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A Comparative Study of Efficacy of Microcurrent Electrical Nerve Stimulation (Mens) and Transcutaneous Electrical Nerve Stimulation (Tens) on Pain and Disability in Patients with Unilateral Lumbar Radiculopathy

Bhanukiran Chauhan[1] Dr. Mahendra Shende (PT)[2]

[1]Intern, Dr. A.P.J. Abdul Kalam College of Physiotherapy, Loni, Maharashtra, India

[2]Principal, Dr. A. P. J. Abdul Kalam College of Physiotherapy, Loni, Maharashtra, India

Abstract: ***Objective: To compare the efficacy of Microcurrent Electrical Nerve stimulation (MENS) and Transcutaneous Electrical Nerve Stimulation (TENS) on patients with unilateral Lumbar Radiculopathy. Methodology: 30 participants of age group 30-50 years were selected according to the selection criteria. They were randomly assigned into two groups. Participants of Group 1 were given TENS, Group 2 were given MENS. The pain was assessed using Numerical Pain Rating Scale and Functional Disability with the help of Oswestry low back disability questionnaire respectively. The entire procedure was explained to the participants and informed consent was taken. TENS as well as MENS was applied daily for a total duration of 1 week. Each session was of 20 minutes with the participant lying in comfortable position. Numerical Pain Rating Scale scores and Functional Disability scores were checked before and after the intervention and results were analyzed. Outcome measure: Numerical Pain Rating Scale and Oswestry low back pain disability questionnaire was used for the purpose of assessment of pain and Functional Disability respectively. Result: There was a statistically significant improvement in the functional disability and pain in the patients treated with the Microcurrent electrical nerve stimulation (MENS) and Transcutaneous electrical nerve stimulation (TENS). Conclusion: Both MENS and TENS were effective but as compared to MENS, TENS was more effective in relieving pain and improving functional disability in patients with unilateral Lumbar Radiculopathy.***

Keywords: Lumbar Radiculopathy, Microcurrent Electrical Nerve Stimulation, Transcutaneous Electrical Nerve Stimulation

1. Introduction

Lumbar radiculopathy is one of the most serious health issue in general population as it retains the function and ability in personal as well as professional life. It can be defined as disorder involving compression of lumbar spinal nerves along with impingement, irritation and inflammation of a spinal nerve root which is most commonly caused due to a protrusion of disc or any degenerative disorder which causes narrowing of the intervertebral foramen.[1] It is different from radicular pain which is a single symptom that is caused from one or more than one spinal nerves. The prevalence of lumbar radiculopathy is somewhere between 9.9 to 25 %.[4]Lumbar radiculopathy is typically determined by radiating pain often with numbness, paraesthesia and or along with weakness of muscle function.[3] Unilateral leg pain greater than the low back pain is seen and it often follow the dermatomal pattern of involvement of affected nerve root. Symptoms also depends upon the nerve root which is been affected.One of the most common diagnostic tests for lumbar radiculopathy are straight leg raise, Bragard's test and tests for tendon reflexes, motor weaknesses and sensory deficits.[3]The most common surgical treatment for Lumbar radiculopathy is Lumbar Laminectomy or Lumbar Laminotomy which can be done with or without Discectomy. The mentioned surgeries for lumbar radiculopathy has a success rate of 60 to 90 % out of which almost 10 to 40 % patients live with residual pain and disability after the surgical intervention.[2]Transcutaneous electrical nerve stimulation (TENS) is defined as application of electrical stimulation directly to the skin to control the pain by the American Physical Therapy Association. TENS is traditionally used for pain control because it's a cheap, non-expensive, easy and safe to use. Presently TENS is used with various frequencies and pulse duration and is classified into high frequency TENS with a frequency of more than 50 Hz and low frequency TENS with a frequency of lower than 10 Hz. Another type is burst TENS in which the frequency is much lower. The intensity is determined by the by the by the response of the patient as either sensory level TENS or motor level TENS.[5]Working of TENS can be explained by the Pain Gate theory proposed by Melzack and Wall in 1965. It suggest that for the pain impulses to pass through the gate there must be an unopposed passage for nociceptive information at the synapses in substantia gelatinosa. But however if the gate is concurrently receiving impulses produced by stimulation of the mechanoreceptors or thermo-receptors which are carried by the myelinated larger diameter fibres then this traffic dominates and causes presynaptic inhibition of the nociceptive impulses. TENS cause stimulation of the endings connected to

large diameter nerves and causes a reduction in pain by closing of pain gate.[6]

Microcurrent electrical nerve stimulation is one of the physiotherapeutic modalities which can deliver microampere range current. Mircocurrent therapy is traditionally used in various conditions such as increasing the rate of healing, to reduce and manage pain, increasing the rate and recovery of the fracture as well as to treat myofascial pain and dysfunction.[7] Mircocurrent is generally defined as current below 1 milliampere and can provide a long lasting relief from a various variety of pain syndromes. The microcurrents block the neuronal transmission of pain signals and even stimulates the release of endorphins.Electro-stimulation with microcurrent causes increased ATP concentrations, membrane transport and protein synthesis. With currents from 50 to 100 microampere the ATP levels increased three to five times.[7]

2. Procedure

30 participants of age group 30-50 years were selected according to the selection criteria.Participants were screen recorded to inclusion and exclusion criteria. The participants were divided into two groups by simple random sampling to ensure randomization. One group had patients who received Transcutaneous electrical nerve stimulation Group 1 (TENS) and the other group had participants received Microcurrent electrical nerve stimulation Group 2 (MENS). The informed written consent was taken from each participant regarding the procedure prior to the study.

Assessment of pain was taken with Numerical pain rating scale (NPRS) and the assessment of functional disability was taken with the help of the Oswestry low back pain disability questionnaire.

Group 1: Transcutaneous electrical nerve stimulation was applied once daily for a total duration of one week (number of effective sessions were 6). Each session was conducted for a duration of 20 minutes. Intensity of TENS was set till the patient felt a comfortable tingling sensation. The patient was placed in a comfortable position either supine lying or prone lying depending upon the area of distribution of pain and two channels were used (total of 4 vacuum electrodes placed in the area of dermatomal involvement or along the area radiation)

Group 2: Microcurrent electrical nerve stimulation was applied once daily for a total duration of one week (number of effective sessions are 6). Each session was conducted for a duration of 20 minutes. Intensity of microcurrent was ranging between 200 to 1000 microampere. The patient was placed in a comfortable position either supine lying or prone lying depending upon the area of distribution of pain. Two channels were used (total of 4 vacuum electrodes placed in the area of dermatomal involvement or along the area radiation)

3. Data Analysis and Result

Table 1: Mean and Standard deviation of NPRS for MENS and TENS before and after treatment

Group	Before Treatment	After Treatment	Student's Paired 't' test value	'p' value and significance
	Mean ± SD	Mean ± SD		
1. TENS	7.33 ± 1.17	1.93 ± 1.38	3.84	p=0.001, significant
2. MENS	7.27 ± 1.16	4.6 ± 0.91	2.96	p=0.001, significant

By applying the students paired t-test there was a significant decrease in mean value of NPRS from Pre to Post treatment (p=0.001) in the group 1 (TENS).

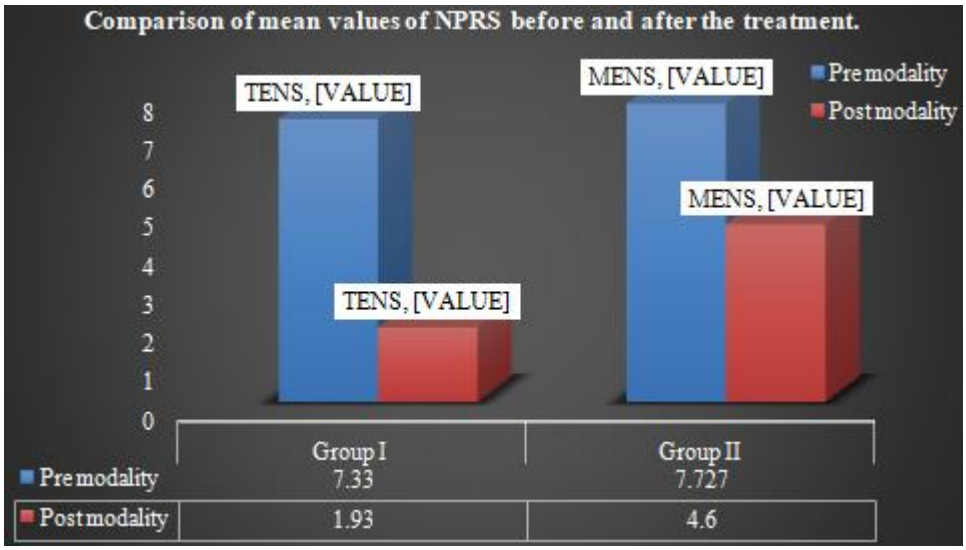

Chart 1:

The pre-intervention scores of **NPRS** in participants treated with TENS were (Average±SD) 7.33 ± 1.17and those treated with MENS were 7.27 ± 1.16.The post intervention values of NPRS in participants treated with TENS were 1.93 ±1 .38 and those treated with MENS were 4.6 ± 0.91**.** On comparing the pre and post intervention values of NPRS in participants treated either with TENS or MENS, it was observed that the difference was extremely significant **(p<0.001)** and the

difference was considerably **more** in the participants treated with TENS as compared to MENS.

Table 2: Mean and Standard deviation of Functional Disability for MENS and TENS before and after the treatment

Group	Before Treatment	After Treatment	Student's Paired 't' test value	'p' value and significance
	Mean ± SD	Mean ± SD		
1. TENS	62.5% ± 8%	28% ± 11%	4.13	p=0.001, significant
2.MENS	70% ± 7%	48% ± 7%	3.03	p=0.001, significant

By applying the students paired t-test there was a significant decrease in mean value of Disability score calculated with the Oswestry low back disability index from Pre to Post treatment (p=0.001) in the group 1 (TENS).

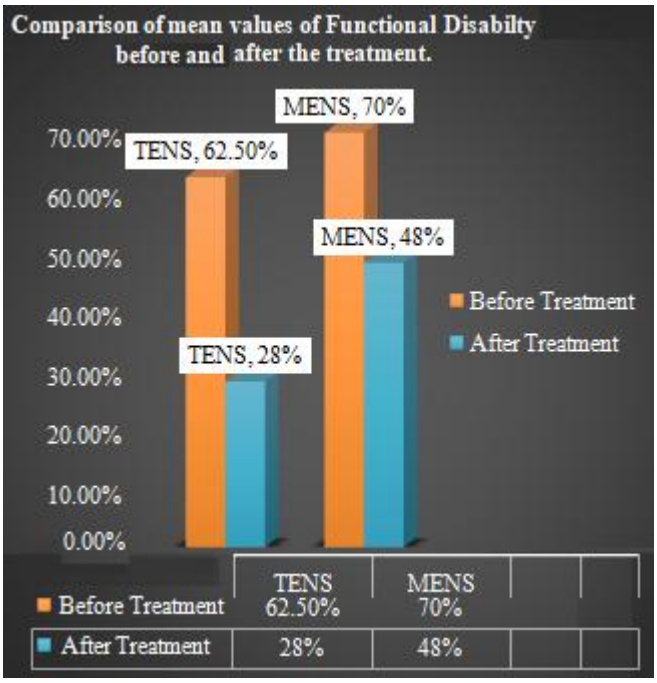

Chart 2

The pre-intervention scores of **Functional Disability** in participants treated with TENS were (Average±SD) 62.5% ± 8%and those treated with MENS were 70% ± 7%.The post intervention values of Functional Disability in participants treated with TENS were 28% ± 11% and those treated with MENS were 48% ± 7%**.** On comparing the pre and post intervention values of Functional Disability in participants treated either with TENS or MENS, it was observed that the difference was extremely significant **(p<0.001)** and the difference was considerably **more** in the participants treated with TENS as compared to MENS.

Thus our study concluded that both TENS as well as MENS were effective but based on our results Transcutaneous Electrical Nerve Stimulation was better than Microcurrent Electrical Nerve Stimulation in treatment of patients with unilateral lumbar radiculopathy.

4. Discussion

In this study it was hypothesized that there will be no significant difference between efficacy of Transcutaneous electrical nerve stimulation and Microcurrent electrical nerve stimulation on the pain and functional disability in patients with unilateral lumbar radiculopathy. But based on our results this hypothesis was rejected. There was statistically significant difference (P_ 0.001) in the pain relief in terms of the Numerical Pain rating scale score and Functional Disability by the Oswestry Disability index reported by the patients obtained with the help of TENS compared to the subjects treated with MENS. All the patients in our study showed significant improvement in the pain as well as functional disability, but however the effect of Transcutaneous electrical nerve stimulation was better than that of Microcurrent electrical nerve stimulation. Farrar et al., identified a significant reduction in the numerical pain rating score of 2 points to be indicative of a clinically important change in the patient's status. All the patients in our study exceeded this level in our study.For the improvement in the pain severity, the findings of our study are in agreement with several previous studies for example, Ordog proved that TENS was effective as a combination of acetaminophen and codeine in the treatment of acute traumatic pain.[8] For LBP, other authors found a significant pain improvement after TENS treatment compared with sham treatment.[9] A recent systematic Cochrane review of the limited data available found evidence that TENS reduced pain and improved the range of motion in chronic LBP patients, at least in the short term.[10]

Pain reduction by the TENS can be explained by the Pain Gate theory proposed by Melzack and Wall in 1965. It suggest that for the pain impulses to pass through the gate there must be an unopposed passage for nociceptive information at the synapses in substantia gelatinosa. But however if the gate is concurrently receiving impulses produced by stimulation of the mechanoreceptors or thermoreceptors which are carried by the myelinated larger diameter fibres then this traffic dominates and causes presynaptic inhibition of the nociceptive impulses. TENS cause stimulation of the endings connected to large diameter nerves and causes a reduction in pain by closing of pain gate.[6]Application of TENS also causes local release of endorphins (Salar et al. 1981).For improvement in the pain severity the findings of our study are in agreement with several previous studies For example, Ellis who applied MENS to lower back and found 70% pain relief. Further McMakin who reported that microcurrent electrical nerve stimulation made significant pain reduction and increased range of motion in chronic low back pain.[7]McMakin also reported that frequency specific microcurrent produces dramatic improvement in collected reports of patients with chronic neuropathic pain.[7]

5. Conclusion

Both MENS and TENS were effective but as compared to MENS, TENS was more effective in relieving pain and

improving functional disability in patients with unilateral Lumbar Radiculopathy.

6. Acknowledgement

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7. Limitations

Sample size was limited because of time bounded study.

8. Clinical Implementation

TENS can be introduced more effective on reducing Pain and Functional Disability in patients with unilateral Lumbar Radiculopathy.

9. Future Scope of the Study

The study can be conduct on large sample size and also it can be conduct for longer duration. Large follow up periods are recommended and also comparison with other techniques can be done.

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