Revista Cubana de Estomatología
Órgano Oficial de la Sociedad Cubana de Ciencias Estomatológicas
ISSN 1561-297X
Rev Cubana Estomatol. 2022;59(2):e3800

RESEARCH ARTICLE

Effect of neuromuscular deprogramming on quality of life and sleep in patients with temporomandibular dysfunction

Efecto de la desprogramación neuromuscular en la calidad de vida y sueño en pacientes con disfunción temporomandibular

Juan Manuel Guízar Mendoza[1] ✉, Claudia Salinas Escoboza[1], Yuridia Ávalos Equihua[1], Norma Amador Licona[1], Francisco Espinosa Albo[1], Salvador Ferrer Tamburini[1]

ABSTRACT

Introduction: Neuromuscular deprogramming reduces the main symptoms such as pain by 70 to 90% in patients with temporomandibular dysfunction, but little information is available on the effect on quality of life and sleep.

Objective: Determine the effect of neuromuscular deprogramming on quality of life and sleep in patients with temporomandibular dysfunction.

Methods: 55 patients with temporomandibular dysfunction were included who were neuromuscularly deprogrammed (29 women and 26 men), with an average age of 34.9 ± 16.5 years. At the beginning and end of neuromuscular deprogramming, surveys were applied to assess the level of chronic pain, perception of quality of life related to oral health, perceived stress, quantity and quality of life, anxiety and depression.

Results: In 37 patients (68%) pain was identified on examination, and it was confirmed in the chronic pain survey. The quality of life perception score was correlated with low sleep quality (r = 0.39; p = 0.008); pain score (r = 0.48; p = 0.003); anxiety (r = 0.55; p = 0.003) and depression (r = 0.41; p = 0.006). Neuromuscular deprogramming reduced patient-reported pain levels from 9.9 to 2.9 (p = 0.001), the percentage of patients with poor sleep quality from 60% to 29% (p < 0.0001), the quality of life score from 40.7 to 23.8 (p = 0.03), and perceived stress levels from 22.1 to 19.1 (p = 0.002).

Conclusions: In patients with temporomandibular dysfunction, neuromuscular deprogramming reduces the level of pain. It is related to better perception in quality of life, higher quality of sleep and decreases perceived stress.

Keywords: chronic pain; stress; temporomandibular joint; quality of life.

RESUMEN

Introducción: La desprogramación neuromuscular reduce los síntomas principales como el dolor de 70 a 90 % en los pacientes con disfunción temporomandibular, pero se dispone de escasa información sobre el efecto en la calidad de vida y sueño.

Objetivo: Determinar el efecto de la desprogramación neuromuscular en la calidad de vida y sueño en pacientes con disfunción temporomandibular.

Métodos: Se incluyeron 55 pacientes con disfunción temporomandibular que fueron desprogramados neuromuscularmente (29 mujeres y 26 hombres), con edad promedio de 34,9 ± 16,5 años. Al inicio y final de la desprogramación neuromuscular, se aplicaron las encuestas para evaluar el nivel de dolor crónico, percepción de calidad de vida relacionada con la salud oral, estrés percibido, cantidad y calidad de vida, ansiedad y depresión.

Resultados: En 37 pacientes (68 %) se identificó dolor a la exploración confirmado en la encuesta de dolor crónico. El puntaje de percepción de calidad de vida se correlacionó con baja calidad de sueño (r = 0,39; p = 0,008); el puntaje de dolor (r = 0,48; p = 0,003); ansiedad (r = 0,55; p = 0,003) y depresión (r = 0,41; p = 0,006). La desprogramación neuromuscular redujo los niveles de dolor referidos por el paciente de 9,9 a 2,9 (p = 0,001), el porcentaje de pacientes con pobre calidad de sueño de 60 % a 29 % (p < 0,0001), el puntaje de la calidad de vida de 40,7 a 23,8 (p = 0,03) y los niveles de estrés percibido de 22,1 a 19,1 (p = 0,002).

Conclusiones: En pacientes con disfunción temporomandibular, la desprogramación neuromuscular reduce el nivel de dolor, se relaciona con mejor percepción en la calidad de vida, mayor calidad de sueño y disminuye el estrés percibido.

Palabras clave: dolor crónico; estrés; articulación temporomandibular; calidad de vida.

INTRODUCTION

Temporomandibular dysfunction (TMD) is the leading cause of facial pain affecting the chewing muscles and the temporomandibular joint (TMJ).[1] A recent metaanalysis has reported 11.3% prevalence in children and adolescents, and 31.1% in adults/elderlies, and it also reports that the most prevalent TMD was disk displacement with reduction as individual diagnosis.[2] Even it has been reported as high as 79% in students of odontology as a mild level.[3]

Recibido: 12/05/2020
Aceptado: 20/06/2020

[1]De la Salle Bajío University, Faculty of Dentistry, Master in Orthodontics. Guanajuato, Mexico.

The cause is multifactorial, it includes anatomical and psychosocial factors, parafunctional activity and trauma, especially at the occlusal level.[4]

The main symptom of TMD is pain in the orofacial region, an unpleasant sensory and emotional experience significantly associated with a poor perception of quality of life and is the main reason for seeking care.[5] The pain of TMD is one of the idiopathic pain syndromes and more than 50% of these patients report poor sleep quality associated with pain severity and stress level.[6] Furthermore, sleep disturbances and depression are risk factors for TMD and are associated with failure of conservative treatment.[7] The relationship between TMD and sleep disturbances can be explained by alterations in circadian rhythms that favor sensitization of the central nervous system for the amplification in the perception of pain.[8] So, the severity of pain as well as functional limitations of TMD and poor quality of sleep could affect daily activities, quality of life, and general health.

The initial treatment of TMD is intended to reduce pain and increase function, mainly mouth opening. It includes muscle relaxants, laser therapy, thermotherapy, physiotherapy and neuromuscular deprogramming.[9] The neuromuscular deprogramming (NMDP) reduces muscle hyperactivity and symptoms up to 70-90% of patients and increases vertical dimension.[10]

The objective of the present study was to determine the effect of NMDP on quality of life and sleep as a combined effect in patients with TMD.

Methods

An interventional, longitudinal and prospective study was carried out. Patients older than 16 years of age identified in the Orthodontic clinic of the Faculty of Dentistry of the University De La Salle Bajío, from July 2018 to June 2019 with diagnosis of TMD were included. Patients who had used narcotics, antidepressants, anticonvulsants or muscle relaxants two weeks prior to their participation were not included. Those who did not follow the recommended use of occlusal splints, develop systemic diseases or suffer some trauma in the craniofacial region were excluded.

Sample size

It was identified by the MedCalc program that n = 26 patients were required (it was decided to duplicate the number of patients for being a before and after study with its baseline evaluation as the control group) for a mean difference of n = 16 in the total quality of life score between the baseline and the final evaluation, with power of 80% and significance of 0.05. Sample size was also calculated based on the comparison of proportions, expecting that NMDP would decrease by 50% the proportion of poor quality sleep, with power of 80% and significance of 0.05 and found that we needed n = 33 patients per group. So, it was selected the bigger simple size and increased to n = 72 patients considering possible losses to follow-up.

Procedures

The dental evaluation included decayed, missing, filled surfaces/teeth index (DMFT) and the simplified oral hygiene index (OHI-S). The diagnosis of TMD was made by an orthodontic specialist applying the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).[11] Patients were classified according to the next diagnostic category: I) muscular alterations, II) displacement of the TMJ disc and III) bone alterations of the joint.

Through palpation, the muscles of mastication, head and neck, were assessed. The active opening movements evaluation included laterality and protrusión movements, and also the clicking phase during opening and closing. Muscle and joint pain points were evaluated using the Mariano Rocabado pain map.[12] The diagnosis of the TMJ and the confirmation of the diagnosis were complemented with mounting of models in an attempt of centric relation in articulator Panadent®, Condylar Position Indicator (CPI), as well as a panoramic X-ray that included both joints, a 4-shot TMJ X-ray and a lateral skull X-ray.

The pain referred by the patient was measured with the Grading the Severity of Chronic Pain scale (GSCP). Patients chose in a range of 0 to 10 as reflected by the intensity of their pain: 0 being the absence of pain and 10 the highest pain.[13]

The impact of the intervention on Oral health-related quality of life (OHRQoL) was measured using the Oral Health Impact Profile OHIP-Mx-49. It instrument explores seven components: functional limitation, pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. A score of zero indicates the absence of all problems, and higher OHIP scores represent more impaired OHRQoL.[14]

The Pittsburgh Sleep Quality Index (PSQI) measured sleep quality. It contains 19 items and evaluates seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction, each component has a score that ranges from 0 (no difficulty) to 3 (severe difficulty). The scores of the seven components are added to give an overall score, ran-

ging from 0 to 21 points.[15] The subjective evaluation of daytime sleepiness as a complement of the evaluation of sleep, was measured with the Epworth scale validated for the Mexican population. The instrument has 8 items each responding on a scale of 0-3, where 0 means zero probability of falling asleep and 3 high probabilities. The sum of the scores on each item provides the total score, with a range of 0-24. A total score < 10 is considered normal, 10-12 as indicative of marginal sleepiness and > 12 suggestive of excessive sleepiness.[16] For this study, poor quality of sleep was considered in case of both, Pittsburgh score ≥ 8 and Epworth score ≥10.

Before and after treatment, the scale for depression and anxiety, as well as the level of perceived stress, was applied using a validated survey for the Mexican population that includes 14 items, with a maximum score of 56 points.[17]

Neuromuscular deprogramming: At the beginning of the intervention, the models obtained were mounted in an articulator in a tentative centric relationship (Panadent Corp., Grand Terrance, CA, USA) for position registration of CPI. Subsequently, the patients were placed a myorelaxant occlusal splints made with heat-cured acrylic resin (Acron-GC). They were asked to use the attachment continuously (24 hours a day), including chewing food, and to remove it only to perform oral hygiene tasks. At baseline, the fitting of the occlusal splints was made to establish at least one point of contact of each antagonist tooth with the occlusal surface of the occlusal splints, and it was follow by the adjustment of the functional guides every week. Patients used this device up to achieving a stable TMJ. This clinic state was considered when the patient was asymptomatic or there was a significant reduction in symptoms, with easy mandibular manipulation and beneficial change in occlusion. Furthermore, NMDP was confirmed with three wax recordings, close to the centric occlusion of the CPI.

After NMDP, the patient's symptoms, pain level, quality of life, quality of sleep, anxiety, depression and perceived stress were re-evaluated.

Statistic analysis

Descriptive statistics was applied, summarizing the qualitative variables in absolute and relative frequencies and the quantitative variables in means and standard deviation. Data normality was assessed with the Kolmogorov Smirnov test. Numerical variables with normal distribution were compared at the beginning and at the end using the paired student's t test. In cases of lack of normality and the comparison of the level of joint and muscular pain considered an ordinal variable, the non-parametric Wilcoxon test was performed. Nominal categorical variables were compared with the chi-square and McNemar tests. The level of statistical significance was considered with a $p < 0.05$. Data analysis was performed with the SPSS software version 21.

Ethics approval

The protocol was reviewed and approved by the local Ethical and Research Committee as a formally constituted Institutional Review Board (IRB) for human studies (number 2017/06/15 assigned), and it followed the ethical principles of the Declaration of Helsinki(18) updated in 2013 and the General Health Law. Subjects who met the selection criteria and signed the informed consent were included in the study.

Results

72 patients with diagnosis of TMD were included. In 17, NMDP was not achieved because lack of adherence to the treatment or drop out of the study. Therefore, the final analysis was made in 55 patients in whom NMDP was accomplish (29 women and 26 men), with an average age of 34,9 ± 16,5 years.

At the baseline dental evaluation, the mean DMFT index was 12,8 ± 7,9 (range 0 to 24), caries 3,97 ± 4,1, lost 2,19 ± 2,45, and filled 5,28 ± 4,7. Periodontal disease was identified in 26 (47%) patients.

The type of TMD was articular in 7 (13%); muscular in 1 (2%) and mixed in 47 (85%) cases. According to the international classification of the TMD, the diagnoses were subluxation in 23 (41%), degenerative joint disease in 23 (41%), myofacial pain in 7 (13%) and arthralgia in 2 cases (5%).

24 (44%) patients were treated with an upper and in 31 (56%) with a lower myorelaxant occlusal splint. The mean time to achieve NMDP was 8,7 ± 3,2 months (interval 5 to 23 months), with no difference for upper and lower myorelaxant occlusal splint (p = 0,809).

At the initial evaluation, in 37 (68%) patients pain was identified at physical examination. The mean referred pain was 9.9 ± 7.7 and the intensity of muscle pain showed a median of 2 (range 0 to 6) and a median joint pain of 2 (range 0 to 7). Patients with initial pain (n = 37) had a higher score of poor quality of sleep than patients without pain (n = 18) [6,86 vs. 4,72; p = 0,03], respectively. In 33 (60%) of 55 patients, poor sleep quality was identified prior to NMDP. The baseline Pittsburgh sleep quality score correlated with the patient's referred pain score (r = 0,42; p = 0,0001); the pain identified in the pain map (r = 0,49; p = 0,0001), anxiety (r = 0,55; p = < 0,0001) and depression levels (r = 0,41; p = 0,006).

The poor quality of life score at baseline was higher in patients with than in those without sleep disorders (48,1 ± 25,6, versus 30,9 ± 17,7; p = 0,02), and it correlated with the poor quality sleep score (r = 0,35; p = 0,01)

and with the level of referred pain (r = 0,37; p = 0,004).

Although no changes in anxiety and depression were observed with NMDP, perceived stress decreased significantly (table 1).

Table 1 *- Stress, anxiety and depression in patients with temporomandibular dysfunction*

	Baseline n = 55	**Final n = 55**	**p**
Stress	22,1 ± 7,9	19,1 ± 6,5	0,002
Anxiety	5,3 ± 3,3	4,4 ± 2,5	0,103
Depression	4,3 ± 3,2	3,5 ± 2,6	0,097

Values are showed as mean ± SD.

Total Pittsburgh and Epworth scores, the proportion of patients with poor quality of sleep and some of the Pittsburgh´s components, significantly decreased after NMDP (table 2).

Table 2 *- Quality of sleep at baseline and after neuromuscular deprogramming*

	Baseline n = 55	**Final n = 55**	**p**
Sleep efficiency	0,73 ± ,95	0,27 ± ,62	0,35
Sleep duration	0,91 ± ,94	0,60 ± ,76	0,02
Sleep latency	1,18 ± 1,02	0,64 ± ,65	0,003
Sleep disturbance	1,16 ± ,60	0,98 ± ,45	0,28
Subjective sleep quality	1,00 ± ,79	0,73 ± ,78	0,001
Daytime disfunction	0,95 ± ,97	0,55 ± ,76	0,03
Total Pittsburgh score	6,16 ± 3,73	3,89 ± 2,83	0,02
Total Epworth score	8,50 ± 5,19	7,93 ± 4,37	< 0,0001
Poor quality of sleep	33 (60%)	16 (29%)	< 0,001

Values are showed as mean ± SD o as n (%).

The neuromuscular deprogramming reduced the levels of referred pain from 9,9 to 2,9 (p = 0,001), the percentage of patients with poor sleep quality from 60% to 29% (p < 0,0001), the quality-of-life score from 40,7 to 23,8 (p = 0,03) and the levels of perceived stress from 22,1 to 19,1 (p = 0,002) and improved the perception of quality of life by reducing the total score, mainly in the components of functional limitation, physical pain, psychological distress, psychological discomfort and handicap, with no change in physical or social disability (table 3).

Table 3 *- Effects of neuromuscular deprogramming on quality of life*

	Baseline n= 55	**Final n= 55**	**p**
Functional limitation	11,35 ± 6,21	7,17 ± 5,79	0,012
Physical pain	9,98 ± 6,15	5,43 ± 4,79	0,0001
Psychological discomfort	6,06 ± 4,52	3,07 ± 3,35	0,025
Physical disability	6,48 ± 5,35	5,15 ± 5,22	0,570
Psychological disability	4,08 ± 4,83	1,62 ± 2,95	0,004
Social disability	1,55 ± 2,52	0,53 ± 1,69	0,528
Handicap	2,00 ± 3,03	0,96 ± 1,84	0,034
Total score	40,7 ± 22,5	23,8 ± 19,9	< 0,0001

Values are showed as mean ± SD.

Discussion

In the present study, the pain referred and identified on examination was near to 70% and these patients showed a lower quality of life than patients without pain. Furthermore, NMDP reduced the intensity of referred pain as pain in muscle and joint, significantly. The pain associated with TMD is conditioned by changes in the afferent pathways, in the brain structures and in the modulating pathways that amplify its perception and favor its chronicity. Also, the pain and limited oral function associated with TMD is frequently aggravated by adverse emotional conditions such as stress and anxiety.[6,19] The therapy with myorelaxant occlusal splint in NMDP has been the mainstay in the treatment of TMD since it allows the masticatory system to return to a physiological position. It, achieves repositioning of the condyle in the articular fossa in a centric position, increases the vertical dimension, decreases the loads on the TMJ, as well as chewing muscle activity and fatigue, reducing symptoms.[20] It has been reported that after NMDP, both functional alterations and pain can improve between 70% to 90% of cases, according to the diagnosis and severity of TMD and the type of occlusal splint used.[21]

The highest scores in the adverse perception of quality of life related to oral health were pain, functional limitation and physical disability components. The intensity of pain, both perceived and identified on physical examination, correlated with the poor perception of quality of life. After NMDP, there was a significant reduction in the adverse perception of quality of life that correlated with the decrease in pain intensity. Chronic pain has been reported to be the variable that explains up to 48% of the variability of the quality of life perception score.[22] In addition to the pain component, functional problems and physical disability, mainly due to the limitation in chewing capacity, were the factors with the highest score on the scale of adverse perception of quality of life, those who after NMDP showed a significant reduction. Improving chewing ability is related with quality of life and is associated with self-perception of general well-being.[23]

So, it seems that the orthodontic treatment, regardless of the severity of the occlusal problems, sex and socio-economic condition, by improving aesthetic appreciation, reducing pain and increasing functional capacity, improves the perception of quality of life.[24]

Poor quality of sleep is reported in up to 50% of patients with TMD.[6] In the present study, daytime sleepiness was identified in near one third of the participants and sleep quality disorders in six of each ten of them. NMDP reduced the proportion of patients with poor sleep quality related to the decrease in pain intensity, as previously reported.[25] Poor sleep quality increases perception of pain severity and psychological stress, reporting an association between primary insomnia and hyperalgesia in patients with TMD.[26] Patients with sleep disorders had also a high score in the adverse perception of quality of life. Considering that sleepiness and poor sleep quality could keep down daily activities, showing as fatigue, morning headache and affecting cognitive and attention skills, all these affecting work capacity, we can understand its relationship with less quality of life.[27] Sleep disturbances in TMD, in addition to being related to pain, can also be explained by structural alterations of the skull. Hence the importance of improving oral health through correcting structural and functional alterations, which can help to improve alterations in the quality of sleep, decrease daytime sleepiness and consequently improve quality of life.[6]

The close relationship between psychosocial factors, pain and sleep disorders with TMD is evident.[28] After the NMDP, the decrease in pain was related to a lower perception of stress as well as an improvement in the perception of the quality of life and sleep, but not in anxiety and depression. It has been reported that behavioral therapy in the attention of psychosocial factors, should be coadjuvant in the treatment of temporo-

mandibular disorders, since them can be a somatic expression of a psychological disorder.[29] Similarly, visible malocclusion problems with excessive overjet with incomplete lip closure, crowded incisors and large diastemas between the incisors, have been associated with bullying and low self-esteem among adolescents, which mainly affect the emotional and social dimension of quality of life.[30]

A limitation of the study was the small sample size that made not possible to compare the effect of NMDP by type and severity of TMD. However, a strength is that we evaluated the NMDP effects not only on pain or joint function but also on quality of life and sleep, important features for well being at long term. Future studies should evaluate other interventions such as behavioral psychological therapy and physical therapy combined with orthodontic treatment in TMD.

Conclusions

NMDP reduces pain and significantly correlates with better quality of life and quality of sleep in patients with TMD.

References

1. Lomas J, Gurgenci T, Jackson C, Campbell D. Temporomandibular dysfunction. Aust J Gen Pract. 2018;47(4):212-5. DOI: 10.31128/AFP-10-17-4375

2. Valesan LF, Da-Cas CD, Réus JC, Denardin ACS, Garanhani RR, Bonotto D, et al. Prevalence of temporomandibular joint disorders: a systematic review and meta-analysis. Clin Oral Investig. 2021;25(2):441-53. DOI: 10.1007/s00784-020-03710-w

3. do Patrocínio RT, Moura AC, Silva E, Carneiro MS, Tenório GM, Machado da Costa CH. Disfunção temporomandibular e ansiedade em graduandos de Odontologia. Rev Cubana Estomatol. 2019;56(1):42-51.

4. Shroff B. Malocclusion as a Cause for Temporomandibular Disorders and Orthodontics as a Treatment. Oral Maxillofac Surg Clin North Am. 2018;30(3):299-302. DOI: 10.1016/j.coms.2018.04.006

5. Kapos FP, Look JO, Zhang L, Hodges JS, Schiffman EL. Predictors of Long-Term Temporomandibular Disorder Pain Intensity: An 8-Year Cohort Study. J Oral Facial Pain Headache. 2018;32(2):113-22. DOI: 10.11607/ofph.1819

6. Rener-Sitar K, John MT, Pusalavidyasagar SS, Bandyopadhyay D, Schiffman EL. Sleep quality in temporomandibular disorder cases. Sleep Med. 2016;25:105-12.DOI: 10.1016/j.sleep.2016.06.031

7. Selaimen CM, Jeronymo JC, Brilhante DP, Grossi ML. Sleep and depression as risk indicators for temporomandibular disorders in a cross-cultural perspective: a case-control study. Int J Prosthodont. 2006;19(2):154-61.

8. Staniszewski K, Lygre H, Bifulco E, Kvinnsland S, Willassen L, Helgeland E, Berge T, et al. Temporomandibular Disorders Related to Stress and HPA-Axis Regulation. Pain Res Manag. 2018 May 2;2018:7020751. DOI: 10.1155/2018/7020751

9. Wieckiewicz M, Boening K, Wiland P, Shiau YY, Paradowska-Stolarz A. Reported concepts for the treatment modalities and pain management of temporomandibular disorders. J Headache Pain. 2015;16:106. DOI: 10.1186/s10194-015-0586-5

10. Andrighetto AR, de Fantini SM. Effects of neuromuscular deprogramming on the head position. Cranio. 2015;33(3):183-8. DOI: 10.1179/2151090314Y.0000000016

11. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, et al. Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group†. J Oral Facial Pain Headache. 2014;28(1):6-27. DOI: 10.11607/jop.1151

12. Collante C, Álvarez O, Altamirano RH, Modenutti C, Osnaghi M. Diagnóstico diferencial de los transtornos temporomandibulares (T. T. M). Revista Facultad de Odontología. 2013; 6(2):45-50. DOI: http://dx.doi.org/10.30972/rfo.621648

13. Ferrer-Peña R, Gil-Martínez A, Pardo-Montero J, Jiménez-Penick V, Gallego-Izquierdo T, La Touche R. Adaptation and validation of the Spanish version of the graded chronic pain scale. Reumatol Clin. 2016;12(3):130-8. DOI: 10.1016/j.reuma.2015.07.004

14. Castrejón-Pérez RC, Borges-Yáñez SA, Irigoyen-Camacho ME. Validación de un instrumento para medir el efecto de la salud bucal en la calidad de vida de adultos mayores mexicanos [Validation of an instrument for measuring the effects of oral health on the quality of life of older adults in Mexico]. Rev Panam Salud Publica. 2010;27(5):321-9. DOI: 10.1590/s1020-49892010000500001

15. Manzar MD, BaHammam AS, Hameed UA, Spence DW, Pandi-Perumal SR, Moscovitch A, et al. Dimensionality of the Pittsburgh Sleep Quality Index: a systematic review. Health Qual Life Outcomes. 2018;16(1):89. DOI: 10.1186/s12955-018-0915-x

16. Sandoval-Rincón M, Alcalá-Lozano R, Herrera-Jiménez I, Jiménez-Genchi A. Validación de la escala de somnolencia de Epworth en población mexicana [Validation of the Epworth sleepiness scale in Mexican population]. Gac Med Mex. 2013;149(4):409-16.

17. González-Ramírez MT, Rodríguez-Ayán MN, Hernández RL. The perceived stress scale (PSS): normative data and factor structure for a large-scale sample in Mexico. Span J Psychol. 2013;16:E47. DOI: 10.1017/sjp.2013.35

18. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191-4. DOI: 10.1001/jama.2013.281053

19. Chichorro JG, Porreca F, Sessle B. Mechanisms of craniofacial pain. Cephalalgia. 2017;37(7):613-26. DOI: 10.1177/0333102417704187

20. Linsen SS, Stark H, Matthias A. Changes in condylar position using different types of splints with and without a chinstrap: a case-control study. Cranio. 2012;30(1):25-31. DOI: 10.1179/crn.2012.004

21. Fernández-de-Las-Peñas C, Von Piekartz H. Clinical Reasoning for the Examination and Physical Therapy Treatment of Temporomandibular Disorders (TMD): A Narrative Literature Review. J Clin Med. 2020;17;9(11):3686. DOI: 10.3390/jcm9113686

22. Blanco-Aguilera A, Blanco-Hungría A, Biedma-Velázquez L, Serrano-Del-Rosal R, González-López L, Blanco-Aguilera E, et al. Application of an oral health-related quality of life questionnaire in primary care patients with orofacial pain and temporomandibular disorders. Med Oral Patol Oral Cir Bucal. 2014;19(2):e127-35. DOI: 10.4317/medoral.19061

23. Anbarserri NM, Ismail KM, Anbarserri H, Alanazi D, AlSaffan AD, Baseer MA, et al. Impact of severity of tooth loss on oral-health-related quality of life among dental patients. J Family Med Prim Care. 2020 Jan 28;9(1):187-191. DOI: 10.4103/jfmpc.jfmpc_909_19

24. Demirovic K, Habibovic J, Dzemidzic V, Tiro A, Nakas E. Comparison of Oral Health-Related Quality of Life in Treated and Non-Treated Orthodontic Patients. Med Arch. 2019;73(2):113-117. DOI: 10.5455/medarh.2019.73.113-117

25. Piccin CF, Pozzebon D, Corrêa ECR. Sleep problems related to the influence of pain and quality of life in patients with temporomandibular dysfunction. Manual Therapy, Posturology & Rehabilitation Journal. 2015:1-5.

26. Dubrovsky B, Janal MN, Lavigne GJ, Sirois DA, Wigren PE, Nemelivsky L, et al. Depressive symptoms account for differences between self-reported versus polysomnographic assessment of sleep quality in women with myofascial TMD. J Oral Rehabil. 2017;44(12):925-33. DOI: 10.1111/joor.12552

27. Gulia KK, Kumar VM. Sleep disorders in the elderly: a growing challenge. Psychogeriatrics. 2018;18(3):155-65. DOI: 10.1111/psyg.12319

28. Canales GT, Guarda-Nardini L, Rizzatti-Barbosa CM, Conti PCR, Manfredini D. Distribution of depression, somatization and pain-related impairment in patients with chronic temporomandibular disorders. J Appl Oral Sci. 2019;27:e20180210. DOI: 10.1590/1678-7757-2018-0210

29. Iwasaki S, Shigeishi H, Akita T, Tanaka J, Sugiyama M. Efficacy of cognitive-behavioral therapy for patients with temporomandibular disorder pain-systematic review of previous reports. Int J Clin Exp Med. 2018;11(2):500-509.

30. Kragt L, Dhamo B, Wolvius EB, Ongkosuwito EM. The impact of malocclusions on oral health-related quality of life in children-a systematic review and meta-analysis. Clin Oral Investig. 2016;20(8):1881-1894. DOI: 10.1007/s00784-015-1681-3

Conflict of Interest

The authors declare that they have no conflicts of interest.

Author's contributions

Conceptualization: Juan Manuel Guízar Mendoza.
Fund acquisition: Juan Manuel Guízar Mendoza.
Administration: Juan Manuel Guízar Mendoza.
Research: Juan Manuel Guízar Mendoza.
Formal analysis: Juan Manuel Guízar Mendoza, Norma Amador Licona.
Methodology: Claudia Salinas Escoboza, Yuridia Ávalos Equihua, Francisco Espinosa Albo, Salvador Ferrer Tamburini.
Research: Claudia Salinas Escoboza, Yuridia Ávalos Equihua, Francisco Espinosa Albo.
Supervision: Claudia Salinas Escoboza, Salvador Ferrer Tamburini.
Original drafting and editing: Claudia Salinas Escoboza, Yuridia Ávalos Equihua, Francisco Espinosa Albo.
Writing-revision and editing: Juan Manuel Guízar Mendoza, Salvador Ferrer Tamburini.