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Research Article

Laser And Ultrasound Therapy

Effect of Low Level Laser Therapy Vs Ultrasound Therapy in The Management of Temporomandibular Joint Pain Syndrome

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Abstract: The temporomandibular joint is a synovial joint made up of articulating surface of the temporal bone and the head of the mandible. Patients suffering from temporomandibular joint pain syndrome will frequently have pain in the region, limitation in opening, asymmetrical jaw movements, and restricted jaw movements. The etiology is associated with several factors, including malocclusion, trauma, emotional stress, and para-functional habits, which cause excruciating pain and inflammation of the surrounding muscle, posterior fibers, and synovial fluid. This study evaluated and compared the effectiveness of low-level laser therapy (LLLT) and ultrasound therapy (UST) in managing temporomandibular joint pain syndrome. This experimental study of pre and post-comparative types involves 30 subjects with temporomandibular joint pain syndrome who were selected from the outpatient department. This study included 30 subjects divided into two groups of each 15 by simple random sampling method.15 sessions each alternate day of low-level laser therapy (GROUP A) and ultrasound therapy (GROUP B) were administered to the affected side. Both groups received stretching exercises as a common intervention. Group A received low-level laser therapy along with stretching exercises for 7 sessions /week/10 min. Group B received ultrasound therapy and stretching exercises for 7 sessions /one weeks/10 min. On comparing the mean values of Group A & Group B on the Visual Analogue Scale Score in terms of pain intensity, it shows a significant decrease in the post-test mean values in both groups, but (Group A - Low-level Laser Therapy) shows 2.33, which has the lower mean value is more effective than (Group B - Ultrasound Therapy) 3.53 at $P \leq 0.001$. Hence the null Hypothesis is rejected. On comparing the pre-test and Post-test between Group A & Group B on VAS Score, Group A shows a highly significant difference in mean values at $P \leq 0.001$. Thus, we conclude that low-level laser therapy is more effective than ultrasound therapy in the management of temporomandibular joint pain syndrome.

Keywords: Temporomandibular joint pain syndrome, low-level laser therapy, ultrasound therapy, stretching exercise, visual analog scale.

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1. INTRODUCTION

The Temporomandibular joint is unique in the body. The mandible is a horseshoe-shaped bone that has an articulation with the temporal bone at each, giving it two separate articulation[1]. The mandibular condyle forms the hinge joint. The articular eminence forms the joint, and the superior surface of the disk is a gliding joint. About 20-30% of the adult population are affected by temporomandibular joint pain syndrome.[2] This condition is more common in females than in males, the age group from 18 to 40 years. Temporomandibular joint pain syndrome is a condition that causes pain and dysfunction and is commonly presented with the popping and clicking of the jaw when opening and closing. [3] A variety of symptoms such as abnormal swallowing and hyoid bone tenderness, may occur. These symptoms compromise quality of life, sleep, and psychological well-being, leading to anxiety, stress, depression, and a negative effect on social function and emotional health. [4] Pain limiting mouth opening, asymmetrical jaw movements, and TMJ sounds are the most common findings in temporomandibular joint pain syndrome. [5] The main treatment for temporomandibular joint pain syndrome is multidisciplinary approach that includes physical therapy modalities such as manual therapy, electrotherapy ultrasound, transcutaneous electrical nerve stimulation laser therapy These methods help in decreasing musculoskeletal load, reduce pain by decreasing inflammation, restore normal joint function Ultrasound heat therapy has always been a primary choice of treatment for temporomandibular joint pain syndrome. [6] The high-frequency sound waves of ultrasound penetrate deep into tissue and produce heat. This draws blood with oxygen and nutrients to the joint region. A light-based treatment that produces monochromatic and coherent light of a single wavelength is called low-level laser therapy (LLLT). It acts via photobiology or biostimulation, altering cell and tissue functions.[7] It acts on the mitochondria causing them to produce more adenosine triphosphate (ATP) and decrease cellular oxygen consumption. It increases serotonin and endorphin levels and decrease prostaglandin (PGE2) and interleukin (IL-1) Beta levels, thereby reducing pain.[8] The inflammation is reduced by inhibiting plasminogen activator, which is responsible for collagen breakdown and increases collagen deposition.[9] Temporomandibular joint acts like a sliding hinge connecting the jawbone to the skull. The syndrome can lead to pain and discomfort. The study needs to reduce the pain and inflammation in the temporomandibular joint and improve jaw movements. The study aims to compare and evaluate the effectiveness of low-level laser therapy (LLLT) and ultrasound therapy (UST) in managing temporomandibular joint pain syndrome.

2. MATERIALS AND METHODS

All the procedures performed in this study involving human participants were according to the ethical standards of Dr MGR Educational And Research Institute(Deemed to be University) Institutional Review Board approval number D-12/PHYSIO/IRB/2022-2023; a total of 30 subjects were selected according to the standard CONSORT (Consolidated Standards of Reporting Trials) criteria (Figure 1) .

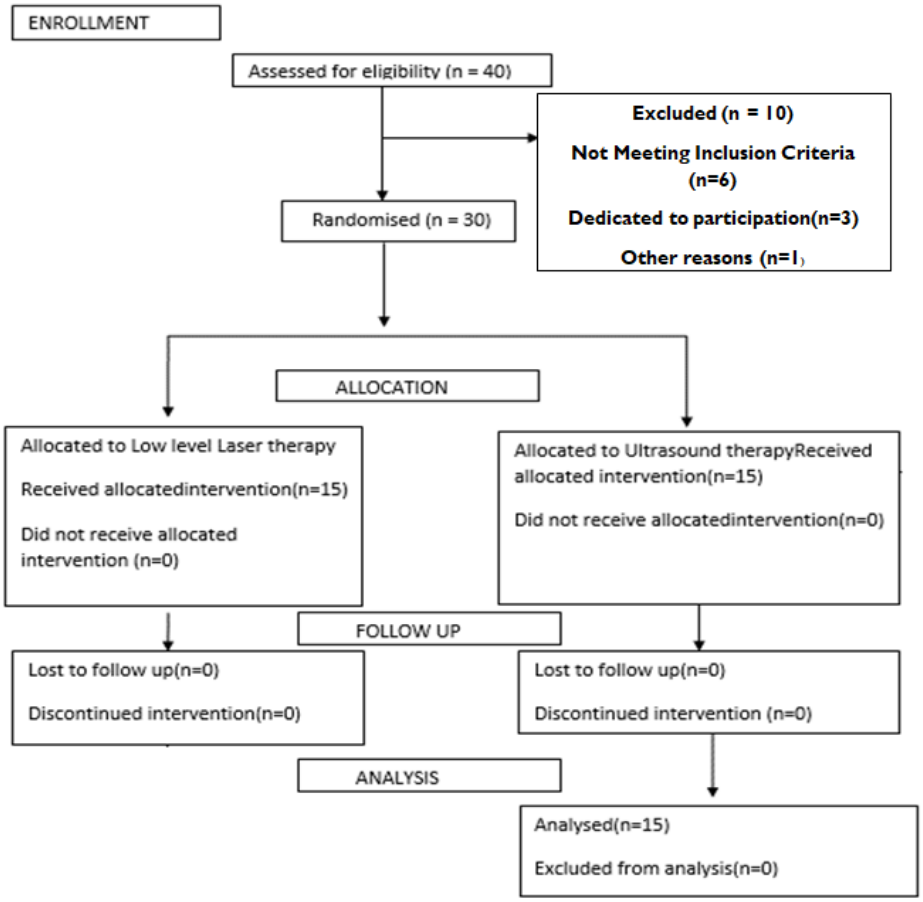


Fig 1: Consort Flow Diagram

The patients were divided into two groups that fulfilled the inclusion criteria and were assigned into two groups consisting of 15 subjects each. Both male and female subjects were included in the age group between 25 and 45 years old. They were provided with informed consent before the study. A detailed explanation of the treatment protocol was given to the patient. Demographic data like name, age, sex, and chief complaints were collected and divided into groups by random sampling method.

2.1. INCLUSION CRITERIA

- Individuals in the age group of 25-45 years.
- Pain in the jaw.
- Both male and female
- Patients with history of temporomandibular joint pain
- Not taking antidepressant medications
- Volunteers

2.2. EXCLUSION CRITERIA

- Individuals with Cancer
- Individuals with open wounds, acute injuries or metal implants.
- Individuals with recent TMJ dislocations
- Individuals who are not willing to participate in the study
- Individuals with impaired circulation
- Pregnant female.

The following procedure was followed for Group A and Group B,

- ✓ Group A – Subjects receive low-level laser therapy of 660nm laser light at 2.2 joules per minute to the temporomandibular joint, duration of 5 min, and then stretching exercise for about 5 min.[7]
- ✓ Group B –The subject received continuous mode ultrasound at a frequency of 1.0MHZ to the temporomandibular joint, duration of 5 min, and then stretching exercise for about 5 min.[8]

2.3. INTERVENTIONS

2.3.1. Group A - Low Level Laser Therapy (LLLT)

The participants of Group A received low-level laser therapy of 660nm laser light at 2.2 joules per minute to temporomandibular joint pain syndrome for a duration of 5 minutes, as shown in Figure 2. It accelerates healing, decreases joint stiffness, reduces long-lasting pain, improves range of motion, and reduces free radicals and oxidative stress. Low-level laser therapy is an infrared light treatment delivered directly to the site of temporomandibular joint pain. It is administered, thus improving tissue repair, pain reduction, and inflammation wherever the laser beam is applied. The patients were given a stretching exercise for about 5 minutes after the laser therapy stretching exercise. It can help with temporomandibular joint pain during flare-ups and reduce muscle spasms and joint tension. The special benefits are

- Decrease pain
- Accelerate healing
- Reduces inflammation.

Fig 2: Low Level Laser Therapy to Temporomandibular Joint

Low-level laser therapy to the temporomandibular joint was given to the patient for about 5 minutes and delivered directly to the site of temporomandibular joint pain.

2.3.2. Group B - Ultrasound Therapy (UST)

The participants of Group B received continuous mode ultrasound at a frequency of 1.0MHZ to temporomandibular pain of duration 5min. It's known to accelerate healing, decrease joint stiffness, alleviate pain, increase the extensibility of collagen fibers, and reduce muscle spasms, as shown in Figure 3 and 4.[8.] Ultrasound is a form of acoustic vibration propagated in longitudinal compression waves at frequencies too high to be heard by the ear. [9] Following the ultrasound therapy, stretching exercises were given to the patients for about 5 minutes. It can help with temporomandibular joint pain during flare-ups and reduce muscle spasms and joint tension. The special benefits are

- Decrease pain
- Decrease joint stiffness.
- Reduces joint tension

Fig 3: Ultrasound Therapy to Temporomandibular Joint

Ultrasound therapy to the temporomandibular joint was given to the patient for about 5 minutes and delivered directly to the site of temporomandibular joint pain.

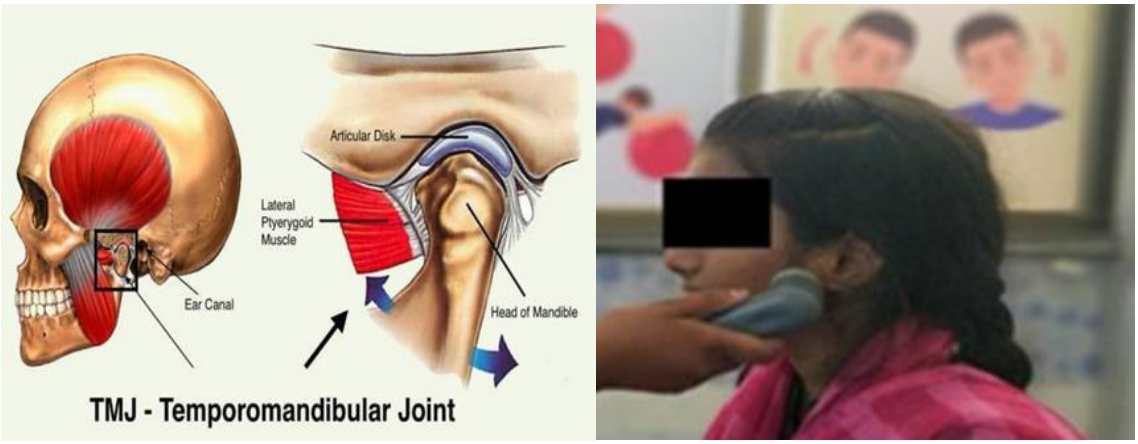


Fig 4: Temporomandibular Joint structure and Ultrasound Therapy given to left side Temporomandibular Joint of subject involved in the study.

2. STATISTICAL ANALYSIS

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using the Statistical Package for Social Science (SPSS) version 24, with a significance level of p-value less than 0.05 and a 95% confidence interval set for all analyses. The Shapiro-Wilk test was used to determine the normality of the data. In this study, the Shapiro-Wilk test showed that the data was normally distributed on the dependent values of VAS (significance 0.402) at P > 0.05. Hence, a parametric test was adopted. A paired t-test was adopted to find the statistical difference within the groups & Independent t-test (Student t-test) was adopted to find the statistical difference between the groups.

3. RESULTS

The sample included 30 patients, whose demographic characteristics and duration of pain are shown in Table 1.

Table 1. Demographic characteristics and duration of arthrogenous pain

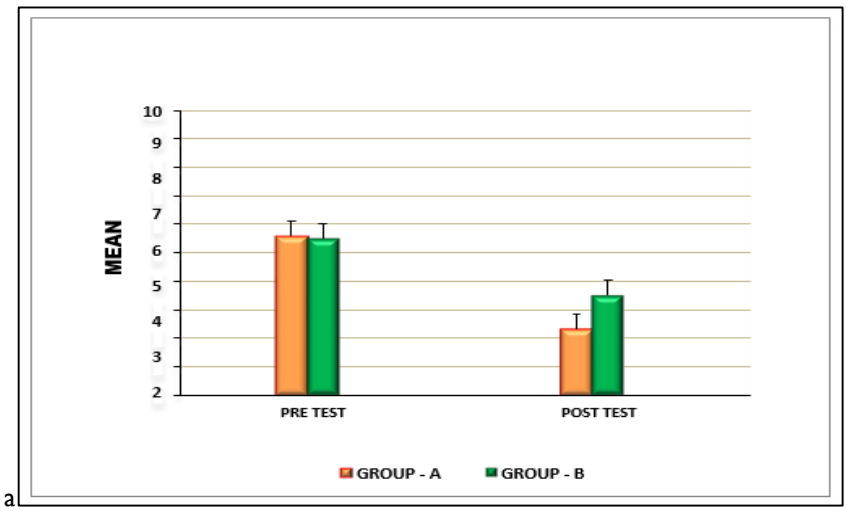
Characteristics	Group A	Group B
Gender		
male	n=15	n=15
Female	n =15	n=15
Mean age(range)	25- 45 years	25- 45 years
Mean duration of pain(range)	12 weeks (6–120)	12 weeks (6–120)

Table 2: Comparison of Visual Analogue Scale Score Between Group – A and Group - B in Pre and Post-Test

#Test	#Group - A		#Group - B		t - Test	df	Significance
	Mean	S.D	Mean	S.D			
Pre Test	5.60	.828	5.53	.743	.232	28	.818*
Post Test	2.33	.617	3.53	.833	-4.48	28	.000***

(- P > 0.05), (***- P ≤ 0.001)*

The above table reveals the Mean, Standard Deviation (S.D), t-test, degree of freedom (df), and p-value between (Group A) & (Group B) in pre-test and post-test weeks. This table shows that there is no significant difference in pre-test values between Group A & Group B (*P > 0.05) and a statistically highly significant difference in post-test values between Group A & Group B (***- P ≤ 0.001), as shown in Table 2.



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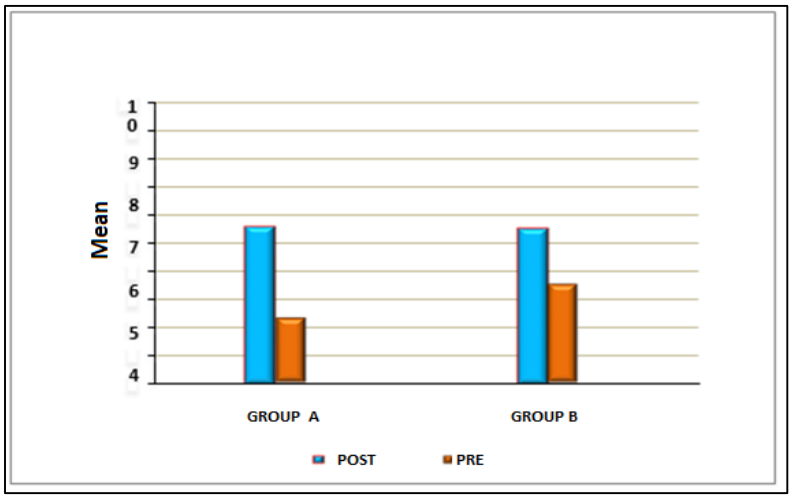
Graph I: Comparison of Visual Analogue Scale Score Between Group – A and Group - B in Pre and Post-Test

Table 3: Comparison of Visual Analogue Scale Score Within Group – A and Group - B Between Pre-Test and Post-Test

#Group	Pre Test		Post Test		T - Test	Significance
	Mean	S.D	Mean	S.D		
Group- A	5.60	.828	2.33	.617	27.64	.000***
Group- B	5.53	.743	3.53	.833	10.24	.000***

(- P ≤ 0.001)***

The above table reveals the Mean, Standard Deviation (S.D), t-value, and p-value between the pre-test and post-test within Group – A & Group – B. There is a statistically highly significant difference between the pre-test- and post- test values within Group A and Group B (***- P ≤ 0.001), as shown in Table 3.



Graph II: Comparison of Visual Analogue Scale Score Within Group – A and Group - B Between Pre-Test and Post-Test

On comparing the mean values of Group A & Group B on Visual Analogue Scale Score in terms of pain intensity, it shows a significant decrease in the post-test mean values in both groups, but (Group A - Low Level Laser Therapy) shows 2.33, which has the lower mean value is more effective than (Group B - Ultrasound Therapy) 3.53 at P ≤ 0.001. Hence the null Hypothesis is rejected. Comparing the Pre-test and Post-test within Group A & Group B on VAS Score shows a highly significant difference in mean values at P ≤ 0.001.

4. DISCUSSION

Temporomandibular joint pain syndrome is more common in 25-45 years of both male and female. According to Sevinc kulekeioglu et al., (2009) low level laser therapy is needed to reduce pain and to manage the temporomandibular pain disorder.[10] Later, Gang zhu xu et al.., (2018) reported that low-level laser therapy improves outcomes and reduces pain [11]. In many early reported studies has showed low level laser therapy to be more effective in reducing pain.[12-23] The present study compares the effectiveness of low-level laser therapy and ultrasound therapy in managing temporomandibular joint pain syndrome. In Group A, level laser therapy (LLLT) was given to 15 patients, and in Group B, ultrasound therapy (UST) was given to 15 patients. Pre and post-tests were taken using a visual analogue scale (VAS). This study compared the effectiveness of low-level laser therapy (LLLT) and ultrasound therapy (UST) in relieving the pain of temporomandibular joint pain syndrome between the group analysis of post-intervention and results in low-level laser therapy (LT) showed more improvement in relieving the pain of the temporomandibular joint. The statistical analysis reveals the mean, standard deviation, independent t-test, and p-test values of visual analog scale (VAS) between group –A and group – B (p ≤ 0.001), showed that statistically significant improvement in post-test value in visual analogue scale (VAS) between group- A and group –B (p ≤ 0.001). In our study group, low-level laser therapy (LL LT) shows a higher mean value in the post-test and is more effective than group B ultrasound therapy (UST).

5. CONCLUSION

On comparing Pretest and Posttest between Group A & Group B on VAS Score, Group A showed a highly significant difference in mean values at P ≤ 0. 001.Thus, we conclude that low-level laser therapy is more effective than ultrasound therapy in the management of temporomandibular joint pain syndrome.

6. LIMITATIONS

The limitations of the current study are the relatively small sample size; however, due to the complexity of the study and the limited availability of the participants eligible for the present investigation, the sample size was restricted to the actual dimension. Further limitations are the mixed gender of the sample, the age group was limited to 25-45 years, and there was a long-term follow-up of the study individuals.

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8. AUTHORS CONTRIBUTION STATEMENT

K. Saraswathi and Koushik Kumar Nandhagopal conceptualized, designed, and gathered data. S. Nandhini and K. Kirupa analyzed these data and inputs were given. Bernard Ebenezer Cyrus, B. Aishwarya and S. Pavithra discussed the methodology and results and contributed to the final manuscript.

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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