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ORIGINAL ARTICLE

Low-level laser therapy and transcutaneous electric nerve stimulation in the management of temporomandibular disorders

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Abstract

Objective: The aim of the present study was to compare low-level laser therapy (LLLT) and transcutaneous electric nerve stimulation (TENS) in the management of patients with temporomandibular disorders (TMDs).

Background: TMDs are a collective term embracing a number of clinical problems that affect the masticatory muscles, the temporomandibular joint and associated structures, or both.

Materials and Methods: A total of 20 patients with TMD of muscular origin were randomly selected and divided into two groups: Group 1 comprising 10 patients who were to receive LLLT and Group 2 constituting 10 patients who were to obtain TENS therapy. Treatment included nine sessions of the respective therapy rendered over the period of 30-day to patients of either group. The visual analog scale (VAS), improvement in mouth opening and evaluation by palpation of temporalis and masseter muscle were used for follow-up analysis. A paired *t*-test was employed to study the significance of the results.

Results: The results showed a reduction in VAS values and tenderness to muscle palpation for both groups. A significant improvement in mouth opening was also noted in the course of therapy in both groups.

Conclusion: Both LLLT and TENS were effective with regard to pain control, improvement in mouth opening and reduction in temporalis and masseter muscle tenderness. LLLT appeared slightly better than TENS therapy when evaluating variables of VAS and mouth opening.

Introduction

Temporomandibular disorders (TMD) is the most frequent reason for patients seeking treatment at the dental office.[1] The greatest cause of non-odontogenic pain in the orofacial region is attributed to dysfunctions in the masticatory muscles.[1,2]

Physiotherapy is frequently employed in the management of TMD. One of the most recent therapeutic modalities in the field of physiotherapy is low-level laser therapy (LLLT). Transcutaneous electric nerve stimulation (TENS) therapy is routinely utilized for treating patients with TMD. However, studies comparing the relative efficacy of the various types of such therapeutic modalities are scarce. Considering the immense importance of and need for clinical studies evaluating the same; the aim of this study was to evaluate and compare the effectiveness of LLLT and TENS in TMD.

Materials and Methods

About 20 subjects diagnosed with TMDs of myogenic origin in accordance with the research diagnostic criteria (RDC) for TMD constituted the study group. The subjects were explained in detail about the study. A written informed consent was obtained from those voluntarily willing to be a part of the study. An Institutional Ethical Clearance was obtained before the conduct of the study.

Subjects with pain in the masseter muscle, temporomandibular joint (TMJ), and/or temporalis muscle region associated with limitation of mouth opening; TMJ sounds and deviation of the mandible during jaw movement constituted the inclusion criteria.[3] The exclusion criteria were: Systemic musculoskeletal diseases, history of TMJ and facial trauma/surgery, discrepancies in occlusal and skeletal relationship, developmental anomalies affecting the TMJ and muscles of mastication, organic changes involving the TMJ, subjects in whom TENS/LLLT is contraindicated and patients on analgesics/anti-inflammatory medications/any other treatment modality for the same.

Around 20 subjects comprising 10 men and 10 women in the age range of 18-65 years (mean age 31.5 years) were randomly selected. The participants were proportionately and randomly assigned to either Group 1: Consisting of 10 patients who were to receive LLLT or Group 2: Composed of 10 patients who were to obtain TENS therapy. In both groups, patients received nine sessions of the respective therapy over the period of 3-week (3 per week on alternate days).

LLLT was performed using prometheus-M: Gallium-arsenide (GaAs) laser with an emission wavelength of 904 nm. The pain causing trigger points were located using the acupuncture point localizer. Laser therapy was executed through light, still and direct contact of the probe, placed perpendicularly on the skin. Each trigger point was irradiated for 3 min at a frequency of 300 Hz as per the manufacturer's recommendations. As the type of laser employed belonged to Class 3B, both the patient and the operator were required to wear the protective eye wear during the entire therapeutic session.

For the application of TENS, a two-electrode TENS (KODYS) capable of operating at a maximum frequency of 11 Hz and maximum amplitude of 08 amps was employed. Electrodes were applied bilaterally over the pre-auricular area for 15 min to enable the low-amplitude, low-frequency alternating stimulus contact the deep mandibular division of the trigeminal nerve, as well as the superficial facial nerve.[4] To avoid discomfort, the patients were trained to adjust the intensity of the equipment as per their sensitivity.

Assessment was done immediately before and after each session employing the visual analog scale (VAS), measurement of mouth opening and palpation of the temporalis and masseter muscles.

Patients were requested to implicate pain levels by placing a vertical line along a 100 mm horizontal line, where the left end symbolized "no pain" and the right end corresponded to "worst pain possible." The distance between the left end the patient's marks denoted a measure of the pain intensity.

To measure the mouth opening, the subjects were instructed to open their mouth within comfort limits. Using a millimeter ruler, the total mouth opening was recorded, a value representative of the distance between incisal edge of the maxillary incisors to that of the mandibular incisors.

In accordance with the RDC guidelines, muscle palpation was performed with firm, yet mild and steady pressure, using approximately 1.5 kgf of pressure.[5] Depending on the patient's reaction to palpation, the pain perceived was graded as: 0 - no pain, 1 - mild pain, 2 - moderate pain, and 3 - severe pain.

The findings at each assessment were recorded in the patient's respective proformas specially designed for the study. No adverse effects were observed or reported by the study subjects during/after the therapy.

Paired *t*-test was used for comparison of treatment results. Significance was set at $P < 0.05$. For all statistical analysis, the SPSS (version 16) software was used.

Results

The present study was performed on 10 men and 10 women in the age range of 18-65 years. The mean age for the men and women was 32.6 and 30.4 years, respectively. Employing the paired *t*-test, comparison of the study groups after assessment at all nine sessions revealed no statistically significant differences in any of the study parameters.

Intragroup analysis showed a statistically significant improvement of all the variables evaluated over the nine therapeutic sessions.

Discussion

Results of this study indicate that both LLLT and TENS were remarkably effective in reducing the signs and symptoms of TMD of myogenic origin. This improvement could be attributed to a cumulative effect over the nine therapeutic sessions, as immediate effect after each session was not noteworthy. A steadily rising improvement for the three parameters evaluated was noted between sessions for both Groups 1 and 2.

As the number of sessions increased, the intensity of pain was assuaged in both groups as divulged by the VAS scores. In this study, 4 of the 10 patients in Group 1 and 3 of the 10 patients in Group 2 reported complete alleviation of pain at the end of nine sessions. Two patients from either group claimed complete relief from pain following just four therapeutic sessions. Astonishingly, another two patients from either group were completely relieved of pain following just two sessions of the respective therapy. Although improvement following session 1 was better in patients receiving TENS therapy, at the end of nine sessions, the trend of improvement appeared better with subjects on LLLT (Figure 1). This could be probably attributed to the fact that laser probes may be applied directly on the skin over the pain epicenter and are hence more site-specific.[6]

Both methods were efficacious in improving the mouth opening over the nine sessions with the trend of improvement being better in patients receiving LLLT (Figure 2). Although a reduction in tenderness of temporalis and masseter muscle was noted in both groups, fluctuation in the severity of the same was noted during the various therapeutic sessions (Figures 3 and 4). Evaluation of pain in response to muscle palpation seems to be possible only with marginal reliability. This could result from examiner error since clinical signs are unreliable by themselves, changing spontaneously over time making it hard to expect the same sign upon successive examinations.[7]

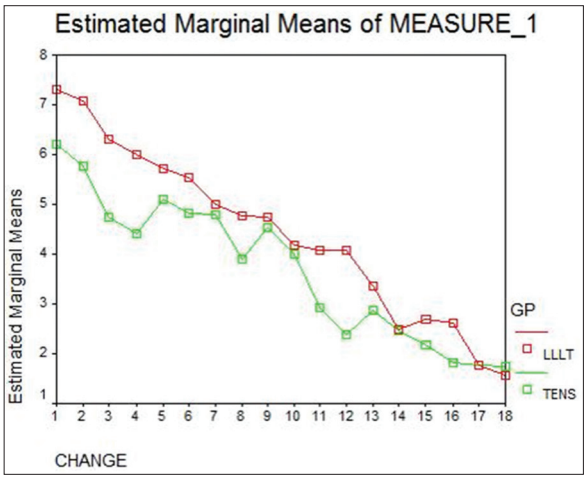

Figure 1: A remarkable decrease in pain intensity as indicated by the mean visual analog scale values for both groups over the nine sessions

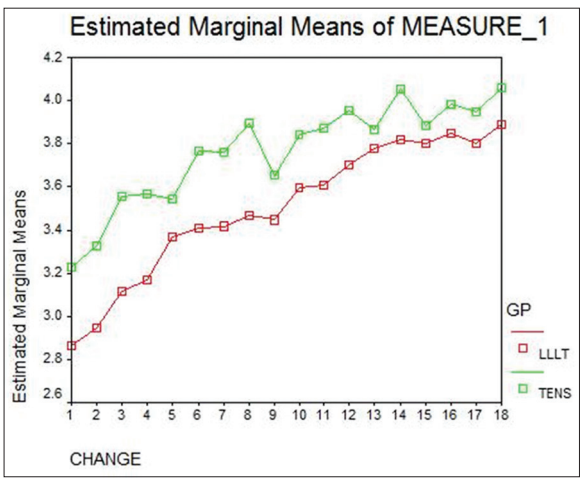

Figure 2: Drastic improvement in mouth opening for subjects belonging to both groups

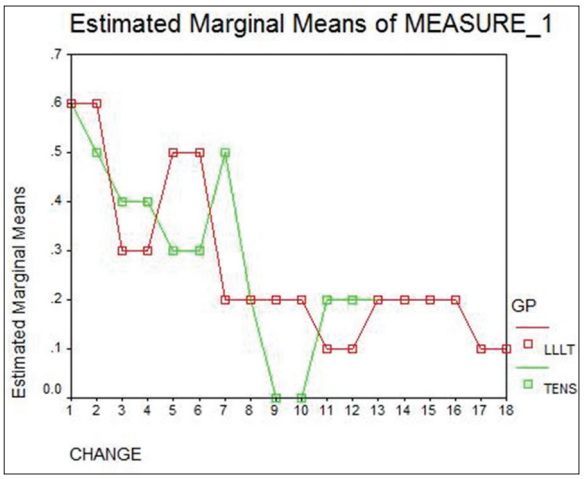

Figure 3: Alteration between improvement and worsening of pain for temporalis as elicited on palpation in course of the therapy

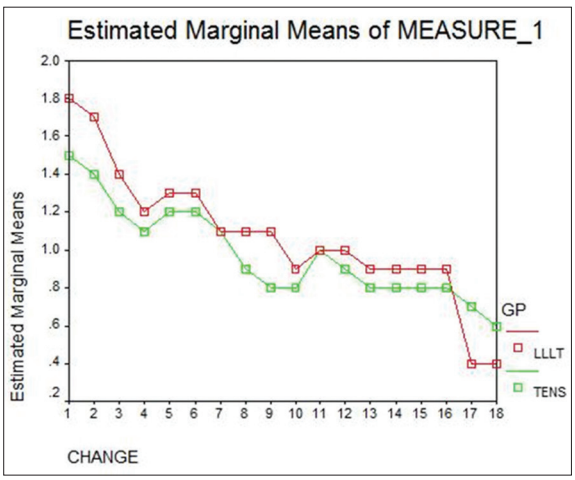

Figure 4: Alteration between improvement and worsening of pain for masseter muscle as elicited on palpation in course of the therapy

LASER represents an elegant acronym for "light amplification by stimulated emission of radiation" and was demonstrated for the 1st time by Maiman in 1960. Soft-laser, low-reactive laser, low-energy laser, and low-intensity level laser are few of the various names that have been given to low-level lasers.[8] The suggested mechanisms of action include: (1) Heating effect, (2) biostimulation, (3) increased vascularity and cellular activity, (4) analgesia, (5) anti-phlogistic reaction, (6) anti-edematous effects, and (7) acceleration of wound healing.[3,8,9]

GaAs diode lasers chiefly emit light at a wavelength of 904 nm in the infrared spectrum, which enables deep penetration into subcutaneous tissues due to low absorption by water or skin pigments.[8] Various studies focusing on LLLT in the management of TMD owing to its analgesic and anti-inflammatory properties have been performed. A study conducted by Frare and Nicolau using laser photobiomodulation (GaAs, 904 nm) depicted positive results with respect to relief of painful symptoms in patients with TMD.[1] LLLT was also proven effective in the management of TMD signs and symptoms with considerable reduction/elimination of pain severity and clicking according to a study performed by Lassemi *et al.*[3]

The utilization of electric waves for pain control forms the basis of TENS. Reports on the results of various clinical studies are limited and deal chiefly with the management of myofascial pain dysfunction syndrome and chronic facial pain.[10] The postulated mechanisms include: The gate control theory, peripheral blockade, counter-irritation, and neurohormonal substance release.[11] According to a study conducted by Rodrigues-Bigaton *et al.*, TENS and high voltage electrical stimulation both promoted reduction in pain intensity in women with TMD.[2] In yet another study performed by Rodrigues *et al.*, a single application of TENS was proved effective in pain reduction. The authors also concluded that TENS improves the

activation pattern of the masticatory muscles in individuals with TMD.[12]

The psychological component of TMD is remarkably significant. Although the placebo effect has been well documented, it is poorly understood. Studies indicate its beneficial effects and account for 30-60% of the effectiveness of various treatments for myofascial pain and dysfunction.[13] According to Núñez *et al*., although a placebo effect can be easily achieved in laser treatment, it cannot be performed for TENS with similar reliability; since the subjects cannot feel anything nor would hear a sound during the therapeutic session, compromising the placebo effect for TENS therapy.[4] Keeping in accordance with the same, this study did not include a placebo control group.

Kato *et al*. conducted a study to compare the effectiveness of TENS and LLLT for the treatment of patients with chronic myogenic TMD. They concluded that both therapies were effective as part of TMD management and a cumulative effect may be responsible for the improvement.[14] The results of our study are also in accordance with the same.

Núñez *et al*. conducted a study to evaluate the effectiveness of LLLT and TENS on the improvement of mouth opening in patients with TMD.[4] The authors concluded that both methods are effective in improving mouth opening. When comparing the two methods, LLLT was more effective than TENS application.[4] Although the results of this study did not reveal any statistically significant differences between the two groups, trend of improvement for the variables of VAS and mouth opening appeared better with LLLT group.

Conclusion

Based on the present study, it can be concluded that both LLLT and TENS provided satisfactory results with respect to pain control, improvement in mouth opening and reduction in temporalis and masseter muscle tenderness. LLLT seemed slightly better than TENS therapy when evaluating variables of VAS and mouth opening. Numerous positive reports as well as the noninvasiveness and safety of low-level lasers, necessitates further clinical evaluation of LLLT. Randomized placebo-controlled trials with a larger sample must be conducted to corroborate this form of therapy.

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