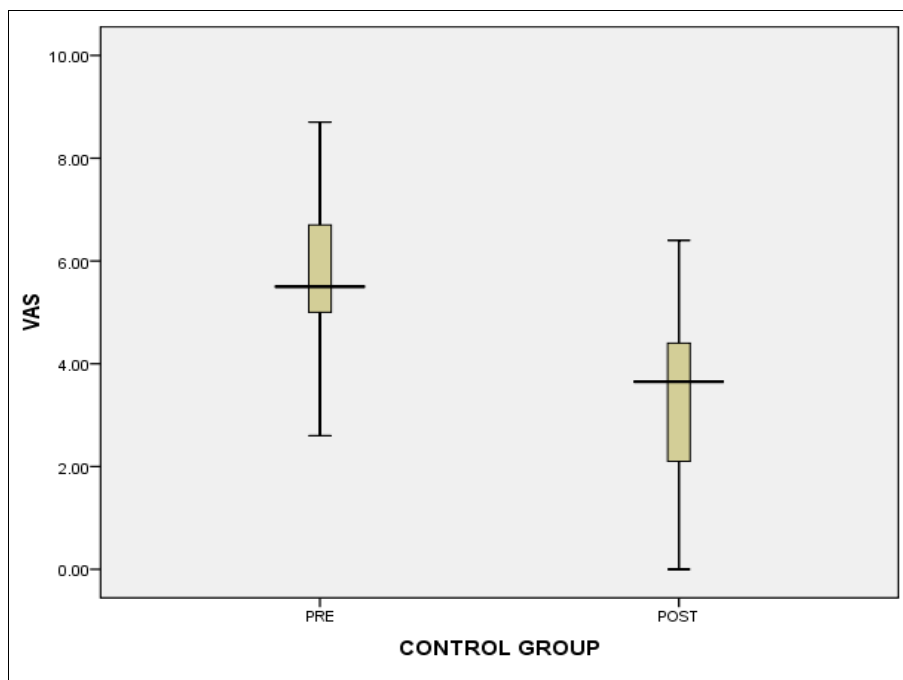
The study included 52 participants, which were divided into two groups, 26 participants in the control and 26 participants in intervention group. Out of the 52 participants, 32 were females with a mean age of 44.87 years and 20 were males with mean age of 38.15 years. The descriptive statistics of study outcomes that is VAS (visual analogue scale) and ROM (range of motion) of ankle dorsiflexion are shown in Table No.1. Statistical analysis of data for the Control group showed significant difference in Pre and Post VAS and ROM ($p=0.00$) ($p=0.00$) respectively. [Table No. 2, Graph No. 1 and 2]. In the Intervention group, significant difference was seen in Pre and Post VAS ($p=0.00$) as well as the Pre and Post ROM in the same group($p=0.00$). [Table No. 2, Graph No. 3 and 4]. When Control and Intervention groups were compared for VAS and ROM, control group showed decrease in VAS significantly ($p=0.00$). Still, there was no significant difference between ROM between control and intervention groups. ($p=0.833$) [Graph 5 and 6].

Table 1: Descriptive Analysis of the Outcome Measures.

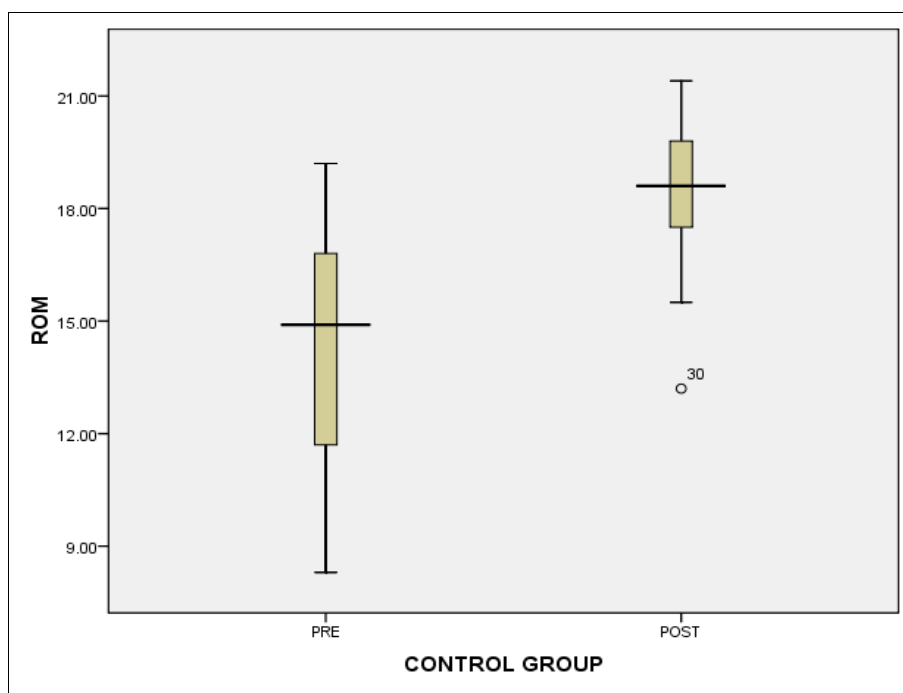
Outcomes	Mean and standard deviation					
	Control			Intervention		
	Pre	Post	Diff	Pre	Post	Diff
VAS	5.780±1.4	3.369±1.75	2.41±1.20	5.81±1.67	4.55±3.24	1.21±0.88
ROM	14.32±3.31	18.38±1.79	3.99±3.4	13.44±3.07	17.6±1.65	4.16±3.16

Table 2: Statistical Analysis of each group along with the test performed.

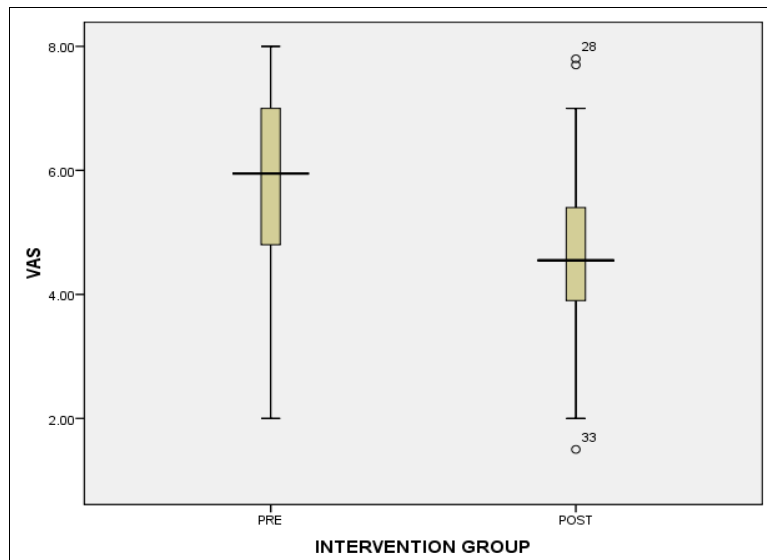
Group	Outcome measures	P value	Test
Control	VAS	0.00	Wilcoxon W test
	ROM	0.00	Wilcoxon W test
Intervention	VAS	0.00	Wilcoxon W test
	ROM	0.00	Wilcoxon W test
Control-Intervention	VAS	0.00	Wilcoxon W test
	ROM	0.833	Mann Whitney U test



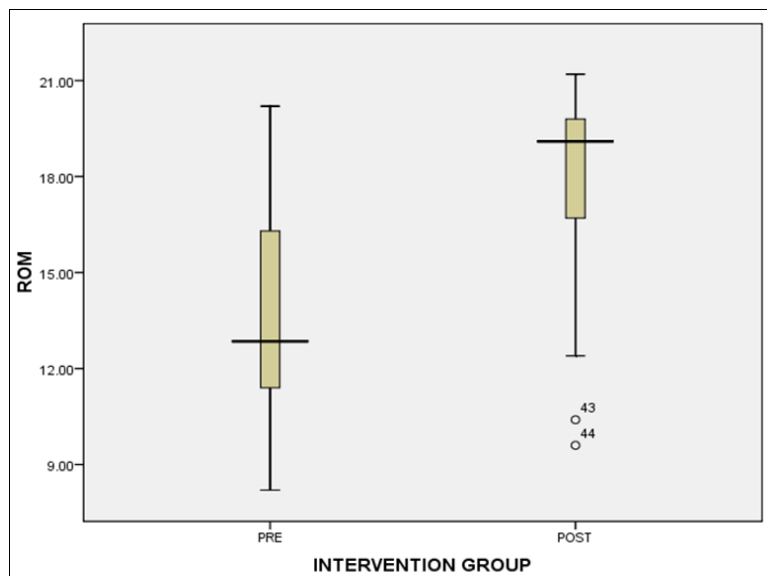
Graph 1: Mean distribution of VAS in Pre and Post control group.



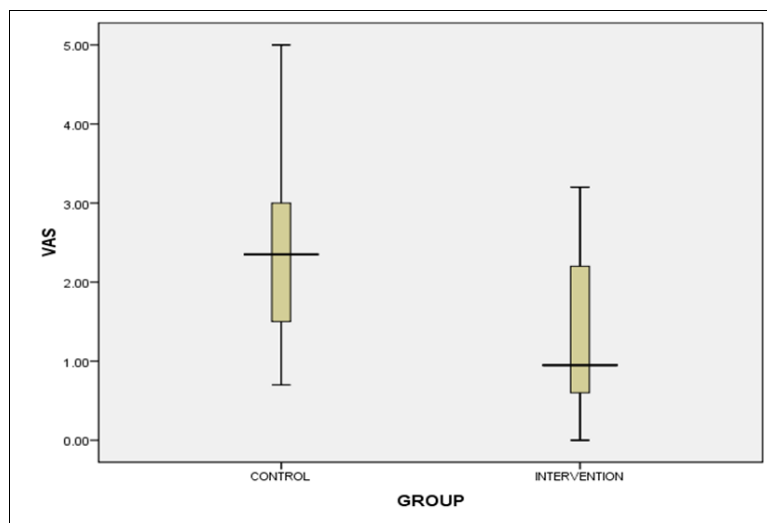
Graph 2: Mean distribution of ROM in Pre and Post control group.



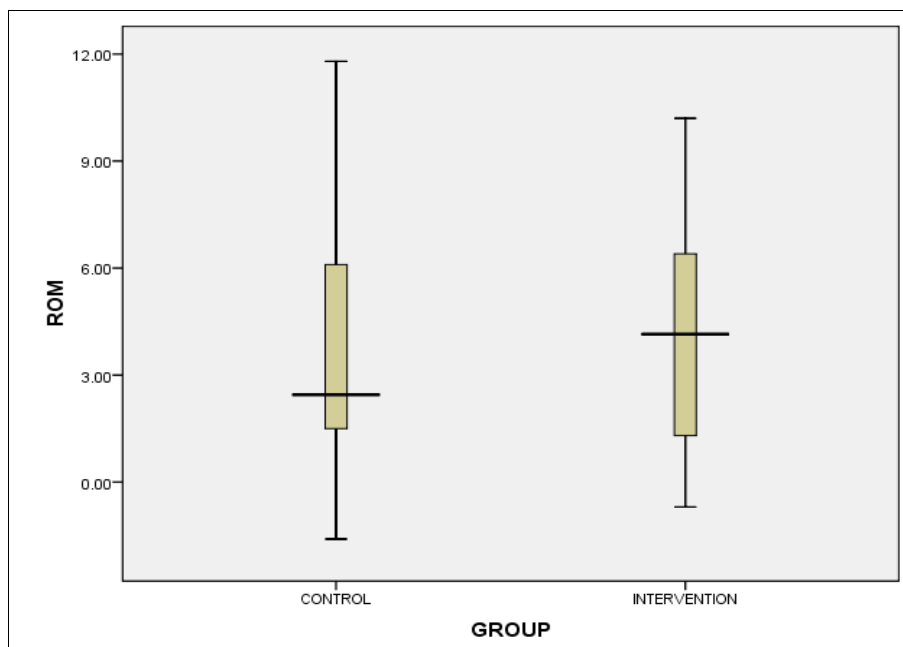
Graph 3: Mean distribution of VAS in Pre and Post intervention group.



Graph 4: Mean distribution of ROM in Pre and Post intervention group



Graph 5: Mean distribution of VAS in control and interventional group.



Graph 6: Mean distribution of ROM in control and interventional group.

Discussion

The purpose of this study is to find out Comparison of Immediate effect of Integrated Neuromuscular Inhibition Technique Vs Traditional therapy in individuals with heel pain. The above study was conducted on 52 participants, which were divided into two groups, 26 participants in control and 26 participants in intervention group. In which 32 were females with mean age of 44.87 years and 20 were males with mean age of 38.15 years. All the participants were selected according to Inclusive and Exclusion criteria. In the study, participants in control group were given active toe movements, ankle isometric exercises, calf muscle stretch and cryotherapy for heel pain.

Table No. 1,2 and Graph No. 1 shows significant difference in Pre and Post VAS ($p=0.00$) in Control group. Our results agree with Bazzani et.al postulated theory, that icing can reduce uncontrolled inflammation and pain by stimulation of mechanoreceptors which send impulses to spinal cord via posterior root. These impulses, which arrive through relatively large diameter fiber nerves, effectively block out pain impulses attempting to gain access to cord i.e., “pain gate”, thus reducing insult to surrounding tissues. This leads to optimal loading via mechanotransduction, is likely to cause optimal healing of injured area^[9]. Other physiological effects of cryotherapy are alternate periods of vasoconstriction and dilatation affect capillary blood flow, and it is across the capillary membrane that tissue fluid and metabolic exchanges take place. This reduces swelling and increased circulation allows more nutrients and repaired substances in injured area.

Table 1,2 and graph 2, shows there were significant different between Pre and Post control group ROM of ankle dorsiflexion with $p<0.001$. Physiologically, during passive stretch, both longitudinal and lateral force transduction occurs. When initial lengthening occurs in the connective tissue, tension rises sharply. After a point, there is mechanical disruption (influence by neural and biochemical changes) of cross bridges as filaments slide apart, leading to abrupt lengthening of the sarcomeres^[10]. Clinically, muscle cannot be measured directly but it can be measured indirectly by representation of angles formed about the joint^[11]. Therefore lengthening of Tendo Achillies is represented by ankle dorsiflexion range.

In this study, participants in the Interventional group were given Integrated Neuromuscular Inhibition Technique consist of trigger point release, MET and Strain Counter Strain for Calf muscle. Table 1,2 and graph 3 shows that in Interventional group there was significant difference in Pre and Post VAS ($p=0.00$). Ischemic compression technique deactivates TrPs and hence reduces pain by trigger point release of calf muscle. Freyer and Fossum have hypothesized that in MET, the sequence of muscle and joint mechanoreceptor activation evokes firing of local somatic efferent. This in turn leads to sympatho-excitation and activation of the periaqueductal Gray matter, which plays a role in the pain gate theory. This takes place in the dorsal horn of spinal cord. Our results agree with previously published trials on this subject indicating the ability of METs, component of INIT to affect trigger points. Chaitow and Delaney²⁸ noticed a consistent reduction of TrPs pain with the Post isometric relaxation approach at 4 weeks follow-up. However, our results showed that pain intensity was reduced after only one session of INIT technique.

Table 1,2 and graph 4, shows there were significant different between Pre and Post Intervention group ROM of ankle dorsiflexion with $p<0.001$. As stated, MET is a commonly utilised method for achieving tonus release (inhibition) in a muscle. The approach involves an isometric relaxation through the influence of the Golgi tendon organs (autogenic inhibition)^[6, 7, 12, 13].

Recent new technique that also try to reduce tension in muscle is Strain Counter Strain. When strain (injury) happens, we counter this injury by finding position that muscle would be at ease or relaxed position and message is sent to brain that muscle can be used gently without further injury i.e., negotiation with brain. Strain Counter Strain is usually used in combination of TrPs release with slight pressure^[6-8, 11-13].

Table 1 and Graph No. 5,6 showed both Control and Intervention groups exhibited significant improvement immediately in pain and ankle dorsiflexion ROM after the treatment ($p<.05$).

Conclusion

The Control group showed more improvements than Interventional for ROM of ankle dorsiflexion. Both INIT and

traditional approaches are effective in reducing plantar heel pain and ankle dorsiflexion range, however, the traditional approach may be a preferred treatment option.

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Limitation

1. This Study shows only immediate effect of INIT technique and Traditional therapy. Carry over effects are not known of above techniques from study.
2. The sample was collected from a single institution.

Recommendation

Results of above study can be used to treat heel pain patients in OPD.

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