ISSN 0976 – 3333

Available Online at www.ijpba.info

International Journal of Pharmaceutical & Biological Archives 2013; 4(6): 1175 - 1180

ORIGINAL RESEARCH ARTICLE

Role of Tens Therapy in Neuropathic Pain

Sadaf Ahmed[1,2*], Hira Zameer[1], Shamoon Noushad[2]andLubna Anwer[1]

[1]*University of Karachi,Physiology Department, Pakistan*
[2]*Advance Educational Institute & Research Centre, Pakistan*

Received 27Sep 2013; Revised 09Dec 2013; Accepted 18Dec 2013

ABSTRACT

Pain is unpleasant sensory & emotional experience associated with tissues damage, while neuropathic pain results from tissue damage in central and peripheral nervous system. The application of electrical current through the skin can be used for pain control by Transcutaneous Electrical Nerve Stimulation (TENS) unit that is known to produce neuro-modulation bay pre synaptic inhibition, endogenous pain control or restoration of afferent input.We want to evaluate the profound effects of TENS therapy among patients with crucial neuropathic pain symptoms methodology base line histories , location & types of neuropathic pain symptoms such as numbness, tingling, burning, paresthesia and lancinating pain were checked of pain while intensity of pain was also determined by using numeric rating scale booth in pre & post TENS therapy.The results showed that pain symptoms among the population with neuropathic pain have remarkably reduced after the application of TENS.By using verbal pain scale chart it has been determined that the crucial neuropathic pain symptoms have been reduced by the application of TENS. These results suggest that TENS reduced pain symptoms during peripheral neuropathy this reduction in pain symptoms support the hypothesis that TENS work through reducing hyperaglesia.

Keywords: Pain intensity, Neuropathic pain, TENS, pain, neuropathy.

INTRODUCTION

Any sensory and emotional distasteful experience is recognized as Pain that can appear as symptom of actual or possible tissue damage due to any injury or disease (McCaffery,1968 &Pasero*et al*., 1999&Richiemer, 2002).If this involves smash up to either the central nervous system (CNS) or the peripheral nervous system (PNS), results in Neuropathic pain that is characterized by burning, electric, tingling and shooting sensations (Bauman, 2002&Macres*et al*., 2002). The key causes like confiscation, diabetes and other tribulations often results in numbness, dysesthesias, hyperesthesia, hyperalgesia, allodynia astypicalappearance of specifically neuropathic pain.Symptoms usually last even afterimprovement of the prime cause that may be due to frenzied sensitization of CNS, results inpoor transmission of signals to spinal cord and brain.The major concern is not only poor control over healing and psychophysiological issues but also there are many limitations in bursting sensationin treatment options. Neuropathic pain syndromes can be further classified in the basis of contingentmechanisms(Portenoy, 1991)as compressive or entrapment neuropathies, plexopathies, radiculopathies and polyneuropathies, other relates problems of in the spinal cord, brain or both. Many of the neurophysiologic, neuroanatomic changes that may occur in neuropathic pain are understood(Gamsa, 1994). Transcutaneous Electrical Nerve Stimulation (TENS)has been clearly recognizedas a purposeful method of pain management by non invasiveelectrostimulation (Lampe, 1978 &Cameron, 2003). It is potulated that this stimulation lessen pain intensity and feel in all physiologically related parts of body(Ellis, 1998),though mainlyit has been used for pain management it is necessary to analyze its analgesic role of and comparison of pain intensities in relation to different characteristic symptoms of pain. (Lazarou*et al*., 2009).There are various studies and case reports have been discussedthat emphasizes the)clinical utilization of TENS for a range painful conditions as low back pain (LBP), joint pain, neuropathic

***Corresponding Author:**Sadaf Ahmed, **Email:**Aeirc.pk@gmail.com

pain&visceral pain (Nnoaham et al., 2008, Fernandez et al., 2008, Peters et al., 2008&Robb*et al*, 2008).TENS is reported to produces neuromodulationby causinginhibition at presynaptic level and contributes to relieve endogenous pain by facilitating the release of endorphin family (Basbaum AI, Fields HL, 1978), in CNS. Moreover elevatedrateof TENS lessen excitation of CNS neurons to spread painsensations bytrimming down glutamate and amplifying GABA release in the spinal cord that leads to the analgesic effect via muscarinic receptors. TENS at much lower frequency help to activates serotonin receptors in the spinal cord facilitates GABA. In painkilling clinical approaches, TENS is much likeable technique to be used in an to lessen neuropathic pain (Forst, *et al*. 2004). Mixed reviews and opinions have been reported by patients and practitioners about advantagesof this approach, vary on individual basis (L. S. Chesterton, *et al*, 2003), and pain threshold (Foster,et al, 2003). It is found to be very useful in in labour (Spank, *et al*. 2000); knee pain(Ng, *et al*, 2003)(Cheing, *et al*, 2003) (Osiri, *et al*, 2000);bladder post operative pain (Kararmaz, *et al*, 2004); limb pain (Cooney, 1997).

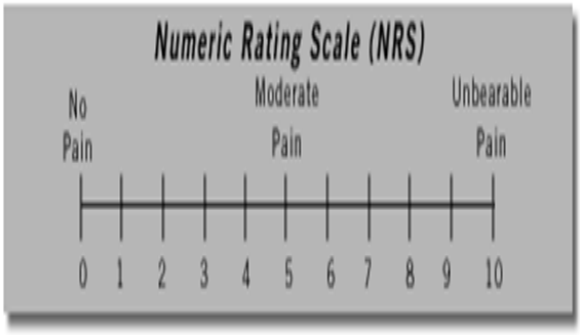
MATERIAL AND METHODS

Thepatients were diagnosed with different types of peripheral neuropathy such as Right lumber reticulopathy, carpel tunnel syndrome, Vitamin. B_{12} deficiency neuropathy, radiculopathy, sciatic nerve compression, lumbosacrel radiculopathy, dysfunction of median nerve. Base line history from all subject were collected through a questionnaire, which included question mainly on current health of the individual, complete history, location of pain, intensity of pain was determined by using Numeric Pain rating scale (Hartrick et al.,2003). Pain was measured on an 11-point numeric pain rating scale

(VAS; scale range: 0, no pain; 10, worse possible pain). TheprincipalTENS efficiency determinant was the reduction in neuropathic painscores at first follow-up visitin comparison with baseline scores. We observed purposely atthe most frequent pain symptom scores of numbness or tingling and burning.

NUMERIC RATING SCALE

Types of neuropathic pain, symptoms either, numbness, tingling, burning, paresthesia, lancinating, electrical shock like Pain Paroxysms (Jensen *et al*. 2001, Dworkin 2002, Hansson 2002, Sommer 2003). The aching pain is common in polyneuropathy (Otto *et al*., 2003) and central pain (Hansson, 2002). The presence of any psychological factor as depression and anxiety that are commonly associated with neuropathic pain was also noted. Moreover the patients were also questioned about the effects of pain on their daily routine.



APPLICATION OF TENS:

Despite of medications, neuropathic patients were also prescribed to TENS Therapy as an effective way to relieve pain. A transcutaneous electrical nerve stimulation (TENS) unit consists of 1 or more electrical-signal generators, a battery, and a set of electrodes. The TENS unit is small and programmable, and the generators can deliver trains of stimuli with variable current strengths, pulse rates, and pulse widths. The preferred waveform is biphasic, to avoid the electrolytic and iontophoretic effects of a unidirectional current (Peters K, *et al*. 2008). The settings for the stimulus parameters used clinically are the following:

Amplitude	**Current at a comfortable, low intensity level, just above threshold**
Pulse width (duration)	120-160µsec (vary)
Pulse rate (frequency)	4-6 Hz (vary)

RESULTS

Table 1: The Table showing appearance of Pain symptoms in patients with Neuropathic pain before and after Transcutaneous Electrostimulation

Symptom	**Pre-TENS**	**Post-TENS**
Tingling	66%	38%
Burning	70%	44%
Deep pain	25%	20%
Restless legs	24%	7%
Numbness	54%	34%
Lancinating	8%	6%

(n=448)

Pain symptoms among the population with neuropathic pain have remarkably reduced after the application of TENS that evident in (**Table 1**). There is a noticeable change in patients reported for burning, tingling, restless legs & numbness.

While the other symptoms like deep pain &Lancinating pain did not show any significant improvement.

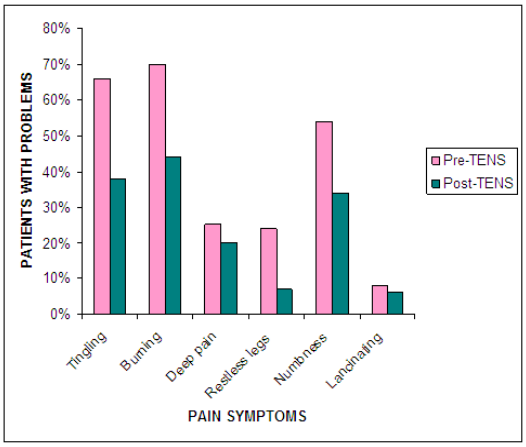


Fig 1: Graph Showing the Comparison of Pain Symptoms between Pre and Post Tens Groups

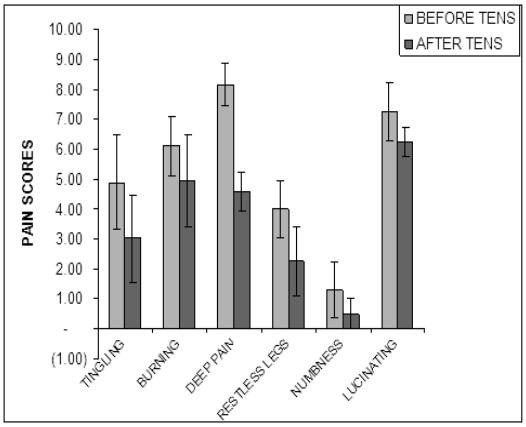


Fig 2: Graph Showing the Comparison of Pain Symptoms betweenthe Pre and Post Tens Groups With the Help of Pain Scores

DISCUSSION

Pain in general includesvariety of sensations, involving the nerves and the brain, ranging from agony to numbness. Unusual sensations such as tingling, burning, or "pins-and-needles" type pain considered as paresthesias. They usually result from nerve damage due to pressure (such as a pinched nerve), entrapment, or diseases. Burning, numbness, shooting pain. Continued nerve damage can lead to numbness, dysesthesia (eg, burning, tingling), and signs of nerve injury detected during neurologic examination. TENS is a passive, non-invasive, non-addictive modality with no acknowledged side effects used clinically by a variety of health care professionals for the reduction of pain (Sluka**,** 2003). TENS works to decrease pain perception and can be useful to control acute and chronic pain. It may also be used with other treatments such as exerciseand othereffects. A session typically lasts from 5 to 15 minutes and treatments may be applied as often as necessary, depending on the severity of pain. Some practitioners refer to TENS as a sort of "electrical massage" (Internet, 2009).

TENS devices can be set in a wide range of frequencies and intensities, depending on patient preferences, desired sensations, and treatment goals. "Conventional TENS" involves the delivery of high or low frequency electrical current to affected areas. TENS has been hypothesized to improve pain in multiple ways. Theories include effects on sensory nerves (Hiraoka, 2002), interference with sensory-discriminative pathways (Bushnell, *et al*. 1991, Marchand, *et al*. 1993 & Sanderson, *et al*. 1995), stimulation of release of natural chemicals that affect the way pain is perceived and transmitted (for example, encephalins and endorphins) (Sjolund, *et al*. 1977, Almay, *et al*. 1985, Abenyakar, *et al*. 1994, Abram, et al. 1981 & Woolf, et al. 1978), or through increased blood flow in treated areas such as the skin or heart (Lundeberg, *et al*. 1988 Kjartansson, *et al*. 1988 &Chauhan, *et al*. 1994). Recent data suggest pain relief from low and high frequency TENS is mediated by the release of mu or delta-opioids, respectively, in the central nervous system (Chandran, *et al*. 2003 &Sluka, *et al*. 2002), and reductions in substance P (Rokugo,*et al*. 2002). Theories used traditionally to explain acupuncture have also been offered, citing effects on flow of vital energy. It is also sometimes suggested that TENS may affect the cardiovascular system, increasing heart rate and reducing blood pressure (Campbell,*et al*. 2002). The low-frequency TENS treatment was effective in improving the viability of ischemic skin flap (Liebano**,** 2008).In our study we tested the effectiveness of episodic transcutaneous electrical nerve stimulation (TENS) on pain symptoms in patients with neuropathic pain. TENS, with a modulated frequency, intensity as high as the subject could tolerate, and electrodes placed over the painful area. Self-report of pain symptoms were assessed on 448 subjects. TENS resulted in significantly less tingling, burning, restless legs and numbness in post TENS groups as compared to pre TENS groups (Table 1). Vaiations in the involvement of unmyelinated&mylinated nerve fibres that generate pain sensations of burning, tingling, numbness etc. alter with respect to known & mysterious pathophysiological findings in intensities as well as in quality and characteristic signs as superficial, lancinating etc.. Although deep pain and lancinating were not significantly different when compared with pre TENS groups. These results suggest TENS

reduces pain symptoms during peripheral neuropathy and maintain quality of life when used as a supplement to pharmacologic analgesia. Reduction in pain symptoms support the hypothesis that TENS works through reducing hyperalgesia.Quantifying the intensity of pain is an essential part of initial and ongoing pain assessment. A variety of validated pain scales are available to assist in the measurement of pain. Whichever method is chosen, it should be systematically applied (Au et al. 1994). Pain measurement tools include simple one-dimensional scales or multidimensional questionnaires. Pain measurement should include both the time-frame and the clinical context of the pain (Chapman et al. 1985). In our study patients were asked about their pain at the time ofassessment and the average intensity over a fixed period of time in order to analyze the course of the pain, it useful to inquire about pain as separate measures for pain "on average", pain "at its worst", and pain "at its least". The Commonly used unidimensionalscales; Verbal Rating Scale (VRS), the Numeric Rating Scale (NRS), a Visual Analog Scale (VAS), and a Pictorial Scale was used. Transcutaneous electrical nerve stimulation (TENS) is an effective adjunctive therapy for neuropathic pain; however, effects of different frequencies of stimulation have not been systematically investigated. Peripheral Neuropathy causes significant neuropathic pain among the patients and requires substantial medication. Therefore, we studied the effects of TENS regarding intensity of pain in peripheral neuropathic pain patients. 448 patients suffering from peripheral neuropathies were randomly allocated to receive TENS. Peripheral neuropathic pain was evaluated using a standard numeric rating scale and through a questionnaire, both high frequency and low frequency TENS, at strong, but comfortable sensory intensity, were applied for 15 to 30 minutes. Pain was assessed before and after application of TENS when patients were at physiotherapy centre. By considering the pain symptoms it has been concluded that both high and low frequency TENS significantly decreased intensity of pain when Pre-TENS groups using the numeric rating scale (P=0.001) compared to the Post-TENS groups (P=0.001) (table-3). TENS in combination with pre and post investigation is found not only as a harmless, low-cost, and easy to do procedure that provides pain. Our TENS study concluded that changes in intensity of pain can be varied with different etiologies but it could be directly bridging the gap of sufferings and cure. though there was certain limitations as sample size that could be sufficiently large to spot significant differences in lessening of pain intensity, and any sensible design enhances the generalize ability of our findings to primary care, making efforts to standardize care in accordance with general practice.*Pain intensity can be used as a fundamentalsequence of symptoms to evaluate pain* The pain intensity–related information association with evaluation of features of a painful stimulus. We propose that intensity processing is both a criticalprecursor and an integral component of the many processescomprising the pain experience (Table: 1). Such processes includeevaluation provides a neurophysiological basis for the highdegree of covaiance between discrete aspects of the painexperience and perceived pain intensity. On a conclusive note of our findings is unlikely to exist for allchange of patient conditions, combined with interacting therapeuticmodalities, an evidence-based approach to pain management is not alwayspossible or beneficial to the patient. In the face of inconclusive evidence,a theory-based approach may help determine if the therapeutic effect ofa given physical agent has the possibility of being a useful clinical tool inthe context of treating a particular patient's mechanism of pain generation.Until controlled efficacy findings are definitive, careful individual patient responsemonitoring of thoughtful theoretical application of adjunctive physicalagents may be a prudent approach to the management of chronic pain. Future studies are needed to identifythe optimal time to achieve maximum antinociceptiveeffect and to confirm and extend these results. Additionalsearch for biologic markers (i.e, epidermal nerve fiber biopsy,microneurography) will be necessary in future protocols todetermine if permanent structural changes can be produced.

REFERENCES

1. Nnoaham KE, Kumbang J. (2008). Transcutaneous electrical nerve stimulation (TENS) for chronic pain. *Cochrane Database Syst Rev*.; CD003222.
2. Fernandez-Del-Olmo M, Alvarez-Sauco M, Koch G, *et al*. (2008). How repeatable are the physiological effects of TENS? *ClinNeurophysiol*.; 119(8):1834-9.
3. Peters K, Carrico D, Burks F. (2008). Validation of a sham for percutaneous

tibial nerve stimulation (PTNS). *Neurourol Urodyn*.
4. Robb KA, Bennett MI, Johnson MI, *et al*. (2008). Transcutaneous electric nerve stimulation (TENS) for cancer pain in adults. *Cochrane Database Syst Rev:* CD006276.
5. Basbaum AI, Fields HL. (1978). Endogenous pain control mechanisms: review and hypothesis. *Ann Neurol*.; 4(5):451-62.
6. Hansson P(2002). Neuropathic pain: clinical characteristics and diagnosticworkup. *Eur J Pain;* 6(Suppl A):47–50.
7. Jensen TS, Gottrup H, Sindrup SH, Bach FW. (2001) The clinical pictureofneuropatic pain. *Eur J Pharmacol*; 429:1–11.
8. Otto M, Bak S, Bach FW, Jensen TS, Sindrup SH.(2003) Pain phenomenaand possible pain mechanisms in patients with painful polyneuropathy.*Pain*; 101:187–192.
9. Sommer C. (2003) Painful neuropathies. *CurrOpinNeurol*;16:623–628.
10. Abenyakar S, Boneval F. (1994) Increased plasma b-endorphin concentrations after acupuncture: comparison of electroacupuncture, traditional Chinese acupuncture, TENS and placebo TENS. Acupuncture in Medicine: Journal of the British Medical Acupuncture Society; 7(1):21-23.
11. Abram SE, Reynolds AC, Cusick JF. (1981) Failure of naloxone to reverse analgesia from transcutaneous electrical stimulation in patients with chronic pain. AnesthAnalg; 60:81-84.
12. Almay BG, Johansson F, Von Knorring L, *et al*. (1985) Long-term high frequency transcutaneous electrical nerve stimulation (hi-TNS) in chronic pain. Clinical response and effects on CSF- endorphins, monoamine metabolites, substance P-like immunoreactivity (SPLI) and pain measures. J Psychosom Res; 29(3):247-257.
13. Au E, Loprinzi CL, Dhodapkar M, *et al*. (1994) Regular use of a verbal pain scale improves the understanding of oncology inpatient pain intensity. *J Clin Oncol.*;12:2751-2755
14. Bushnell MC, Marchand S, Tremblay N, *et al*. (1991) Electrical stimulation of peripheral and central pathways for the relief of musculoskeletal pain. Can J PhysiolPharmacol; 69(5):697-703.
15. Campbell, TS, Ditto B. (2002) Exaggeration of blood pressure-related hypoalgesia and reduction of blood pressure with low frequency transcutaneous electrical nerve stimulation. Psychophysiology; 39(4):473-481.
16. Chandran P, Sluka KA. (2003) Development of opioid tolerance with repeated transcutaneous electrical nerve stimulation administration. Pain; 102(1-2):195-201.
17. Chauhan A, Mullins PA, Thuraisingham SI, *et al*. (1994) Arrhythmias/pacing/electrical stimulation: effect of transcutaneous electrical nerve stimulation on coronary blood flow. Circulation; 89(2):694-702.
18. Hiraoka K. (2002) Neural mechanisms underlying the effect of transcutaneous electrical nerve stimulation in humans. ElectromyogrClinNeurophysiol 2002; 42(6):359-366.
19. Kjartansson J, Lundeberg T, Korlof B. (1988) Transcutaneous electrical nerve stimulation (TENS) in ischemic tissue. PlastReconstrSurg 1988; 81(5):813-815.
20. Liebano RE, Abla LE, Ferreira LM. **(**2008) Effect of low-frequency transcutaneous electrical nerve stimulation (TENS) on the viability of ischemic skin flaps in the rat: an amplitude study.Wound Repair Regen.; 16(1):65-9.
21. Lundeberg T, Kjartansson J, Samuelsson U. (1988) Effect of electrical nerve stimulation on healing of ischaemic skin flaps. Lancet; 2(8613):712-714.
22. Marchand S, Charest J, Li J, *et al*. (1993) Is TENS purely a placebo effect? A controlled study on chronic low back pain. Pain; 54(1):99-106.
23. RokugoT, Takeuchi T, (2002) Ito H. A histochemical study of substance P in the rat spinal cord: effect of transcutaneous electrical nerve stimulation. J Nippon Med Sch; 69(5):428-433.
24. Sanderson JE, Tomlinson B, Lau MS, *et al*. (1995) The effect of transcutaneous electrical nerve stimulation (TENS) on

autonomic cardiovascular reflexes. ClinAuton Res; 5(2):81-84.
25. Sjolund B, Terenius L, Eriksson M. (1977) Increased cerebrospinal fluid levels of endorphins after electro- acupuncture. ActaPhysiolScand; 100(3):382-384.
26. Sluka KA, Chandran P. (2002) Enhanced reduction in hyperalgesia by combined administration of clonidine and TENS. Pain; 100(1-2):183-190.
27. Sluka KA, Walsh D. **(**2003)Transcutaneous electrical nerve stimulation: basic science mechanisms and clinical effectiveness. J Pain. Apr; 4(3):109-21.
28. Woolf CJ, Mitchell D, Myers RA, *et al*. (1978) Failure of naloxone to reverse peripheral transcutaneous electro-analgesia in patients suffering from acute trauma. S Afr Med J; 53(5):179-180.
29. Bauman T (2002). Pain Management. In Pharmacotherapy: A Pathophysiologic Approach, fifth edition. McGraw-Hill, 1103=1117.
30. Richiemer S, Macres S. Understanding Neuropathic Pain.http:// www. spineuniverse.com/treatment/pain/ag_060500richeiner_neuropain.html (accessed 2002 June 10).
31. *Dworkin RH, Fields,HL (2005). "*Fibromyalgia from the perspective of neuropathic pain*". J RheumatolSuppl75: 1–5.*
32. *Portenoy RK (1989). "Painful polyneuropathy". NeurolClin7 (2): 265–88.*
33. Gamsa A. (1994). The role of psychological factors in chronic pain. I. A half century of study. Pain.;57:5-15
34. Richeimer, S., &Macres, S. M. (2003). Understanding neuropathic pain. *Retrieved January*, *27*.
35. LazarosLazarou, AthanasiosKitsios, IoannisLazarou, EvagelosSikaras, and AthanasiosTrampas, 2009. Effects of Intensity of Transcutaneous Electrical Nerve Stimulation (TENS) on Pressure Pain Threshold and Blood Pressure in Healthy Humans Clin J Pain _ Volume 25(9); 773-780.
36. Ellis B. Transcutaneous electrical nerve stimulation for pain relief: recent research findings and implications for clinical use.PhysTher Rev. 1998; 3:3–8.
37. Dean J, Bowsher D, Johnson MI. The effects of unilateral transcutaneous electrical nerve stimulation of the median nerve on bilateral somatosensory thresholds. ClinPhysiolFunct Imaging. 2006;26:314–318
38. Cameron MH. Physical agents in rehabilitation: from research to practice. Philadelphia:W.B. Saunders; 2003.
39. Lampe GN: Introduction to the use of transcutaneous electrical nerve stimulation devices. PhysTher 58:1450-1454, 1978.
40. Baron R. Peripheral neuropathic pain. From mechanisms tosymptoms. Clin J Pain 2000; 16:S16-20.