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Original Article

Role of Transcutaneous Electric Nerve Stimulation Therapy as Adjuvant Pain Reduction in the Management of Temporomandibular Disorders

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ABSTRACT

Objective: To evaluate and compare the efficacy of Transcutaneous Electrical Nerve Stimulation (TENS) therapy and conventional pharmacologic treatment in reducing pain intensity among patients with temporomandibular disorders (TMD).
Study Design: Quasi-experimental study.
Place and Duration of the Study: Department of Oral Medicine and Radiology, Armed Forces Institute of Dentistry (AFID), Rawalpindi, Pakistan from Feb to Jul 2025.
Methodology: A total of 60 patients clinically diagnosed with TMD-associated pain were enrolled and divided into two equal groups. Group-A received pharmacologic therapy consisting of a combination of diclofenac potassium (50 mg), paracetamol (325 mg), and chlorzoxazone (250 mg) three times daily for five days. Group-B received two sessions of TENS therapy, each lasting 30 minutes and five days apart, along with the same medication. Pain intensity was assessed using the Visual Analog Scale (VAS) before and after treatment.
Results: The mean pain score in Group A decreased from 5.03±0.56 to 1.10±0.48 (p<0.001), and in Group B from 5.13±0.57 to 0.97±0.56 (p<0.001). Post-treatment comparison revealed significantly greater pain reduction in the TENS group compared to the pharmacologic group (p=0.002).
Conclusion: Both treatment modalities significantly alleviated TMD-associated pain; however, TENS therapy demonstrated superior pain relief, supporting its role as an effective adjunct to conventional management.

Keywords: Orofacial Pain; Pain Management; Temporomandibular Joint Disorders; Transcutaneous Electric Nerve Stimulation.

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INTRODUCTION

Temporomandibular disorders, or TMDs, are a group of musculoskeletal conditions that have been described by pain, limited opening of the jaw, joint noises, and dysfunction of the masticatory muscles, as well as those of the temporomandibular joints and other related areas.[1,2] It has been shown that the symptoms of TMDs appear in almost 27.9% of Asians.[3] Although traditional methods have been used, many patients continue to exhibit symptoms of chronic discomfort, joint hyperactivity, and chronic pain, which emphasizes the necessity of additional treatment options that are non-pharmacologic.[4,5]

Despite the non-invasive nature and minimal adverse effects the use of transcutaneous electrical nerve stimulation (TENS) in the management of TMD-related pain has been recognized.[6] Some studies show that patients with TMD derive better results after the use of TENS. Fertout *et al*. found A decrease in pain among 19.2% and 77% patients and an improvement in function such as the ability to open the jaw by 8.7% and 19.5% through TENS.[7] Likewise, Ferreira *et al*. found a significantly higher degree of pain relief, increased pressure pain thresholds, and reduced electromyographic activities of the masticatory muscles in the active TENS group when compared to the placebo group (p<0.05).[8] Moreover, Shanavas et al. found better pain management when using TENS in conjunction with medications when compared to medications alone.[9] On the contrary, the existing literature reveals variability in treatment regimens and the sparse availability of high-quality randomized studies.[10]

Owing to the prevalence of pain related to TMD and the disadvantages of monotherapies, assessing TENS as an adjunct modality assumes great importance. In Pakistan, very little evidence is known to exist on the adequacy of TENS in TMD treatment. Accordingly, this study aims to determine the efficiency of TENS as an adjunct modality along with conventional treatment compared to conventional treatment alone.

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METHODOLOGY

This was a quasi-experimental study conducted in the Department of Oral Medicine and Radiology of Armed Forces Institute of Dentistry (AFID), Rawalpindi, Pakistan from February 2025 to July 2025, on patients reporting to the Dental OPD. Ethical approval was obtained from the Institutional Review Committee before the commencement of the study vide letter no. 918/Trg dated 13 May 2020. Sample size was calculated using G*Power version 3.1.9.7 and formula for a two-tailed independent samples comparison was used, by taking level of significance 5%, power 80%, and using the mean difference of 0.65 in VAS pain scores with pooled standard deviation of 0.84.[9] The calculated sample size was 27 participants per group, which was increased by 10% to compensate for possible dropouts, making a final sample size of 30 participants per group (total 60). A total of 60 patients presenting with clinical symptoms of pain associated with TMD were selected for this study. Patients were selected using a convenience sampling method.

Inclusion Criteria: Aged 18-60 years; presenting for assessment of temporomandibular disorders, which are pain-related; myositis/myospasm, disc displacement ± reduction (with/without arthralgia), or anterior synovitis/capsulitis.

Exclusion criteria: Patients having a history of trauma in the maxillofaçial region, infections occurring within the oral and facial region, and congenital or developmental abnormalities of the maxillofaçial region were not selected. Patients with a condition or treatment contra-indicating the use of Transcutaneous Electrical Nerve Stimulation (TENS) were not chosen. These patients would include those with a cardiac pacemaker, cardiac instability, epilepsy, and adhesive electrode hypersensitivity.

The study procedure was explained, and informed written consent was obtained from all the participants. Patients were assigned into two equal groups. Group A received conventional medication of a combination of analgesics and muscle relaxants (Ultrazox tablet—chlorzoxazone 250 mg, diclofenac potassium 50 mg and paracetamol 325 mg; manufactured by Ranbaxy Laboratories Ltd., Gurgaon, India) thrice daily for five days. Group B received the same medications in addition to TENS therapy (Bharat Medical Systems, Chennai, India) administered for 30 minutes twice, separated by an interval of five days (Figure-1). The intensity of pain for all patients was recorded on the Visual Analog Scale (VAS) before and after treatment and was duly documented.

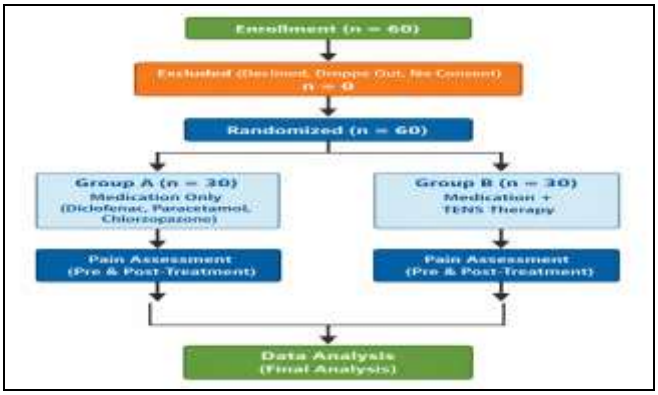


Figure: Patient flow chart

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0 (IBM Corp., USA). Descriptive statistics, including Mean±SD for quantitative variables such as age and pain scores, and frequency and percentage for categorical variables such as gender and clinical diagnosis, were calculated. The normality of data distribution was tested using the Shapiro–Wilk test. Because the data were not normally distributed, non-parametric tests were applied. A Wilcoxon signed-rank test was used to evaluate the differences in pain scores before and after treatment within each group, while the Mann–Whitney U test was used to compare between the two groups. All statistical analyses used a p-value of ≤ 0.05 as statistically significant.

RESULTS

The mean age of participants in Groups A and B was 39.07±7.71 and 36.37±6.60 years, respectively (p=0.150). In each group, slightly more than half of the members were men, and the remaining percentage represented women. In both groups, the gender composition was similar. There was no significant difference in gender composition between the two research groups. (p=0.795). Diagnoses included myositis/myospasm (16.67% each), disk displacement with reduction (50.00% vs 36.67%), synovitis/capsulitis (20.00% vs 23.33%), and disk displacement without reduction (13.33% vs 23.33%) (p=0.680) (Table I). Mean pain score reduced in Group A from 5.03±0.56 to 1.10±0.48 and in Group B from 5.13±0.57 to 0.97±0.56 (both p<0.001), indicating significant pain reduction after treatment in both groups (Table-II). Intergroup comparison after treatment revealed significantly greater improvement

in Group B as compared to Group A (p=0.002) (Table III).

Table-I: Comparison of Demographic and Clinical Characteristics Between Study Groups (n = 60)

Variables	Categories	Groups		*p*-value
		Group-A	Group-B	
Age Mean±SD		39.07±7.71	36.37±6.60	0.150
Gender n (%)	Male	17(56.67%)	16(53.33%)	0.795
	Female	13(43.33%)	14(46.67%)	
Clinical Diagnosis n (%)	Myositis/ myospasm	5 (16.67%)	5(16.67%)	0.680
	Disk displacement with reduction	15(50.00%)	11(36.67%)	
	Synovitis/capsulitis	6(20.00%)	7(23.33%)	
	Disk displacement without reduction	4(13.33%)	7(23.33%)	

Table-II: Intragroup Comparison of Pain Intensity Scores Between first and Second visits (n = 60)

Study Groups		Median (IQR)	*p*-value
Group-A	First visit	5 (0)	<0.001
	Second visit	1 (0)	
Group-B	First visit	5 (1)	<0.001
	Second visit	1 (0)	

**Wilcoxon-signed ranked test*

Table III: Intergroup comparison of Post-treatment Pain Reduction Between Study Groups (n = 60)

Study Groups	Median (IQR)	*p*-value
Group-A	4 (0)	0.002
Group-B	4 (1)	

**Mann–Whitney U test*

DISCUSSION

In the present study, both groups showed significant reductions in pain intensity after therapy, with more pronounced pain relief in the group treated with adjunctive TENS (Group-B) compared to medication alone (Group-A). The demographic and diagnostic profiles were similar, suggesting that the differential improvement was due to the adjunctive TENS intervention.

The most recent systematic review and meta-analysis (seven trials, n = 184) of electrical stimulation modalities in TMD by Serrano *et al*. reported that electrical stimulation (including TENS) produced a clinically meaningful reduction in pain versus sham or control: mean difference (MD) = −1.12 cm on the VAS (95% CI −1.5 to −0.8), although effects on range of motion and muscle activity were not significant and heterogeneity was moderate (I^2 = 57%).[11] This meta-analytic estimate is consistent with our finding of greater pain reduction in the TENS-adjunct group and supports the external validity of our results. A comprehensive systematic review and meta-analysis by Johnson *et al*. found moderate-certainty evidence that TENS reduces pain intensity during or immediately after treatment compared with placebo, with no serious adverse events reported; the authors concluded that TENS provides short-term analgesia for musculoskeletal pain conditions including TMD.[12] This supports our finding of superior short-term pain reduction in the TENS-adjunct group.

Recent randomized trials and controlled clinical reports have repeatedly demonstrated immediate post-TENS pain reductions-reporting ranges of ~19-77% reduction-and improvements in muscle sensitivity or EMG indices,[13] which parallels the magnitude and direction of effect observed in our study. Although short-term analgesia with TENS is well-supported, evidence for consistent functional gains-for example, sustained increases in maximum mouth opening-are mixed (Alam *et al*.; Díaz *et al*.).[14,15] A 2019 review summarized by Saranya *et al*. that though pain relief after TENS is commonly reported, increases in mouth-opening amplitude are generally modest-e.g., often <20% improvements-and heterogenous across studies.[16] In the current study, we focused primarily on pain intensity; thus, our positive pain outcomes align with the bulk of literature but should be interpreted cautiously with regard to functional recovery. Regional clinical data by also reflect benefit: a recent study from a similar clinical setting comparing TENS with analgesics reported statistically significant improvements in mouth opening and pain with TENS versus analgesics alone-post-treatment mouth opening and pain improvement both favoring TENS, p<0.001-which corroborates the clinical relevance of our findings in outpatient dental practice. A local clinical study conducted in Peshawar by Rehman et al. similarly demonstrated that patients receiving TENS therapy experienced greater pain reduction and functional improvement compared to those treated with analgesics alone. The proportion of patients achieving complete remission and shifting from severe to mild or moderate pain categories was notably higher in the TENS group, supporting the superior therapeutic efficacy of TENS in managing temporomandibular disorder–related pain.[17]

Three complementary mechanisms likely explain the superior pain relief in the TENS group. First, gate-control modulation at the dorsal horn reduces nociceptive transmission, producing rapid analgesia.[18] Second, frequency-dependent activation of endogenous opioid pathways during TENS can sustain analgesic effects beyond stimulation periods.[19]

Third, there is direct reduction in masticatory muscle hyperactivity, as already shown by the decrease in EMG amplitudes in several trials, reducing peripheral nociceptive input from trigger points and overloaded muscles.[20] These are mechanisms which are supported by both experimental and clinical data and provide an explanation for why larger net pain reduction is obtained by combining pharmacologic analgesia (fast symptomatic relief) with TENS (neuromodulation + muscle relaxation) than either alone would be capable of producing.[21]

LIMITATIONS OF STUDY

Despite consistent short-term effects, pooled reviews highlight heterogeneity in TENS protocols (frequency, pulse width, electrode placement, session length), moderate between-study heterogeneity, and limited long-term follow-up. Thus, while our study reinforces TENS as a safe, low-cost adjunct that produces clinically meaningful short-term pain reductions, larger trials with standardized protocols and longer follow-up are required to confirm durability of benefit and effects on function. Future work should also report standardized effect sizes (e.g., MD on VAS with 95% CI) and include objective EMG or functional endpoints to strengthen mechanistic inference and clinical recommendations.

CONCLUSION

It may be concluded that both pharmacologic therapy and TENS were effective in significantly reducing the intensity of pain among TMD patients within the limits of this quasi-experimental study. However, TENS therapy showed relatively better improvement, which indicates that it can be a worthy adjuvant to conventional medication in managing pain associated with TMD. This non-invasive therapy is associated with minimal adverse effects; hence, its use can lead to better clinical outcomes. Therefore, TENS can be used as an effective and patient-friendly therapeutic modality in routine dental practice.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

MHA & SM: Conception, study design, drafting the manuscript, approval of the final version to be published.

RT & HR: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

SS & TAK: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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