Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/15553
DOI URL: http://dx.doi.org/10.21474/IJAR01/15553

*RESEARCH ARTICLE*

# TRANSCUTANEOUS ELECTRIC NERVE STIMULATION THERAPY IN TEMPOROMANDIBULAR DISORDERS- A SYSTEMATIC REVIEW

**Nayana S.M, Roopashri R.K, Gowri P. Bhandarkar, Ujwala S. Shetty, Meghana H.C and Raghavendra Kini**

## *Manuscript Info*

***Manuscript History***
Received: 24 August 2022
Final Accepted: 27 September 2022
Published: October 2022

***Key words:-***
TemporomandibularDisorders, Transcutaneous Electric Nerve Stimulation, Low Level Laser Therapy, Muscle Relaxant, Clicking Sound, Visual Analog Scale, Randomized Control Trial

## *Abstract*

Temporomandibulardisordercharacterizes a varied group of pathologies affecting temporomandibularjoints, masticatory muscles, or both.The treatment of temporomandibular disorders is a major challenge because of its varied causes and structures involved and also because the functioning of one joint is always dependent on the other. Transcutaneous electric nerve stimulation is a non-pharmacological method of pain control and recently it is gaining importance in treatment of temporomandibulardisorders. Hence this study was undertaken to analyze the effect of transcutaneous electric nerve stimulation on pain due to temporomandibular disorders and to compare the efficacy of transcutaneous electric nerve stimulation treatment over other treatments available for the same.Electronic search for articles published in various journals were undertaken through various search engines from 2020-2022. 9 randomized control trials of transcutaneous electric nerve stimulation therapy performed on temporomandibular disorder patients were selected for analysis. The efficacy of transcutaneous electric nerve stimulation therapy was compared with conventional therapy [muscle relaxant+ analgesic], low level laser therapy,Microcurrent Nerve Stimulation therapy, Physiotherapy, and Placebo therapy.Results of selected study conclude that transcutaneous electric nerve stimulation therapy is superior to all other treatment modalities included in the study in the treatment of pain due to temporomandibular disorders. Maximum reduction in pain was obtained in combination therapy of transcutaneous electric nerve stimulation with muscle relaxant, hot fermentation, and soft diet.Transcutaneous electric nerve stimulation along with medication proved to be highly effective in treating pain due to temporomandibular disorders.



## Introduction:-

Temporomandibulardisorder [TMD] characterizes a varied group of pathologies affecting temporomandibular joints [TMJ], masticatory muscles, or both. They are the most common orofacial pain which is nonodontogenic in origin [8]. Muscle or TMJ pain,clickingsound,mandibular deviation or deflection, and restricted mouth opening are the salient features of TMD.Epidemiological studies disclose its prevalence to be 82% in the general population. Pain in the masticatory muscles and difficulty in mouth opening is seen in 48 % of the cases.[6].Parafunctional habits like bruxism, impacted or buccoinverted 3 rd molars, trauma, malocclusion, psychological factors, and stress are the



**Corresponding Author:- Nayana S.M**

common etiological factors of TMD.Conditions like arthritis,cyst in TMJ, and associated region can also contribute to TMD [3].

The treatment of TMD is a major challenge because of its varied causes and structures involved and also because the functioning of one joint is always dependent on the other.Patients usually prefer non-invasive treatment.Occlusalsplint,biofeedback sessions, orthodontic treatment,physiotherapy,lasertherapy,pharmacological interventions, and transcutaneous electric nerve stimulation[TENS] are used in the management of TMD patients[5]

TENS is a non-pharmacological method of pain control. In 1972 FDA classified TENS as a class II device. Pulsed electric current is produced by batteries or alternating current is distributed to intact skin surfaces through the electrodes. Pain relief is achieved by stimulating the superficial nerve. Gate control theory and the endogenous opioid theory explain the analgesic effect of TENS [1]. TENS is a patient-friendly and non-invasivetherapy[1]. Though TENS has been in practice for many years, it has not been widely used for TMD disorders. Hence this study was undertaken to analyze the effect of TENS on pain due to TMD and to compare the efficacy of TENS treatment over other treatments available for the same.

## Materials And Methods:-

**Study design:-**

Considering the obtainability of a variety of treatment modalities for TMD and the availability of numerous randomized controlled trials [RCT] we decided to carry out a systematic review to compare the effectiveness of TENS for pain due to TMD with other treatment modalities available. For this, we followed the guidelines given by the Preferred Reporting Items for Systematic reviews Reviews and Meta-Analyses Protocols (PRISMA-P).

**Criteria forconsidering studies for inclusion–**

RCT performed on patients with muscle pain due to TMD was considered for the study.

**Search strategy-**

A systematic literature review was conducted for English language publications through thevarious search engine like google scholar, Science direct, Research gate, Willey publication, etc using the keywords 'Transcutaneous electric nerve stimulation, "TENS" or "TMD" or " MPDS", "VAS", "muscle relaxant", from 2020-2022**.**The publications with RCTs were selected. Only the publications in the English language were considered.

**Participants:-**

RCTs with human participants diagnosed to be suffering from TMD

**Type of interventions:-**

Study and patient characteristics:- RCTs of TENS therapy performed on TMD patients were selected for analysis.

## Results:-

**Study selection:-**

As per the PRISMA guidelines,among 100 articles selected from all databases,atotal of 9 RCTs met our inclusion criteria which included 5 different modalities and are compared with TENS therapy for pain due to TMD.All studies were published after 2004.Selected RCTS had subjects of age groups ranging from17-60 years .4 multi-arm study and 5 two arm studywere included in the study**.** These studies excluded patients with pacemakers, pregnant women, epileptic patients, and other implants placed in the body.

The efficacy of TENS therapy is compared with conventional therapy [muscle relaxant+ analgesic],low level laser therapy[LLLT],Microcurrent Nerve Stimulation (MENS) therapy, Physiotherapy, and Placebo therapy.

**Adverse reactions-**

Among the 9 studies, none of them have mentioned side effects.

**Characteristics of outcome**

Method of measuring pain-All studies have used a Visual analog scale[VAS] for measuring pain.VAS is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a

continuum. It is avalidated,subjective measure for acute or chronic pain. Scores are recorded by making a 10 cm line between "no pain" and "worst pain". The initial pain and the final pain intensity are measured to evaluate the difference. The values can be used to track the progression of pain or compare pain between patients with similar conditions.

Among all the 9studies,results in 5 studies were given as pain reduction after treatment in percentage. The results in the other 4 studies were given in mean VAS score with standard deviation.TENS therapy showed excellent results compared to all other treatment modalities included in the study. Maximum reduction in pain was obtained [97.4 % reduction in pain] in combination therapy of TENS with muscle relaxant, hot fermentation, and soft diet.

LLLT therapy, MENS therapy, Physiotherapy also helps in the reduction of pain to an extent. Even the placebo therapy resulted in a mild reduction in pain as it psychologically relieves the anxiety of the patient. But all the studies conclude that TENS therapy is superior to all other treatment modalities included in the study in the treatment of pain due to TMD.

## Discussion:-

TMD is a cluster of related disorders in the masticatory system, which has numerous signs and symptoms such as tenderness in the muscle and 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 the opening, jaw catching during opening or closing.Joint sound and pain are the major complaints. Joint pain arises from elongation or compression of muscles attached to TMJ, retrodiscal tissues, discal or capsular ligaments [5].

In 2013,the international research diagnostic criteria for temporomandibular dysfunction consortium network published an updated classification of TMD and broadly divided it into 2 groups; intraarticular and extraarticular. The exact etiopathogenesis, diagnosis, and treatment plan are not known even after many studies related to TMD have been done.[3]

TENS is an economical, non-invasive, self-administered technique for pain relief. They have very less side effects and no potential for overdose, so the patient can titrate the treatment as required. The purpose of conventional TENS is to selectively activate large-diameter non-noxious afferents (A-beta) to reduce nociceptor cell activity and sensitization at a segmental level in the central nervous system. TENS is applied at the various pulsed duration of stimulation, frequencies, and intensities.TENS is categorized into 2 types. High-frequency TENS- >50Hz,low-frequency TENS-<10 Hz. The mechanism of action of high-frequency TENS is by gate control theory and provides short-term analgesia. Low-frequency TENS works through the release of endogenous opioids which cause more systemic and long term response[s] [1]

Among the selected studies, AltafHussainChalkoo et al, Shailaja et al, Shanavas et al have compared TENS therapy with muscle relaxants. In the study by AltafHussainChalkoo et al,muscle relaxant thiocolchicoside and analgesic diclofenac were given with hot fermentation and diet in the first group of patients. Thiocolchicoside act as a gamma aminobutric acid receptor antagonist and act at supraspinal level. Diclofenac is a non-steroidal anti-inflammatory drug. In the second group of patients,TENS therapy was instilled. In the third group combination of therapy in the first two groups was given. In the fourth group placebo therapy was given.The study concluded that the combination therapy of TENS and muscle relaxant with analgesic resulted in a 97.4 reduction in pain[2].

In the study by Shailaja et al, a comparison of cyclobenzaprineand tens therapy is included. Cycobenzaprine is a serotonin receptor antagonist,centrally acting skeletal muscle relaxant, and exerts muscle relaxant effect by central inhibition serotonergic descending system.A 78.94% reduction in the intensity of pain was seen in patients using TENS when compared to the other group who had only a 55.07 % reduction in the intensity of pain [9]. In the study by Shanavas et al,TENS therapy in combination with ultrazox tablet which is a combination of chlorzoxazone 250 mg, diclofenac potassium 50 mg,paracetamol 325 mg is compared with ultrazox tablet alone.Mean pain reduction was 4.5 with TENS whereas it was 3.5 with only medication[6].

Among the selected studies, ArashMansourian et al,Selfie et al,have compared TENS therapy with LLLT. In the study by ArashMansourian et al, LLLT and medications[10 mg fluoxetine, 0.25 mg clonazepam, baclofen] were given to the first group of patients. LLLT has analgesic and anti-inflammatory which help in the treatment of muscle

pain. It increases the mitochondrial activity affecting Na- K pump and increases vascularisation.[2]. In the second group of patients, TENS therapy along with medications [10 mg fluoxetine, 0.25 mg clonazepam, baclofen] was given. These medications are selective serotonin reuptake inhibitor antidepressants. Antidepressants have an analgesic effect along with an antidepressant effect. There is a close connection between pain and psychosocial factors. It is important to treat the psychological issues of the patient along with physical pain.In the third group of patients, only medications were given.In the first group of patients, the mean VAS score in the 3 rd week of treatment was 4.47±2.22, VAS score in the 8 th week of treatment was 5.94±0.29,In the second group of patients, the mean VAS score in the 3rd week is 4.06±2.18 and in the 8 th week is 5.69±0.29.In the third group of patients VAS score in the 3 rd week of treatment was 2.80±1.30 and in 8 th week is 5.94 ± 0.29. The 3 modalities resulted in improvement in pain relief,but the combination of TENS and LLLT with medication yielded excellent results.

In thestudyof Selfie et al, in the first group of patients,TENS therapy was given with a maximum frequency of 50 Hz and 15 mA output current for 30min with 4 sittings in a month. In the second group of patients, SHAM TENS was given. SHAM therapy is an inactive treatment or procedure that mimics closely therapy in a clinical trial. In SHAM TENS, the same technique with the device off was given. In the third group of patients, LLLTfor 30 min was given. In the fourth group of patients SHAM LLLT, the same technique with the device off was given. Among all these TENS therapy was effective in pain reduction 67.29 % which is followed by LLLT [60.36%],SHAM TENS [16.41%], SHAMLLLT[16.02%][7].

In the study byRela et al comparison of physiotherapy and TENS therapy in TMD patients was included. Physiotherapy is effective in relieving and managing TMD even when symptoms are severe.It reduces inflammation and promotes healing in tissues. By reducing muscle spasms physiotherapy helps to improve joint alignment which results in the reduction of pain. In the first group of patients, TENS therapy was given, and in the second group of patients, physiotherapy was given. Pre-treatment VAS score was 5.72± 0.951 and post treatment VAS score was 0.15 ±0.37 for the first group of patients. In the second group of patients pre-treatment VAS score was 5.70± 0.98 and post treatment VAS score was 1.20 ± 0.41. The study proved that TENS is superior to physiotherapy in pain control[5].

In thestudy bySaranya et al, a comparison of MENS and TENS therapy is included. MENS is a type of electro therapy that delivers subminimal stimulation lower than 1000 microamps.They do not excite motor fibers and are considered microcurrent units. MENS is used with either probes alone or combined with pads[6]The study concluded that TENS was more effective in pain control than MENS. There was 91.02 % reduction in pain in group A patients and 86.05 % reduction in pain in group B patients.

In studies by Harneet Singh et al, Moger et al comparison of TENS therapy and placebo therapy was included.Placebos have been intellectualized by their inert content and their use as controls in clinical trials and treatments in clinical practice [4]. Placebo treatment results in the reduction of anxiety and provide hope for the patient and thereby providing psychological benefit.Both the studies proved that TENS therapy shows excellent results compared to placebo therapy

**Table 1:-** Characteristics of studies included in systematic review.

| | Study | Age of subjects [years] | Gender [M:F] | Sample size | Treatment Modality | Frequency | Duration | Outcome |
|---|---|---|---|---|---|---|---|---|
| 1 | AltafHussainChalkoo et al | 17 to 60 years | 1:0.621 | 60 | Group A- muscle relaxant(thiocolchicoside 4 mg ), analgesics (diclofenac 50mg ), hot fermentation, and soft diet | 2 times daily | initially for 5 days and was continued up to 15 days if no relief in symptoms was reported | 83.7% reduction in pain |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Group B-TENS therapy-frequency - 10Hz. Intensity was different for different patients | Once in 3 days | 30-min over the tender muscles after every 3 days (total five sittings). | 65% reduction in pain |
| | | | | | Group C-combination of TENS and - muscle relaxant(thiocolchicoside 4 mg ), analgesics (diclofenac 50mg ),hot fermentation, and soft diet | Medications 2 times daily and tens therapy once in 3 days | Medications initially for 5 days and was continued upto 15 days if no relief of symptoms, Tens therapy 30 min over tender muscle after every 3 days[5 sittings] | 97.4% reduction in pain |
| | | | | | Group D-Placebo | Zero intensity and zero frequency | -5 sittings | No change in pain scores |
| 2 | ArashMansourian et al | 18 to 60 years | 18.54: 81.46 | 108 | GROUP A-LLLT + 10 mg fluoxetine, 0.25 mg clonazepam, baclofen | 10sessions+fluoxetine once daily, clonazepam once daily, baclofen 3 times daily | 2 sessions per week+ medications for 2 month | 3rd week-4.47±2.22 |
| | | | | | | | | 6th week-5.39±0.35 |
| | | | | | | | | 8th week-5.94±0.29 |
| | | | | | GROUP B-TENS + 10 mg fluoxetine, 0.25 mg clonazepam, baclofen | 10 sessions+ fluoxetine once daily, clonazepam once daily, baclofen 3 | 3 sessions per week+ medication for 2 month | 3rd week-4.06±2.18 |
| | | | | | | | | 6th week-4.94±0.35 |
| | | | | | | | | 8th week-5.69±0.29 |
| | | | | | GROUP C-10 mg fluoxetine, 0.25 mg clonazepam, baclofen | fluoxetine once daily, clonazepam once daily, baclofen 3 times daily | medication for 2 month | 3rd week-2.80±1.30 |
| | | | | | | | | 6th week- 4.42 ±0.35 |
| | | | | | | | | 8th week- 5.94 ±0.29 |
| 3 | Harneet Singh et al | 18 to 60 years | 14:26 | 40 | Group I-TENS therapy-pulse frequency range of 2-50 Hz ±10% | once in a week for a period of four consecutive weeks and were followed up in the fifth | 30 min per sitting | 87.5% reduction in pain |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | week | | |
| | | | | | Group 2-Placebo<br><br>placebo inert tablets (Myolax)[3] containing starch, dicalcium phosphate (DCP), lactose, modified starch (MS), talcum | once daily | One month | 76.6 % reduction in pain |
| 4 | Shailaja et al | Not mentioned | Both | 40 | Group A-TENS therapy<br>Pulse frequency rate: 2 - 150 PPS (HZ), Pulse width duration: 250 micro seconds (fixed), | Once in 5days for 15 days | 20 min each visit | reduction in intensity of pain was 78.94%. |
| | | | | | Group B-Cyclobenzaprine therapy | 10 mg once daily | 15 days | reduction of pain was 55.07% |
| 5 | Shanavas et al | 20 to 55 | 16:24 | 40 | Group A-medication [combination of analgesics and muscle relaxants — (ultrazox tablet-chlorzoxazone 250 mg, diclofenac potassium 50 mg, paracetamol 325 mg) | Thrice daily | 5 days | The mean pre-treatment VAS value in group A was 5.35 and the mean value for post-treatment VAS was 1.9.<br>Mean pain reduction value is3.5 |
| | | | | | Group B-TENS THERAPY+ Ultrazox tab | 30 min<br><br>Medication thrice daily | Once in 5 days for 10 days<br><br>Med – 5 days | The mean pre-treatment VAS value in group B was 5.9 and the mean post-treatment VAS value was 1.8<br>Mean pain reduction value is 4.1 |
| 6 | Saranya et al | Above 18 yrs | 18:42 | 60 | Group A<br>**Sub group 1**-TENS frequency at VAS range of 0–5<br><br>**Subgroup 2-**TENS frequency at VAS range above 5 | 20 min | 5 consecutive days | 91.02 % reduction in pain |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | Group B<br>**Subgroup 3**<br><br>MENS frequency at VAS range of 0–5<br><br>**Subgroup 4**<br>MENS frequency at VAS range above 5 | 20 min | 5 consecutive days | 86.05 % reduction in pain | |
| 7 | Moger et al | 15-60 | Both | 45 | Group A – TENS Therapy | Once in week | 1 month | 66.1% reduction in pain | |
| | | | | | Group B-Placebo TENS | Once in week | 1 month | 57% reduction in pain | |
| 8 | Rela et al | 15-60 | Both | 122 | Group A-TENS | 45 min | 1 month<br>4 sittings | Pre treatment vas score<br><br>5.72± 0.9S1 | Post treatment VAS score<br><br>0.15 ±0.37 |
| | | | | | Group B-Physiotherapy | | 1 month<br>4 sittings | 5.70± 0.98 | 1.20 ± 0.41 |
| 9 | Selfie et al | 18-50 | Both | 40 | Group A-TENS maximum frequency of 50 Hz and 15 mA output current | 30 min | 1 month<br>4 sittings | 44.95 ± 5.74 | 14.70 ± 6.50 |
| | | | | | Group B SHAM TENS Same technique with device off | 30 min | 1 month<br>4 sittings | 43.73 ± 5.16 | 36.55 ±5.78 |
| | | | | | Group C-lowlevel laser therapy[LLLT] | 30 min | 1 month<br><br>4 sittings | 44.58 ±4.34 | 17.67 ± 5.27 |
| | | | | | Group D-SHAM LLL Same technique with device off | 30 min | 1 month<br>4 sittings | 17.67 ± 5.27 | 37.15 ±4.58 |

## Conclusion:-

TMD is a major challenge faced by many people that negatively affect their daily lives.There is a steep increase in the number of patients with TMD. Pain deteriorates the quality of life of the patient and creates an imbalance in psychological stability. Relieving pain with a non-invasive device is a boon to the medical world. .TENS along with medication proved to be highly effective in treating pain due to TMD. The exact etiology behind the pain due to

TMD should be confirmed.Combination of TENS therapy and medication should be given paramount importance while planning the treatment for pain due to TMD.

## Acknowledgements:-

The authors declare no conflict of interest. This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Reference:-

1. Kasat V, Gupta A, Ladda R, Kathariya M, Saluja H, Farooqui AA.2014. Transcutaneous electric nerve stimulation (TENS) in dentistry- A review. J ClinExpDent.6(5):e562-8.
2. Mansourian A, Pourshahidi S, Sadrzadeh-Afshar MS, Ebrahimi H. A .2019.Comparative Study of LowLevel Laser Therapy and Transcutaneous Electrical Nerve Stimulation as an Adjunct to Pharmaceutical Therapy for Myofascial Pain Dysfunction Syndrome: A Randomized Clinical Trial. Front Dent.16(4):256-264
3. MaragathavalliG , Uma Maheshwari TN.2021.Efficacy of transcutaneous electric nerve stimulation over systemic pharmacotherapy in the management of temporomandibular joint disorders – A systematic review and meta-analysis. J Indian Acad Oral Med Radiol 33[3];321-7.
4. Moger G, Shashikanth MC, Sunil MK, Shambulingappa P.2011.Transcutaneous electrical nerve stimulation therapy in temporomandibular disorder: A clinical study. J Indian Acad Oral Med Radiol.23(1):47-52
5. Rela R, Nayyar A.2018. Transcutaneous electric nerve stimulation (TENS) as pain management in TMD patients: A cross sectional study. Int. J. Appl. Dent. Sci. 4(4): 298-301
6. Saranya B, Ahmed J, Shenoy N, Ongole R, Sujir N, Natarajan S.2019.Comparison of transcutaneous electric nerve stimulation (TENS) and microcurrent nerve stimulation (MENS) in the management of masticatory muscle pain: a comparative study. Pain Research and Management. Vol 2019;1-5
7. Seifi M, Ebadifar A, Kabiri S, Badiee R M, Abdolazimi Z, Amdjadi P .2017.Comparative effectiveness of low level laser therapy and transcutaneous electric nerve stimulation on temporomandibular joint disorders. J Lasers Med Sci.8(Suppl 1):S27-S31
8. Shanavas M, Chatra L, Shenai P, Rao PK, Jagathish V, Kumar SP, Naduvakkattu B.2014. Transcutaneous electrical nerve stimulation therapy: An adjuvant pain controlling modality in TMD patients - A clinical study. Dent Res J.11[6]:676-9.
9. Shailaja S, Yadav V, Bhagat A, Sachdeva P.2019.Tens and cyclobenzaprine in TMDS - a comparative study. Int. J. Sci. Res.8(11):48-50.