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CLINICAL EFFECTIVENESS EVALUATION OF LASER THERAPY AND DRY NEEDLING IN TREATMENT OF PATIENTS WITH MYOFASCIAL PAIN IN MASSETER MUSCLE

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ABSTRACT

Myofascial pain is considered a type of muscular TMD, being common in patients with musculoskeletal pain associated with active or latent trigger points. Among the therapeutic options, there are low-intensity laser therapy and dry needling. The aim of this study was to compare the efficacy of these two therapies in the masseter muscles of patients with myofascial pain.

Ten patients diagnosed with myofascial pain, with or without limitation of mouth opening, were randomly divided into two groups for treatment with low intensity laser therapy (G1) (n = 5) or dry needling (G2) (n = 5). The pain symptomatology and the mouth opening measurement were evaluated weekly before the start of treatment, and one week after the final treatment.

The comparison between G1 and G2 in relation to the improvement in mouth opening was not statistically significant ($p > 0.05$). However, dry needling (G2) has shown numerically to be more effective than laser therapy in a shorter period comparing initial and final mouth opening. Regarding the pain symptomatology, both therapies were effective comparing the initial and final evaluations of patients with myofascial pain ($p < 0.05$).

KEYWORDS: Temporomandibular joint; Temporomandibular Joint Disorders; Dry needling; Laser Therapy Trigger points; Myofascial pain.

INTRODUCTION

According to the American Academy of Orofacial Pain, Temporomandibular Disorder (TMD) is a term that covers a large number of clinical problems affecting the masticatory muscles, temporomandibular joint (TMJ) and associated structures (Okeson, 2013). TMD is considered a sub-classification of musculoskeletal dysfunctions and typically

presents a recurrent or chronic course with a substantial fluctuation of its signs and symptoms over time (Andrade & Frare, 2008).

Myofascial pain is considered a common diagnosis in patients with musculoskeletal pain associated with active or latent myofascial Trigger Points (TP). (Han & Harrison, 1997; Alvarez & Rockwell, 2002; Cagnie, Dewitte, Barbe, Timmermans, Delrue & Meeus, 2013). TP are defined as a very sensitive point in a tight band of skeletal muscle fibers that, spontaneously or by compression, causes local pain and in a distant region from the stimulated one, known as referred pain (Lin, Kaziyama & Teixeira, 2001). The muscle tension band restricts muscle stretching resulting in limitation of movement, muscle shortening, decreased muscle function effectiveness, and pain induced by muscle inhibition. Coordination is affected as well as the reflex inhibition of the antagonistic activity of the muscles (Pearce, 2004). An active TP causes spontaneous pain in response to movement, stretching or compression of the affected site, while a latent TP is considered a sensitive point with pain or discomfort in response only to compression (Hong, 2006; Kuan, 2009).

Through histological studies, it was confirmed that the presence of extreme sarcomeres contraction, resulting in tissue hypoxia, with the oxygen saturation in a TP is less than 5% at normal. Hypoxia leads to the local release of various nociceptive chemicals, including bradykinin, CGRP, and P-substances associated with the pain sensing mechanism. Bradykinin is a nociceptive agent that stimulates the release of tumor necrosis factor and interleukins, from which they can stimulate the release of another bradykinin (Dommerholt, 2011). These algogenic substances create a hypersensitivity local zone at the muscle, and a raised temperature at TP areas, suggesting a metabolic or blood flow increase at these tissues (Okeson, 2013). The diagnosis of TP is made by physical examination, which must consider the physical signs including presence of palpable tension in a musculoskeletal area, presence of hypersensitive nodules in the area of muscular tension, visible or palpable local contraction upon compression (Lavelle, Lavelle & Smith, 2007).

Treatment options include pharmacological and non-pharmacological interventions. In pharmacological methods non-steroidal anti-inflammatory drugs and narcotic medications are used for control of the symptoms. Non-pharmacological methods include physical therapy, stabilizing splints, sprays and massage (Rayegani, Bayat, Bahrami, Raeissadat, Kargozar, 2014). Physical therapies include postural training, exercises to extend and relax muscles, increase range of motion, reduce cracking and stabilize the TMJ. Physical agents include electrotherapy, ultrasound, iontophoresis, analgesic agents,

acupuncture, low intensity laser therapy (LILT) and dry-needling (DN). LILT and DN are considered to be effective interventions for the treatment of myofascial pain (Venâncio, Camparis & Lizarelli, 2002; Catão, Oliveirta, Costa & Carneiro 2013).

LILT is a non-pharmacological, non-invasive and low-cost modality that has been widely used in physiotherapeutic clinical practice for the relief of pain and tissue regeneration (Kato, Kogawa, Santos & Conti., 2006; Fikackova, Dostálová, Vosická, Peterová, Navrátil & Lesák, 2006; Melchior, Machado, Magri, & Mazzeto, 2016). This therapeutic modality provides regulation of cellular physiological functions, mediation of inflammatory processes, potentiation of tissue repair processes, and promotion of analgesia in cases of acute or chronic pain (Venâncio et al. 2002; Sanseverino, 2001; Catão et al., 2013; Shukla & Muthusekhar, 2016). The literature has shown satisfactory results with LILT in the deactivation of TP and decrease of myofascial pain, resulting in functional ability improvement and patient's life quality when applied correctly (Simunovic, 1996; Gür, Sarac, Cevik, Altindag & Sarac., 2004; Carrasco, Guerisoli, Guerisoli & Mazzeto, 2009; Kannan, 2012; Uemoto, Garcia, Gouvêa, Vilella & Alfaya, 2013).

DN technique consists basically of inserting the needle directly into the TP without the use of any medication, stimulating local pain relief (Kalichman & Vulfsons, 2010; Rayegani et al., 2014). This method has been used more frequently for the control of muscular pain, not only for the reduction of pain, but also for the advantages associated with a simple methodology for clinical applications, cheaper application materials and less risky procedures (Chou, Kao & Lin, 2012; Ziaeifar, Arab, Karimi & Nourbakhsh, 2014).

Sensory stimulation caused by DN promotes the mechanical rupture of dysfunctional terminal plates integrity corresponding to the place where TP develops (Chou, Kao & Lin, 2012). This stimulus promotes a blocking effect on the dorsal intra-cortical nontoxic information passage (which causes tissue damage and consequent pain sensation) generated by the TP nociceptors with the consequent relief of myofascial pain (Chu, 1995).

According to the literature both techniques have good efficacy in the treatment of muscular pain. In the study by Andrade & Frare (2008) LILT associated with manual therapy techniques obtained statistically significant reduction of pain symptomatology compared to the group treated only with manual therapy techniques when comparing pre and post treatment values after application of visual analog scale. In the same sense, in a study by Farias, (2005), electromyography was able to obtain electrical activity records of TP in

masseter muscle before and after the LILT application, demonstrating that there was relaxation and analgesia of the muscle with consequent increase of mouth opening amplitude.

Ferreira, de Oliveira, Guimarães, Carvalho A & De Paula (2013), showed that laser acupuncture was efficient in obtaining complete remission of the symptoms of temporomandibular and myofascial pain after 3 months of treatment and promoted greater and faster reduction of the symptoms in comparison with the placebo group. Furthermore, for patients in whom conservative treatment was adopted, the laser acupuncture was a secure, noninvasive, and effective treatment modality because it improves the chronic pain associated with TMD and has no side effects.

Regarding the studies on DN, in the study by Fernández-Carneiro, La Touche, Ortega-Santiago, Galan-del-Rio, Pesquera, Ge, et al**.** (2010)**,** the application of dry needling of active TP in masseter muscle induced significant jaw opening when compared to sham dry needling (placebo group) in TMD patients. In the same sense Gonzáles-Perez, Infante-Cossio, Granados-Nuñes & Urresti-Lopez (2012), after evaluation of TP in the external pterygoid muscle observed that in those patients who had significant pain before starting treatment (values 8 to 10 in visual analog scale), it was common that they had a reduction of 6 points, while those that started with mild pain (value less than 6) the expected reduction of pain was 4 points or less.

The aim of this study was to compare the therapeutic effects of LILT and DN in individuals who presented myofascial pain in the masseter muscle.

METHODS

This project was approved by the Ethics Committee on Human Research of the Federal University of Juiz de Fora (Minas Gerais, Brazil).

Ten patients aged 18 to 70 years old, with orofacial pain complaints, were referred to the Diagnostic and Guidance Service for Patients with Temporomandibular Disorder (“Serviço ATM”) of the Faculty of Dentistry of Federal University of Juiz de Fora (UFJF). Patients in myofascial pain treatment and with systemic diseases such as fibromyalgia, arthrosis, arthritis and rheumatism were excluded.

The diagnosis of myofacial pain was confirmed through Research Diagnostic Criteria (RDC / TMD - Axis I) (Dworkin & Le Resche, 1992), applied by a single examiner, specialist in TMD area. This diagnosis was considered when the presence of myofascial pain with limitation of mouth opening, and when the opening (unassisted and without pain) measurement

was less than 40 mm, according to item 4 from RDC / DTM - Axis I, in which the edge of a millimeter ruler is placed at the incisal edge of the maxillary central incisor that is the most vertically oriented and then measured vertically to the labioincisal edge of the opposing mandibular incisor. The maxillary incisor chosen was indicated on the form for each patient.

The criteria established by Travell & Simons (1999) were used to diagnose active and latent TP: presence of a palpable muscle tension band with a hypersensitive palpation point, as well as a sensory abnormality or referred pain produced by TP. For active TP, this referred pain should correspond to the individual's existing pain complaint. The hypersensitivity of TP was confirmed by the patient's "jump sign", which can be manifested by facial expressions such as grimaces, verbal responses that signal pain, or by movement of the body to escape the pain.

Before the starting the treatment the pain intensity of each participant was measured according to the Visual Analogue Scale (VAS), graded from 0 to 10 in which 0 represents absence of pain and 10 represents the highest degree of discomfort in which patients indicated the painful sensation at the time of the examination. In addition, the initial measure of mouth opening of each patient was measured according to item 4 from RDC/DTM - Axis I.

Ten patients selected were randomly and divided into two groups of 5 individuals each one: Group 1 (G1) (n = 5) submitted to LILT; Group 2 (G2) (n = 5) submitted to DN. The application of each therapy method was contraindicated in areas with wounds, spots or scars.

G1 patients were provided with12 LILT sessions once a week according to the protocol of Venâncio et al. (2002). TP were identified with a ballpoint pen so that they could be precisely located during the procedure (Figure 1). The application was done in a punctual way and in perpendicular contact with the skin, bilaterally (Figure 2), with LILT equipment, previously calibrated, with red light source at 660nm wavelength (Whitening Lase II DMC Equipamentos, São Carlos, SP, Brazil), energy density of 40 J / cm², average power of 40 mW or 1.6 J of total energy, continuous emission mode for 40 seconds with the conventional tip. The physical evaluation symptoms were recorded at thirteen different times, corresponding to the session before the beginning of the treatment and the 12 sessions of LILT application, in order to visualize the symptomatic evolution of the individuals in the sample.

Figure 1: *TP marked with ballpoint pen.*

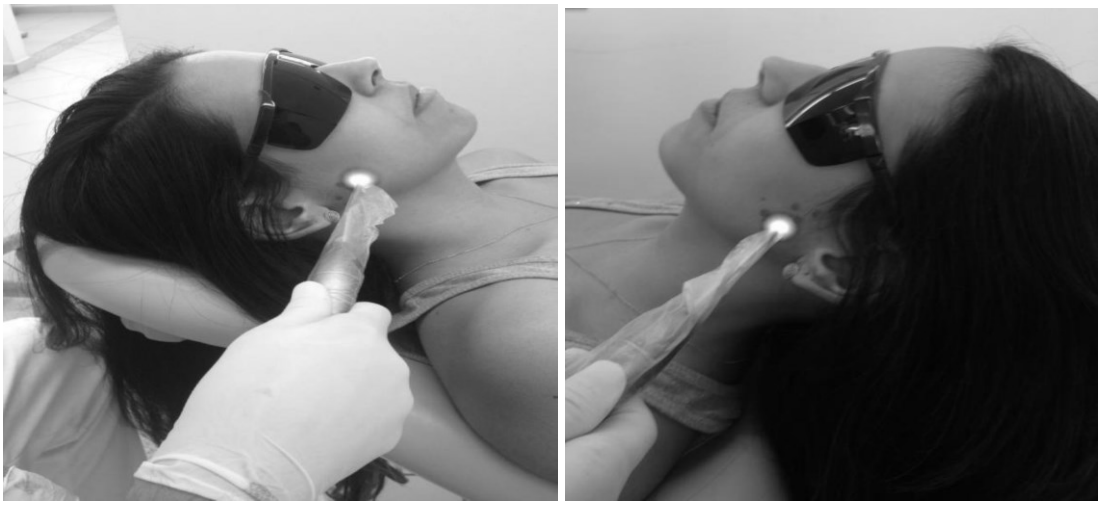

Figure 2*: LILT application bilaterally.*

G2 patients were provided with 6 sessions of DN, unilaterally in 2 patients and bilaterally in 8 patients, according to the complaint of where the patient was experiencing pain and the presence of TP. DN was made with sterile acupuncture needles (DongBang Acupuncture®, Boryeong, Chungnam, Korea) with a 0.25 x 30mm caliber and 5cm long enveloped by a cylindrical plastic holder 4.5cm long. After the needle insertion, smooth and rotating movements were performed for 1 minute in each TP (Figure 3). In cases of pain after the procedure, thermotherapy was recommended with ice or moist heat in the painful area. After finishing the treatments, the mouth opening measurements were done again according to item 4 from RDC / TMD - Axis I.

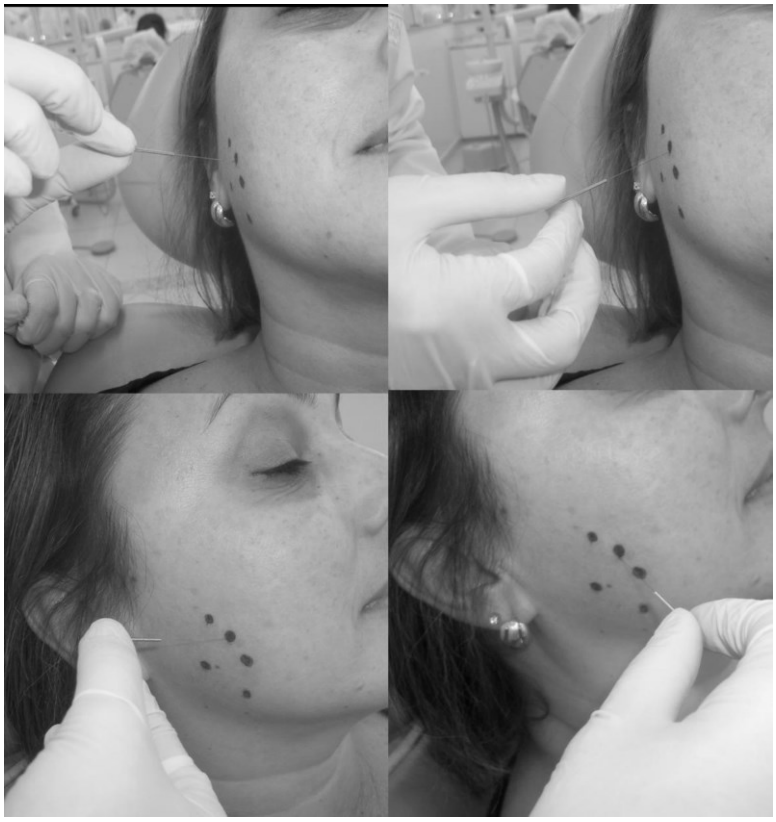

Figure 3: *Rotating movements made with the needle during the DN technique.*

According to the analysis of all DN and LILT sessions, the mean of individual symptom grade of both groups was calculated, in order to compare the pain level of each patient and of each sample before and after the end of the treatments. Absolute and relative frequencies and descriptive measurements were obtained for continuous data (means and respective standard deviations). Mouth opening measurements at the first moment (M1) and the moment after treatment (M13) were compared, as well as VAS measurements using ANOVA test. Statistical analysis of the results was done using software SPSS 14.0 and Epi Info 6. The Kolmogorov-Smirnov test showed normal distribution of quantitative measures ($p > 0.05$).

RESULTS

The sample was composed of 10 female patients, with mean age of 39.2 years old.

GROUP 1:

The patient's frequency in G1 diagnosed with TMD, according to RDC / TMD Axis I, is described in Table 1. Regarding the number of TP identified in G1, the total mean was approximately 5 points marked on each side of the face.

Table 1: Diagnosis frequency of TMD in patients evaluated for treatment with LILT (G1).

TMD Diagnosis	***Frequency – n (%)***
Muscle Disorder	
Myofascial pain	*1 (20%)*
Myofascial pain with opening limitation	*2 (40%)*
Disk Displacement	
With reduction	*2 (40%)*
Without reduction with opening limitation	*1 (20%)*
Without reduction without opening limitation	*0 (0%)*
Arthralgia, Arthritis or Arthrosis	
Arthralgia	*0 (0%)*
Arthritis	*0 (0%)*

The measurement of mouth unassisted and without pain, before and after G1 treatment is described in Table 2 (RDC / DTM - Axis I, item 4).

Table 2: *Measurement of mouth opening without help and without pain before (initial) and after one week of the end (final) treatment with LILT (G1).*

Moment	Minimum (mm)	Maximum (mm)	Mean (mm)	Standard Deviation (mm)	(p)
Initial	35	44	38	4,243	p=0,72
Final	44	50	35,2	3,564	

The maximum mouth opening measurement unassisted, even with discomfort before and after G1 treatment, is described in Table 3 (RDC / DTM - Axis I, item 4).

Table 3: *Measurement of maximum mouth opening without help before (initial) and after one week (final) of treatment with LILT(G1).*

Moment	Minimum (mm)	Maximum (mm)	Mean (mm)	Standard Deviation (mm)	(p)
Initial	42	55	47,4	5,550	p=0,31
Final	44	50	46,4	2,302	

The weekly value of VAS and its respective mean values at each time of G1 treatment are described in Table 4.

***Table 4**: Measurement of VAS individually and respective means and standard deviation according to the moments of treatment with LILT (G1).*

	PATIENTS (VAS)					Total Mean	Standard Deviation
MOMENTS	**1**	**2**	**3**	**4**	**5**		
M1	6	5	10	6	7	6,8	1,923
M2	5	6	8	7	7	6,6	1,14
M3	3	5	10	6	7	6,2	2,588
M4	4	1	9	5	5	4,8	2,863
M5	3	0	10	3	4	4	3,674
M6	1	1	6	3	5	3,2	2,28
M7	1	0	6	4	5	3,2	2,588
M8	2	0	6	5	4	3,4	2,408
M9	2	0	8	4	4	3,6	2,966
M10	2	0	8	3	5	3,6	3,049
M11	1	0	9	2	5	3,4	3,646
M12	3	0	9	2	3	3,4	3,361
M13	2	0	8	2	3	3	3

Considering the mean value of VAS in M1 before treatment up to M5, no significant statistical difference was found ($p > 0.05$). However, from M6, the comparison with M1 showed a statistically significant difference ($p < 0.05$), showing improvement in the index of pain indicated by patient

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GROUP 2

The patient's frequency in G2 diagnosed with TMD, according to RDC / TMD Axis I, is described in Table 5. Regarding the number of TP identified for DN, considering all patients, TP total mean per side was approximately 4 points marked in each patient's face.

Table 5: Diagnosis frequency of TMD in patients evaluated for treatment with DN (G2).

TMD Diagnosis	*Frequency – n (%)*
Muscle Disorder	
Myofascial pain	*1 (20%)*
Myofascial pain with opening limitation	*4 (80%)*
Disk Displacement	
With reduction	*1 (20%)*
Without reduction with opening limitation	*0 (0%)*
Without reduction without opening limitation	*0 (0%)*
Arthralgia, Arthritis or Arthrosis	
Arthralgia	*2 (40%)*
Arthritis	*0 (0%)*

The measurement of mouth opening unassisted and without pain, before and after G2 treatment is described in Table 6 (RDC / DTM - Axis I, item 4).

Table 6*: Measurement of mouth opening without help and without pain before (initial) and after one week of treatment end (final) with DN (G2).*

Moment	*Minimum (mm)*	*Maximum (mm)*	*Mean (mm)*	*Standard deviation (mm)*	*(p)*
Initial	*23*	*42*	*31,9*	*6,789*	*p=0,17*
Final	*25*	*48*	*36,2*	*6,460*	

The maximum mouth opening measurement unassisted, even with discomfort before and after G2 treatment, is described in Table 7 (RDC / DTM - Axis I, item 4).

Table 7: *Measurement of mouth opening without help and without pain before (initial) and after one week of treatment end (final) with DN (G2).*

Moment	***Minimum (mm)***	***Maximum (mm)***	***Mean (mm)***	***Standard deviation (mm)***	***(p)***
Initial	*32*	*49*	*39,6*	*5,501*	*p=0,17*
Final	*32*	*52*	*43,1*	*5,567*	

The weekly value of VAS and its respective mean values at each time of G2 treatment are described in Table 8.

Table 8: *Measurement of VAS individually and respective means and standard deviation according to the moments of treatment with DN (G2).*

MOMENTS	**PATIENTS (VAS)**					Total Mean	Standard Deviation
	1	**2**	**3**	**4**	**5**		
M1	10	8	7	7	9	8,3	1,494
M2	8	0	3	6	5	5,5	3,472
M3	5	5	3	8	9	6,1	2,998
M4	3	0	3	6	1	3,3	2,497
M5	0	0	0	5	5	2,6	2,836
M6	0	0	3	7	0	3,4	2,675
M7	1	0	0	6	0	2,3	2,869

The comparison between the values of initial and final mouth opening unassisted and without pain and initial and final maximum mouth opening unassisted did not show significant statistical differences as demonstrated in Figure 4 and Figure 5

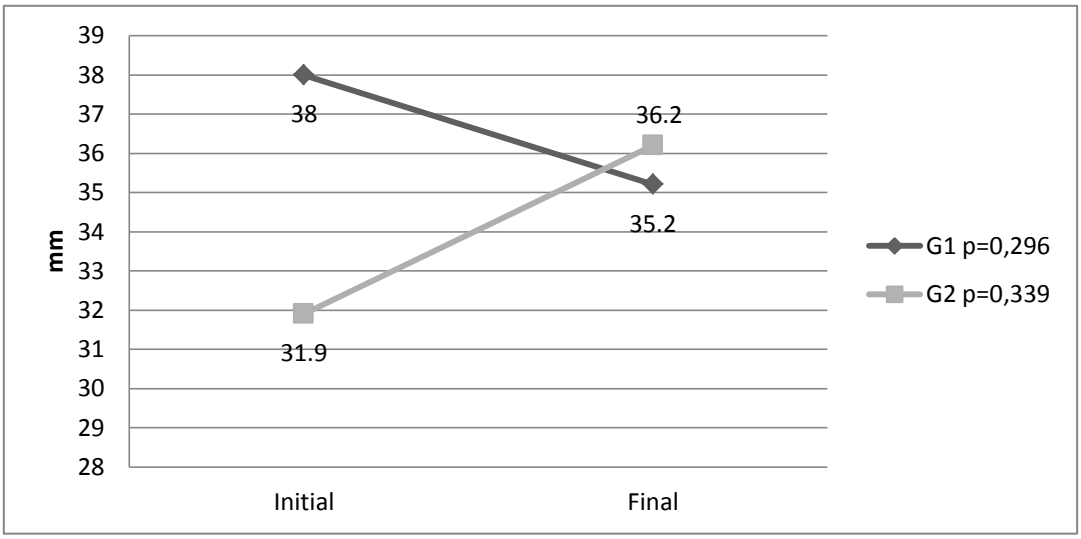

***Figure 4**: Initial and final pain comparison of mouth opening without help and painless between G1 and G2.*

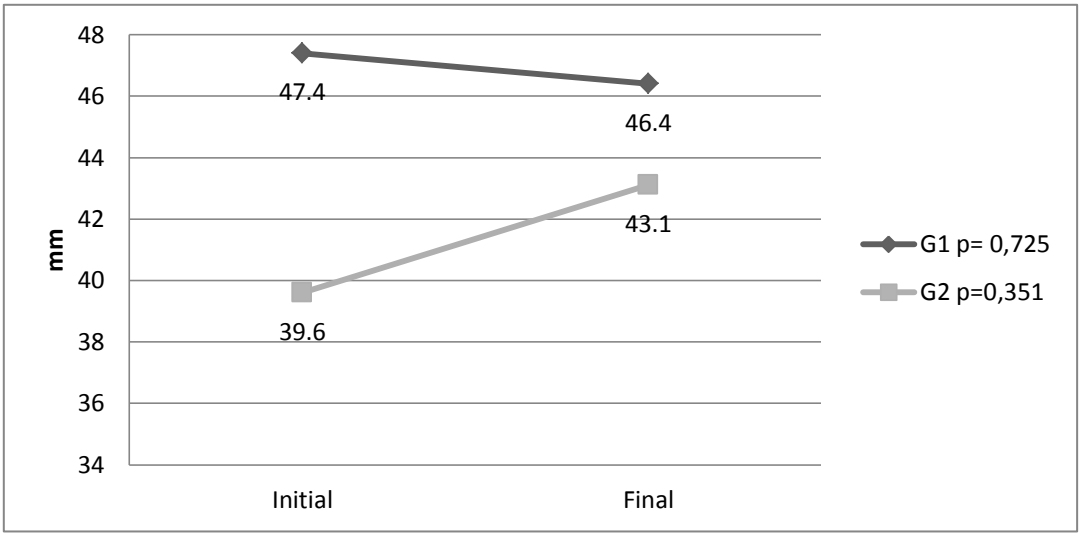

***Figure 5** Initial and final pain comparison of mouth opening without help between G1 and G2.*

Considering the mean value of VAS in M1 before treatment up to M3, no significant statistical difference was found (p> 0.05). However, from M4, the comparison with M1 showed a statistically significant difference (p <0.05), showing improvement in the index of pain indicated by patient.

Comparing the groups based on the results obtained from the initial and final VAS mean of each treatment, no significant statistical difference was observed between the treatments, both of which provided significant improvements in patients' pain and quality of life (Figure 6) .

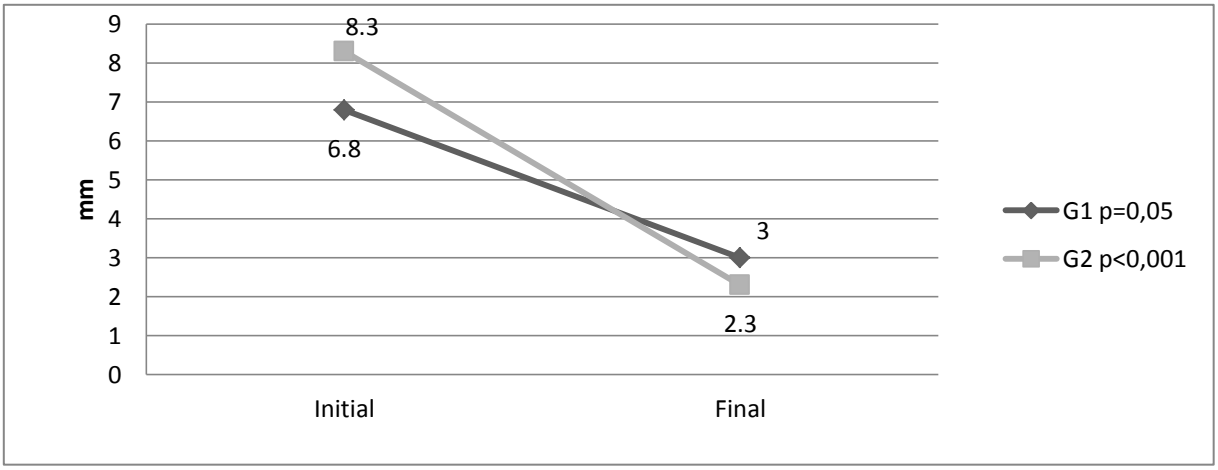

Figure 6: *Comparison of VAS results between G1 and G2 and p values respectively.*

DISCUSSION

The sample of the present study was composed entirely of female patients (n = 10) with mean age of 39.2 years. According to Le Resche, Saunders, Von Korff, Barlow & Dworkin (1997), TMD presents higher prevalence in women at reproductive age, with reduction in the prevalence in the postmenopausal period, suggesting an important relation with the hormonal oscillation. Ilha, Rapoport, Ilha Filho, Reis & Boni (2006) suggest that there is an increase of the symptoms of TMJ dysfunction in women due to estrogen and prolactin, which can exacerbate the degradation of articular cartilage and bone, as well as stimulate a series of immune responses in these joints. Another relevant cause is the fact that women present higher stress indexes than men, resulting in a higher incidence of diseases with psychosomatic involvement (Penna & Gil, 2006).

LILT increases the cell membrane permeability allowing it to function effectively, which accelerates tissue healing, increasing the

release of endorphin (Chow, Heller & Barnsley, 2006). DN is effective in the treatment of musculoskeletal pain by providing muscle relaxation through stimulation of the endogenous suppressor pain system bringing better sleep quality and decreasing anxiety (Lavelle et al., 2007).

Despite the small number of patients in the sample, the evaluation of pain by VAS demonstrated, numerically, better results from DN in relation to LILT. The Uemoto, Azevedo, Alfaya, Reis, Gouvêa & Garcia study (2013), in which only the DN group also showed a significant symptom improvement.

There is still disagreement in the literature regarding the number of clinical sessions for LILT and DN therapies. As in the present study, Simunovic (1996) recommends the laser application two or three times a week, but Venâncio et al. (2002) suggests a larger number (30 sessions) for decrease of pain. In addition, Cagnie et al. (2013) showed that after 20 sessions of DN, there was functional and pain relief in patients evaluated, disagreeing with the present study.

The maximum mouth opening and the presence of disorders in each individual varies according to gender (Bianchini, 2000; Manfredi, Silva & Vendite 2001). Okeson (2013), states that other central excitatory effects, beyond the referred pain by the presence of TP can be noted, for example, protective co-contraction that alters normal muscle activity, in the presence of some injury with the main intention of protecting the part threatened. This may be clinically noted as an opening limitation, which may justify the results that are not statistically significant between the values measured before and after treatment found in the present study.

Uemoto et al. (2013), demonstrated that the two therapeutic modalities did not produce significantly better results in relation to mouth opening because the application was exclusive to the masseter muscle and may not have provided the relaxation of other muscles participating in the mandibular movements. In agreement with the present study, besides the application of the techniques only in the masseter muscle, it was observed that the presence of other concomitant TMD diagnoses, suggesting possible influence on values of mouth opening.

LILT and DN, as suggested by the literature, represent alternatives to the treatment of patients with myofascial pain, constituting effective and non-invasive methods. It is extremely important for the professional to have the knowledge and understanding of the proper execution of the techniques when determining a treatment plan in order to decrease and relieve the patient's pain.

CONCLUSIONS

LILT and DN in the masseter muscle were effective in reducing symptomatology of patients with myofascial pain. DN was demonstrated numerically to be more effective than LILT in a shorter period of sessions when the initial and final mouth opening was evaluated. Although studies have demonstrated the efficacy of dry needling and laser therapy for the deactivation of TP, there is a lack of clinical trials comparing the two techniques. Considering the small sample and the importance of these therapies, further controlled studies are needed on this subject, including the association with other muscle regions as SCM, with the objective of promoting an efficient treatment for patients with myofascial pain.

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