

# Effectiveness of acupuncture, ozonio therapy and low-intensity laser in the treatment of temporomandibular dysfunction of muscle origin: a randomized controlled trial

Efetividade da acupuntura, ozonioterapia e do laser de baixa intensidade no tratamento da disfunção temporomandibular de origem muscular: um ensaio clínico randomizado

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## Resumo

**Introdução:** Uma das causas mais comuns de dores orofaciais é a disfunção temporomandibular (DTM). **Objetivo:** O objetivo deste estudo foi comparar a efetividade da acupuntura, ozonioterapia e laserterapia no tratamento de pacientes com DTM muscular, através de um ensaio clínico randomizado. **Material e método:** Foram avaliados 12 professores e estudantes de pós-graduação da Universidade de Passo Fundo, diagnosticados com DTM, com faixa etária entre 23 e 50 anos, de ambos os sexos. Os indivíduos foram divididos aleatoriamente em 3 grupos: G1: laserterapia, G2: acupuntura, e G3: ozonioterapia. Foram aplicados questionários de diagnóstico de DTM (RDC/TMD), questionário de Qualidade de Vida (OHIP-14), Escala de dor (EVA) e mensuração de abertura bucal máxima. Para caracterização da amostra, utilizaram-se estatísticas descritivas e porcentagem, que foram apresentadas empregando-se distribuições de frequências absolutas e relativas. As variáveis qualitativas foram analisadas com os testes de Wilcoxon  $p \leq 0,05$ . **Resultado:** Não houve diferença estatisticamente significativa entre os tratamentos. Em relação a dor e a abertura bucal máxima, os grupos não apresentaram diferença estatística quando analisados individualmente, mas quando comparados de maneira geral, apresentaram diferenças estatísticas ( $p=0,002$  e  $p=0,003$ ). **Conclusão:** Pode-se considerar que todos os tratamentos foram capazes de diminuir a dor e melhorar a capacidade de abertura bucal máxima relacionadas à DTM muscular. Pode-se concluir ainda que a qualidade de vida relacionada à DTM, em relação a variável dor, de uma maneira geral mostrou-se efetiva quando comparada antes e após as intervenções.

**Descritores:** Transtornos da articulação temporomandibular; terapia a laser; terapia por acupuntura; ozonioterapia.

## Abstract

**Introduction:** One of the most common causes of orofacial pain is temporomandibular disorder (TMD). **Objective:** The aim of this study was to compare the effectiveness of acupuncture, ozone therapy and laser therapy in the treatment of muscle TMD patients through a randomized controlled trial. **Material and method:** Twelve professors and postgraduate students from the University of Passo Fundo, diagnosed with TMD, aged between 23 and 50 years old, of both sexes, were evaluated. Individuals were randomly divided into 3 groups: G1: laser therapy, G2: acupuncture, and G3: ozone therapy. TMD diagnostic questionnaires (RDC / TMD), Quality of Life Questionnaire (OHIP-14), Pain Scale (VAS) and maximum mouth opening were applied. Descriptive statistics and percentage were used for sample characterization, which were presented using absolute and relative frequency distributions. Qualitative variables were analyzed with Wilcoxon tests  $p \leq 0.05$ . **Result:** There was no statistically significant difference between treatments. Regarding pain



and maximum mouth opening, the groups showed no statistical difference when individually analyzed, but when compared in general, they did ( $p=0.002$  and  $p=0.003$ ). **Conclusion:** It can be considered that all treatments were able to decrease pain and improve maximal opening capacity related to muscle TMD. It can also be concluded that the TMD-related quality of life, in relation to the pain variable, was generally effective when compared before and after the interventions.

**Descriptors:** Temporomandibular joint; temporomandibular joint disorders; laser therapy; acupuncture therapy; ozone.

## INTRODUCTION

For the American Academy of Orofacial Pain (AAOP) TMD is defined as a set of pain and/or dysfunctional conditions related to masticatory muscles, temporomandibular joints (TMJs) and nearby structures<sup>1</sup>.

Because it is a multifactorial disorder, TMD may be related to several factors, including psychological, structural, parafunctional, occlusal or degenerative factors<sup>2</sup>.

TMD is a disorder that increases over the years and consequently increases its prevalence in the population. At least 40% have already presented some sign of this dysfunction, such as noise and more than 30% have at least one symptom, such as pain in the ATM<sup>3</sup>; considering that young adults aged 13 to 35 years are the most affected population due to greater exposure to stressors, and the correlation between physical pain and emotional stress has been proven<sup>4</sup>.

There are several treatments indicated for TMD, and most of them have an effect on pain minimization, muscle relaxation and increased mouth opening<sup>5</sup>. Several types of treatment are studied and used, including botulinum toxin, myorelaxant plaque, physiotherapy, electrotherapy, low-intensity laser, acupuncture and surgical treatments in some cases. However, the literature with controlled clinical studies is still controversial regarding the treatment of TMD with these types of methods<sup>5</sup>.

One of the recommended treatments is acupuncture, which consists of stimulating specific points along the body skin, involving various methods, such as penetrating thin needles or applying heat, pressure or laser light<sup>6</sup>. Acupuncture can help relieve the discomfort and pain associated with these conditions as it may rebalance circulating energy (Qi) in the meridians and studies have shown its effectiveness in pain control<sup>6</sup>.

Low-intensity laser is one of the treatment modalities in dentistry and has been widely used in the health field for therapeutic and bio stimulation purposes<sup>7</sup>. It is a highly concentrated electromagnetic light that in contact with the tissue can result in several effects, influencing the synthesis, release and metabolism of numerous signaling substances involved in analgesia, through direct irradiation without causing thermal response<sup>7</sup>.

Another treatment that has been extensively studied for TMD is ozone<sup>8,9</sup>, allowing promising results to be obtained. Ozone is used worldwide for many diseases as it is highly effective against viruses, bacteria and fungi, and has anti-inflammatory action. It acts to increase local oxygen supply, promoting local homeostasis and inhibiting bacterial proliferation in many diseases, including cancer and rheumatoid arthritis<sup>10,11</sup>.

Therefore, the aim of this study was to evaluate the effectiveness of acupuncture, ozone therapy, and low-level laser in pain perception and in improving the quality of life of TMD students and postgraduate teachers. The hypothesis of the study is that acupuncture, ozone therapy and low-intensity laser will be effective in pain perception and in improving the quality of life of patients suffering from temporomandibular dysfunction.

## MATERIAL AND METHOD

The study is characterized as a randomized controlled trial. Twelve *stricto sensu* postgraduate professors and students from the University of Passo Fundo, proven to have muscular TMD, divided into 3 groups (n=4), aged between 23 and 50 years, of both sexes, were evaluated.

This study was submitted to the Research Ethics Committee of the University of Passo Fundo, approved with the opinion number: 3.006.284. The research complies with Resolution 466/2012 of the National Health Council, which deals with regulatory standards and ethical aspects of research involving human beings.

Individuals with unilateral or bilateral myofascial pain, mutually protected occlusion, reports of clenching or signs of tooth attrition were included. Exclusion criteria were: pregnancy or lactation during the study, use of systemic drugs that interfere with the musculoskeletal system or stress level, current use of myorelaxant plaques; use of full dentures, Bränemark protocols and removable partial dentures; reports of psychiatric problems or depression, cancer patients and needle phobia patients.

All participants answered the RDC/TMD (Research Diagnostic Criteria for Temporomandibular Disorders) questionnaires for TMD diagnosis<sup>12</sup>; Quality of Life Questionnaire (OHIP-14)<sup>13</sup>, VAS (Visual Analogue Scale) pain scale and maximum mouth opening measurement.

After selecting the 12 patients, 3 groups were created with 04 patients each (n=4). For this, the patients were numbered from 1 to 12 and after that, the site Research Randomizer<sup>14</sup> was used to randomize the samples, and the first group received low-intensity laser treatment, the second group received acupuncture treatment, and the third group received treatment with ozone therapy. Pain perception was measured using the Visual Analogue Scale (VAS) before the first application of each therapy, immediately and after the last session and 30 days after treatment. Maximum mouth opening was measured using a specific, flexible, standardized millimeter-sized ruler for individual use (JON, Trade-in Dental Products, São Paulo, Brazil). Individuals were instructed to perform the maximum mouth opening and hold until the examiner completed the procedure.

According to the manufacturer of the Therapy EC device (DMC Equipment®, São Carlos, SP, Brazil), individuals from the laser therapy group received the application of low-intensity laser, infrared light, wavelength: 808nm ± 10nm. Useful intensity Infrared laser emitter: 100 mW ± 20%, being applied at target points (over bilateral anterior temporal and masseter muscles)<sup>15</sup> 2J, with 72h intervals, for a total of six sessions.

In the group that received acupuncture a protocol of local and distal points proposed by Rosted<sup>6</sup> was used, where local points on the face and neck are recommended: ST-6, ST-7, SI-18, GV-20, GB-20, BL-10. As a distant point, the LI-4 is recommended. They were performed by a qualified professional, totaling six sessions, lasting 30 minutes each, once a week. Acupuncture needles (Dongbang®, Dongbang FTL Co, Seoul, South Korea) were used in the 0.25mm x 30mm measurements.

In the patients of the Ozone Therapy group, the Philozon Medplus® ozone generator (Philozon, Balneário Camboriú, Santa Catarina, Brazil) was used, with ozone - oxygen concentration of 10-20 µg/mL, placed in a 5 mL syringe<sup>16</sup>. A 0.8 x 40 mm needle was used and inserted intramuscularly into the trigger points of the masseter and temporal muscles bilaterally. Injecting 0.1 to 0.3 mL to 1 mL (maximum product on each side) twice a week for a total of six sessions.

For sample characterization, descriptive statistics and percentage were used, which were presented using univariate (absolute and relative) frequency distributions, as well as bi and multivariate contingency tables. Quantitative variables were described by measures of central

tendency or position (mean, median, average rank) and variability (standard deviation, 25th and 75th percentiles, minimum and maximum).

Data with non-normal distribution (pain) were analyzed using the *Wilcoxon* test for comparison between groups and for analysis in each group over time. All analyses were performed using the Statistical Package for Social Sciences (SPSS) software, version 22.0, considering  $p \leq 0.05$ .

## RESULT

Table 1 shows the sample characterization according to the RDC questionnaire. The sample consisted of 12 individuals, with a mean age of 32.83 years, most of them female (83.3%), leucoderms (75%), single (58.3%) and income of two times the minimum wage. (41.7%). Regarding facial pain, 12 participants (100%) reported having facial pain in the last month, 10 (83.3%) reported that facial pain is recurrent and 11 (91.7%) reported feeling pain or stiffness. TMJ in the morning. Individuals reported TMJ symptoms, crackling (100%), and headache (91.7%). In addition, many were prevented from performing basic activities such as yawning (75%) and eating hard foods (66.7%).

**Table 1.** Characterization of the sample according to the RDC / TMD questionnaire

Variables	N	%
Age (mean and standard deviation)		32.83 ± 8.60
Sex		
Male	2	16.7
Female	10	83.3
Source		
European (leucoderms)	7	58.3
South-American (meloderm)	3	25.0
Other	2	16.7
Origin ancestors		
African	2	16.7
European	9	75.0
Others	1	8.3
School grade		
Higher Education	5	41.7
Masters / Doctorate	7	58.3
Marital status		
Married in the same room	4	33.3
Divorced	1	8.3
Never married	7	58.3
Income		
0 to minimum wage	1	8.3
Twice the minimum wage	5	41.7
Three times the minimum wage	1	8.3
Four times the minimum wage	1	8.3
Eight times the minimum wage	2	16.7
Nine times the minimum wage	2	16.7
	N	%
Facial pain in the last month	12	100%
Onset of facial pain (years)		6.25 ± 3.27

Table 1. Continued...

Variables	N	%
Type of pain in the face		
Persistent	2	16.7
<b>Recurring</b>	<b>10</b>	<b>83.3</b>
Number of days prevented from performing activities due to pain (mean and standard deviation)		2.41 ± 7.15
Facial pain intensity that interfered with your daily activities (mean and standard deviation)		2.41 ± 3.02
Prevention of opening the mouth because of pain	5	41.7
TMJ Symptoms		
Click	10	83.3
<b>Crackle</b>	<b>12</b>	<b>100.0</b>
Grinding teeth sleeping	10	83.3
Grinding Your Teeth Awake	8	66.7
TMJ pain or stiffness in the morning	11	91.7
Noise or ringing in the ears	5	41.7
Uncomfortable bite	7	58.3
Headache last months	11	91.7
What activities did the TMJ problem prevent you from doing?		
Chew	5	41.7
Drinking	1	8.3
Exercising	2	16.7
<b>Eating hard foods</b>	<b>8</b>	<b>66.7</b>
Eating soft food	2	16.7
Smile / Laugh	4	33.3
Sexual activity	2	16.7
Brushing your teeth or face	2	16.7
<b>Yawning</b>	<b>9</b>	<b>75.0</b>

Subtitle: n (absolute value); % (relative value).

Regarding the Quality of Life questionnaire (OHIP-14) (Table 2), all questions sought to relate the oral condition to their themes. It can be observed that there was no statistically significant difference in the comparison within each isolated group, either pre-intervention or post-intervention. However, when all groups were analyzed together, there was a significant difference in pain-related QoL ( $p=0.012$ ) and physical inactivity ( $p=0.028$ ).

Table 2. Comparison of dependent variables before and after intervention

Group	Variable	Pre-intervention			Post-intervention			Value $p^*$
		Q1	Median	Q3	Q1	Median	Q3	
<b>Acupuncture</b>	QOL Functional Limitation	0.00	0.00	0.00	0.00	0.50	1.75	0.180
	QOL Pain	4.00	4.50	6.50	1.50	4.00	5.75	0.102
	QOL Psychological Discomfort	2.50	5.00	7.50	2.00	3.00	6.25	0.655
	QL Physical Disability	0.00	2.00	4.75	0.00	0.00	.75	0.157
	QOL Psychological Disability	1.25	2.50	4.50	2.00	3.00	5.50	0.593
	QV Social Disability	1.25	2.00	2.75	1.00	2.50	4.00	0.564
	QL Disability	0.25	1.00	1.00	0.00	0.50	3.25	0.655
<b>Laser Therapy</b>	QL Functional Limitation	.00	.50	2.50	.00	.00	.00	0.180

Table 2. Continued...

Group	Variable	Pre-intervention			Post-intervention			Value <i>p</i> *
	QOL Pain	1.25	2.50	4.50	.25	1.50	2.00	0.257
	QOL Psychological Discomfort	.75	3.50	5.50	1.00	4.00	5.50	0.785
	QL Physical Disability	.00	1.00	5.00	.00	.00	1.50	0.414
	QOL Psychological Disability	1.25	2.50	3.00	2.00	2.50	3.00	0.564
	QV Social Inability	.00	2.00	4.0	.25	1.50	2.00	0.581
	QL Disability	.00	.50	2.50	.00	.00	2.25	0.785
<b>Ozone Therapy</b>								
	QOL Functional Limitation	0.50	2.00	2.75	0.00	0.00	3.00	0.276
	QOL Pain	4.00	4.00	5.50	1.25	2.50	5.25	0.109
	QOL Psychological Discomfort	4.25	5.50	6.75	1.25	4.50	7.75	0.705
	QL Physical Disability	2.25	3.00	6.75	0.00	0.50	2.50	0.144
	QOL Psychological Disability	3.00	3.50	5.50	1.00	2.50	4.00	0.083
	QL Social Inability	2.50	4.00	6.25	0.50	3.00	4.75	0.083
	QL Disability	1.00	1.50	4.25	0.00	1.00	2.75	0.593
<b>Total</b>								
	QOL Functional Limitation	.00	.00	2.00	.00	.00	.75	0.391
	QOL Pain	3.25	4.00	5.00	1.00	2.00	4.50	<b>0.012</b>
	QOL Psychological Discomfort	3.25	4.50	6.00	2.00	4.00	6.75	0.631
	QL Physical Disability	.00	2.50	4.75	.00	.00	1.00	<b>0.028</b>
	QOL Psychological Disability	2.00	3.00	3.75	2.00	2.50	4.00	0.472
	QL Social Inability	1.25	2.50	4.00	1.00	2.00	4.00	0.280
	QL Disability	.25	1.00	1.75	.00	.00	2.75	0.777

Subtitle: Q1 (first quartile); Q3 (third quartile); \* (Wilcoxon test). In bold ( $p < 0.05$ ).

Regarding pain (VAS scale) and maximum mouth opening, there were no statistical differences in the groups individually. However, when the groups were analyzed in general, the variable pain and maximum mouth opening showed statistical differences ( $p = 0.002$  and  $p = 0.003$ ) respectively (Table 3).

**Table 3.** Comparison between the variables pain (VAS) and maximum mouth opening before and after intervention

Group	Variable	Pre-intervention			Post-intervention			Value <i>p</i> *
		Q1	Median	Q3	Q1	Median	Q3	
<b>Acupuncture</b>	Pain (VAS)	1.62	4.83	5.66	0.75	3.58	4.66	0.066
	Mouth Opening	3.91	4.58	4.91	4.18	4.59	5.09	0.109
<b>Laser Therapy</b>	Pain (VAS)	3.45	4.41	5.12	2.00	2.00	2.12	0.068
	Mouth Opening	3.52	4.20	4.86	3.91	4.48	5.15	0.068
<b>Ozone Therapy</b>	Pain (VAS)	2.75	3.75	5.62	0.50	1.16	1.33	0.068
	Mouth Opening	3.69	3.91	4.50	4.25	4.43	4.82	0.068
<b>Total</b>	Pain (VAS)	3.37	4.00	5.54	1.08	2.00	2.41	<b>0.002</b>
	Mouth Opening	3.72	4.23	4.77	4.16	4.46	4.88	<b>0.003</b>

Subtitle: Q1 (first quartile); Q3 (third quartile); \* (Wilcoxon test). In bold ( $p < 0.05$ ).

There was no statistical difference in the comparison of pain and mouth opening between pre-intervention and 30 days after treatment and between immediate post-intervention and 30 days after treatment, isolated by group. However, there was a statistical difference in the overall groups in the immediate pre-intervention and 30 days after treatment ( $p = 0.010$ ) (Table 4).

**Table 4.** Comparison of pain and mouth opening between pre-intervention and 30 days after treatment and between immediate post-intervention and 30 days after treatment

Group	Variable	Pre-intervention			30 days after the intervention			Value <i>p</i>
		Q1	Median	Q3	Q1	Median	Q3	
Acupuncture	Pain (VAS)	1.62	4.83	5.66	0.50	3.50	7.25	1.00
	Mouth Opening	3.91	4.58	4.91	4.05	4.60	5.07	0.715
		Immediate post-intervention			30 days after the intervention			
		Q1	Median	Q3	Q1	Median	Q3	Value <i>p</i>
	Pain (VAS)	0.75	3.58	4.66	0.50	3.50	7.25	0.465
	Mouth Opening	4.18	4.59	5.09	4.05	4.60	5.07	0.715
Laser Therapy		Pre-intervention			30 days after the intervention			
		Q1	Median	Q3	Q1	Median	Q3	Value <i>p</i>
	Pain (VAS)	3.45	4.41	5.12	0.00	1.50	4.50	0.109
	Mouth Opening	3.52	4.20	4.86	4.05	4.60	5.37	1.000
		Immediate post-intervention			30 days after the intervention			
		Q1	Median	Q3	Q1	Median	Q3	Value <i>p</i>
Ozone Therapy	Pain (VAS)	2.00	2.00	2.12	0.00	1.50	4.50	0.068
	Mouth Opening	3.91	4.48	5.15	4.05	4.60	5.37	0.066
		Pre-intervention			30 days after the intervention			
		Q1	Median	Q3	Q1	Median	Q3	Value <i>p</i>
	Pain (VAS)	2.75	3.75	5.62	0.00	0.50	5.50	0.141
	Mouth Opening	3.69	3.91	4.50	4.25	5.00	5.07	0.144
Total		Immediate post-intervention			30 days after the intervention			
		Q1	Median	Q3	Q1	Median	Q3	Value <i>p</i>
	Pain (VAS)	.50	1.16	1.33	0.00	0.50	5.50	1.000
	Mouth Opening	4.25	4.43	4.82	4.25	5.00	5.07	0.273
		Pre-intervention			30 days after the intervention			
		Q1	Median	Q3	Q1	Median	Q3	Value <i>p</i>
Total	Pain (VAS)	3.37	4.00	5.54	0.00	1.50	5.00	<b>0.010</b>
	Mouth Opening	3.72	4.23	4.77	4.05	5.00	5.07	0.533
		Immediate post-intervention			30 days after the intervention			
	Q1	Median	Q3	Q1	Median	Q3	Value <i>p</i>	
	Pain (VAS)	1.08	2.00	2.41	0.00	1.50	5.00	0.056
	Mouth Opening	4.16	4.46	4.88	4.05	5.00	5.07	0.169

Subtitle: Q1 (first quartile); Q3 (third quartile). (*Wilcoxon* test). In bold ( $p < 0.05$ ).

## DISCUSSION

In the present study, we chose to study TMD signs and symptoms in graduate students and undergraduate teachers. It can be stated that the hypothesis of the present study was proven. There was an improvement in quality of life and decreased pain perception in all groups receiving the treatments. According to literature, TMD has no defined etiology, and this disorder is a multifactorial condition and is directly related to several pathophysiological factors<sup>2</sup>.

According to Bove et al.<sup>4</sup>, the incidence of muscle TMD is between 15 and 30 years of age, and its prevalence, commonly, from four women to one man<sup>17</sup>, studies show that women of childbearing age are more vulnerable to the function of the female hormones<sup>18</sup>.

Individuals with TMD may have discomfort, limited jaw movement, poor mouth opening, difficulty biting and cutting food, pain that radiates to various areas of the jaw, TMJ or head, and pain when chewing muscles or at ATM<sup>1</sup>. According to Caramêz et al.<sup>19</sup>, pain on palpation in these regions is directly linked to the presence of trigger points within the masticatory muscles. The following findings could be confirmed in our study, headaches, muscle aches, limitations in performing activities such as eating hard foods, TMJ crackles and painful trigger points were reported by most participants.

Studies claim that TMDs and headaches are directly related diseases, and their prevalence in the TMD population ranges from 48% to 77%, while in the general population the prevalence is 45%<sup>20</sup>. Other symptoms, such as joint noises, pain during mandibular movement, pain in the temporomandibular area, stress, depression, anxiety and poor sleep quality are symptoms that are linked to headaches<sup>20</sup>.

To investigate the signs and symptoms of individuals, as well as the diagnosis of muscle TMD, the study used the RDC/TMD<sup>12</sup>, corroborating similar studies found in the literature<sup>17</sup>. In addition, the present study found that all individuals had muscle pain and had masseter and temporal muscle pain, which is in line with studies found in the literature<sup>21</sup>.

According to Okeson<sup>22</sup>, for the initial treatment of TMD, simple, reversible, minimally invasive and low-cost procedures should be chosen for patients.

In the study, the QoL related TMD was evaluated using the OHIP-14 instrument. These surveys of the OHIP-14 questionnaire try to relate the oral condition to each one's themes. It can be observed that there was no statistically significant difference in the comparison within each group when compared separately, either pre-intervention or post-intervention. But when all groups are compared with each other, there was a significant difference in pain-related QOL and physical inactivity-related QOL. These results are corroborated by more research found in the scientific literature<sup>23</sup>.

Individuals diagnosed with muscle TMD undergoing low-level laser therapy have been effective in treating pain and improving muscle function and quality of life, and it is estimated that its cumulative effect may be responsible for this improvement<sup>24</sup>. In addition, the results of the application of low-level laser therapy show that this therapy was effective in reducing pain during the observation period, but the study did not present statistically significant differences<sup>24</sup>. These results can be corroborated by the present study. The laser therapy group produced a very positive effect in terms of decrease and pain control in muscular TMD, showing increased maximum mouth opening and decreased pain, even without statistically significant difference.

In a randomized study, effects of trigger point acupuncture were compared with simulated acupuncture treatments on pain and oral function in TMD patients<sup>25</sup>. Pain intensity (visual analog scale) and oral function (maximum mouth opening) were analyzed. After treatment, pain intensity was lower in the trigger point acupuncture group, but oral function remained unchanged in both groups. The present study used assessment parameters similar to that study and found similar results, but there were no significant differences in pain improvement, not even in the maximum mouth opening in the analyzed periods.

There are few studies in the literature that use ozone to treat TMD<sup>8,9</sup>. González Rodríguez et al.<sup>26</sup> used this alternative therapy for the treatment of TMD. These studies have shown that ozone therapy is a very effective treatment for relieving TMJ pain, when compared to pain medications ozone stands out. These results can be corroborated in the present study, the ozone therapy group showed a decrease in pain and improvement in maximal mouth opening, but without showing statistically higher differences from the laser therapy and ozone therapy groups.

It can be stated that the proposed therapies when analyzed in general were effective in reducing pain and improving maximum mouth opening. But when compared in isolation between them, neither group was more effective than the other. It is believed that there was no statistically significant difference in most of the analyzed variables, due to the size of the sample, which was a limiting factor of the study, as it was restricted due to the high rate of non-attendance by the individuals. Further studies in this area are needed to utilize these minimally invasive and cost-effective therapies for patients.



## CONCLUSION

Given the study, it can be considered that all treatments were able to decrease pain and improve maximal opening capacity related to muscle TMD. It can also be concluded that QoL related to TMD, in relation to the pain variable, was generally effective when compared before and after the interventions.

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## CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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