Evaluation of conventional therapy, transcutaneous electric nerve stimulation therapy, and placebo in management of myofascial pain-dysfunction syndrome: A comparative study

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Abstract

Background: One of the highly prevalent and distressing conditions affecting orofacial region is orofacial pain. For proper management and correct diagnosis, clinician needs to have sound knowledge of all painful conditions affecting orofacial region. Our study focuses on myofascial pain-dysfunction syndrome (MPDS).

Materials and Methods: A total of 60 patients who reported to the post-graduate Department of Oral Medicine and Radiology were selected randomly after complete clinical and radiographic evaluation into four Groups of 15 patients each. Group A was given conventional treatment including muscle relaxants, analgesics, soft diet, and hot fomentations, Group B transcutaneous electric nerve stimulation therapy (TENS), Group C combined conventional and TENS treatment while Group D as the placebo group. All four groups were analyzed under four parameters of visual analog scale measurement, interincisal mouth opening, muscle tenderness, and clicking.

Results: In Group C, a significant improvement was seen in terms of muscle tenderness, pain, and maximum mouth opening (MMO) during different visits. Average values for pain, muscle tenderness, and MMO were significantly better in combined conventional group as compared to conventional, TENS therapy and placebo group.

Conclusion: It was concluded at the end of the study that the effective treatment modality in MPDS is combined conventional method as compared to other methods of treatment.

Keywords
TENS therapy, Muscle relaxants, Placebo, Pain score, Mouth opening

Introduction

Myofascial pain syndrome (MPS) is very common compliant with which patients report to a dentist. It reduces the sense of well-being, causes pain and discomfort in the majority of population. The main causes behind myofascial pain-dysfunction syndrome (MPDS) are the myofascial trigger points which are present in painful taut bands of muscles. In spite of the significant impact on public health, a clear mechanistic understanding of the disorder does not exist. This is mainly due to the complex nature of the disorder which involves the integration of cellular signaling, excitation-contraction coupling, neuromuscular inputs, local circulation, and energy metabolism.[1] In spite of various treatment regimens patients of MPDS learn to live with this distress and discomfort. Irrespective of treatment, symptoms may get relieved, aggravated or may be persistent in patients of MPDS. The four cardinal symptoms of MPDS, i.e., pain, tenderness, clicking and limited mouth opening are mainly due fatigue and spasm of muscles of mastication.[2] MPDS is characterized by regional pain originating from hyperirritable foci located within painful taut bands of skeletal muscle, known as myofascial trigger points. Main causes of MPDS may be from direct or indirect trauma, spine pathology, exposure to cumulative and repetitive strain, postural dysfunction, and physical deconditioning. Treating the underlying etiology is currently the most widely accepted strategy for MPS therapy. If the root cause is not properly treated, hyperirritable myofascial trigger points may reactivate and MPDS may persist.[3]
Transcutaneous electric nerve stimulation (TENS) therapy has been used in the treatment of many conditions including low back pain, cervical pain, joint pain and a variety of other disorders. The electrical stimulus is typically generated from the portable electrically operated device and is transmitted to the patient by electrodes applied to the face near the taut and tender muscles. The frequency was kept constant 10 Hz and intensity was different for different patients. TENS treatment appears to be more effective in alleviating long-lasting chronic pain than acute pain of short duration.

The mode of action of TENS in reducing pain is unknown and uncertain but has been attributed to neurological, physiological, pharmacological and psychological effect. The neurologic action of TENS is based on gate control theory of pain given by Melzack and Wall. 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 edema and a decrease in resting muscle activity. Pharmacologically it involves the stimulated release of endorphins, which are endogenous morphine-like substances hence help patients suffering from MPDS.\(^1\)

**Materials and Methods**

A total of 60 patients of both the sex and in the age group ranging from 17 to 60 years of age were selected from the post-graduate Department of Oral Medicine and Radiology. After complete case history, clinical and radiographic examination using orthopantomography (OPG) diagnosis of MPDS was made, and patients were divided into four groups consisting of 15 patients each.

Case history included onset, duration, progress of the chief complaint, relevant dental, medical, family and personal history. Special concern was made for eliciting the history of clenching and bruxism, which are the established etiological factors for MPDS. Intraoral examination was done systematically with special relevance to attrition, abrasion, occlusal facets, abfraction of the teeth, linea alba on cheek mucosa and tongue indentations, which would suggest the presence of parafunctional habits such as bruxism or clenching.

**Inclusion criteria**

Patients with pain in the preauricular area, tenderness in one or more muscles of mastication during function or on palpation and patients with reduced mouth opening.

**Exclusion criteria**

Patients with radiographic changes suggestive of pathological conditions of temporomandibular joint (TMJ). Patients with some underlying systemic disease like cardiac ailments especially cardiac pacemakers or arrhythmias. Pregnancy, patients with irregularly placed teeth, epilepsy, central nervous system disorders such as multiple sclerosis, patients with undiagnosed orofacial pain or any sort of skin lesion at the site where electrode is to be placed.

Group A consisting of 15 patients was primarily included to study the efficacy of well-established treatment modality of muscle relaxant (thiocolchicoside 4 mg bd), analgesics (diclofenac 50 mg bd) initially for 5 days and was continued up to 15 days if no relief in symptoms was reported, hot fomentation, and soft diet. Group B consisting of 15 patients was included to check the effectiveness of TENS therapy [Figure 1].

Group C consisting of 15 patients treated by the combination of TENS and conventional therapy as given in Group A and B. Group D was the placebo group consisting 15 patients who were treated by TENS unit, with zero intensity and frequency, i.e., no electrical stimulation (five sittings). In all the patients four parameters were recorded before during and after the treatment. Pain sensation and tenderness by visual analog scale (VAS), interincisal distance in mm using vernier caliper and clicking [Figure 2]. These findings were recorded on the day of starting the treatment, and thereafter.
the parameters were regularly reassessed on 5th, 10th, and 15th day, respectively. Only those patients were selected who had normal TMJ complex on radiographic evaluation using OPG [Figure 3].

TENS therapy was administered for a period of 30-min at each application of low frequency electric stimulation of 10 Hz, intensity adjusted as tolerated by the patient for the period of 30-min over the tender muscles after every 3 days (total five sittings).

Statistical methods
Statistical software’s SPSS (Version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Data were analyzed by means of descriptive statistics, viz., percentages, means and standard deviations. Graphically, the data were presented by bar diagrams. ANOVA and paired t-test were employed for comparison between various groups. P < 0.05 was considered statistically significant.

Results
In our study, total of 60 patients were included with the youngest being 17-year-old and the oldest being 60 years of age. 15% of patients were <20 years of age, 65% were between 20 and 40-year-old and 20% were above 40-year-old with a mean age of 32.2 years [Table 1].

These findings were consistent with Okeson, 2003 which also states that commonly affected age group is 2nd and 3rd decade of life.\(^5\) Total number of females in our study were 37 and males 23 with a ratio of 1:0.621, which correlates with study done by Riden in 1986.\(^6\)

Table 2 is demonstrating the comparison between pre-treatment and post-treatment changes in mean pain scores. Group A shows 83.7% reduction in pain, Group B shows 65% reduction in pain, Group C shows 97.4% reduction in pain whereas Group D shows no change in pain scores. From this, we can conclude that combined approach is better in comparison to conventional, TENS, and placebo in terms of pain relief. Table 2 also shows that there is 76.6% reduction in tenderness of muscles of mastication in Group A, 56.8% reduction in Group B, 95.1% reduction in Group C however in Group D initially there was reduction in VAS scores of tenderness during second visit but at completion tenderness increased by 2.7%. This shows that combined therapy was more effective than medication and TENS therapy alone.

To evaluate the efficacy of TENS therapy in the management of masticatory muscle disorders very less research has been done. Similar to our study in 1986 Geissler and McPhee also observed that TENS therapy was very effective in painful conditions of muscular origin.\(^7\) Similar to our study List and Helkimo in 1992 used TENS therapy in craniomandibular disorders and found that 57% were benefited.\(^8\) Table 2 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. Harsha puri et al.\(^9\) Mean change in interincisal distance in Group A is 3.8 mm, Group B is 2.5 mm, Group C is 7.5 mm and Group D is −0.2 mm. There was 13.3%, 6.7%, 40% and 0% reduction in clicking sounds in Group A, Group B, Group C and Group D respectively at the end of the study.

Discussion
Earlier, MPDS was attributed to the inflammation of fibrous tissues around the ligaments, tendons, muscles and periosteum of the stomatognathic system. But now, this syndrome has been broadly defined as “dysfunction of the masticatory and associated muscles characterized by pain.” But no signs of obvious pathogenesis causing the syndrome have been found, it relies significantly on the clinical examination.

Many factors may be contributing to MPDS such as:
1. Occlusal disturbances,
2. Intracapsular disorders or
3. Emotional turmoil.

Etiologic factors also include:
1. Whip lash injury from a road traffic accident
2. Wrestling blow
3. Trauma from falling, and unexpectedly biting into a hard object.

Some complain of the pain immediately following a long dental appointment.
Mechanism of pain in MPDS

Constriction of blood vessels — muscle hyperactivity — contraction of fibers and formation of firm bands — leads to pain.

One of the significant signs of MPDS is the presence of trigger points in a specific group of muscles. They are activated by pressure, movement and tension, be it physical or emotional. Trigger points differ from “tender spots” in the sense that the pain of tender spots are localized in the surrounding of the spot while trigger points pain refers to a distant area. However, the treatment of both is exactly the same. Pain associated with MPDS is usually unilateral. It may be bilateral in some, but if bilateral, it need not be symmetrical. The quality or character of the pain reported by the patient most often will fall into three gross categories:

1. A dull-aching pain
2. A sharp-shooting pain (burning), and
3. A tight-drawing sensation.

In our study management includes soft diet, hot fomentations, medication, TENS therapy, and to some extent placebo.

Diet

Elimination of hard, chewy and sticky food helps to reduce loading forces on the joints and to rest hypertonic jaw muscles.

Rest

Each patient should be made aware of the relationship between stress and muscle tension. Resting the jaw is possible by making the patient aware of their unconscious postural, swallowing, clenching or grinding habits.

Table 2: Pre- and post-treatment changes in pain, tenderness and MMO

<table>
<thead>
<tr>
<th>Clinical parameter</th>
<th>Group</th>
<th>Baseline</th>
<th>Follow-up</th>
<th>Difference</th>
<th>Percentage change</th>
<th>P value*</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
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<tr>
<td>Pain</td>
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<td></td>
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<td>Group A</td>
<td>3.7</td>
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<td>0.6</td>
<td>0.91</td>
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<td>Group B</td>
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<td>1.07</td>
<td>1.4</td>
<td>0.91</td>
<td>2.6</td>
<td>65.0</td>
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<tr>
<td>Group C</td>
<td>5.0</td>
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<td>0.1</td>
<td>0.35</td>
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<td>97.4</td>
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<td>Group D</td>
<td>4.1</td>
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<td>4.1</td>
<td>0.83</td>
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<td>0.0</td>
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<tr>
<td>Tenderness</td>
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<td>Group A</td>
<td>4.3</td>
<td>0.88</td>
<td>1.0</td>
<td>1.25</td>
<td>3.3</td>
<td>76.6</td>
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<tr>
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<td>0.98</td>
<td>1.9</td>
<td>1.06</td>
<td>2.5</td>
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<tr>
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<td>5.5</td>
<td>0.83</td>
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<td>0.46</td>
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<td>Group A</td>
<td>38.7</td>
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<td>39.9</td>
<td>3.26</td>
<td>0.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

P value for difference in percentage change from baseline to follow-up. *Statistically significant difference. MMO: Maximum mouth opening, SD: Standard deviation

Thermotherapy or hot fomentations

Moist heat is applied by laying a hot moist towel, electric heating pad over the symptomatic area. This combination should remain in place for 10-15 min.

Medication

Included muscle relaxant thiocolchicoside 4 mg twice daily and diclofenac twice daily for 5 days if patients does not report any relief from symptoms then medications was continued for up to 15 days. Thiocholchicoside is a well-known muscle relaxant. It acts as a γ-aminobutyric acid receptor antagonist. It mainly acts at supraspinal level through a complex regulatory mechanism. It is well tolerated for a period of 6 months of oral administration. However, it has got the proconvulsant effect which should be kept in mind while prescribing this medicine. Diclofenac is a non-steroidal anti-inflammatory drug. It acts by reducing the production of prostaglandins by inhibiting cyclogenase enzymes (COX-1) and COX-2 which are believed to be responsible for pain and inflammation at the sites of injury. Thus, diclofenac can be used in MPDS patients for reducing the pain at the sites of muscle tenderness. Knežević have shown that conventional therapy is also useful in relieving trismus in patients with MPDS. According to Al Quran 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. In Group A patients, soft diet, hot fomentations, analgesic 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
Combination of conventional conservative treatment and TENS therapy for management of MPDS

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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.

Conclusion

It can be concluded from this study that both conventional therapy, i.e., medication, soft diet and hot fomentations, and TENS therapy was helpful in decreasing pain and tenderness and increasing mouth opening, however, combined method has shown greater promise in improving all the study parameters viz. pain, tenderness, mouth opening and clicking which can be attributed to combined effects of both the treatments regimens leading to increased vascularity and decrease in inflammation and an overall improvement in symptoms. It is recommended that to achieve better response in MPDS patients combination of conventional and TENS therapy can be given which will provide patients the benefits of both the therapies.

References
