Original Article

# Pain Management in Temporomandibular Joint Disorders by Active and Placebo Transcutaneous Electric Nerve Stimulation: A Comparative Study

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## ABSTRACT

**Objective:** To determine and compare the effectiveness of active TENS and placebo therapy in the management of pain in TMD patients.
**Methods and Material:** Total 40 patients, 20 received active TENS therapy and 20 received placebo TENS therapy. Visual Analogue Scale (VAS) was used to measure the change in pain and tenderness in muscles of mastication & Temporomandibular joint, during and after TENS therapy along with mouth opening.
**Results:** Active TENS therapies have shown significant improvements in the intensity of pain, muscles and TMJs tenderness and interincisal distance. Placebo TENS therapy also showed same results but to the lesser extent.
**Conclusions:** Both the therapies effective in reducing intensity of pain in TMDs, especially the active TENS therapy, in the musculoskeletal and chronic pain along with improvement in the range of mandibular movement/mouth opening/interincisal distance.

**Keywords**: Temporomandibular joint disorder, Active TENS therapy, Placebo TENS therapy.

## INTRODUCTION

Even though the Temporomandibular joint disorder (TMD) viewed as one syndrome, current research supports that TMD is a cluster of related disorders in the masticatory system, that has many signs and symptom [JP Okeson 1996],[1] such as tenderness in the muscle and Temporomandibular joint (TMJ), decreased mandibular range of motion, clicking, stiffness, pain or fatigue in facial muscles; ear symptoms like tinnitus, fullness, vertigo; sensation of variable bite changes; deviation to the affected site during opening; jaw catching during opening or closing.[2]

There are many controversies regarding etiology, diagnosis and treatment of TMDs. Currently the known etiologies are parafunctional habits, trauma, stress, systemic, hereditary, emotional and malocclusion along with a host of predisposing, activating and perpetuating factors.[3] Based on multifactorial etiology, treatment of the TMD usually involves more than one modality; main goal is pain reduction and restoration of normal jaw function. To achieve these goals a well defined program has to be designed to treat the disorder, hence reducing the contributing factors.[4]

Variety of treatment modalities have been proposed for TMDs, like mechanical, physiological, psychological, and pharmacological, placebo and physical methods. Some of these methods were already evaluated and contradictory outcomes were observed. Physical therapy treatment is directed not only to the relief of pain, but more importantly, it restores the underlying casual factors of musculoskeletal balance in TMDs and also the normal mechanics at the TMJ itself. Transcutaneous electrical nerve stimulation (TENS) is one of the most effective physical therapy technique.[5]

Shane and Kessler [1967], first described use of TENS in dentistry, yet to gain the acceptance. TENs works on the principle that, electrical stimulation is directed to pain areas via surface electrodes, and current passed through these areas which reduces or eliminates pain. It's a safe, noninvasive, effective and swift method of analgesia. By using TENs, potential adverse reactions of other methods of pain control are eliminated.[6,7] It can be used effectively throughout all the stages of TMDs.

It has been accepted since 1950 that, placebo plays an important role in all therapy. A study by Jagger, R. G *et al* has shown that psychological methods such as placebo therapy appeared to be effective in patients with TMDs. Placebo therapy also contributes 30 to 40% of pain reduction.[9] There are very few studies regarding the evaluation and effectiveness of TENS in TMD. An effort was made to evaluate and compare the pain relieving effects and mouth opening between active and placebo TENS therapy in TMD patients.

## MATERIALS AND METHODS

Randomized placebo-controlled, single blind clinical study was conducted in 40 patients of either sex with TMDs, with an age range from 20 to 60 years, visiting to department of oral medicine and radiology. Specific examinations for the diagnosis of TMDs were made based on the standard diagnostic criteria given by Widmer CG *et al*.[10]

Patients with clinical and/or radiographic evidence of organic changes in the TMJ, pain attributable to recent trauma, dental surgery, metabolic diseases, vascular disease, neoplasia, psychiatric disorders, heart diseases and cardiac pacemakers, pregnancy, bleeding disorders, neurological disease involving head and neck like Bell's

palsy, undiagnosed dental pain and patients who have been treated with TENS previously without any improvement in the condition were excluded from the present study. Patients with TMDs pain, especially in the preauricular region during function and palpation, tenderness in one or more muscles of mastication, Patients being treated with some other therapy were considered provided a washout period of at least one week were considered for the study.

Selected Patients were randomly assigned to one of the following two groups: Group A [n = 20], who received active and group B [n = 20] who received placebo TENS therapy. Then they were subjected to digital panoramic and TMJ radiographs for the radiographic evaluation to rule out pathologic conditions in the maxilla, mandible, TMJ, and dentition [Figure 1, 2].

TENS Therapy: Conventional KODYs TENs XL unit [high frequency & low intensity]. Amplitude of 0 -80 Hz [above threshold], Current at low intensity, Pulse width [duration] of 1-11 microseconds, and Pulse rate [frequency] of 0 -11 Hz when stimulus intensity is set high which was comfortable for the patient was set. At baseline and every treatment visits, all the participants made to sit in upright position, surface electrodes were placed on sigmoid notch area and back of the neck to complete the circuit, TENS therapy was given for 30 minutes for active TENS therapy, as directed by Wessberg GA *et al*,[5] Esposito CJ *et al*[6] and Geissler PR *et al*.[7] Whereas 20 patients were given placebo TENS therapy, who were exposed to identical treatment conditions like active TENS therapy with the exception that there was no current output from unit [Figure 3, 4].

The following parameters were recorded at the baseline visit, 1 day after the first sitting of TENS therapy, 1 day after the second and third sitting of TENS therapy, later at the follow-up visit [1 week after the 4th sitting of TENS therapy]. Then analyzed the type of pain (continuous or intermittent), intensity of pain on Visual Analogue Scale (VAS), muscles and joints tenderness and mouth opening without pain.

### Ethics

Ethical approval taken by Ethical Review Committee of Institution Before commencing the study.

For each patient, we explained about the need and design of the study, benefits of the therapy, and possible side effects, once they agreed to sign over written consen, included in the study.

### Data analysis

We have used Paired-t test and unpaired t-test for the statistical analysis.

## RESULTS

Treatment results were grossly subjective, based primarily on the patient's comparison of the pretreatment and post treatment signs and symptoms, and their status 1 week later.

Pretreatment evaluation [Table 1]: Comparison of pain intensity and mouth opening before starting the TEN'S therapy, found was not significant ($p > 0.05$), in both the study and placebo groups.

Comparison of pre and post treatment VAS score in study and placebo groups [Table 2]: Reduction in the intensity of pain was noted in each interval of TENS therapy in both study and placebo groups. When compared from pre treatment pain to post treatment, patients were completely free of pain in both the groups, and the difference was statistically significant [$p < 0.05$].

Comparison of pre and post treatment mouth opening in study and placebo groups [Table 3]: Both study and

placebo group showed significant ($p < 0.05$), increase in the mouth opening in each interval.

Comparison of Mean VAS Score in Study and Placebo group at the end of treatment (Table 4): At the end of the treatment, mean VAS score in study and placebo groups were 0.15 and 0.41. Mouth opening also showed mean score of 36.70 in study group and 33.35 in placebo group. The difference between the groups was statistically significant ($p< 0.05$).

## DISCUSSION

Joint pain and sounds are the most common complains in the TMDs. Joint pain originates from the elongation or compression of muscles attached to the temporomandibular joint (TMJ), discal or capsular ligaments and retrodiscal tissues. Alteration in the muscular activity and consequences for the movements are frequent signs in TMD patients, generally related to pain. Pain is the most frequent symptom and often accompanies the condition which can compromise mandibular movements and lead to a reduction in quality of life in the TMD patients.[11]

Different therapeutic procedures such as occlusal splint, orthodontic treatment, biofeedback sessions etc, have been used to diminish the pain in TMD patients.[12] But classical massage and the application of Transcutaneous electric nerve stimulation (TENS) proved to modify the muscular activity of the TMJ.[13] Not invading the tissues of the face, jaw, joint or involves surgery.[14] There will be no permanent changes in the structure or position of the jaw or teeth in TENs therapy.[15] It produces electro analgesia, probably by one or of the following mechanisms like presynaptic inhibition in the dorsal horn of the spinal cord, endogenous pain control by releasing endorphins, enkephalins, dynorphins and direct inhibition of an abnormally excited nerve and restoration afferent input.[16]

It's widely used to relieve acute and chronic pain in various conditions like head and neck pain like neurogenic pain, musculoskeletal pain, muscle and joint pain in temporomandibular joint disorders.[5] In this randomized control trial only patients with pain without radiographic evidence of TMJ pathology were included.

A placebo is defined as a positive response to unknown therapy. According to the Literature, placebo analgesia and, responses have changed dramatically. In current days, the placebo analgesia represents as one of the best investigated model.[17] Placebos are used in randomized control trails (RCTs) to be compared with the "real" drug, device, procedure, or behavioral manipulation.[18]

The common age of occurrence of TMD was reported to be in the second to fourth decades of life. Age of subjects in the present study is consistent with other studies conducted by the authors like, Okeson JP *et al*, Juniper RP *et al* and Riden DK *et al*.[17-19] Regarding the gender, we found no significant gender differences like Beaton RD *et al*, who found the similar observations in his study.[20] On contrary, Isacsson G *et al*, Jensen R *et al* found female predominance.[12,22]

The efficacy of active TENS therapy in group A [study], showed decrease in the TMD pain similar to the study conducted by Moystad A *et al*.[9] List T and Helkimo M *et al* reported 57% reduction in pain following TENS therapy in patients with myogenic craniomandiublar disorders.[23] Mehta N *et al* observed 57% reduction in pain following TENS therapy in patients with joint or muscle pain.[24] However, Wessberg GA *et al*, observed 95% success rate immediately after TENS therapy and 86% success rate in 1 follow up therapy in 21 patients treated for

myofascial pain dysfunction.[5] Giessler PR and McPhee PM, reported that 63.6% of patients with joint and muscle pain were pain-free after TENS therapy,[7] Where in our study we found 75% success rate. The difference in the success rate could be attributed to the disparity between the samples with regard to differences in biological, psychological, and social components affecting the TMDs, as well as stimulation parameters used in the TENS therapy.

However in the group B [placebo], our results are similar to the observations made by Moystad A *et al*, who found the significant reduction in pain following placebo TENS therapy in 19 spatients with TMDs.[9] Where Mehta N *et al* reported 4.5% and 14.3% reduction in muscle joint pain following placebo TENS therapy.[24]

Transcutaneous Electric Nerve Stimulation in patients with internal derangements of TMJ studied by Linde *et al*, found improvement in mouth opening, which was consistent with our study.[25] Thiemi Kato *et al* found increased mouth opening in his study[26]. Increase in the interincial distance in the patients with orofacial pain after TENS therapy was found by Mehta *et al* and Thiemi Kato *et al* which is similar to our observation; however, in contrast to present study, they did not find any improvement in placebo group.[24,27,28]

Significant pain reduction (mean-0.15) in study group, and increase in the mouth opening (mean-36.70) observed in study group is greater than placebo TENS therapy groups (mean-1.2 and 33.35). Similar to our observation, various authors have found the strong tendency among patients with TMDs responded positively to the active than placebo TENS therapies.[9,22] The significant reduction in patients with TMD pain in our study could be attributed to placebo effects of TENS therapy, as its provision is an expression of reassurance and care on the part of the therapies.

## CONCLUSION

Pain reduction and improvement in the mouth opening are the main goal in the treatment of TMDs; we found encouraging results in our study. Active TENS therapy showed favorable results in pain management in TMD patient, especially in muscular or chronic pain and mouth opening, as compared to the placebo TENS therapy. Accordingly we would like to justify that, the use of this TENS therapeutic regimen in the management of TMDs; however, small sample size requires replication of these findings in a larger sample of patients for the better results.

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**Table 1.** Comparison of mean pretreatment VAS score and mouth opening in study and Placebo group

| S. No. | VAS Score | Study Group (n=20) | | Placebo Group (n=20) | | '$t_{38}$' value | 'p' value | Significance |
|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | | | |
| 1 | VAS Score | 5.72 | 0.91 | 5.70 | 0.98 | 0.17 | 0.87 | Not Significant |
| 2 | Mouth Opening | 28.60 | 2.26 | 28.50 | 2.87 | 0.12 | 0.90 | Not Significant |

**Table 2.** Comparison of pre and post treatment VAS score in study and Placebo groups

| S. No. | Group | Pretreatment | | Post treatment | | '$t_{19}$' value | 'p' value | Significance |
|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | | | |
| 1 | Study Group [A] | 5.72 | 0.91 | 0.15 | 0.37 | 25.52 | 0.0001 | Significant |
| 2 | Placebo Group [B] | 5.70 | 0.98 | 1.20 | 0.41 | 17.54 | 0.0001 | Significant |

**Table 3.** Comparison of pre and post treatment mouth opening in study and Placebo groups

| S. No. | Group | Pretreatment | | Post treatment | | '$t_{12}$' value | 'p' value | Significance |
|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | | | |
| 1 | Study Group [A] | 28.60 | 2.26 | 36.70 | 2.87 | 9.95 | 0.0001 | Significant |
| 2 | Placebo Group [B] | 28.50 | 2.87 | 33.35 | 2.70 | 8.83 | 0.0001 | Significant |

**Table 4.** Comparison of mean VAS score in study and Placebo group at the end of treatment

| S. No. | Group | Pretreatment | | Post treatment | | '$t_{12}$' value | 'p' value | Significance |
|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | | | |
| 1 | Study Group [A] | 28.60 | 2.26 | 36.70 | 2.87 | 9.95 | 0.0001 | Significant |
| 2 | Placebo Group [B] | 28.50 | 2.87 | 33.35 | 2.70 | 8.83 | 0.0001 | Significant |

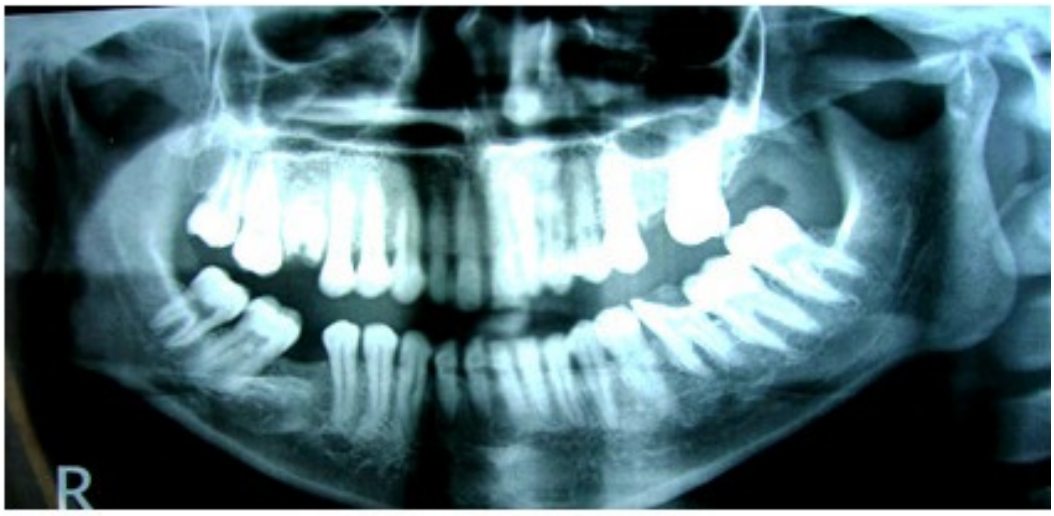


**Figure 1.** Panoramic radiograph for radiographic examination

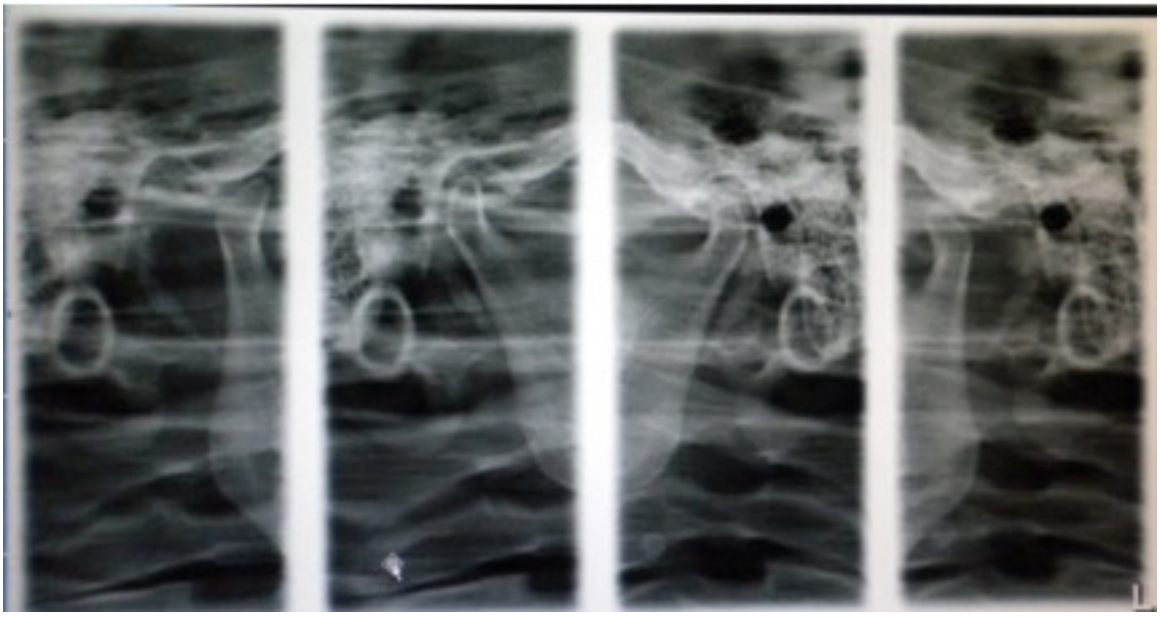

**Figure 2.** TMJ open and closed view for radiographic examination

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**Figure 3.** Conventional KODYs TENs XL unit

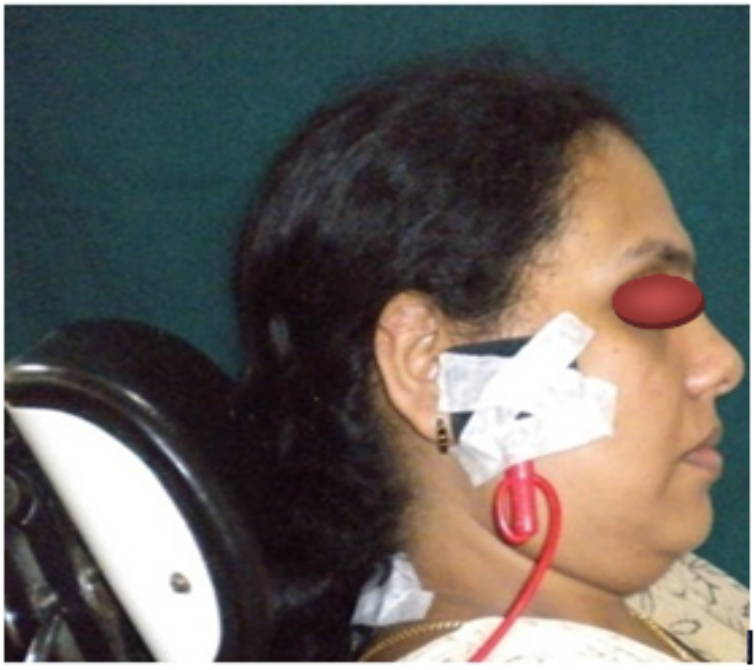

**Figure 4.** Surface electrodes over pretragus region for optimum transcutaneous stimulation