CASE STUDY

Conventional therapy and Transcutaneous Electrical Nerve Stimulation (TENS) therapy in the treatment of Myogenous Temporomandibular Disorder- A study

Dr. Harsha Puri¹, Dr. Amit Ramchandani², Dr Sonali Kadam³, Dr. Hemant Umarji⁴

¹Postgraduate Student
²Assistant Lecturer
³Associate Lecturer
⁴Professor & Head
Department of Oral Medicine and Radiology
Government Dental College and Hospital
Mumbai, INDIA

Corresponding Author
Dr. Harsha Puri
Postgraduate Student
Department of Oral Medicine and Radiology
Government Dental College and Hospital
Mumbai, INDIA
E-mail: harsha.puri8@yahoo.com
Mobile: +91-9561230542

Access this Article Online

Abstract
Patients with MPDS that has become chronic may present a frustrating medical situation, which may include persistent aggravation of pain, long term medication, repeated health care visits and an ongoing dependency on the health care system. Number of established local and systemic factors as etiology of MPDS has been known so it is not surprising therefore that the treatment modalities are equally diverse, varied and ineffective. Even the most optimistic and positive clinician is forced to accept that there is no significantly curative treatment modality to manage this complex problem. In our study an attempt is made to evaluate the efficacy of Transcutaneous electrical nerve stimulation (TENS) and conventional therapy in the management of MPDS.

Use of broad spectrum antibiotics in the dental setting has increased for therapeutic and prophylactic purposes in an alarming fashion. This is leading to the development of resistance to drugs and has become inefficient in curing infections. Studies throughout the world have shown that the prescription of antimicrobials by dentists is more prophylactic rather than treating a disease. Therefore, the inappropriate prescribing of antibiotics by dental practitioners is playing a significant role in the emergence of resistant microbial strains.

Materials and method – 60 patients were selected randomly after complete radiographic evaluation into 4 Groups of 15 each. Group A was given Conventional treatment, Group B TENS, Group C Combined Conventional and TENS treatment while Group D was Placebo group. All 4 groups were analysed under 4 parameters of VAS measurement, interincisal mouth opening, muscle tenderness and clicking.

Results – In group A, 86% cases showed complete relief of pain sensation with the use of conventional therapy. In group B, 60% cases showed complete relief of pain sensation, while the group C i.e. combined therapy showed maximum relief from pain of 93%. group D patient did not show any relief.

Conclusion - It can be concluded from this study that both conventional therapy and TENS therapy were effective in relieving the pain sensation in MPDS patients. Combined therapy was more effective in providing the faster relief from pain sensation compared to conventional therapy and TENS therapy

Key words - Myofascial pain dysfunction syndrome, Transcutaneous electrical nerve stimulation, VAS

Introduction
Myofascial pain is the regional masticatory muscle pain disorder characterised by the referred pain from a trigger point within the myofascial structure.
A trigger point is a localised deep tenderness in the taut band of skeletal muscle, tendon or ligament that has the ability to cause pain in a definite anatomic distribution when stimulated. This condition was described by Schwartz (1955) as temporomandibular joint syndrome. Other terms used for this condition are Costen's Syndrome, TMJ Syndrome, Pain Dysfunction a syndrome. The epidemiologic study shows that atleast 30% of population suffers from this problem. The ratio of female to male is 3:1. MPDS is characterized by a constant dull preauricular pain which may be radiating and diffuse in nature. It is frequently associated with painful or limited mouth opening and clicking. It is difficult to know the initiating point since the condition has multifactorial origin. According to Bell “pain of muscle origin are the most frequent cause of discomfort about the head and neck”. Because dental pain is most frequent cause of orofacial pain, he also states that “a good rule to follow in diagnosing the pain about the face and mouth is initially to assume that pain is dental until proven otherwise, then muscular then to proven otherwise”. Transcutaneous electrical nerve stimulation (TENS) therapy has been used in the treatment of phantom limb pain, peripheral nerve injury, low back pain, cervical pain, joint pain and variety of other disorders. The electrical stimulus is typically generated from portable battery operated device and is transmitted to the patient by electrodes applied to the facial skin. The frequency, intensity and the repetition rate of the stimulus usually vary. TENS treatment appears to be more effective in alleviating chronic pain than acute pain. The mode of action of TENS in reducing pain is uncertain but has been attributed to neurological, physiological, pharmacological and psychological effect. The neurologic action of TENS is based on Melzack and Wall’s gate control theory of pain. TENS supposedly blocks pain signal being carried over the small unmyelinated C-fibers to carry a light touch sensation. Physiologically it affects muscle movements, the fasciculation of muscle may result in increase circulation, a decrease in oedema and a decrease in resting muscle activity. Pharmacologically it involves the stimulated release of endorphins, which are endogenous morphine like substances. Lastly the probable placebo effect of TENS in relieving pain must also be considered.

This study is proposed to compare the tested conventional therapy with the latest Transcutaneous electrical nerve stimulation therapy which is a non-invasive analgesic technique delivering high or low frequency current across the intact skin which activate underly ing nerves switching on the antinociceptive mechanism leading to pain relief.  

**Aims**

To determine effectiveness of TENS in the management of Myofascial pain disorder, to compare the efficacy of TENS with Conventional therapy, to determine the efficacy of Combined use of Conventional and TENS therapy in myofacial pain disorder. The objectives were to evaluate the improvement in VAS (visual analogue scale), if any, to evaluate whether the tenderness (on palpation) of muscles of mastication has reduced or not, to evaluate the changes in interincisal distance in pre & post treatment cases to signify improvement and to evaluate clicking if present has reduced or not.

**Materials and Methods**

Sample size of 60 patients, each group comprising of 60 patients was selected. Group A consisting of 15 patients was primarily included to study the efficacy of well established treatment modality of muscle relaxant, analgesics, hot fomentation and isometric exercises. Group B consisting of 15 patients was included to determine the efficacy of recently tried out TENS therapy Group C Consisting of 15 patients treated by the Combination of TENS & Conventional therapy as given in Group I and II. Group D - Placebo group consisting of 15 patients who were treated by TENS unit, with zero intensity & frequency i.e. no electrical stimulation [Total 8 sittings]. Case history included onset, duration, progress of the chief complaint, relevant dental, medical, family and personal history. Special stress was given in eliciting the history of clenching and bruxism, which are the established epiological factors for MPDS. Greater emphasis was given in obtaining the history of muscle pain, limited mouth opening, deviation, clicking etc. Clinical examination was done giving stress on Mouth opening Deviation, deflection Clicking, crepitus Tenderness in TMJ region,Muscles of mastication: Intraoral examination was done systematically with special relevance to attrition, abrasion, occlusal facets, abrasion of the teeth, linea alba on cheek mucosa and tongue indentations, which would suggest the presence of para-functional habits such as bruxism or clenching. Distance between the incisal edges of upper and lower central incisors with the mouth fully open was measured using a Vernier calliper. For evaluation of pain patients were asked to quantify his/her complaints on the VAS (Visual Analogue Scale). Intensity of pain was measured using rating such as Visual Analogue Scale (VAS). AVAS consists of a 10 cm line on which 0 cm “no pain” and 10 cm “pain as bad as it could be”. The patient marks the points along the line that best represents his or her pain, and the score is measured from the “no pain” end of the scale.  

**Materials and Methods**

Sample size of 60 patients, each group comprising of 60 patients was selected. Group A consisting of 15 patients was primarily included to study the efficacy of well established treatment modality of muscle relaxant, analgesics, hot fomentation and isometric exercises. Group B consisting of 15 patients was included to determine the efficacy of recently tried out TENS therapy Group C Consisting of 15 patients treated by the Combination of TENS & Conventional therapy as given in Group I and II. Group D - Placebo group consisting of 15 patients who were treated by TENS unit, with zero intensity & frequency i.e. no electrical stimulation [Total 8 sittings]. Case history included onset, duration, progress of the chief complaint, relevant dental, medical, family and personal history. Special stress was given in eliciting the history of clenching and bruxism, which are the established epiological factors for MPDS. Greater emphasis was given in obtaining the history of muscle pain, limited mouth opening, deviation, clicking etc. Clinical examination was done giving stress on Mouth opening Deviation, deflection Clicking, crepitus Tenderness in TMJ region,Muscles of mastication: Intraoral examination was done systematically with special relevance to attrition, abrasion, occlusal facets, abrasion of the teeth, linea alba on cheek mucosa and tongue indentations, which would suggest the presence of para-functional habits such as bruxism or clenching. Distance between the incisal edges of upper and lower central incisors with the mouth fully open was measured using a Vernier calliper. For evaluation of pain patients were asked to quantify his/her complaints on the VAS (Visual Analogue Scale). Intensity of pain was measured using rating such as Visual Analogue Scale (VAS). A VAS consists of a 10 cm line on which 0 cm “no pain” and 10 cm “pain as bad as it could be”. The patient marks the points along the line that best represents his or her pain, and the score is measured from the “no pain” end of the scale.
Laskin’s criteria were adhered to while arriving at the diagnosis which stated four Positive signs - limited mouth opening, clicking, stiffness of muscles of mastication and tenderness or trigger points and two negative signs - there should be no pain when palpated through external auditory meatus and there should be no clinical, radiologic or biochemical evidence of any pathologic changes in TMJ$^1$.

During Radiographic examination patients were subjected TMJ modification view. OPG was obtained on the Planmeca Proline series 2002 at 70 Kvp, 8mA and an exposure time of 6.3 sec for closed mouth and open mouth position. Only those patients who did not have radiographic evidence of degenerative changes (such as flattening, osteophytes, bony erosions, ely’s cyst, subcortical hyperstosis ) in TMJ were selected.

**Treatment**

After detailed case history, clinical examination and investigation - the diagnosis of MPDS was made and the patients were randomly divided in four groups. Group A consisting of 15 patients was primarily included to study the efficacy of well established treatment modality of muscle relaxant, analgesics, hot fomentation, and isometric exercises. Group B consisting of 15 patients was included to determine the efficacy of recently tried out TENS therapy. Group C Consisting of 15 patients treated by the Combination of TENS & Conventional therapy as given in Group I and II. Group D – Placebo group consisting 15 patients who were treated by TENS unit, with zero intensity & frequency i.e. no electrical stimulation. [Total 8 sittings]. In all the patients 4 parameters were recorded before during and after the treatment. Those were Pain sensation by VAS, Interincisal distance in mm. Clicking and muscle tenderness. These findings were recorded on the day of starting the treatment, and thereafter the parameters were regularly reassessed on 1 week, 2 week, 3 week, 4 week, 1 month, 2 month and 3 month respectively Patients were also prescribed the following muscle relaxants and analgesics. Group A was advised Muscle Relaxants & Analgesics, Tizanidine 2mg was prescribed for 5 days and was continued if pain still persisted, for a maximum period of 15 days. It is a centrally acting muscle relaxant (α-2 adrenergic agonist). Nimesulide 100 mg was prescribed for 5 days and was continued if pain still persisted for a maximum period of 15 days. It is a selective Cox 2 inhibitor analgesic (Tab Nise-MR). Local Application of Diclofenac gel for 5 days and was continued if pain still persisted for a maximum period of 15 days. (Relaxyl Gel). It is an Acrlylacetic acid derivative. Group B Comprised of 15 Patients treated with Transcutaneous electrical nerve stimulation (TENS) therapy. TENS therapy was administered for a period of 30 minutes at each application of low frequency electric stimulation of 4Hz, intensity adjusted as tolerated by the patient for the period of 30 min over the tender muscles, 2 seating per week for 4 weeks (total – 8 Sittings). Patients were instructed to relax completely and keep the part to be treated still and to report if any increase of pain or other sensations immediately.

**Results**

The data obtained from the study was carefully tabulated in the form of a master chart. In group A, 86% cases showed complete relief of pain sensation with the use of conventional therapy - Daniela et al$^2$. In group B (TENS therapy) in our study 60% cases showed complete relief of pain sensation - Terezhalmy et al, Block and Laskin, Gold et al. Our results in group B patients treated with TENS therapy are slightly less, but in general agreement with Terezhalmy et al, Block and Laskin$^3$ and Gold et al. Group C i.e. Combined therapy showed maximum relief from pain of 93%. T. Lundeberg et al (1984) said TENS is efficient and in some patients more efficient pain suppressive measures as compared to aspirin$^4$. It is suggested on the basis of these findings that vibratory stimulation and TENS therapy merit consideration in the choice of treatment of myofascial or musculoskeletal pain. Wessberg et al combined TENS therapy with splint and occlusal adjustment and claimed 95% success rate, however it is uncertain whether the beneficial effects were due to the TENS, the splint, the occlusal adjustment , a placebo effect or a combination of these or the other objects. Our findings in group C patients appear to be comparable to those of Wessberg et al$. Group D i.e. Placebo group (TENS with zero intensity and frequency) did not show any improvement in pain sensation- Marchand et al, Graff- Radford S B et al.

Table 1 and graph 1 shows the comparison of pre and post-operative changes in mean pain score. Percentage change of pain sensation was calculated using the formula (follow up value – baseline value) x 100 divided by baseline value. It shows -87.30% pain reduction Group A, -85 % pain reduction Group B and -90.62 % pain reduction in group C.

Table 2 and graph 2 shows the comparison of changes in mean pain score and percentage change in follow up period. Combined therapy has a beneficial effect in providing faster relief from pain sensation when compared to the two therapies using individually i.e. group A and group B.

Table 3 and graph 3 shows comparison of pre and post-operative changes in mean interincisal distance. TENS therapy shows slight amount of improvement in the oral opening but the combined therapy has shown greater promise in improving the symptoms of trismus and this could be
attributed to the specific mode of action of muscle relaxant and TENS therapy of increased vascularity, reduction in inflammation etc. Delaine et al. and Wieselmanna-Penker et al. Mean change in interinsical distance in group A is 3.0, group B is 2.2, group C is 4.0 and group D is 0. Table 4 and graph 4 shows the efficacy of the conventional therapy, TENS therapy, combined therapy and placebo therapy in relation to muscle tenderness. During the follow up period it was observed that combined therapy was faster in alleviating the muscle tenderness in MPDS patients.

Table 5 and graph 5 demonstrates the efficacy of the conventional therapy, tenn therapy, combined therapy and placebo therapy in relation to clicking. Neither conventional therapy nor TENS therapy were effective in improving the clicking in MPDS patients but the combined used of both therapies caused 60% reduction in clicking. Table 6 and graph 6 shows the Age and sex distribution in MPDS patients. Firas A.M. et al studied 114 pts with myogenous temporomandibular disorder and they reported the mean age of 33.5 years with 57% patients in the 3rd decade (coincide with our study mean age in our study was 32.27 years with 46.66% patients in the 3rd decade).

Table 7 and graph 7 demonstrates the efficacy of the conventional therapy, TENS therapy, Combined therapy and Placebo therapy in providing lasting relief. Even if both the modalities employed provided substantial relief, in a few cases the relief was not long lasting. It has been shown by Laskin et al that patients with MPDS usually have episodes of relapse, as was seen in our study

**Discussion**

Pain is a characteristic feature of MPDS. According to Laskin pain in MPDS is due to muscular overextension or overcontraction which gives rise to muscle fatigue. In muscle fatigue there is increased production of lactic acid, which further stimulates nociceptors present in muscle leading to increased pain. Integrated Trigger Point Hypothesis introduced by Simons, which brings together several findings of MTrPs to describe a possible sequence of MTrP development (Simons et al., 1999). Included in this sequence is an “energy crisis” that perpetuates an initial sustained contracture at the muscle fibers near an abnormal endplate. Due to excessive ACh release from the motor endplate, it is hypothesized that sustained sarcomere contracture leads to increased local metabolic demands and compressed capillary circulation. With reduced blood flow and diminished sources of adenosine triphosphate (ATP), muscle fibers are locked in a contracture without sufficient energy to return Ca2+ to the sarcoplasmic reticulum and restore a polarized membrane potential. Additionally, the local hypoxic conditions and energy crisis may elicit the release of neuroactive substances and metabolic by-products that could sensitize peripheral nociceptors. The Cinderella Hypothesis (Hagg 1988) provides a possible explanation of MTrP development that complements the Integrated Trigger Point Hypothesis. The Cinderella Hypothesis describes how musculoskeletal disorder symptoms may arise from muscle recruitment patterns during sub-maximal level-exertions with a moderate or low physical load. According to Henneman’s “size principle”, smaller type I muscle fibers will be recruited first and be derecruited last during these static exertions, using only a fraction of motor units available. As a result, these ‘Cinderella’ fibers are continuously activated and metabolically overloaded, while larger motor units do not work as hard and spend less time continuously activated. Sub-maximal exertions, such as postural maintenance, can lead to possible muscle damage and disturbance of Ca2+ homeostasis, suspected features that may contribute to MTrP pain. A study by Treaster et al. (2006) supports the Cinderella Hypothesis. The study demonstrated that low-level, static, continuous muscle contractions in office workers during 30 min of typing induced the formation of MTrPs. Their findings suggest that “MTrP may provide a useful explanation for muscle pain and injury that can occur from low level static exertions”.

K. D. Rainsford et al. (2006) Nimesulide is a COX 2 inhibitory NSAID invented by Dr George Moore. Nimesulide demonstrates preferential COX-2 inhibitory activity, sparing COX-1 in most clinical models. The proposed mechanism of action includes inhibition of release of histamine from mast cells and basophils, hydroxyl-radicals (which are scavenged), superoxide radicals (O2 –) and the production of hypochlorous acid by activated polymorphonuclear neutrophil (PMN) leukocytes. Reduction in O2 •, neutrophil adherence and expression of receptors (which have been observed at relatively high concentrations of the drug) and phosphodiesterase (PDE) IV, with consequent increase in the intracellular levels of cyclic-3’,5’-adenosine monophosphate (cyclic-AMP), which in turn may negatively regulate the release or production of histamine, as well as leukotrienes, pro-inflammatory cytokines and enzyme release by leukocytes. The production of platelet activating factor (PAF) from activated platelets and other cells, metalloproteinases (MMPs) which can cause the destruction of proteoglycans (PrGns), collagens and other components of connective tissue matrix in joints. Rapidly distributed in synovial fluid, hence extensively used in osteoarthritis. The activity of nitric oxide synthases (NOS) and the subsequent production of nitric oxide (NO) and peroxynitrite
(ONOO•-) from combination of NO with hydroxyl radical; these reactive oxygen species (ROS) being key mediators of the cellular destructive and inflammatory events in inflammation⁹. Reduced mouth opening is one of the characteristic features of the myogenous temporomandibular disorder. According to Firas A et al reduction in mouth opening is related to spasm of closing muscles, which leads to trismus. Reduction in mouth opening further adds to the discomfort of the patient as he finds difficulty in food intake and mastication and it is desirable to bring about improvement in the trismus.⁰ In group A patients, isokinetic exercise and muscle relaxants and group B i.e. TENS can be considered to be effective in reducing the myospasm. In group C patients, it may be possible that the Combined therapy has effectively caused relaxation of closing muscles greater than in group A and group B patients as the mode of action of both the modalities is different but the combined effect is additive.

The mean change in interincisal opening in group A is 3, in group B is 2.27, group C is 4 while 0 in group D. After the treatment the improvement in the interincisal distance is significantly (P<0.05) more in group C than in group A and group B by Paired T test.

*P<0.05 Significant

Delaine et al have shown that conventional therapy is also useful in relieving trismus in patients with MPDS. Detailed perusal of the voluminous data available in the literature failed to show significant number of study carried out with TENS therapy and amongst the limited studies available it was noted that interincisal distance was not considered as a parameter in establishing the efficacy of the modality. Therefore it is not possible to compare our findings related to improvement in trismus with any other authors.

However, Wiesellmann-Penker et al had shown decreased mean electromyographic levels in muscles thereby leading to local relaxation of masticatory muscles.

However as seen from our study TENS therapy shows slight amount of improvement in the oral opening but the combined therapy has shown greater promise in improving the symptoms of trismus and this could be attributed to the specific mode of action of muscle relaxant and TENS therapy of increased vascularity, reduction in inflammation etc.

Limitations- EMG (Electromyography) which measures muscular activity would be a good parameter to assess the pre and post treatment status in MPDS cases. However due to lack of easy and affordable availability this facility could not be utilized in this study.

Conclusion

It can be concluded from this study that both conventional therapy and TENS therapy were effective in relieving the pain sensation in MPDS patients. In this study combined therapy was more effective in improving the interincisal distance compared to conventional therapy and TENS therapy. During the follow up period it was observed that combined therapy was faster in alleviating the muscle tenderness in MPDS patients. In this study neither conventional therapy nor TENS therapy were effective in improving the clicking in MPDS patients but the combined used of both therapies caused 60% reduction in clicking. Both conventional therapy and TENS therapy when used alone were not that significant in reducing pain than when they were used together in relieving the muscle tenderness in MPDS patients. Majority of the patients i.e. 83.33 % included in this study belonged to 21 to 40 yrs age group. Both the treatment modalities were ineffective in providing a lasting relief in a limited number of patients. It is recommended that in order to provide faster and longer lasting relief from pain, limited mouth opening and muscle tenderness the judicious combination of TENS therapy and conventional therapy can be given. This will provide the patients with beneficial effects of both the therapies.

References

1. Bruce Blasberg, Martin Greenberg Burkit’s textbook of Oral Medicine, Diagnosis and Treatment, Tenth edition.
7. J.P. Shah, J.V. Danoff, M.J. Desai, S. Parikh, L.Y. Nakamura, T.M. Phillips, L.H. Gerber, Biochemicals associated with pain and inflammation are elevated in sites near
10.


16. Daniel M. Laskin. Diagnosis and treatment of myofascial pain- dysfunction (MPD) syndrome. Journal of prosthetic Dentistry 1986; 56;1 pg no. 75-84


22. Firas Am and Mudar S. Kamal: Anterior midline point stop device(AMPS) in the treatment of myogenous TMDs; comparision with the stabilizing splint and control group. OOOe 2006 101 741 – 7.
