

A Comparative Study on Efficacy of Three Different Treatment Modalities for Temporomandibular Joint Pain and Dysfunction

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Abstract

Aim: The aim of the study is to investigate the efficacy of three treatment options (splint therapy, physical therapy, and pharmacologic therapy) in patients suffering from painful temporomandibular joint clicking.

Materials and Methods: 60 patients were included in the study suffering from temporomandibular joint disorders randomly divided into three treatment groups. Twenty patients which were given pharmacological treatment (group I), 20 patients will received TENS therapy (group II), and 20 patients will be given splint therapy (group III). In all the three groups, subjective and objective assessments were evaluated at the time of diagnosis, after the first week of initiation of therapy and every week for three months of follow up.

Results: There was gradual reduction seen in VAS scores, muscle tenderness, TMJ clicking and significant improvement in mouth opening in Group III therapy during the follow-up period as compared to Group I and Group II therapy.

Conclusion: The conventional soft occlusal splint therapy is a much safer and effective mode of a conservative line of therapy in comparison to long-term pharmacotherapy and TENS therapy in patients with TMJ pain and dysfunction.

Key Words: Temporomandibular joint, Myofascial pain dysfunction syndrome, occlusal splint therapy, pharmacotherapy, TENS

Introduction

Temporomandibular Joint (TMJ) is a ginglymoarthrodial joint, referring to its dual compartment structure and function (ginglymo- and arthrodial) [1]. The etiology of TMD is little understood, but associated with several factors including trauma, emotional stress, malocclusion, and parafunctional habits (clenching or bruxing) [2]. The most common signs and symptoms, are pain localized in the pre-auricular area or in the masticatory muscles; jaw motion abnormalities; articular sounds, such as click or crepitus, during mandibular movements [3]. As a consequence of the multifactorial pathogenesis, therapeutic concepts must be interdisciplinary. Consequently, many different therapies-some conservative and reversible, others irreversible, including surgery and repositioning of the mandible, have been advocated for patients with TMJ dysfunction. Due to the difficulty in determining the etiology and the possibility that the symptoms are secondary to some other disorders of TMJ or muscles of mastication, initial treatment given should be reversible [4]. Therefore, the purpose of the present study is to investigate the efficacy of three treatment options (splint therapy, physical therapy, and pharmacologic therapy) in patients suffering from painful temporomandibular joint clicking.

Selection of Patients

Patients were selected for the study among the patients visiting the Department of oral medicine and radiology, SPPGIDMS, Lucknow, for the treatment for TMJ pain and clicking. 60 patients were selected after thorough examination that fulfilled the requirements on the basis of exclusion and inclusion criteria and are willing to participate in the study. Inclusion criteria were a chief complaint of acute pain (duration <3 months) in the joint on at least one side, and Presence of reciprocal joint clicking during jaw opening and closing that was eliminated

on protrusive opening [5]. Exclusion criteria were the presence of systemic diseases (i.e. rheumatic diseases), history of recent trauma, wearing of full dentures, and therapeutic co-interventions during treatment. All aspects of the study were approved by the Ethical Committee of the institution.

Methodology

Patients were made to sit comfortably on a dental chair. Clinical examinations were carried out wearing sterile hand gloves and mouth mask with patient seated appropriate to the procedure being performed. Recording of demographic data, general history, TMD history, and physical examinations were carried out in a systematic manner at the baseline visit. All the relevant data were entered in the proforma and a copy of the proforma is enclosed. Each participant underwent a standardized clinical examination.

The study comprised of total 60 patients which were randomly divided into 3 groups i.e. Medicine, Splint, and TENS groups with 20 patients in each groups, out of which 29 were male (48.33%) and 31 were females (51.67%). The total mean age of male and female was 28 years (Medicine=28.7, Splint=28.1, TENS=27.3) (Table 1 and 2).

Examination for TMD

TMJ examination

Digital palpation of the TMJ was done using the middle and index fingers and by audibly listening during opening and closure of the mouth. Listening to joint sounds was done with the examiner's ear within 5 cm of the TMJ as described by Goho and Jones. The examiner placed the middle and index finger over the TMJ area on each side of the head and the student was asked to open and close several times. Any sounds on closing or opening were recorded. This was again repeated with the little fingers pressed anteriorly in the external auditory

Table 1. Distribution of samples by gender in three groups.

Group	Male	%	Female	%	Total
Medicine group	10	50.00	10	50.00	20
Splint group	10	50.00	10	50.00	20
Tens group	9	45.00	11	55.00	20
Total	29	48.33	31	51.67	60

Table 2. Mean and SD age of male and females in three groups.

Group	Male		Female		Total	
	Mean	SD	Mean	SD	Mean	SD
Medicine group	25.5	6.3	31.9	11.9	28.7	9.9
Splint group	32.2	9.6	23.9	4.3	28.1	8.4
Tens group	29.0	12.6	25.8	5.5	27.3	9.2
Total	28.9	9.8	27.2	8.4	28.0	9.0

meatus, i.e. against the posterior aspect of the joint for the confirmation of TMJ sounds.

Examination of muscles of mastication

Digital palpation of the TMJ and associated muscles was performed to detect tenderness using the index, middle and the third finger. The recommended technique was used comprising of simultaneous palpation of the left and right side using approximately 3lb of pressure. Temporalis muscle, Masseter muscle, Lateral pterygoid, Medial pterygoid.

Group assignment

The selected patients suffering from temporomandibular joint disorders will be divided randomly into three treatment groups. Twenty patients will be given pharmacological treatment (group I), 20 patients will received TENS therapy (group II), and 20 patients will be given splint therapy (group III). In all the three groups, subjective and objective assessments were evaluated at the time of diagnosis, after the first week of initiation of therapy and every week for three months of follow up.

Group I - will receive an orally administered combination of muscle relaxants and analgesics comprising of Ibuprofen 400 mg, Paracetamol 325 mg, and Chlorzoxazone 250 mg in two doses daily for a period ranging from 5-7 days initially. If the patients reported with recurrence of pain during their post treatment follow-up, they were advised to repeat the same treatment regimen.

Group II - will be given Transcutaneous Electrical Nerve Stimulation (TENS) therapy for a period of two weeks daily for 20 minutes at variable intensity.

Group III - will be treated with occlusal splint therapy for a period of three months (For every 1-2 week period). Patients will be instructed to wear the splint at night to take care of parafunctional habits if any.

Procedure of TENS

After briefly explaining the procedure to the patient, obtain the consent for treatment. Determination of electrode pad placement is then made, depending on the treatment to be performed. The site of pad placement is gently swabbed with isopropyl alcohol or alcohol wipes and dried to remove any skin oils or substances that may interfere with current flow. In males, facial hair should be shaved. The pad is then placed with the projection for lead attachment angled towards the inferior. The connector is then attached and locked into the position. The dentist then stimulates the area with appropriate stimulation mode(s) using required waveform parameters.

The dentist should make adjustments while discussing with the patient the sensation being experienced. Muscular fasciculation is a sign of reaching the minimal therapeutic level. After reaching this level, the operator can slowly increase the amplitude over a 20 seconds period to a maximum tolerable level to "dial out" any discomfort. Rapid increase in amplitude knob settings will not cause any tissue damage, but can cause acute discomfort. Maximum benefit is obtained after 25-30 minutes of treatment. Prolonged treatment should be avoided, as it initiates a dull ache, which gradually increases in intensity.

After treatment is completed, the control knobs (amplitude and frequency knobs) are turned off completely, electrode leads are detached and the pads are removed from the face. The pads are then washed with water and mild soap gently and dried before replacing into the kit

Criteria for the muscle relaxation appliance

The following eight criteria must be achieved before the patient is given the muscle relaxation appliance:

1. It must accurately fit the maxillary teeth, with total stability and retention when contacting the mandibular teeth and when checked by digital palpation.
2. In CR all posterior mandibular buccal cusps must contact on flat surfaces with even force.
3. During protrusive movement the mandibular canines must contact the appliance with even force. The mandibular incisors may also contact it but not with more force than the canines.
4. In any lateral movement only the mandibular canine should exhibit laterotrusive contact on the appliance.
5. The mandibular posterior teeth must contact the appliance only in the CR closure.
6. In the alert feeding position the posterior teeth must contact the appliance more prominently than the anterior teeth.
7. The occlusal surface of the appliance should be as flat as possible with no imprints for mandibular cusps.
8. The occlusal appliance is polished so it will not irritate any adjacent soft tissues.

Fabrication and adjustment of the occlusal splint

An alginate impression of the maxillary and mandibular arches was made. A soft occlusal splint was fabricated from a 3 mm-thick, soft polyvinyl sheet. The sheet was adapted to a maxillary cast. The fabrication was done in a vacuum former, pressure moulding device (BIOSTAR® SCHEU-DENTAL GmbH, Iserlohn, Germany) with a thermally controlled, infrared heater. This machine accomplished vacuum suctioning of the warmed sheet of thick, resilient mouthguard material (BIOPLAST® SCHEU-DENTAL GmbH, Iserlohn, Germany) over the maxillary cast. When the sheet had properly adapted to the cast in the vacuum former, it was taken out. The splint was then separated from the cast with a laboratory knife/scissors, the edges were smoothed and the palatal area removed. The splint was then disinfected with 2% glutaraldehyde and placed in the patient's mouth to check for retention. Chair side occlusal adjustment was made by evenly warming the occlusal surface of the splint with an alcohol torch before insertion into the patient's mouth. A functional imprint was developed in centric using bilateral, centric relation manipulation such that it had evenly distributed

bilateral, posterior contact with little or no contact with the anterior teeth when in centric occlusion. Anterior guidance provided posterior separation in excursive movement. A carbide bur was used to remove the excess material from the imprint to develop the desired occlusal pattern. The soft splint was then polished with pumice, disinfected and the appliance then placed in the patient's mouth.

Statistics

The VAS scores, number of tender muscles, maximum comfortable mouth opening between the groups were compared with the help of the student's t-test (paired and unpaired tests). $P < 0.05$ was considered to be significant. TMJ tenderness between the groups was compared using the Wilcoxon matched pairs test. The Kruskal Wallis ANOVA test was used for the comparison of TMJ pain and dysfunction between all the groups.

Results

The comparison of different variables measured between the three groups at various time intervals. The VAS scores (*Graph 1*); number of tender muscles (*Graph 2*) and TMJ clicking

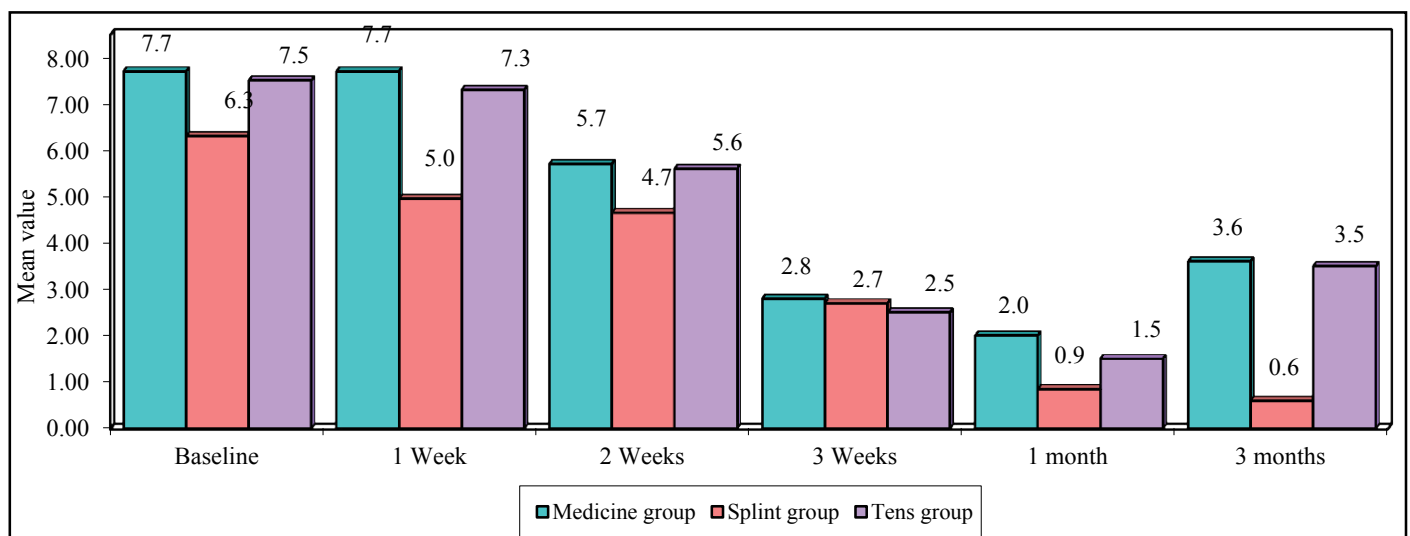
Graph 4 showed significant reduction in Group III (patients on occlusal splint therapy) compared to Group I (patients on pharmacotherapy) and Group II (patients on TENS) during the three months of treatment follow-up.

Also, it can be noted here that a significant increase in mouth opening (*Graph 3*) was observed in Group III (patients on occlusal splint therapy) compared to Group I (patients on pharmacotherapy) and Group II (patients on TENS). VAS scores for pain intensity (*Graph 1*) showed significant reduction in Group III immediately after seven days of therapy on the other hand, Group I and Group II showed no reduction in VAS scores immediately after seven days of therapy, but significant reduction was seen in the 3rd month of treatment follow-up.

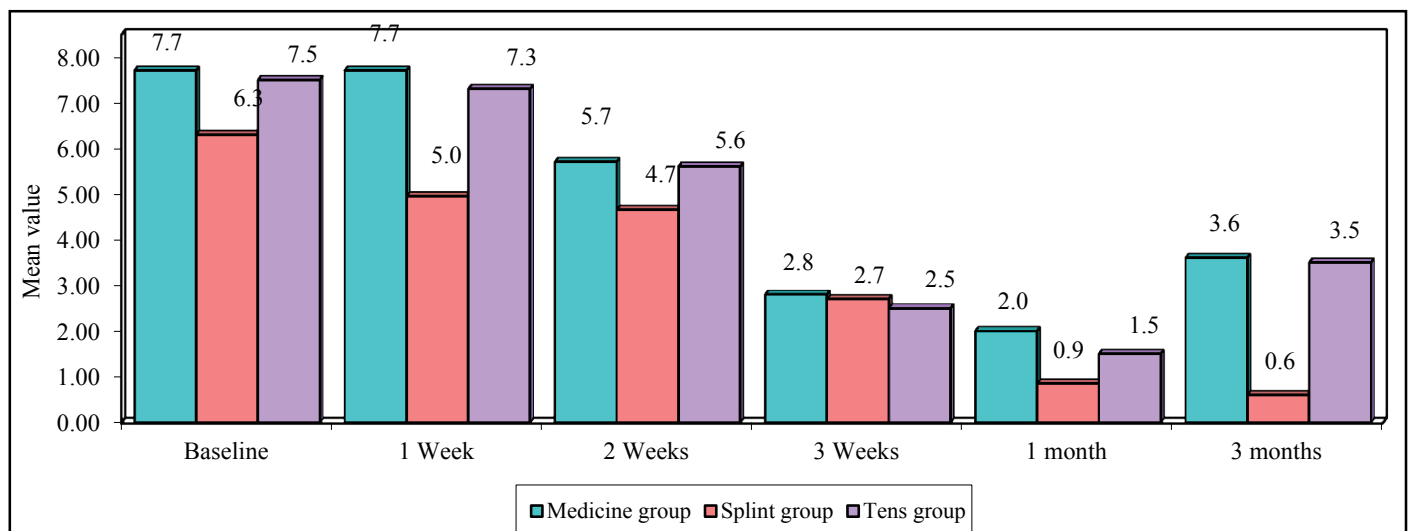
Though it was observed that the VAS score in the splint group was highly significant than other two groups, the difference between the groups was statistically highly significant.

Discussion

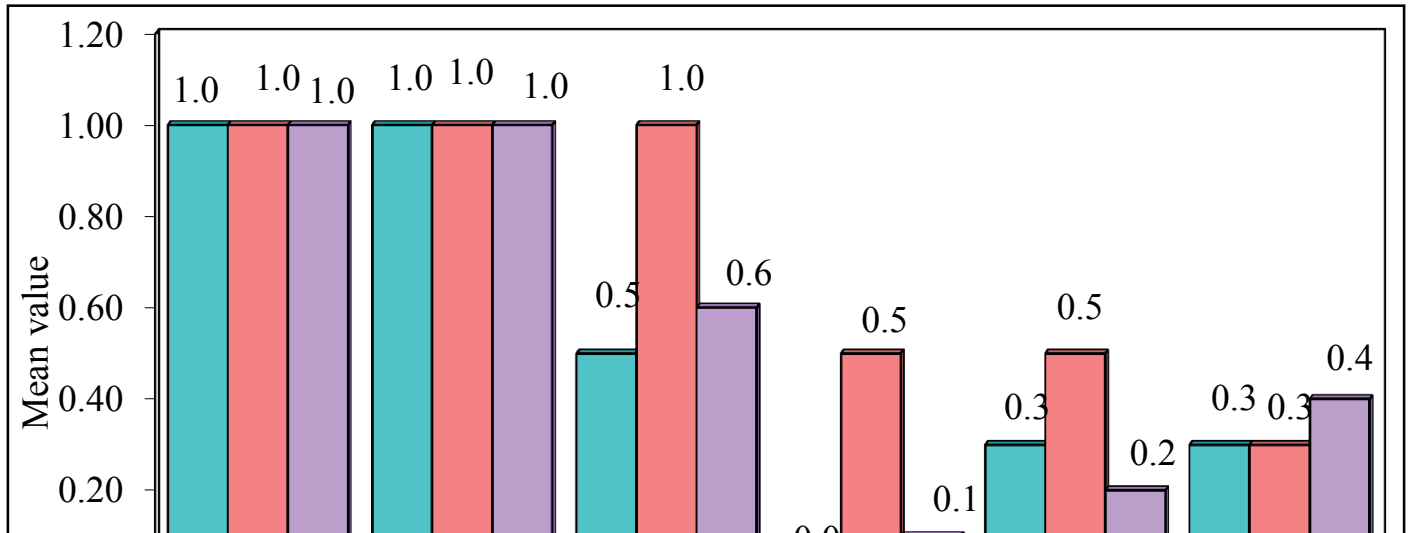
Among all of the factors that have been studied as potential causes for TMD, behavioral and psychologic factors have received the most significant amounts of attention during the



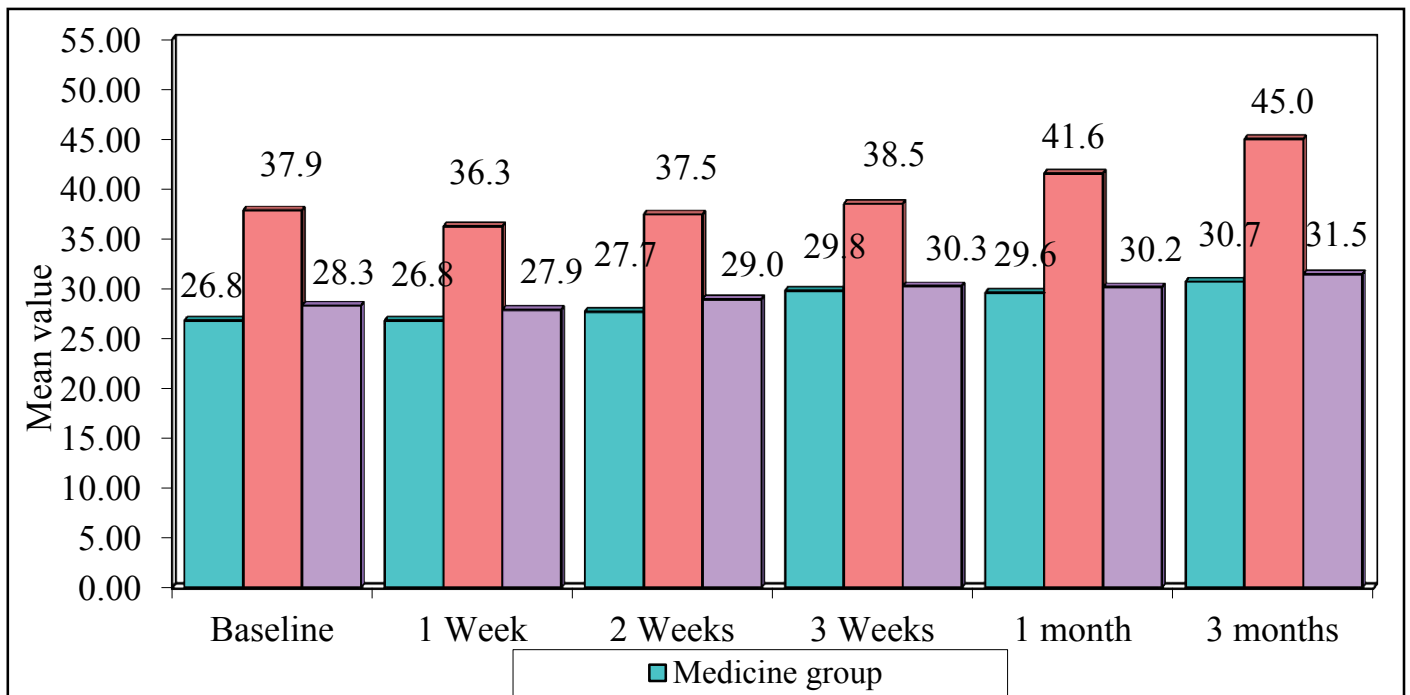
Graph 1. Comparison of three groups (Medicine group, Splint group and Tens group) with respect to VAS scores by Kruskal Wallis ANOVA.



Graph 2. Comparison of three groups (Medicine group, Splint group and Tens group) with respect to Muscles scores by Kruskal Wallis ANOVA.



Graph 3. Comparison of three groups (Medicine group, Splint group and Tens group) with respect to Maximum Opening (mm) scores by one way ANOVA.



Graph 4. Comparison of three groups (Medicine group, Splint group and Tens group) with respect to TMJ Sound scores by Kruskal Wallis ANOVA.

past few years. There is now a reasonable body of scientific data suggesting that behavioral and psychologic factors are important in the development of some types of TMD, and particularly those associated with muscle pain and dysfunction [6]. The success for a treatment of any disorder relies on two considerations: relieving of symptoms and treating the cause. In this view, various treatment modalities for TMD have been tried and tested over time. Choosing a specific conservative treatment modality for TMD patients depends on clinicians' expertise, patient presentation, and elimination of possible etiologic factors. Till date, no single treatment modality has been proven to be better than any other for TMD.

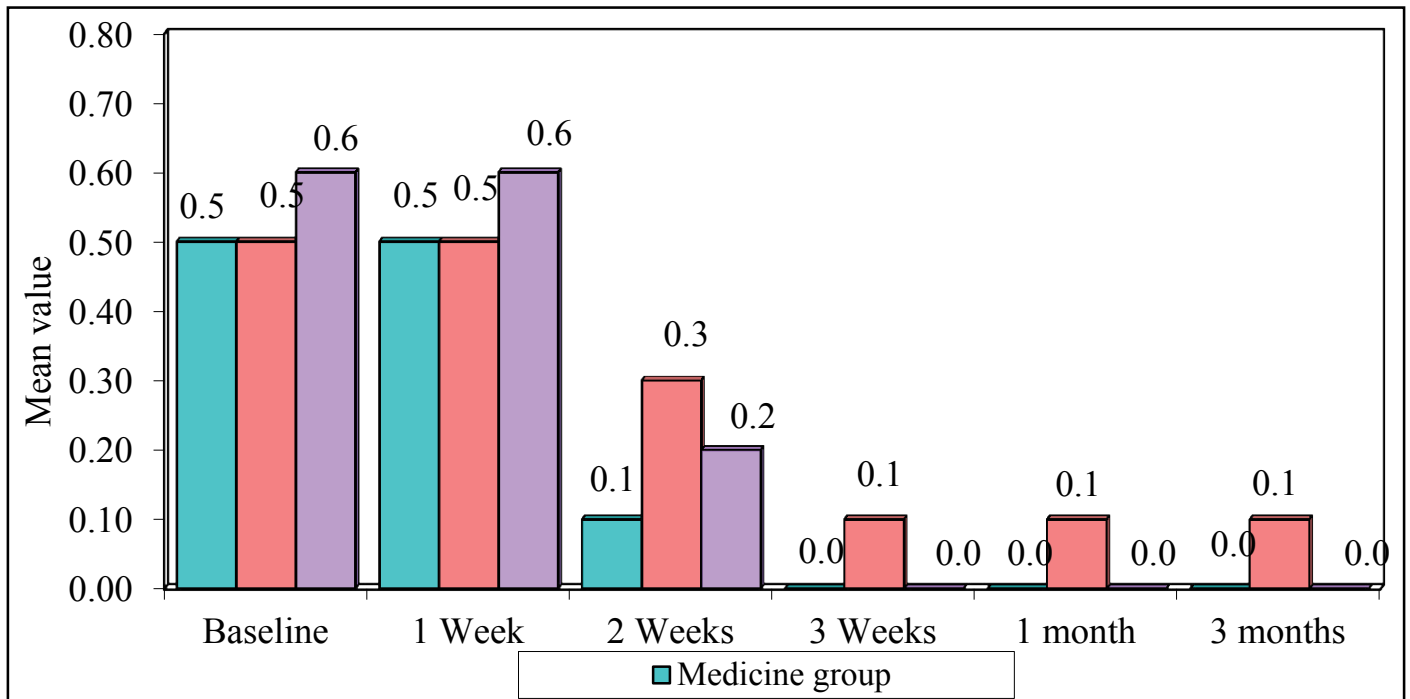
The present study evaluates the efficacy of three different treatment modality in the treatment of TMJ pain and dysfunction, being conservative treatment modalities [7].

All the 3 groups showed significant reduction at each week intervals. In the existing study, significant pain

reduction was observed in all the three groups. At the end of the treatment, pain reduction in **GROUP III** (90.48%) was slightly more than the **GROUP I** (53.25%) and **GROUP II** (53.33%). The difference between the groups was statistically highly significant. Though there was statistically significant difference is seen between the treatment groups, **GROUP III THERAPY** was slightly more effective and highly significant than **GROUP I** and **GROUP II THERAPY** in relieving pain.

TENS therapy is supposed to stimulate large, fast, myelinated, non-nociceptive neurons in the painful area, "closing the central gate" for those stimuli generated by pain specific fibers. This system, associated to the activation of an endogenous opioid system is supposed to be responsible for the analgesic effect of the TENS [8].

NSAIDs are known to be effective in the management of mild-to-moderate inflammatory conditions, particularly of the musculoskeletal system [9]. Muscle relaxants are administered



Graph 5. Comparison of three groups (Medicine group, Splint group and Tens group) with respect to TMJ Sound scores.

to reduce skeletal muscle tone and are often administered to patients with muscle tone and chronic orofacial pain to help prevent or alleviate the increased muscle activity. They are thought to decrease muscle tone without the impairment of motor function by acting centrally to depress polysynaptic reflexes [10]. One probable explanation for this event is that as optimal effects were seen when the concentration of drugs was optimal in the body during treatment. When the therapeutic effects of the drugs wore off, the symptoms reappeared [11].

Tsuga et al. [12] concluded that 87% of their patients had reduced TMJ pain; VAS reduction was seen in 50% of the patients. Harkins et al. [13] found that 74% of the patients with soft splints had reduction in facial myalgia. This is in agreement with the conclusions of Raphael et al. [14] who found that occlusal splints had decreased the VAS scores during a six-week follow-up study in patients with myofascial pain. In a prospective randomized study, Ismail et al. [15] demonstrated that, as well as splint therapy, physical therapy in combination with splint therapy was able to improve the VAS score and mandibular mobility of patients with arthrogenic TMD.

In all the three groups there was gradual but significant decrease in tenderness in all masticatory muscles and TMJs. The decrease in tenderness was slightly more in **GROUP III** than in **GROUP I and II** but the difference was statistically significant except for medial pterygoid muscle ($p < 0.05$) at the follow-up visit. The reduction in muscle tenderness was significantly ($p < 0.05$) more in **GROUP III** than other group at the follow-up visit (70% reduction in **GROUP I**, 60% in **GROUP II** and 75% reduction is seen in the **GROUP III**).

This improvement can be explained by the fact that occlusal splints with equal-intensity contacts on all of the teeth, with immediate disclusion of all posterior teeth by the anterior teeth and condylar guidance in all movements. This will relax the elevator and positioning muscles and contribute to the reduction of abnormal muscle hyperactivity [16].

Kovaleski et al. [17] have also shown significant reduction in clicking, TMJ and muscle tenderness in response to occlusal splint therapy when patients were followed up for two months. There are only few studies on TENS therapy evaluating the efficacy on muscles tenderness.

In the present study at the follow-up visit, the increase in mean mouth opening was 14.55% for **GROUP I**, 11.13% for **GROUP II** and 18.89% for **GROUP III** and was statistically significant, although there was no significant difference between the groups. **GROUP III THERAPY** was slightly more effective and highly significant than **GROUP I and GROUP II THERAPY** in respect to maximum mouth opening. Mehta N, et al. [18] observed increase in the interincisal distance in patients with orofacial pain after TENS therapy, which is similar to our observation. Also, at the end of the follow-up period, further reduction in pain and tenderness was substantially more in **GROUP III**, whereas in other groups, it was very minimum. Thus it appears that **GROUP III THERAPY** is useful in relaxing the muscles of mastication, in relieving pain, and thus, in breaking the pain-tension-pain cycle of TMD. Suvinen et al. [19] have also shown improvement in mouth opening after splint therapy. Occlusal splint therapy decreased the pain and tenderness in the muscles and joints of the patients in the present study, apparently allowing an increase in their maximal mouth opening.

There was no report of serious side effects due to drug intake in any patient. In **GROUP III**, a few patients had initial side effects such as dryness of mouth, occasional feeling of tightness of the appliance, and a feeling of queasiness and presence of foreign object, which gradually decreased within few days [20].

The present study supports the use of conventional soft occlusal splints in the safe management of patients with TMJ pain and dysfunction.

Conclusion

The conventional soft occlusal splint therapy is a much safer and effective mode of a conservative line of therapy in comparison to long-term pharmacotherapy and TENS therapy

in patients with TMJ pain and dysfunction. Furthermore, randomized blinded trials with appropriate control groups are necessary to validate the effectiveness of occlusal splint therapy in a larger study sample.

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