International Journal of Physiotherapy and Research,
Int J Physiother Res 2015, Vol 3(2):992-98. ISSN 2321-1822
DOI: http://dx.doi.org/10.16965/ijpr.2015.121

Original Article

EFFECTIVENESS OF DIADYNAMIC CURRENT AND MENS IN HEEL PAIN: A RANDOMIZED CLINICAL TRIAL

Anand B. Heggannavar *[1], Preeti R. Ramannavar [2], Satyam S. Bhodaji [3].

[*1] Assistant Professor, Dept. of Orthopedic Manual Therapy, KLE University, Institute of Physiotherapy, Belgaum, Karnataka, India.
[2,3] Physiotherapist, Dept. of Physiotherapy, KLE University, Institute of Physiotherapy, Belgaum, Karnataka, India.

ABSTRACT

Relevance: Heel pain is one of the most common conditions leading to functional disabilities seen worldwide. There are different methods to manage heel pain, conservatively, and/or surgically. Physiotherapy treatment, as a part of conservative management, involves reduction of pain and improvement of functional ability by various approaches like exercise therapy, electrotherapy and manual therapy techniques. Various studies have shown that Diadynamic current and MENS along with conventional treatments give significant beneficial effects in pain reliving. Hence the present study was undertaken to compare and see the effect of Diadynamic current and MENS in heel pain.
Participants: 30 subjects (mean age 25.73 ± 6.56) diagnosed with heel pain were recruited from Out-Patient Department of Physiotherapy of KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi.
Method: Subjects were randomly allocated into 2 groups namely Group A (n=15) who received Diadynamic current along with conventional treatment as Therapeutic ultrasound and strengthening and stretching exercises and Group B (n=15) who received MENS with conventional treatment same as in group A for 7 days. The outcome measures were Visual Analog Scale (VAS) for pain, Pain disability index (PDI) and foot disability index (FDI) for functional disability.
Analysis: Within group and between group analyses after intervention was done to assess changes using paired t-test and unpaired t - test.
Result: Mean difference of VAS scores for Group A was 6.9 ± 1.48 and for Group B was 4.3 ± 2.43. Mean difference of PDI scores for Group A was 274 ± 117 and for Group B was 171 ± 99.Mean difference of FDI scores for Group A was 0.36 ± 0.24 and for Group B was 0.15 ± 0.15. Intra group comparison was statistically significant with p= <0.001 for both the groups in terms of VAS, PDI and FDI respectively. Inter group comparison was statistically significant with p= 0.005, 0.031, 0.007 for VAS, PDI and FDI respectively.
Conclusion: Diadynamic current is effective in reducing pain and secondarily improving the functional ability in subjects with heel pain.
KEY WORDS: Diadynamic current, Microcurrent Electrical Neuromuscular Stimulator or MENS, Pain Disability Index and Foot Disability Index.

Address for correspondence: Anand B. Heggannavar, Assistant Professor, Dept. of Orthopedic Manual Therapy, KLE University, Institute of Physiotherapy, Belgaum 590010, Karnataka, India.
E-Mail: anandhegs@yahoo.co.in

Access this Article online

Quick Response code

DOI: 10.16965/ijpr.2015.121

International Journal of Physiotherapy and Research
ISSN 2321- 1822
www.ijmhr.org/ijpr.html

Received: 12-03-2015	Accepted : 23-03-2015
Peer Review: 12-03-2015	Published (O): 11-04-2015
Revised: None	Published (P): 11-04-2015

INTRODUCTION

The heel is the portion of the human body that lies at the back side of each foot. There are 26 bones in the human foot, of which the heel

(calcaneus) is the largest. It is found right beneath the ankle joint. Experts say that stress placed on a foot when walking may be 1.25 times of our body weight, and 2.75 times when running [1]. Heel pain is usually focused on the underside or the back of your heel. In the majority of cases, heel pain has mechanical cause. It may also caused by arthritis, infection, an autoimmune problem, trauma, a neurological problem, or some other systemic condition [2]. Up to 10% of the population may present with heel pain over the course of their lives, which underscores the importance of practitioner familiarity with the diagnosis of plantar fasciitis and the associated risk factors, both intrinsic and extrinsic [3].

Heel pain is a common problem that people face, especially women. Mild heel pain can be short-term and may disappear on its own. However, it can persist for a long time and turn into a chronic condition which needs immediate attention [4]. Various measures are available for the treatment of heel pain such as conservative management including Pharmacotherapy and Physiotherapy, or surgical management. Physiotherapy treatment aims at reduction of pain and stiffness, improve joint mobility, increase muscle strength and to help the individuals affected with heel pain greater functional independence in performing activities of daily living using various approaches such as exercise therapy, electrotherapy, manual therapy techniques, taping and by providing ergonomic advice to the patient.

Diadynamic current is basically a variation of sinusoidal currents. Sinusoidal currents are alternating low frequency currents, having frequency of 50 Hz and pulse duration of 10 m sec, providing 100 stimuli / sec. There are five different currents available for Diadynamic therapy 1-DF (Fixed di-phase), 2- MF (Fixed mono-phase), 3- CP (Short periods), 4- LP (Long periods) and 5- RS (Syncopal Rhythm). It has a long-lasting analgesic effect. Diadynamic current has shown beneficial effects in reducing heel pain through its various physiological effects like pain masking, vasodilatation and hyperemia, muscle fiber stimulation and stimulation of vibration sense [5]. The Can et al (2003) study compared TENS with Diadynamic therapy for a group of patients with patellofemoral pain, they recruited 40 subjects among which group A consist of 20 individuals and group B consist of 20 individuals. These results showed that both the therapies that are TENS and Diadynamic currents were effective in terms of pain management [6]. Ratajczak B, Hawrylak A et al. studied the comparison with the efficiency of analgesic Diadynamic current therapy and TENS in low back discopathy in age group of 45 to 60 years who was diagnosed with low back pain syndrome due to discopathy where subjected to therapy. There were 80 sample size in which group A of 40 individuals were given Diadynamic current therapy and group B of 40 individuals were given TENS therapy. On the basis of research they concluded that Diadynamic current and TENS therapies in low back discopathy have an analgesic impact and improve functional fitness [7].

MENS is a device used to send weak electrical signals into the body. Such devices apply extremely small (less than 1 micro ampere) electrical currents to nerves. Microcurrent electrical nerve stimulation uses micro-amperage current as opposed to mill amperage current which is found primarily in TENS devices. Micro amp current is 1/1000 of a milliamp current and is closer to our own body's natural healing current. MENS works more on a cellular level and aids in the healing process while relieving pain. It has been found that MENS can help increase levels of a chemical called ATP (adenosine triphosphate) which promotes protein synthesis and healing in tissue cells [8]. Gabriel A, et al. studied the effective posto-perative analgesia is a prerequisite to enhance the recovery process and reduce morbidity. The sample size was 33 in which they concluded that MENS therapy, which enhances postsurgical recovery by stimulating the body's nature healing process [9]. Zuim PR, et al. studied the application of MENS and occlusal splint therapy in TMD (temporomandibular disorders) patients with muscle pain. 30 samples were studied in which they concluded that there was an equal result found between both the therapies [10].

There are various literatures suggesting the effect of Diadynamic currents on numerous musculoskeletal pains. Similarly, there have

been various studies on the effect of MENS on pain. As there is paucity of study suggesting the effectiveness of these modalities on the basis of comparison, the aim of this study is to examine the effectiveness of Diadynamic current and MENS along with the same conventional treatment in both the groups in terms of heel pain reduction and increase in functional ability.

METERIALS AND METHODS

Participants: 30 subjects with heel pain were recruited in the study as per the following inclusion criteria: 1) Individuals with age between 18 to 45 years, 2) Participant willing to participate in the study, 3) Unclassified mechanical plantar heel pain, 4) Chronic heel pain defined as at least 3 months of ongoing heel pain with no evidence of acute trauma to the heel,5) Degree of heel pain rating on the 0-10 Visual Analog Scale (VAS) is at least 3 for heel pain experienced upon taking the first few steps of the day. Subjects were excluded if they had 1) Evidence of acute trauma to the heel, 2) Loss of plantar foot sensation, 3) Skin ulceration (infection or wound) on the heel and surrounding area, 4) Benign and malignant tumors, 5) Any Neurological conditions. Informed consent was taken from the participant before intervention. Study was carried out in KLES Dr Prabhakar Kore Hospital and Medical Research Center, after approval of Institutional Ethical Committee, KLEU Institute of Physiotherapy, Belgaum.

Outcome measures: The outcome measures were Visual Analog Scale (VAS)[11], for pain, Pain Disability Index and Foot Disability Index for functional disability. Pain was measured using VAS by asking the patient to mark a point indicating the severity of his/her pain on a 0 to 10 cm horizontal scale, where 0 signified no pain and 10 signified the worst pain. Pain Disability Index [12] is the rating scale which has been designed to measure the degree to which aspects of their life are disrupted by chronic pain. In other words, it is to know how much pain is preventing individuals from doing what they would normally do or from doing it as well as they normally would. PDI has 7 categories of life activity listed; individual should circle the number on the scale that describes the level of disability they typically experience. A score of 0 means no disability at all, and a score of 10 signifies that all of the activities in which they would normally be involved have been totally disrupted or prevented by their pain. Foot disability Index is the questionnaire which has been designed to give the physical therapist information as to have their foot pain has affected their ability to manage everyday life. FDI [13] has 12 sections in each 6 statements from which any one should be marked whichever most closely applies to the individual.

Intervention: After briefing the participants informed consent was obtained. The subjects were randomly allocated into 2 groups by chit method. Group A: Diadynamic currents, Therapeutic ultrasound, stretching, exercises. Group B: MENS, Therapeutic ultrasound, stretching, exercises.

Diadynamic current was used with increase in intensity gradually until definite vibration or prickling sensation occurs, duration was not more than 12 minutes; for Modulation 4 And frequency was one session daily not more than 15 minutes for 7 sessions.

Fig. 1: Application of Diadynamic Current.

MENS was used with increase in intensity gradually until prickling sensation occurs, Frequency: 1 microampere for 15 minutes for 7 sessions.

Fig. 2: Application of MENS Current.

Therapeutic ultrasound at intensity of 1W/cm2, frequency 100-200 and duration of 1 MHz, continuous, for 5 minutes for both the groups as conventional treatment.

The Low intensity exercise given as the conventional treatment included 1. Ankle toe movements, 2. Walking on toes, 3. Toe curling, 4. intrinsic muscle strengthening of Foot. Followed by stretching exercises that included, 1. General calf stretch, 2. Foot sole stretch 3. Ball stretch.

RESULTS

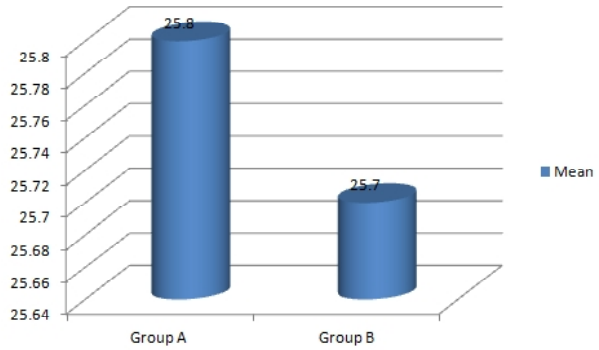
The results were analyzed in terms of reduction in pain, and functional improvement. Statistical analysis was done using SPSS version 16. Statistical measures such as mean, standard deviation and test of significance (paired and unpaired "t" tests) were used to analyze the data.

Demographic profile: Each group had 15 participants. Mean age of group A was 25.8 ± 7.14 years and mean age of group B was 25.7 ± 5.99 years (Table 1, Graph 1). Due to the randomization process and patient compliance, both males and female participants were noted in both the groups. 15 participants in group A included 13 females 2 males that in group B out of 15, 13 were females and 2 were males.

Table 1: Age distribution among Group A and Group B.

	Mean	SD
Group A	25.8	±7.14
Group B	25.7	±5.99

Graph 1: Age distribution.



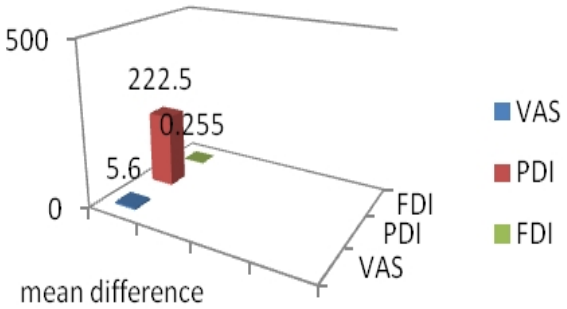
Outcome parameters: Within each group a statistically significant decrease in pain and increase in functional ability was noted. In group A, the mean VAS score pretreatment of 7.6 ± 1.12 reduced to 0.67 ± 0.72 post-treatment with mean difference of 6.9 ± 1.48. In group B, the mean VAS score pretreatment of 7.8 ± 0.77 reduced to 3.4 ± 2.06 with mean difference of 4.3 ± 2.43. Intra group comparison of pain score revealed statistical significance with t=3.64and p =0.001for Group A and t= 2.99 and p=0.001 for Group B. In group A, the mean PDI score pretreatment of 326 ± 132 reduced to 52 ± 36 post-treatment with mean difference of 274 ± 117. In group B, the mean PDI score pretreatment of 289 ± 152 reduced to 118 ± 88 with mean difference of 171 ± 99. Intra group comparison of pain score revealed statistical significance with t=2.43 and p= 0.001 for Group A and t= 2.51 and p=0.001 for Group B. In group A, the mean FDI score pretreatment of 0.59 ± 0.25 reduced to 0.23 ± 0.6 post-treatment with mean difference of 0.36 ± 0.24. In group B, the mean FDI score pretreatment of 0.47 ± 0.26 reduced to 0.32 ± 0.13 with mean difference of 0.15 ± 0.15Intra group comparison of pain score revealed statistical significance with t=2.56 and p =0.001 for Group A and t= 2.82 and p=0.001 for Group B. (Table 2, Graph 2)

Table 2: Intra group comparison of outcome measures.

		Mean diff	t	P
VAS	Grp A	6.9± 1.48	3.65	0.001*
	Grp B	4.3± 2.43	2.99	0.001*
PDI	Grp A	274± 117	2.43	0.001*
	Grp B	171± 99	2.51	0.001*
FDI	Grp A	0.36± 0.24	2.56	0.001*
	Grp B	0.15± 0.15	2.82	0.001*

***** Statistically significant

Graph 2: Mean difference of Outcome Measures.



Between groups comparison showed statistical significance with t values 2.802, 2.159 & 2.72 and p values 0.005, 0.031 &0.007 for VAS, PDI and FDI respectively. (Table 3)

Table No. 3: Inter group comparison of outcome measures.

		t	P
Group A	VAS	2.802	0.005*
Vs	PDI	2.159	0.031*
Group B	FDI	2.72	0.007*

***** Statistically significant

DISCUSSION

The present study was undertaken to determine the effectiveness of Diadynamic currents and MENS on heel pain, as measured using Visual analog scale. The other outcomes parameters were functional limitation measured by Pain disability Index and Foot Disability Index.

Group A received Diadynamic current along with conventional treatment (Therapeutic ultrasound + exercise + Stretching) while group B MENS in addition to conventional treatment.

Both groups showed improvement in pain as evident by a decrease in the VAS score and improvement in functional ability as evident in PDI and FDI score.

The mean difference of VAS scores for group A was 6.9 ± 1.48 and for group B was 4.3 ± 2.43. Intra group comparison of pain score revealed statistical significance with p value < 0.001^{+} in both the groups. These may be attributed to Diadynamic current that have the effect of pain reliving through 1) Pain masking i.e. increase of the stimulation threshold by DF current, 2) Vasodilatation and hyperemia due to release of histamine in the tissues. The same can occur in deeper structures by reflex activity, 3) Muscle fibers stimulation as Diadynamic current stimulates the muscle fibers, causing muscle contraction. CP and LP currents stimulate increase blood flow to the muscle and reduce edema, 4) Stimulation of vibration sense that leads to central masking of pain sensation [5], where MENS treatment concentrate on pain and/or speeding wound healing and recovery [14]. It also has been theorized that MENS increase the protein synthesis, stimulate the regeneration of injured tissue, stimulate lymphatic flow and relive myofascial trigger points. MENS works more on a cellular level and aids in the healing process while relieving pain. It has been found that MENS can help increase levels of a chemical called ATP (adenosine triphosphate) which promotes protein synthesis and healing in tissue cells [8].

A study conducted by Ratajczak B, Hawrylak A et al. to compare the efficiency of analgesic Diadynamic current therapy and TENS in low back discopathy in age group of 45 to 60 years who was diagnosed with low back pain syndrome due to discopathy where subjected to therapy. On the basis of research they concluded that Diadynamic current and TENS therapies in low back discopathy have an analgesic impact and improve functional fitness [7]. Present study agreed with a clinical trial by Philipson T, et al on the application of Diadynamic current on chronic soft-tissue pain in the neck and shoulder girdle. On the basis of research they concluded that Diadynamic current therapy gives equal pain relief for both neck and shoulder girdle soft-tissue pain [15].

Micro current treatments concentrate on pain and/or speeding wound healing and recovery [14]. It also has been theorized that MENS increase the protein synthesis, stimulate the regeneration of injured tissue, stimulate lymphatic flow and relive myofascial trigger points. A study was done by Gabriel A et al. for effective postoperative analgesia is a prerequisite to enhance the recovery process and reduce morbidity and concluded that MENS therapy, which enhances postsurgical recovery by stimulating the body's nature healing process [9]. Present study correlated with Zuim PR et al. studied the application of MENS and occlusal splint therapy in TMD (temporomandibular disorders) patients with muscle pain and concluded that there were equal results found between both the therapies [10].

Diadynamic currents and MENS therapy are effective in reducing pain. Inter group comparison showed significant difference with t =2.802 and p= 0.005 confirming Diadynamic current more effective than MENS Therapy.

The mean difference of PDI scores for group A was 274 ± 117 and for group B was 171 ± 99.

The mean difference of FDI scores for group A was 0.36 ± 0.24 and for group B was 0.15 ± 0.15. Intra group comparison of both functional out-

-come measures were pain statistically significant with p value < 0.001+ in both the groups. Pain and muscle weakness are the contributing factors for the disability seen in these patients with heel pain .Reduction in pain will lead to an improvement in the function of these patients, which was also seen in the present study. Inter group comparison showed significant difference with t =2.159 and p= 0.031 and t =2.72 and p= 0.007 for PDI and FDI scores confirming group A functional abilities were more than group B which could be attributed to the therapy that was given to the participants in both the groups.

Participants in both groups received Therapeutic ultrasound prior to the exercises, which is a non-pharmacological preferential heating treatment. It helps cause a temporary increase in their extensibility, and hence a decrease in joint stiffness. The advantages of using ultrasound to achieve this heating is due to the preferential heating of collagen tissue and to the effective penetration of this energy to deeply placed structures. This acceleration may increase the rate of phagocytosis, movement of particles and the cells. Hana Hronkova et al performed a study on possibilities of the analgesic effect of ultrasound therapy and non invasive therapy, and concluded that there was complete reduction of pain in 50% of participants, partial improvement in 16.6% and no effect in 33.3% of participants treated with ultrasound therapy [16].

The increase in functional ability may be due to increase mobility of soft tissue and subsequently improves range of motion (ROM) by elongating (lengthening) structures that have adaptively shortened and have become hypomobile over time. A randomized, prospective study with 2-year follow up compared Achilles tendon stretching with plantar fascia tissue specific exercises [17]. The authors found plantar fascia–specific stretching exercises was better. A study was conducted to see the effectiveness of stretching on pain and function in people with plantar heel pain. In this 6 studies were done to compare stretching with a control, stretching to an alternative intervention, stretching to both alternative and control interventions, and different stretching techniques and durations. Study comparing different stretching techniques, showed a statistically significant reduction in some aspects of pain in favour of plantar fascia stretching over calf stretches in the short term [18].

The present study results reflect that Diadynamic current along with the conventional treatment i.e. ultrasound, stretching and exercises had better improvement than that of MENS along with the conventional treatment i.e. ultrasound, stretching and exercises which was measured in terms of pain relief, improvement in functional ability.

Limitations: Study was confined to heel pain of non specific and non traumatic conditions.

Recommendations for Future Study: The present study can be conducted with specific condition of heel pain. Studies with longer duration are recommended with longer follow-up period to assess long term benefits.

CONCLUSION

Diadynamic current is effective in reduction of pain and thereby improving the functional ability in subjects with heel pain. It can be added as an adjunct to the existing protocol for management of heel pain.

ACKNOWLEDGEMENT

We are grateful to all the participants for providing time for the study. A heartfelt gratitude to the Management of KLEU Institute of Physiotherapy Belgaum and KLES Dr Prabhakar Kore Hospital and Medical Research Centre, Belgaum for providing the infrastructure facilities to carry out the study.

Conflicts of interest: None

REFERENCES

[1]. MNT, what is heel pain? What causes heel pain?, http://www.medicaln ewstoday.com/articles/181453.php, January 2015.

[2]. Mayo clinic, Symptoms Heel Pain, Definition http://www.mayoclinic.org/symptoms/heel-pain/basics/definition/sym-20050788, By Mayo clinic staff, January 2015.

[3]. LER, the epidemiology of Plantar fasciitis a. http://lermagazine.com/article/the-epidemiology-of-plantar-fasciitis, by Capt. Danielle L. Scher, MD; Lt. Col. Philip J. Belmont, Jr., MD; and Maj. Brett D. Owens, MD, January 2015.

[4]. The healthsite, 6 possible causes of heel pain http://www.thehealthsite.com/diseases-conditions/6-possible-causes heelpain/?gclid =CPa7nvL Wm8QCFYcljgodejUArg,by Shraddha Rupuvate, January 2015.

[5]. Evidence Based Guide to Therapeutic Physical Agents. Alain-Yvan Belanger.2003. Lippincott Williams Wilkins.

[6]. Can, F., R. Tandoðan, et al. (2003). "Rehabilitation of patellofemoral pain syndrome: TENS versus Diadynamic current therapy for pain relief." The Pain Clinic 15(1): 61-68.

[7]. Ratajczak B, Hawrylak A, Demidaœ A, et al. . Effectiveness of Diadynamic current and TENS in disc disease lumbar part of spine. J Back Musculoskeletal Rehabil 2011; 24(3):155-9.

[8]. Carolyn R, McMakin, Microcurrent Therapy: A novel treatment method for chronic low back myofascial pain. A case Review ,Journal of body work and movement therapies (2004) 8,143-153.

[9]. Gabriel A, Sobota R, Gialich S, Maxwell GP. The use of Targeted Microcurrent Therapy in postoperative pain management. Plast Surg Nurs. 2013 Jan-Mar;33(1):6-8.

[10]. Paulo Renato Junqueira Zuim; Alicio Rosalino Garcia; Karina Helga Leal Turcio; Marcelo Matida Hamata**,** Evaluation of microcurrent electrical nerve stimulation (MENS) effectiveness on muscle pain in temporomandibular disorders patients, J. Appl. Oral Sci. vol.14 no.1 Bauru Jan./Feb. 2006.

[11]. Price DD, McGrath PA, Rafii A, Buckingham B, The Validation of the Visual Analogue Scale as Ratio Scale Measures for Chronic and Experimental Pain, Pain 1983, 45-56.

[12]. Chibnall JT Tait RC. The Pain Disability Index: Factor Structure and Normative Data. ArchPhys Med Rehabil. 1994; 75: 1082-1086.

[13]. Vetrano M, Vulpiani MC, Erroi D, Vadalà A, Ferretti A, Saraceni VM Cross-cultural adaptation and reliability of the Italian version of the Foot Function Index (FFI-I) for patients with plantar fasciitis. J Sports Med Phys Fitness.2014 Oct; 54(5):636-43.

[14].Lambert MI, Marcus P, Burgess T, Noakes TD. Electromembrane microcurrent therapy reduces signs and symptoms of muscle damage Med Sci Sports Exerc. 2002 Apr; 34(4):602-7.

[15]. Philipson T, Haagensen N, Laumann V, Nies M, Thorup K, Hansen TI.The effect of diadynamic current on chronic soft-tissue pain in the neck and shoulder girdle. Ugeskr Laeger 1983;145:479-81

[16]. Hronkova H, Navrtil L, Skopek J and Kymplova J, Possibilities of the Analgesic therapy of Ultra sound and Non-Invasive therapy 19.02.2000, www.laserpartner.org. pg: 2.

[17]. DiGiovanni BF, Nawoczenski DA, Lintal ME, et al. Tissue-specific plantar fascia-stretching exercise enhances outcomes in patients with chronic heel pain. A prospective, randomized study. J Bone Joint Surg Am. Jul 2003; 85-A (7):1270-7.

[18]. Sweeting D, Parish B, Hooper L, Chester R The effectiveness of manual stretching in the treatment of plantar heel pain: a systematic review. J Foot Ankle Res. 2011 Jun 25; 4:19.

How to cite this article:

Anand B. Heggannavar, Preeti R. Ramannavar, Satyam S. Bhodaji. EFFECTIVENESS OF DIADYNAMIC CURRENT AND MENS IN HEEL PAIN: A RANDOMIZED CLINICAL TRIAL. Int J Physiother Res 2015;3(2):992-998.
DOI: 10.16965/ijpr.2015.121