

TMJ Disorder Pain Management By Low-Level Laser Therapy And Ultrasound Heat Therapy- A Comparative Study

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Abstract:

Background- The most probable outcomes in temporomandibular joint disorders (TMDs) is intense pain, inflammation of the underlying muscles, posterior fibers, and synovial fluid, restricted mouth opening, unbalanced jaw movements, and sounds. The aim of present study was to assess and compare the effectiveness of ultrasound heat therapy and low-level laser therapy (LLLT) on TMD-related pain reduction.

Methodology- There were 42 patients (age range, 25-45 years) in this prospective study, categorized into two groups 21 participants of each. A NSAID medication was advised to all participants twice a day for 5 days for momentary pain control before starting of therapy. Participants were maintained on a soft diet and were advised to limit the opening of their mouths during the same time. The affected side underwent 15 sessions of LLLT (Group A) or ultrasound therapy (Group B).

Results- The mean visual analog scale scores for groups A and B were 4.81 (2.01) and 6.19 (1.20) individually, at the end of therapy; the difference was statistically significant, favouring the LLLT group. Likewise, for group A and group B, the mean mouth opening was 3.99 (0.40) and 3.65 (0.41), in both; the difference was significant statically and the LLLT group was preferred.

Conclusion- For the treatment of TMD-related pain without underlying bony pathology, present study recommends LLLT.

Keywords- TMJD, LASER Therapy, Ultrasound Heat Therapy

Introduction:

The American Academy of Orofacial pain describes temporomandibular disorders (TMDs) as “a collective term that includes a number of clinical problems that involve the masticatory muscles, the temporomandibular joint (TMJ) and the associated structures”.¹ The most common TMD symptoms include pain that limits mouth opening, uneven jaw movements, and sounds. TMJ pain is believed to be the most frequent source of severe chronic orofacial pain.² For several decades, TMJ has been a source of concern.³

Various physical therapy for TMD are moist heat, ultrasound, laser, exercises, transcutaneous electrical nerve stimulation (TENS), microwave, and manual therapy.⁴ These strategies help to reduce musculoskeletal tension, minimize pain by reducing inflammation, help to restore joint function and help to resume normal daily activity.⁵

A preferred consideration of treatment for TMD has been ultrasound heat therapy as its sound waves reach deep into tissues and create heat that attracts blood to the joint area with oxygen and nutrients.⁶ Patients have benefited immensely from therapeutic lasers also.

Low-level laser therapy (LLLT) is a light-based procedure that produces monochromatic and coherent light of a single wavelength. It works by photobiology or bio-stimulation, modifying the roles of cells and tissues. It impacts on the mitochondria, allowing them to generate extra adenosine triphosphate (ATP) and to reduce the usage of cellular oxygen. It reduces pain by increasing serotonin and endorphin levels while decreasing prostaglandin (PGE 2) and interleukin (IL-1) beta levels. By inhibiting the plasminogen activator that is essential for collagen breakdown, inflammation is decreased and collagen deposition is increased.¹

There are no data relating the efficacy of LLLT with the gold standard ultrasound therapy in the treatment of TMD pain so present study was aimed to assess and compare the effectiveness of ultrasound heat therapy and LLLT on TMD-related pain reduction.

Methodology:

There were 42 patients (age range, 25-45 years) seeking relief of TMD-related pain in the outpatient dental department, they were selected and categorized into two groups 21 participants of each for the study. Prior the study an ethical approval was obtained from the institutional ethical committee. With the OpenEpi program and a 95 % confidence interval and 80 % control, the sample size was determined utilizing variables from a study done by Madani *et al.*, in 2014.⁷ Patients without TMJ structural anomalies, had a 3-month history of TMD-related pain,

not on antidepressants, and willing to undergo therapy were included for the study. An informed written consent was also obtained from the participants.

Prior to the start of the intervention, for pain control the participants were given an analgesic (Tab Myospaz Forte) twice daily for 5 days. The participant was advised to eat a soft diet and limited mouth opening throughout the period. If the pain continued after five days, then these patients were chosen for the research. The participants were divided into two groups: group A (LLLT) and group B (ultrasound heat therapy) using the sequential numbering with opaque sealed envelope (SNOSE) technique. 15 sessions were granted to each category (one on alternate days).

Participants rated their pain prior to therapy using a visual analog scale (VAS) ranging from 0-10, where a score of 0 represented no pain and a score of 10 showed the worst pain. By using a flexible millimeter ruler at the incisal edge of the maxillary central incisor that is the most vertically oriented and measured vertically to the labio-incisal edge of the opposing mandibular incisor to assess the pre-therapy mouth opening.

Group A- By using single handheld probe of type Class III B and Class 2M laser machine (Silberbauer®) with a wavelength of 660 nm, O/P 60 wM, laser light was delivered for 3 minutes at 2.2 Joules / minute directly over the TMJ. The probe was positioned directly perpendicular to the skin at the middle of the upper part of the joint, approximately 1 cm in front of the tragus.^{7,8}

Group B-By using a coupling agent for 10 minutes/session at 1.8w/cm² the ultrasonic therapy was carried out. In the continuous mode, a Bionics Innovation Unit was used at a frequency of 1 MHz and a wavelength of 1.5 mm.¹ Participants were maintained on a soft diet and were advised to limit the opening of their mouths during the same time. The data were analyzed by using t-test on SPSS 23.0 software by keeping significance level at p<0.05.

Results:

The study had 22 females and 20 males aged 25-45 years (mean age 37± 2.13 years) participants. Pre-treatment, VAS-rated pain ranged from 5 to 9 for group A and from 6 to 9 for group B. For group A and group B, the mean pre-therapy VAS score was 8.09 (1.37) and 7.47 (0.98), accordingly, without any statistically significant difference between the two groups (1.68, p> 0.05). Post-treatment, VAS-rated pain varied from 2 to 6 in group A and 6 to 9 in group B. The mean VAS score was 4.81 (2.01) and 6.19 (1.20), respectively, in group A and B. A significant difference was observed in the contrast of post-therapy VAS scores between the two groups (2.70, P < 0.001). A significant difference was detected between both pre- and post-treatment VAS scores in group A (3.78, P < 0.005) and group B (6.17, P < 0.001; Table 1) was shown in the intergroup correlation.

Table1: Comparison of VAS score for pain

Groups	Pre-therapy	Post-therapy	Pre- vs Post-therapy comparison (Intragroup) t statistic (p-value)
Group A n = 21 (LLLT)	8.09 (1.37)	4.81 (2.01)	3.78 (P < 0.005)*
Group B n = 21 (Ultrasound)	7.47 (0.98)	6.19 (1.20)	6.17 (P < 0.001)*
A vs B (Intergroup comparison) t statistic (p-value)	1.68 (P > 0.05)	2.70 (P < 0.001)*	

*Statistically significant

Pre-treatment, mean mouth opening was 3.85 (0.44) and 3.61 (0.44) separately in group A and B, and no significant differences were observed between the two groups (1.76, P > 0.05). The mean opening of the mouth in group A and B after therapy was 3.99 (0.40) and 3.65 (0.41), independently. The inter-group correlation of mouth opening values showed a statistically significant difference (2.72, P 0.001). There were no significant differences in the intra-group comparison of pre- and post-therapy mean values in group A (1.07, P > 0.05) and group B (0.30, P > 0.05). (Table 2)

Table 2: Comparison of mouth opening

Groups	Pre-therapy	Post-therapy	Pre- vs Post-therapy comparison (Intragroup) t statistic (p-value)
Group A n = 21 (LLLT)	3.85 (0.44)	3.99 (0.40)	1.07 (P > 0.05)
Group B n = 21 (Ultrasound)	3.61 (0.44)	3.65 (0.41)	0.30 (P > 0.05)
A vs B (Intergroup comparison) t statistic (p-value)	1.76 (P > 0.05)	2.72 (P < 0.001)*	

*Statistically significant

Discussion:

TMD is now commonly accepted to include a number of conditions like TMJ pain, pain of masticatory muscle, or both. Chronic pain associated with TMD is frequently incorrectly located in the muscles of the TMJ and masticatory muscles and can be transferred to nearby nasal, cranial, facial and cervical regions.

The most probable outcomes in temporomandibular joint disorders (TMDs) is intense pain, inflammation of the underlying muscles, posterior fibers, and synovial fluid, restricted mouth opening, unbalanced jaw movements, and sounds. Factors leading to TMD include occlusal disruptions and psychological causes.

Ultrasound therapy has often been favourite treatment for reducing TMD pain and inflammation.⁹ Mast cells degranulate in response to the ultrasound, releasing arachidonic acid. This is a building block for prostaglandins and leukotriene synthesis. Inflammatory mediators are all of these.¹⁰ The thermal and non-thermal properties of therapeutic ultrasound contribute to its therapeutic effects. Vibration that is similar to sound waves but at a higher frequency, outside the range of human ears, is used in this procedure. It penetrates the soft tissues as this acoustic energy is absorbed, causing molecules to vibrate under prolonged compression and rarefaction cycles.¹¹ The more intense ultrasound beams generate more frictional heat in the tissue. The heat produced is thought to increase tissue cell metabolism, which aids in soft tissue healing.¹² The sound waves induce tissue vibration at a strength of 1.25 w/cm², causing heat in the treatment area and an increase in blood flow to the tissues. The increased blood flow transfers vital nutrients while also eliminating inflammatory exudates. When the inflammation subsides, the discomfort subsides. In addition, the permeability of the cell membrane to sodium is changed, which can alter the electrical activity or the threshold for pain.¹³

Ultrasound at the power levels used in this study was capable of heating human tissues and inducing biological effects. Thus, a fair degree of palliative care may be achieved either alone or in combination with other available conservative treatment modalities through the use of ultrasound therapy for therapeutic results in dentistry.¹³

LLLT is a newer medication to alleviate joint pain and inflammation that is gaining interest.^{14,15} In this study, 21 patients were treated with LLLT. Since it relaxes the musculature, it offers pain relief. It also increases blood circulation and decreases palpation tenderness in stressed muscles.¹⁶

A comparison of pain VAS scores before and after treatment was made between the two groups (Table 2). Since the P-value was >0.05, both groups had identical pain levels, meaning that the random assignment of the two groups was successful. When the pre- and post-therapy VAS scores for both groups were compared, there was a statistically significant difference. However, the contrast between the two treatment groups for the post-treatment VAS pain score showed a statistically significant difference in favor of the LLLT group. This indicates that LLLT is more effective at managing pain than ultrasound therapy. LASER radiation induces membrane hyperpolarization, which then requires greater stimulation to stimulate the potential for cellular action. Furthermore, the analgesic impact of LASER radiation is related to a rise in beta-endorphin in the cerebrospinal fluid and a regularization of the inflamed tissue's telethermographic condition.¹⁷ According to

Srivastava et al., LLLT has therapeutic benefits for patients, including quicker wound healing and pain relief, and is a safer care modality.¹⁸ According to a systematic review of the effectiveness of LLLT in the treatment of TMD, it tends to be effective in reducing pain in TMD patients. It may be a feasible treatment choice for patients who want a non-invasive, complementary therapy.⁴ Taher claimed that LLLT was the cure for TMJ pain; after treatment, patients were pleased and pain relief was reported.¹⁹⁻²² The use of LLLT in the treatment of TMJ pain has been suggested.²⁰

In both groups, the mouth opening was assessed. Group A had a wider mouth opening during therapy than Group B. The biochemical effect of the LASER light may boost vessel growth by stimulating the development of vascular endothelial growth factor and the conversion of adenosine monophosphate to nitric oxide. This results in a decrease in discomfort and therefore an improvement in the opening of the mouth.^{22, 23} This indicates that LLLT is healthier than ultrasound therapy for mouth opening.

In conclusion, the present research suggests LLLT with no underlying bony pathology to treat TMD-related pain. A long-term multicenter randomized controlled trial, on the other hand, would help to validate our results.

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