

## Evaluation of Short-Term Effectiveness of Orthopedic Manual Therapy in Signs and Symptoms of Myofascial Pain: A Controlled Clinical Trial.

Evaluación de la eficacia a corto plazo de la terapia manual ortopédica en signos y síntomas de dolor miofascial: un ensayo clínico controlado.

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**Receipt** : 03/15/2019 **Revised:** 10/30/2019  
**Acceptance:** 04/24/2020

### Cite as:

Vivanco-Coke S, Jiménez-Silva A, Ríos-Quiñinao F, Frugone-Zambra R & Tobar-Reyes J.

Evaluation of Short-Term Effectiveness of Orthopedic Manual Therapy in Signs and Symptoms of Myofascial Pain: A Controlled Clinical Trial.

J Oral Res 2020; 9(2):121-128.

**Doi:**[10.17126/joralres.2020.019](https://doi.org/10.17126/joralres.2020.019)

**Abstract:** To evaluate the short-term effectiveness of orthopedic manual therapy (OMT) in signs and symptoms of myofascial pain (MFP) in young adults. **Materials and Methods:** An experimental controlled clinical study was performed in young adults between 19 and 24 years old. Thirty-one patients with MFP according to Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were divided into two groups. Group A: Orthopedic Manual Therapy (n=16; 10 females, 6 males; 21.6 ± 1.70 years old), and Group B: Control group (n=15; 10 females, 5 males; 20.9 ± 2.00 years old). The participants of group A were treated for a period of 6 weeks; Six therapeutic interventions were performed. Degree of dysfunction (Helkimo index), pain level (VAS scale), and range of mandibular movements (opening and lateral movements) were taken at baseline (T0) and immediately at post-treatment (T1). The data were analyzed with chi-square test and t-test;  $p < 0.05$  was considered significant. **Result:** After the OMT, there were no significant changes in diagnosis of MFP according to RDC/TMD ( $p = 0.41$ ); however, there was a statistically significant improvement in the Helkimo index ( $p = 0.0083$ ) and the level of pain according to the VAS scale ( $p = 0.0004$ ). Mandibular movements did not show significant differences ( $p > 0.05$ ). **Conclusion:** This study suggested that a 6-week period of OMT treatment has a clinically significant effect in pain level and degree of dysfunction in patients with MFP. A longer follow-up study is required to better assess the effects of manual therapy.

**Keywords:** Temporomandibular joint disorders; myofascial pain syndromes; musculoskeletal manipulations; young adult; movement; pain

**Resumen:** Evaluar la efectividad a corto plazo de la terapia manual ortopédica (TMO) en los signos y síntomas del dolor miofascial (DMF) en adultos jóvenes.

**Materiales and Métodos:** Se realizó un estudio clínico controlado en adultos jóvenes entre 19 y 24 años. Treinta y un pacientes fueron diagnosticados con DMF según los criterios de diagnóstico para trastornos tempo-romandibulares (CDI/TTM) y se dividieron en dos grupos. Grupo A: Terapia manual ortopédica (n = 16; 10 mujeres, 6 hombres; 21,6 ± 1,70 años), y Grupo B: grupo de control

(n = 15; 10 mujeres, 5 hombres; 20,9 ± 2,00 años). Los participantes del grupo A fueron tratados por un período de 6 semanas. Se realizaron seis intervenciones terapéuticas. El grado de disfunción (índice Helkimo), el nivel de dolor (escala EVA) y el rango de movimientos mandibulares (movimientos de apertura y laterales) se evaluaron al inicio del estudio (T0) e inmediatamente después del tratamiento (T1). Los datos se analizaron con la prueba de chi-cuadrado y la prueba t de student; se consideró significativo cuando  $p$  fue menor a 0.05. **Resultados:** Después de la TMO, no hubo cambios significativos en el diagnóstico de DMF según CDI /TTM ( $p=0,41$ ); sin embargo, hubo una

mejora estadísticamente significativa en el índice Helkimo ( $p=0.0083$ ) y el nivel de dolor según la escala EVA ( $p=0.0004$ ). Los movimientos mandibulares no mostraron diferencias significativas ( $p>0.05$ ). **Conclusión:** Este estudio sugirió que un período de 6 semanas de tratamiento con TMO tiene un efecto clínicamente significativo en el nivel de dolor y el grado de disfunción en pacientes con DMF. Se requiere un estudio de largo plazo para evaluar de mejor forma el efecto de la terapia manual ortopédica.

**Palabra Clave:** Trastornos de la articulación temporomandibular; síndromes del dolor miofascial; manipulaciones musculoesqueléticas; adulto joven; movimiento; dolor.

## INTRODUCTION.

Temporomandibular disorders (TMD) are defined as a group of disorders involving the masticatory muscles, the temporomandibular joint (TMJ) and associated structures.<sup>1</sup> The etiology and management of TMD are still poorly understood.<sup>2-4</sup>

Myofascial Pain (MFP) represents the largest subgroup of TMD and is the major complaint among TMD patients.<sup>5</sup> The MFP has been defined as “a pain of muscle origin, including pain complaint as well as pain associated with localized areas of tenderness to palpation in muscle”.<sup>6</sup> Nowadays,<sup>7</sup> it is defined as “a pain of muscle origin, plus a report of pain spreading to the immediate site of tissue stimulation (e.g., the palpating finger) but within the boundary of the masticatory muscle being examined. Limitation of mandibular movement(s) secondary to pain may be present”. Myofascial pain with referral includes a report of pain spreading out of the limits of the muscle. MFP shows a prevalence of 45% of the population and incidence of 23%, according to the OPPERA study.<sup>7-9</sup>

The therapy objectives in the management of MFP are elimination of pain, inactivation of trigger points, and release of tight bands.<sup>10</sup> There is no unique and effective treatment currently available for MFP.

The alternatives for management consider acupuncture, ultrasound, trigger point injections, non-steroidal anti-inflammatory drugs, physical exercises, and interocclusal appliances.

Despite this lack of evidence, the available literature supports the reversible and conservative treatment, as well as prevention of TMD over invasive treatments.<sup>11,12</sup>

Interocclusal appliances are the most indicated treatment alternatives. Nevertheless, their mechanism of action is not entirely understood in pain management.<sup>12,13</sup>

The “American Academy of Orthopedic Manual Physical Therapists” indicates that OMT comprises any hands-on treatment provided by a physical therapist. OMT includes the mobilization of joints in different ways and with different velocities, muscle stretching, passive and counter-resistance movements of the affected member to improve muscle activation. Some specific techniques over soft tissues are used to improve mobility and function of tissues and muscles.<sup>14</sup>

A recent study demonstrated that applications of a pressure release technique for 60 to 90 seconds on the levator scapulae increases pressure pain threshold and strength.<sup>15</sup> OMT should improve blood circulation, decrease muscle spasm, induce muscle relaxation around the joint, break muscle adhesions, increase mobility range, and decrease pain.<sup>16</sup> There is a lack of evidence for the application of manual therapy in the masticatory muscles.

Due to the scarce evidence related to the management of signs and symptoms in patients with MFP and the lack of information related to a specific treatment, the aim of this experimental clinical study was to determine the short-term effectiveness of OMT in muscular signs and symptoms of young patients with MFP.

## MATERIALS AND METHODS.

The study was performed in accordance to the principles of the Declaration of Helsinki and under the biosecurity normative for patient management.

The project and the informed consent were approved by the ethical committee of Arturo Prat University, Victoria campus, Chile. Subjects were selected among the students of the university's Physiotherapy Faculty.

Inclusion criteria: Males and females 19 to 24 years old with masticatory muscle pain and diagnosed with myofascial pain or myofascial pain with limited opening range according to the RDC/TMD. Diagnosis should include the masticatory muscles (masseter and temporal)<sup>6</sup> and the pain should be present for 3 months or more.

Exclusion criteria: Temporomandibular joint pain, non-painful intra-articular disorders, reported trauma on the head and neck areas, systemic diseases and neurologic disorders.

A total of 115 volunteers were examined by a blind instructed researcher.

Sixty subjects were diagnosed among one of both groups of myofascial pain including the masticatory muscle. Twenty-nine of whom decided not to participate in the study, and 31 were assigned into two groups according to their interest in participating or not in the treatment itself.

Group A: Subjects who received Orthopedic Manual Therapy (n=16; 10 females, 6 males;  $21.6 \pm 1.7$  years) by a single physiotherapist with experience in patients with myofascial pain;

and Group B: Only subjects who consented to an evaluation at T0 and T1 but with no thrust manipulation (n=15; 10 females, 5 males;  $20.9 \pm 2.0$  years) (Figure 1).

The OMT treatment consisted of six therapeutic interventions and was provided for a total period of six weeks. The therapy was performed by another researcher. All subjects were informed about the therapeutic intervention. Each session was performed for 15 minutes following three techniques in the same sequence:

**a)** Superficial myofascial release: The technique of non-specific traction for myofascial release in the temporal muscle was applied.

The anterior tragus area was used as a starting point to generate the myofascial traction force facing upwards through the temporal muscle belly. The pressure was applied directly on the patient's skin until it reached the area of myofascial resistance.

The pressure was maintained at the restriction point for 90-120 seconds, without sliding into the skin nor forcing the tissue. When the restriction point

decreased, a technique of myofascial induction (three-dimensional release of the soft tissues of the temporal muscle) was performed. Afterwards, the procedure was performed again until the next myofascial restriction was reached.<sup>17</sup>

**b)** Strain-counterstrain technique: This technique was applied in the masseter muscle belly, in the medial pterygoid muscle, and in the anterior portion of the temporal muscle.

The painful and tense point to palpation was located in the shortened muscle to avoid a stretch reflex and to keep it in a position of no pain. Perpendicular pressure was progressively applied to the trigger point while sensing how the muscle tissue under the pressure point was losing its tone.<sup>18,19</sup>

**c)** Deep transverse massage: Using the index and middle fingers, the massage was performed transversely on the muscle fibers with depth, that is to say, adding load. This technique was applied on the fibers of the temporal and masseter muscles generating a right-angled friction against the skin.

The massage was also performed on each muscle from one lateral end to the other. The transverse sliding allows the appropriate movement of the tissue and exerts the pressure enough to displace the muscular tissue. During the first session, DTM was applied for 1 to 2 minutes on each muscle. On the following sessions it was applied for 3 to 4 min on each muscle.<sup>20</sup>

RDC/TMD diagnostic procedures were applied at T0 and 6 weeks after (T1).

The Helkimo dysfunction index<sup>21</sup> was used to evaluate the severity of the dysfunction, but not the influence of psychosocial factors. Also, the level of pain (VAS scale), and the range of mandibular movements (opening and lateral movements) were taken by the same clinical researcher.

The data were tabulated and analyzed with chi-square test and Student t-test;  $p < 0.05$  was considered significant. GraphPad PRISM 7.0d software was used.

## RESULTS.

Thirty-one subjects were included in the study, 16 of who consented to receive the therapy and 15 did not, but they consented to being re-evaluated at T1. This latter group represents a null control group.

After OMT, there were no significant changes in diagnosis of MFP according to RDC/TMD ( $p=0.41$ ) (Figure 2); however, there was a statistically significant

improvement in the Helkimo index ( $p=0.0083$ ) (Figure 3). Regarding the mandibular movements, there were no significant differences in mouth opening ( $p=0.56$ ), right mandible movement ( $p=0.1946$ ), or left mandible movement ( $p=0.1485$ ) between the two groups (Table

1). In relation to the pain level according VAS, group A was  $3.5\pm 1.03$  (min 0 and max 6) at T0; at T1, VAS average level was  $1.5\pm 0.89$  (min 0 and max 3) ( $p=0.0004$ ) (Figure 4).

Figure 1. Flow diagram of the study.

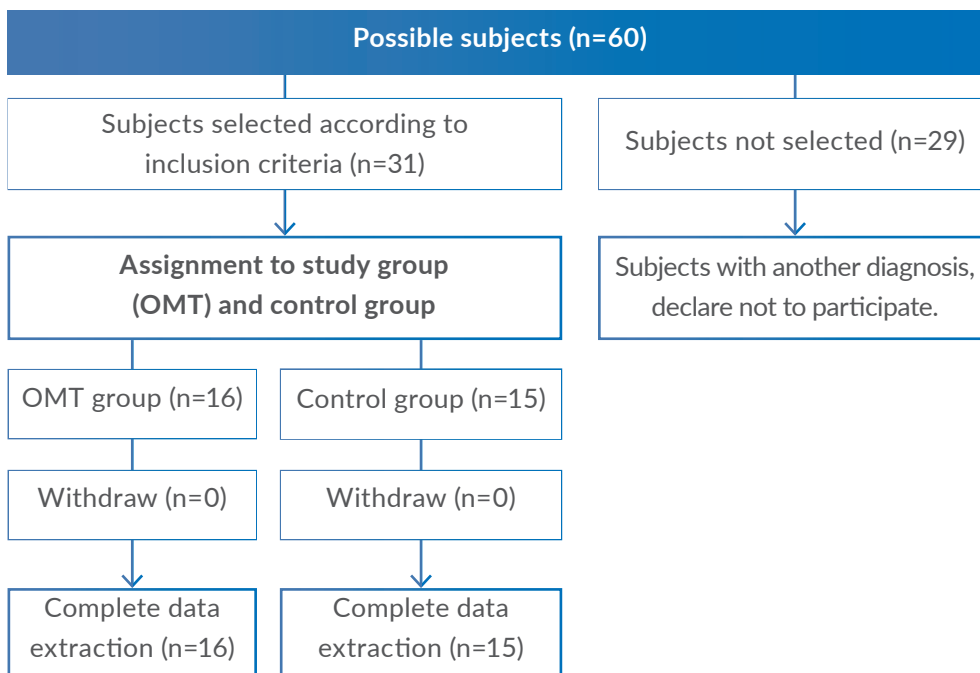
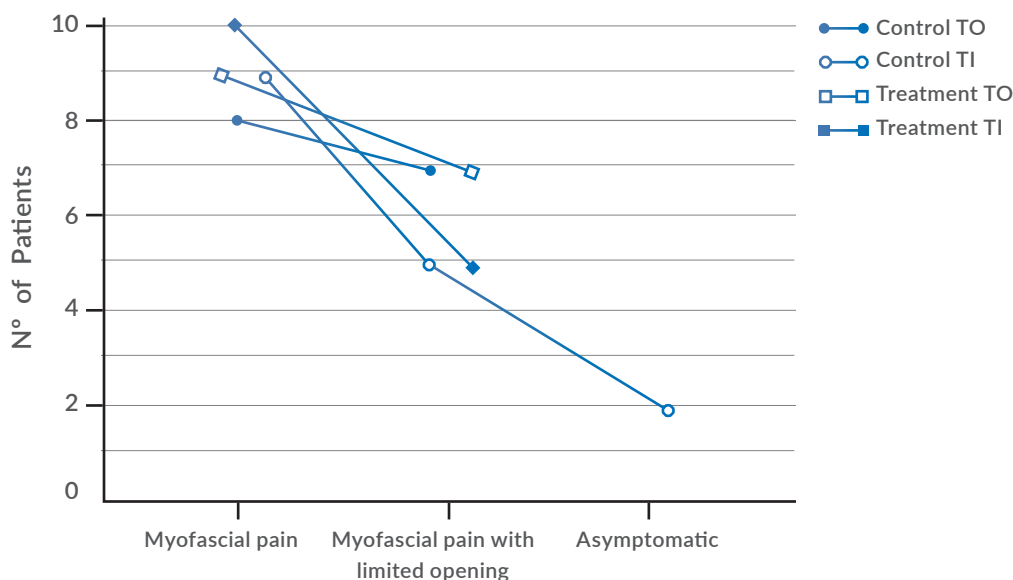
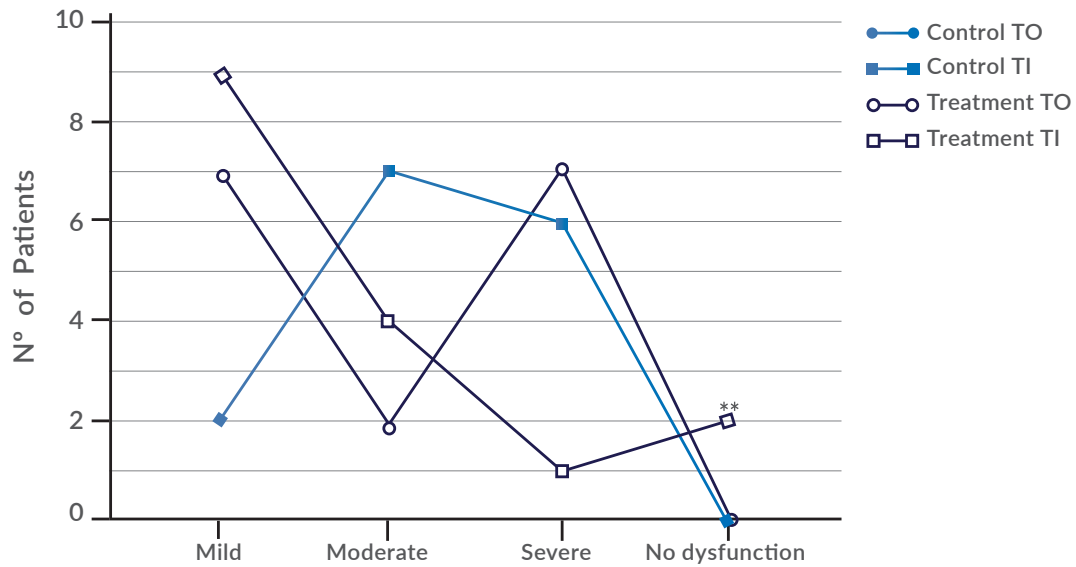


Figure 2. Diagnosis evaluation.



RDC/TMD was used to diagnose subjects of both groups at baseline and at the end of the study period, those classified in axis 1 group 1 (Myofascial pain and Myofascial pain with limited opening) were included. Symbols indicate the number of patients diagnosed for each group at baseline and at the end of the study. No statistical difference was found between groups ( $p=0.41$ ).

Figure 3. Analysis of degree of dysfunction.



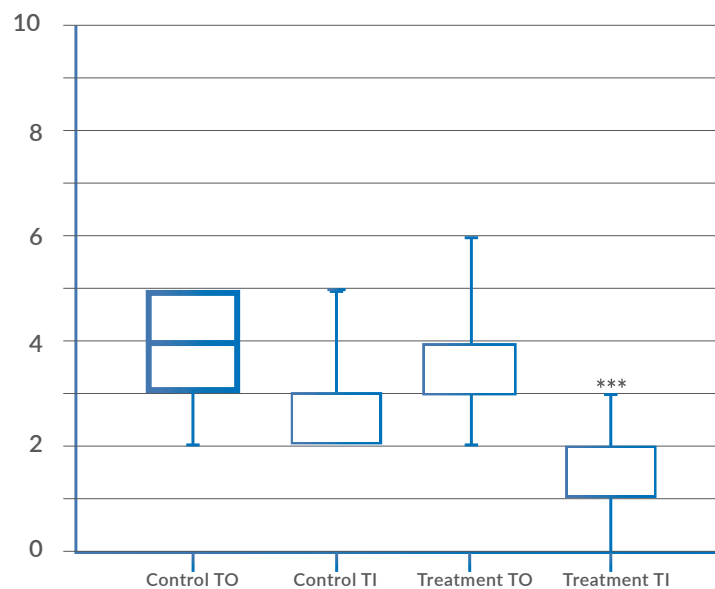
Helkimo index was used to evaluate the degree of dysfunction.

Subjects were classified into mild, moderate, and severe TMD according to the test.

Symbols indicate the number of patients diagnosed for each group at baseline and at the end of the study.

Improvement was observed only in patients of OMT group. Statistical significance between groups was found ( $p=0.0083$ ).

Figure 4. Pain evaluation.



To assess pain, a VAS scale of 10 points was applied.

Boxes express the points given by each subject of each group at baseline and at the end of the study period.

Statistical significance between groups was found, where subjects under OMT treatment had less pain ( $p=0.0004$ ).

**Table 1.** Results on mandibular movements.

	Group A: OMT						Group B: Control					
	O		RL		LL		O		RL		LL	
	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1
1	45	46	11	12	12	12	44	43	13	12	10	10
2	40	43	9	10	8	9	40	40	9	9	12	12
3	45	45	3	5	5	6	40	41	11	12	11	10
4	38	41	9	9	7	8	42	43	8	8	7	8
5	38	40	8	8	7	8	38	38	10	10	5	7
6	37	39	8	9	7	7	40	40	9	9	7	9
7	43	45	6	7	6	8	44	45	11	12	12	12
8	40	44	12	12	11	11	45	45	15	15	10	11
9	33	37	6	6	4	5	30	31	5	5	4	5
10	33	36	4	6	3	4	35	34	5	8	10	10
11	30	34	8	8	5	6	33	33	11	9	10	8
12	33	35	7	7	5	7	34	35	7	8	7	7
13	35	36	9	9	7	7	39	40	7	7	6	7
14	35	39	12	12	13	13	38	41	12	11	10	10
15	38	41	7	8	8	8	35	36	12	10	10	10
16	34	37	9	9	5	7						
$\chi$	37.31	39.88	8.00	8.56	7.06	7.88	38.47	39.00	9.66	9.66	8.73	9.07

Opening, left and right laterotrusion were measured at baseline and at the end of the study. Results are expressed as millimeters. No statistical significance was found between groups.

**OMT:** Orthopedic manual therapy. **O:** Opening. **RL:** Right laterotrusion. **LL:** Left laterotrusion. **T0:** Initial evaluation. **T1:** Final evaluation.  $\chi$ : Mean.

## DISCUSSION.

The aim of this research was to determine the short-term effectiveness of OMT in the muscular signs and symptoms of young patients with MFP. This symptomatology considered pain decrease, increased mandibular movement range, and Helkimo dysfunction index in young subjects with myofascial pain.

Even though the diagnosis of patients did not change in both groups between T0 and T1, VAS and Helkimo dysfunction index in the study group showed a significant difference at the end of the treatment period ( $p=0.0083$ ). No changes were observed in the control group. Regarding the use of VAS scale to assess pain and dysfunction, this study supports the evidence available that indicates it would not be reliable due to behavioral variables involved for these measurements. This situation was also observed in another study that evaluated pain on temporalis muscle after the use of essential oils (ping-on).<sup>22</sup> Therefore, Helkimo dysfunction index is more reliable because it is based on clinical

parameters that can be measured. The explanation about the lack of change in the diagnosis after the muscle manipulation is based on the time that is required to manage the inflammatory process. The findings of this study concur with the results of Calixtre *et al.*<sup>15</sup> In that systematic review, they concluded that OMT (release and myofascial massage) would relieve pain and increase pain threshold under pressure in subjects with signs and symptoms of temporomandibular disorders. However, the authors indicated that the results may vary depending on the therapeutic technique used. Heredia-Rizo *et al.*,<sup>23</sup> have analyzed the immediate effect on masticatory muscles with a technique called myofascial induction. They observed that there was not a significant difference in the muscle soreness, mouth opening range and head posture.

Their data appear to be similar with the data of this study, but the difference lays on the pressure level applied over the muscles. In myofascial pain release, the technique works with pain sensation; However, in

myofascial induction, the activity does not induce pain. This is an important difference because the concept of irritation of the trigger points is not the same, therefore, it is not comparable. Another difference with this study is the diagnostic tool and the pain condition of the subjects.<sup>23</sup>

According to Gomez-Kalamir *et al.*,<sup>24</sup> OMT would improve the range of movement.<sup>25</sup> However, this result was not observed in our study. This might differ due to the manual techniques applied (important bias concerning the professional thrust manipulation), the diagnosis criteria, or the total follow-up time. When considering other alternatives for myofascial pain treatment, the OMT seems to be better than other techniques.

Guarda-Nardini *et al.*,<sup>26</sup> compared the effectiveness between botulinum toxin injection and a protocol of myofascial release in patients with temporomandibular disorders. They observed that the use of botulinum toxin showed better results on mouth range movement; however, patients who received OMT showed greater reduction of muscle pain. This may be due to the effect of the toxin on the muscle function.

The objective of the available physical treatment modalities is to relax the tight bands of the musculature, inactivate the trigger points, and regulate underlying factors.<sup>27,28</sup> It is possible that, in patients with MFP, the muscles are affected by a decrease in the blood flow due to a vasoconstriction produced after an increase of activity.<sup>15</sup> Under this situation, nutrients and metabolites would be altered and inflammatory mediators could sensitize the nociceptors and provoke pain.<sup>29,30</sup>

Moreover, the trigger points will cause referred pain, movement difficulties, fatigue, and other muscles dysfunctions.<sup>15</sup> OMT and myofascial release techniques tend to equilibrate the length of the sarcomeres. On one hand, this action generates hyperemia, and on the other, it induces a central reflex mechanism for muscle spasm relief leading to pain relief.<sup>31</sup> Considering all the above, plus the contribution of myofascial trigger points on patient's pain and disability, a multimodal treatment plan including dry needling and manual therapy techniques should be considered.<sup>32</sup>

By analyzing the results, it seems to be more effective to diagnose the pathology under a function and disability index because, according to a clinical diagnosis, different ranges of pain that are perceived and categorized as pain are not classified under a dysfunction scale. In the same way, the analysis of many therapies should be evaluated

by using a function and disability index.

### Limitations of the study

The results of this research showed a favorable outcome regarding function and disability due to pain. This study was conducted based on diagnosis but did not consider etiologic factors like bruxism.<sup>33</sup> Those factors could require a different type of research bias so results could be different when awake bruxers are included in the exclusion criteria.

An overload due to clenching and grinding may be associated with blood flow, microcirculation, and ischemic pain.<sup>30,33</sup> This situation could make the pain permanent for a long time compared with patients without bruxism. Authors suggest a longer follow-up study to evaluate the results on the effectiveness of the treatment in the long term. It is also suggested to add other instruments for pain evaluation like the algometer, and other groups with different therapeutic alternatives.

### CONCLUSION.

This study suggested that a six-week period of OMT treatment has a clinically significant effect in pain level and degree of dysfunction in patients with MFP, but the diagnosis of the lesion may not vary due to other factors such as bruxism or those related to psychosocial impairments.

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**Conflict of interests:** The authors declare that there is no conflict of interests regarding the publication of this article.

**Ethics approval:** This research was approved by the Ethics Committee of Arturo Prat University, in Victoria, Chile.

**Funding:** None.

**Authors' contributions:** All authors contributed to this manuscript

**Acknowledgements:** The authors thank Dr. Alfredo Gary Bufadel for his expert assistance and Miss Carolina Moreira Parada for kindly correcting the English spelling and grammar of this paper.



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