

EDUVALDO CAMPOS SOARES JÚNIOR

**Alteração do padrão de sono em pacientes portadores de
disfunção temporomandibular sintomática: uma revisão
sistemática**

*Change in the sleep pattern in patients with symptomatic
temporomandibular dysfunction: a systematic review*

Dissertação apresentada à Faculdade
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EPÍGRAFE

"O Dado mais importante que separa o ser humano de todos os seus irmãos e primos da escala filogenética é o conhecimento; só o conhecimento liberta o homem, só através do conhecimento o homem é livre e em sendo livre: ele pode aspirar uma condição melhor de vida para ele e todos os seus semelhantes. Só consigo entender uma sociedade na qual o conhecimento seja a razão de ser precípua que o governo dá para a formação do cidadão. Minha mensagem é de que o homem tem de saber, conhecer e em conhecendo ele é livre".

Enéias Ferreira Carneiro

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Introdução e Referencial Teórico

Desordens Temporomandibular (DTM) é um termo coletivo para um determinado número de problemas clínicos que envolvem a musculatura mastigatória, a articulação temporomandibular, estruturas associadas ou ambos. O dispositivo interoclusal de cobertura total é um tratamento de escolha para o controle da dor em pacientes com DTM.¹

A disfunção temporomandibular (DTM) é definida como um conjunto de distúrbios que acometem os músculos mastigatórios, a articulação temporomandibular (ATM) e suas estruturas associadas.² Apesar de a DTM estar presente em homens e mulheres de todas as faixas etárias, vários estudos constataam uma predominância de DTM nas mulheres, com idades entre 20 e 40 anos, compondo cerca de 80% da população geral.^{3,4,5,6,8} Há uma baixa prevalência de sinais e sintomas em crianças, que vai aumentando gradualmente nos adolescentes e adultos jovens, decrescendo a partir dos 45 anos, sendo rara na população idosa.^{7,9} Os pacientes com DTM são acometidos por uma elevada prevalência de sinais e sintomas, capaz de causar um prejuízo nas esferas da vida social, familiar e profissional, o que acarreta um impacto negativo na sua qualidade de vida⁶. Estudos observacionais constataram através de uma avaliação psicológica realizada com 20 pacientes com problemas na ATM, a presença de dor em 100% dos casos, e a presença de conflitos nas áreas: familiar (90%), afetiva (95%), profissional (45%) e social (95%).^{6,10,11}

A dor é o sintoma mais comum relatado pelos pacientes, sendo geralmente localizada nos músculos mastigatórios, na região pré-auricular e na ATM.¹² Outros sinais e sintomas incluem: limitação dos movimentos mandibulares, ruídos articulares e cefaléia.⁶ Entre 40% e 60% dos indivíduos na população geral apresentam algum tipo de DTM, apesar de não relatarem queixas de algum sintoma relacionado, e isto se deve à presença de sinais subclínicos que não são relatados como sintomas pelos pacientes.¹³

Atualmente, a DTM é explicada através do modelo etiológico multifatorial, em que vários fatores são aceitos em sua determinação.¹³ Apesar de existir um consenso em relação à multifatorialidade, há pouca concordância em relação à importância dos fatores etiológicos envolvidos, e ainda não se sabe até que

ponto estes fatores podem ser considerados predisponentes, desencadeantes ou perpetuantes.^{9,13}

A DTM pode se apresentar como uma condição de dor aguda ou crônica, podendo ainda estar associada a outras condições de dor crônica, tais como: cefaléia tensional, fibromialgia, síndrome da fadiga crônica e a síndrome do intestino irritável^{14,15,16}. Importante ressaltar que estas doenças são caracterizadas por anormalidades neuroendócrinas, distúrbios biopsicossociais frequentes e queixas, incluindo fadiga, ansiedade, depressão e distúrbios do sono^{14,15,16}.

O sono é uma atividade que ocupa de um terço à metade de nossas vidas sendo fundamental para uma boa saúde mental e emocional, além de ser essencial na manutenção saudável do organismo. Os padrões eletroencefalográficos bem como a duração dos diferentes estágios de sono modificam-se ao longo da vida e, por sua vez, pessoas com idades e estágios de vida diversos, também apresentam necessidades individuais, sugerindo que o sono tenha múltiplas funções¹⁷.

A dor, quando associada tanto a despertares do sono quanto a outros marcadores de instabilidade de sono, identificados de forma subjetiva (auto-relato) ou objetiva (polissonografia), podem prejudicar a qualidade do sono.^{9,10,11,12} Embora a literatura descreva que tanto a privação crônica de sono quanto a baixa qualidade de sono, podem induzir a hipersensibilidade dolorosa, exacerbar respostas dolorosas além de alterar os estágios de humor, os mecanismos fisiopatológicos desta relação ainda não estão estabelecidos.^{19,20,21,22}

Sabe-se que os distúrbios do sono prejudicam a qualidade de vida e são uma das comorbidades mais prevalentes entre indivíduos com dor crônica.²⁰ A literatura descreve que 50 a 70% destes pacientes apresentam também algum tipo de distúrbio do sono.^{20,23} A dor pode estar associada a uma instabilidade no sono, quebra na continuidade dos ciclos de sono NREM - REM, além da fragmentação excessiva do sono, aumentando a percepção de sono não-reparador.²⁰

A relação entre dor e a baixa qualidade de sono é considerada bidirecional, sono de baixa qualidade exacerba a dor, enquanto que níveis aumentados de

dor afetam o sono²⁴ . Os distúrbios do sono têm sido implicados como fatores perpetuantes em pacientes com DTM não respondedores e com resultados ruins de tratamento^{25,26}, enquanto que, a baixa qualidade de sono é considerada um preditor consistente para a dor.²⁷

Com relação a dor orofacial crônica, de uma forma em geral, sabe-se que 66% dos pacientes relatam distúrbios do sono e 77% relatam uma redução na qualidade do sono desde o início de sua dor.^{16,18,28,29,30} Entretanto, de uma forma mais específica, os estudos que avaliam a relação entre sono e dor nos pacientes portadores de DTM ainda são poucos.³⁰

CAPÍTULO

ARTIGO 1

Alteração do padrão de sono em pacientes portadores de disfunção temporomandibular sintomática: uma revisão sistemática.

Change in the sleep pattern on patients with symptomatic temporomandibular dysfunction: a systematic review.

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Alteração do padrão de sono em pacientes portadores de disfunção temporomandibular sintomática: uma revisão sistemática

Change in the sleep pattern on patients with symptomatic temporomandibular dysfunction: a systematic review

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RESUMO

Este trabalho visa sintetizar os resultados obtidos por estudos sobre a qualidade do sono em indivíduos portadores de disfunção temporomandibular sintomática. Esta revisão sistemática seguiu as orientações do PRISMA e está registrada na base de dados PROSPERO. A busca de dados foi feita de maneira individualizada e detalhada nas principais bibliotecas eletrônicas, sem limite de ano, sendo incluídos estudos observacionais, com restrição da linguagem em inglês e português. A extração de dados foi realizada de forma independente por dois revisores. As extrações, sumarização, análise qualitativa e avaliação do risco de viés foram feitas utilizando a ferramenta Newcastle-Ottawa Quality Assessment Scale [NOQA] para estudos observacionais. 749 artigos foram selecionados, e após aplicado os critérios de elegibilidade, 20 estudos foram selecionados para inclusão. Os artigos escolhidos estão entre 2009 e 2021, e visam responder a pergunta em formato PICO: “Os pacientes portadores de disfunção temporomandibular sintomática apresentam prejuízo na sua qualidade de sono?” O risco de viés mostra estudos com baixo risco, e outros com incerteza ou risco alto. Dos 20 estudos incluídos para análise detalhada, 8 utilizaram a polissonografia para investigar potenciais distúrbios do sono e suas relações com os níveis de dor. Dos 11 estudos que utilizaram o questionário de Pittsburgh, 11 relatam um comprometimento importante na qualidade do sono, e 3 avaliou a cefaléia tensional descrevendo a correlação da DTM com ansiedade. Os resultados desta revisão sugerem que a qualidade do sono deve ser investigada nos pacientes portadores de DTM, e o tratamento influencia positivamente na resolução da dor.

Palavras-chave: Qualidade de Sono, Disfunção Temporomandibular, Questionário de Pittsburgh, distúrbios do sono, dor

ABSTRACT

This study aims to summarize the results obtained from studies on sleep quality in individuals with symptomatic temporomandibular disorders. This systematic review followed PRISMA guidelines and was registered in the PROSPERO database. The search for data was carried out individually and in detail in the main electronic libraries, with no year limit, and observational studies were included, with language restriction in English and Portuguese. Data extraction was performed independently by two reviewers. The extractions, summarization, qualitative analysis and risk of bias assessment were performed using Newcastle-Ottawa Quality Assessment Scale [NOQA] for observational studies tools. 749 articles were selected, and after applying the eligibility criteria, 20 studies were selected for inclusion. The articles chosen included are between 2009 and 2021, and aim to answer the question in PICO format: “Do patients with symptomatic temporomandibular dysfunction present impairment in their sleep quality?” The risk of bias shows studies with low risk, and others with uncertainty or high risk. Of the 20 studies included for detailed analysis, 8 used polysomnography to investigate potential sleep disturbances and their relationship to pain levels. Of the 11 studies that used the Pittsburgh questionnaire, 11 reported an important impairment in sleep quality, and 3 evaluated tension headache by describing the correlation of TMD with anxiety. The results of this review suggest that sleep quality should be investigated in patients with TMD, and treatment positively influences pain resolution.

Keywords: Sleep quality; Temporomandibular disorder; Pittsburgh Sleep Quality Index; Sleep disturbance, Pain

Introduction

Temporomandibular disorder (TMD) affects 5 to 12% of the population and is often associated with chronic orofacial pain.¹ TMD may present as an acute or chronic pain condition, and it may also be associated with other chronic pain conditions, such as: tension headaches, fibromyalgia, chronic fatigue syndrome and irritable bowel syndrome.^{5,6,7} Important emphasize that these diseases are characterized by neuroendocrine abnormalities, frequent biopsychosocial disorders and complaints, including fatigue, anxiety, depression and sleep disorders.^{5,6,7}

Sleep is an activity that occupies one third to half of our lives, being fundamental for good mental and emotional health, as well as being essential for the healthy maintenance of the organism. Electroencephalographic patterns as well as the duration of different sleep stages change throughout life and, in turn, people with different ages and life stages also have individual needs, suggesting that sleep has multiple functions.⁸

Pain, when associated with both awakenings from sleep and other markers of sleep instability, identified subjectively (self-report) or objectively (polysomnography), can impair sleep quality.^{9,10,11} Although the literature describes that both chronic sleep deprivation and poor sleep quality can induce painful hypersensitivity, exacerbate painful responses in addition to altering mood stages, the pathophysiological mechanisms of this relationship are not yet established.^{9,10,11,12}

It is known that sleep disorders impair quality of life and are one of the most prevalent comorbidities among individuals with chronic pain.¹⁰ The literature describes that 50 to 70% of these patients also have some type of sleep disorder.^{10,13} Pain can be associated with sleep instability, break in the continuity of NREM-REM sleep cycles, in addition to excessive sleep fragmentation, increasing the perception of non-restorative sleep.¹⁰

Non-restorative sleep is a subjective report by the patient, described as restless, light, of poor quality or not sufficiently restorative, even though it is within the normal range of polysomnographic examinations, similar to what we know as paradoxical insomnia.¹⁴

The relationship between pain and poor sleep quality is considered to be bidirectional, poor sleep exacerbates pain, while increased levels of pain affect sleep.¹⁹ Sleep disturbances have been implicated as perpetuating factors in non-responders and

TMD patients. with poor treatment results.^{20,21} While poor sleep quality is considered a consistent predictor for pain.²²

Regarding chronic orofacial pain, in general, it is known that 66% of patients report sleep disturbances and 77% report a reduction in sleep quality since the onset of their pain.^{1,7,23,24,25} However, more specifically, studies evaluating the relationship between sleep and pain in patients with TMD are still few.

Understanding that changes in sleep patterns can potentiate painful symptoms and interfere with therapeutic results, the objective of this systematic review was to identify, evaluate and synthesize the results of studies conducted on the quality of sleep of individuals with symptomatic temporomandibular disorders (TMDs) . The clinical question in “PICO” format in our study was: “Do patients with symptomatic temporomandibular disorder present impairments in their sleep quality?”

Materials and Methods

This review adhered to the PRISMA checklist, Systematic Review Methodology, which establishes guidelines and steps for it to be carried out, emphasizing randomized clinical trials, observational studies, and can be used as a basis for reports of systematic reviews of other types of research.²⁶ Registered with PROSPERO with number CRD42018083875 (<http://www.crd.york.ac.uk/PROSPERO>).

Eligibility Criteria

This review included studies that evaluated the effect of pain on sleep quality in individuals with symptomatic temporomandibular disorders. The TMD diagnosis must have been made using the RDC/TMD and DC/TMD. The studies analyzed included full-night polysomnography performed in a sleep laboratory and/or the Pittsburgh Questionnaire.

Search Strategy

The data search was carried out in an individualized and detailed manner, developed in the following databases: Cochrane, Medline, PubMed and Lilacs. The search strategy included “Mesh” terms. There was no restriction on the date of

publication. A manual search was also performed to add other articles that were not tracked in the electronic search. The terms used are described (Table 1), and different combinations were used using Boolean operators “AND” and “OR” for the search.

Two reviewers (M.B.P.C and T.C.A.C) independently performed the reading of titles and abstracts; and in case of divergence, a third reviewer (E.C.S.J) was selected for evaluation and reading, in order to reach a definitive consensus on whether or not to include the article.

The PICO strategy (P = patient/population problem; I = intervention; C = comparison; O = outcome) used to guide the development of this review and the search in the literature was:

P: patients with TMD diagnosed by the RDC/TMD or DC/TMD;

I: polysomnography and/or Pittsburgh Questionnaire;

C: patient with TMD and patient without TMD;

O: change in physiological sleep pattern.

Inclusion Criteria

Was used as inclusion criteria, studies that: (a) differentiated patients with symptomatic TMD, with and without changes in sleep pattern; (b) polysomnography exams for sleep assessment; (c) without restriction of age, gender and year of publication; (d) original language in English or Portuguese; (e) prospective and retrospective studies; (g) human studies.

Exclusion Criteria

As exclusion criteria, studies that: (a) studies of review types; (b) letters; (c) conference abstracts; (d) patients with craniofacial deformities, genetic syndromes or neuromuscular diseases.

Selection of Studies

The titles and abstracts of the articles selected for this research were independently evaluated by the reviewers, following the established inclusion criteria. Articles that did not have their inclusion coincided, a discussion was held among the reviewers to reach a

resolution. The complete versions of the selected articles were obtained for reading. If the title and abstract did not provide sufficient information about the inclusion criteria, the full text was obtained and read so that a decision could be made. For the full texts included in the quantitative analysis, data extraction was performed independently by the reviewers (Fig 1).

Risk of Bias in Individuals Studies

Two reviewers [E.C.S.J and P.C.S.J] evaluated 20 studies were selected for analysis, and risk of bias assessment. The tool Newcastle-Ottawa Quality Assessment Scale [NOQA] for an Observational Studies developed by Well et al., was used, in which 3 criteria are analyzed in each study, in a total of 9 subdivisions (Table 2). Each criterion receives an evaluation in which 1 point is assigned in the corresponding item, totaling 9 points. The points awarded for each quality item served as a quick visual assessment.

Data Extraction

Data were independently extracted by the reviewers, obtaining the following items: (1) year; (2) author; (3) title; (4) publication periodical; (6) study design; (7) number of research participants; (8) sleep analysis method; (9) DTM type; (10) pain analysis method; (11) type of pain scale used; (12) results obtained; and (13) conclusion after sleep analysis (Table 3).

Results

The 20 selected studies present as a characteristic in their methodologies the correlation between pain and sleep quality in individuals diagnosed with temporomandibular disorders (TMD). As a general design, the studies presented a sample of 10,234 patients diagnosed with TMD and 464 control patients. The year of publication of the included studies ranged from 2009 to 2021. As a method of assessing sleep quality, we used: Polysomnography (PSG)^{24,30,32,33,38,39,40,41}, ISI (Insomnia Severity Index)⁴⁰, SIS-D (Structure Interview Sleep Disease)²⁴, PSQI (Pittsburgh) Sleep Quality Index)^{29,31,32,34,36,37,42,43,44,45,46,47}, DASS-21 (Depression Anxiety Stress Scales-

21)^{31,36,43,44,46}, VAS (Visual Analog Scale)^{23,29,30,32,33,35,40} and OHRQoL (Oral-Health Related Quality of Life)^{45,46}.

Pain analysis methodologies were used BPI (Brief Pain Inventory)^{42,47}, SCL-90R (Symptoms Checklist 90-Revised)^{42,47}, PCS (Pain Catastrophizing Scale)^{42,47}, RDC-TMD (Research Diagnostic Criteria for Temporomandibular Disorder)^{24,34,37,38,39,43,44,45,46}, DNIC (Diffuse Noxious Inhibitory Control)^{41,32} and OHIP-TMD (Oral Health Impact Profile for Temporomandibular Disorder)^{31,45,46}. Nine (45%) studies evaluated muscle TMDs only, while 11 (55%) sought to assess muscle, joint and combined TMDs.

The incidence of poor sleep quality related to pain in TMDs was described in all studies. Eight studies^{24,30,32,33,38,39,40,41} in which PSG was the diagnostic test of sleep quality demonstrate that when diagnosing sleep disorders, polysomnography should be performed to determine the level of this change. A study relates poor sleep quality to pain as a potentiating factor for obstructive sleep apnea and primary insomnia⁴⁰. Twelve (60%) studies used the PSQI as a sleep quality diagnostic questionnaire, demonstrating the correlation between pain and sleep as an intensifying factor for anxiety, depression and stress^{29,31,32,34,36,37,42,43,44,45,46,47}. Seven case-control studies sought to correlate sleep quality with episodes of pain in TMDs, and in two of them myofascial pain is related to greater sleep fragmentation and low quality^{23,31,32,33,34,38,45}. One of them related a worsening of sleep quality in cases of combined TMDs (muscle and joint)⁴⁵. A case-control study in which 2 types of muscular TMD (moderate [9.4%] and mild [32.4%]) and healthy [58.2%] were evaluated, it was observed that in the control group [51, 4%] and [69.6%] test group had poor sleep, and when comparing the groups, it is observed that TMD severity is related to quality of life and emotional state, influencing sleep quality³¹.

A case-control study compares two sleep quality assessment methods PSG and PSQI in which the poor sleep quality presented by TMD patients on the PSQI is more related to depressive symptoms than the results of polysomnography³². An observational study in patients with chronic pain in which the VAS method was applied to assess the quality of sleep and pain in a heterogeneous group of TMDs being articular [42.7%], headache [23.6%], neuropathic [18.5 %], trigeminal neuralgia [8.0%] and post-traumatic neuropathic pain [7.0%], identified that health comorbidities, nocturnal awakenings and pain are related to sleep quality and negatively influencing quality of life³⁵.

Discussion

The results of this systematic review converge to a significant association between painful TMD and sleep quality. In the general context, there is a wide variability between studies in terms of samples, different criteria for assessing pain and ways of classifying or subclassifying TMD, which makes comparisons and conclusions somewhat challenging. As for the sleep quality evaluation criterion, the most used instrument was the PQSI (12 of the 20 studies included). The relationship between sleep problems and pain is a significant and impactful conclusion on the quality of life of patients in the studies.

Of the articles that used the PSQI as a tool to assess sleep quality, there is unanimity in the descriptions of poor sleep quality in patients diagnosed with TMD, when compared to patients without TMD^{29,31,32,34,36,37,42,43,44,45,46,47}. However, we observed different methodological criteria for pain assessment in patients with TMD, which can be a confounding factor when seeking standardization of criteria. These authors^{23,29,30,31,32,35,41,42,47} observed statistically significant differences in the total score of the questionnaire, as well as in the indices of subjective sleep quality, sleep disturbances and daytime dysfunction. Evaluating axis II of the RDC, the authors^{33,34,36,44,45,46} observed a severity in TMD, also related to quality of life, emotional states (DASS-21)^{31,36,44,45,46}, especially in those with symptomatic TMD, being these factors: depression, anxiety and stress.

A point of convergence in most studies is the subdivision of TMD cases (muscular, joint and combined) in which the correlation between painful TMD symptoms and sleep quality in these groups is sought. Combined TMDs were more associated with high levels of pain and poor sleep quality than other TMDs alone. One of the most prevalent factors in these situations is the psychosocial association of patients, as something that enhances the symptoms, functioning as a “vicious” circle .

The authors^{29,30,31,32,34,36,42,47} who sought to assess pain through other tools, converged to psychosocial factors as a criterion to intensify pain. painful picture as well as reducing the quality of sleep. The main results among the psychosocial factors were pain catastrophizing , stress, anxiety and psychological stress. Sleep and pain can be seen

from the circular perspective, that is, pain generates poor sleep, which will consequently lead to a day of exacerbated pain, not reaching restful sleep, therefore, it will not achieve the benefits of restful sleep.

A retrospective study evaluated medical records by collecting information about patients diagnosed with chronic pain. Through the VAS, values from zero to ten were assigned to pain, as well as applying it to sleep quality, identifying the most varied types of pain: joint pain, headache, neuropathic, trigeminal neuralgia and post-traumatic neuropathic pain. It identified that the poor quality of sleep associated with pain leads to a reduction in the quality of life, directly influencing general and mental health and the development of work functions, requiring a multidisciplinary intervention³⁵.

The relationship between chronic pain and sleep disturbances remains to be elucidated; PSG is the gold standard for assessing the sleep architecture and can be used for an objective diagnosis of sleep patho-physiology^{24,38}. Despite the wide availability of sleep disorder centers in the USA, PSG remains expensive. General practitioners are increasingly aware of sleep disorders, but they often identify more patients with suspected sleep disorders than they can reasonably refer for full sleep-laboratory investigations. There is, therefore, a need for triage questionnaire that can be used to distinguish high-risk patients from the larger group of patients that the general practitioner believes possess some of the symptoms of sleep disorder²⁴. In the study by Dubrovsky, 2014, it was evidenced that patients with symptomatic and healthy muscle TMD had stage N1 and the number of awakenings associated with increased respiratory events (RERA), as well as low sleep efficiency. In the study by Smith, 2009, it was observed that 43% of patients with symptomatic muscle TMD had sleep disorders, 36% insomnia, 28.4% obstructive sleep apnea, with PSG being the test of choice for diagnosis of sleep disorders. sleep.

Two studies sought to evaluate another parameter within the TMDs, which is sleep bruxism (SB), using PSG and EAD as an evaluative criterion for pain as a sleep quality assessment methodology^{23,24}. Contradicting the other authors, the authors identified that the number of SB events per hour of sleep were inversely proportional to pain levels in patients with TMD. Another factor that influences the intensity and presence of generalized pain in patients with SB is high age.

Due to the variability of studies, samples, different groupings, different methodologies for assessing TMD, pain and sleep, it was considered a limiting factor of this review. However, painful manifestations in TMD have a high impact on sleep quality

and vice versa. The methodologies used in the studies to assess pain levels are diverse, which may represent a confounding factor in the comparative criteria between the studies. Some instruments use visual scales to determine pain intensity or questionnaires (VAS; DC-TMD; BPI; PCS; SCL-90R), others deal with psychosocial issues (DASS-21; OHRQoL; OHIP-TMD).

Sleep disorders can worsen TMDs as well as the opposite, so these changes must be treated and monitored preventively, with primary interventions. Public health actions such as campaigns that help improve sleep quality, physical exercises, tools capable of measuring sleep stages, heart rate at night, can help improve sleep quality. Observational studies are subject to the most varied types of design, which may represent a high degree of heterogeneity, limiting comparisons between groups and types of studies. Research that seeks to intervene directly with the patient, such as randomized clinical trials with blinding, may present more assertive responses to TMD diagnostic methods, sleep, establishing new and more protocols with a high degree of reliability.

Conclusion

Considering the high prevalence of sleep disorders reported by studies that used polysomnography as a diagnostic tool, as well as the impact on subjective sleep quality described in studies that used the Pittsburgh questionnaire, the results of this systematic review suggest that sleep quality should be investigated in patients with temporomandibular disorders. The authors also suggest that individuals with clinical complaints regarding sleep quality should be referred for polysomnography. The treatment of sleep disorders can positively impact the clinical picture of chronic pain described by individuals with the pathology object of this research.

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Subtitles

Figure 1. Flow Diagram of Literature search and selection criteria

Table 1. List of terms used in the bibliographic search.

Table 2: Newcastle-Ottawa Quality Assessment Scale [NOQA] for a Observational Studies.

Table 3. Descriptive summary of the characteristics of the included articles (n=20)

Abbreviations and Acronyms

VAS: Visual Analog Scale;

OHIP-TMD: Oral Health Impact Profile for Temporomandibular Disorder;

PSG: Polysomnography;

PSQI: Pittsburgh Sleep Quality Index;

DASS-21: Depression Anxiety Stress Scales-21;

ISI: Insomnia Severity Index;

SIS-D: Structure Interview Sleep Disease;

RDC-TMD: Research Diagnostic Criteria for Temporomandibular Disorders;

BPI: Brief Pain Inventory;

PCS: Pain Catastrophizing Scale;

SCL-90R: Symptoms Checklist 90-Revised;

OHRQoL: Oral-Health Related Quality of Life;

DNIC: Diffuse Noxious Inhibitory Control;

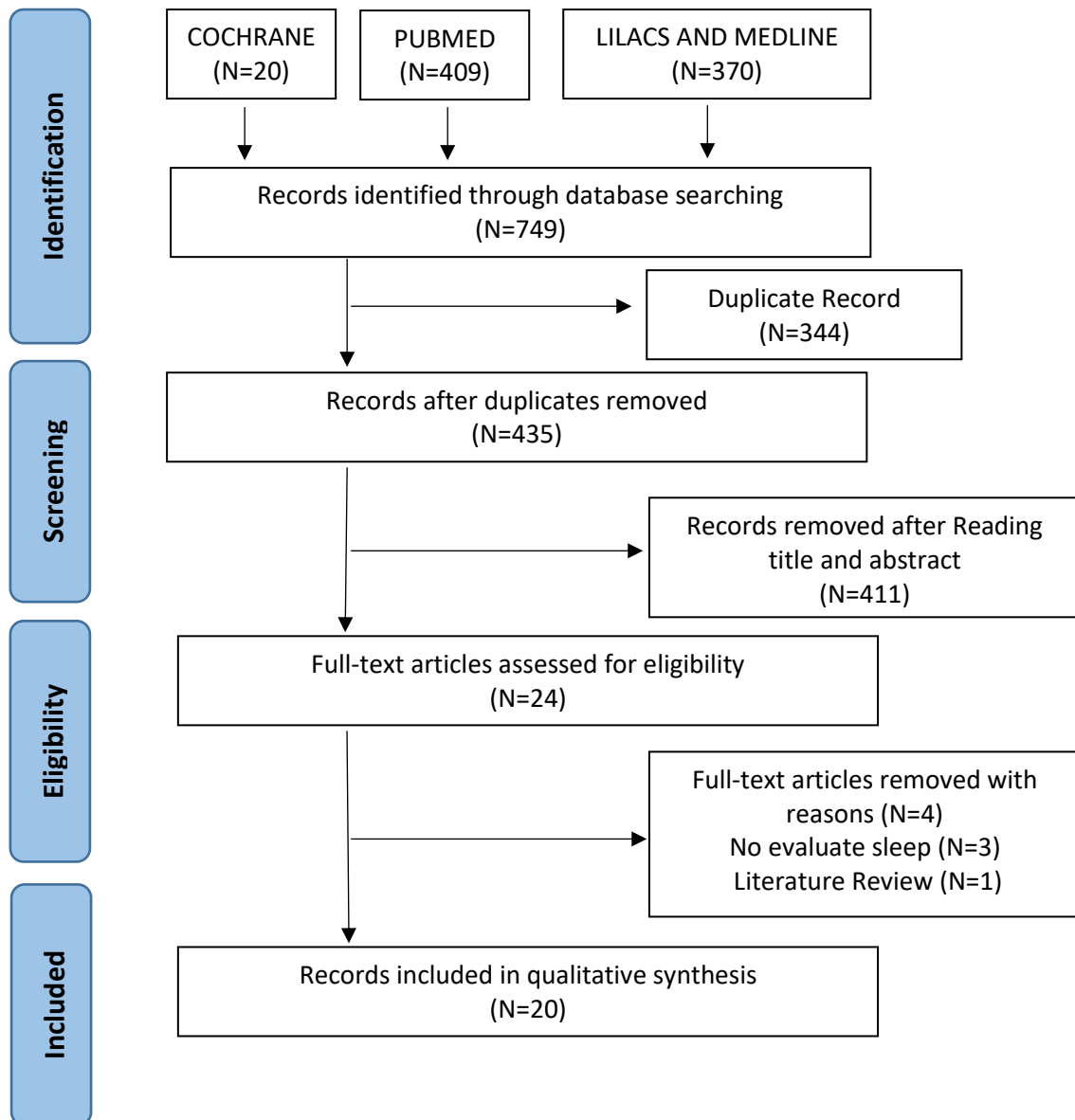


Figure 1. Flow Diagram of Literature search and selection criteria

Table 1. List of terms used in the bibliographic search.

Database	Terms
#1	"temporomandibular joint disorders"[Mesh] OR "TMD" AND "sleep" OR "sleep disorders" OR "insomnia"
#2	"temporomandibular joint disorders"[Mesh] OR "TMD" AND "sleep" OR "sleep disorders"
#3	"temporomandibular joint disorders" [Emtry] OR "temporomandibular joint disease" AND "sleep" OR "sleep disorders" OR "anxiety"
#4	"temporomandibular disorder" [Subheading] OR "associated disease" OR "coexistent conditions" OR "TMD" AND "concomitant conditions" OR "concomitant disease" OR "sleep" OR "sleep disorders" OR "insomnia"
#5	#1 AND #2 AND #3 AND #4

Table 2: Newcastle-Ottawa Quality Assessment Scale [NOQA] for a Observational Studies.

Studies	Items								Score	%
	Selections				Comparability	Expousure/Outcome				
	1	2	3	4		1	2	3		
Edwards et al., 2009	-	-	-	-	●●	●	-	-	3/9	33,3
Smith et al., 2009	-	-	-	●	●	●	●	-	4/9	44,4
Quartana et al., 2010	-	-	-	●	●	●	●	-	4/9	44,4
Raphael et al., 2013	-	-	-	●	●	●	●	-	4/9	44,4
Dubrovsky et al., 2014	-	-	-	●	●	●	●	●	5/9	55,5
Dias et al., 2015	●	●	-	-	●●	●	●	-	6/9	66,6
Lei et al., 2016	-	-	-	-	●	●	-	-	2/9	22,2
Rener-Sitar et al., 2016	●	●	●	●	●	●	●	-	7/9	77,7
Haviv et al., 2017	-	-	-	-	●	●	●	-	3/9	33,3
Siqueira et al., 2017	-	-	-	-	●	●	●	-	3/9	33,3
Dubrovsky et al., 2017	●	-	●	●	●●	●	●	-	7/9	77,7
Natu et al., 2018	●	●	-	-	●	●	●	-	5/9	55,5
Lee et al., 2018	●	●	-	-	●	●	●	-	5/9	55,5
Wagner et al., 2018	-	●	-	-	●	●	●	-	4/9	44,4
Kim et al., 2019	●	●	-	-	●	●	-	-	4/9	44,4
Cao et al., 2020	●	●	-	-	●	●	●	●	6/9	66,6
Yap et al., 2020	●	-	-	-	●	●	-	-	3/9	33,3
Yap et al., 2021	●	●	-	●	●●	●	●	-	7/9	77,7
Lei et al., 2021	●	●	-	-	●	●	●	●	6/9	66,6
Kim et al., 2021	-	●	-	-	●	-	-	-	2/9	22,2

Table 3. Descriptive summary of the characteristics of the included articles (n=20)

Year	Author	N° of patients	Type of TMD	Pain Analysis Method	Sleep Analysis Method	Main Results	Conclusion
2021	Kim et al.	131 DTM	Symptomatic muscular TMD	PROs BPI SCL-90R PCS	PSQI	There was a correlation between high pain levels and poor sleep quality. Individuals with mandibular movement limitations and pain catastrophizing, as well as stress, have a worsening pain picture as well as reduced sleep quality	Mandibular functional limitations are associated with biopsychosocial factors, cardiac disease factors, poor sleep quality, and are aggravated by symptomatic TMD.
2021	Lei et al.	1079	Muscular TMD, Intra-articular Disorders and Combined TMD	DC-TMD OHIP-TMD	PSQI and DASS-21 OHRQoL	There was a significant prevalence of emotional stress associated with poor sleep quality in the muscle and combined TMD groups compared to the joint disorder group.	Symptomatic TMD is associated with high levels of emotional stress as well as poor sleep quality. TMD-related pain directly interferes with quality of life, and increases the individual's stress, thus increasing symptomatic TMD.
2021	Yap et al.	845 DTM 116 Control	Muscular TMD, joint TMD and combined TMD	DC-TMD	PSQI	Patients who presented TMD combined with pain symptoms also showed worse sleep quality. Among the combined TMD pictures, the association of myalgia with the presence of arthralgia was observed.	Sleep quality is worse in cases of combined TMD (muscle and joint pain).
2020	Yap et al.	420 DTM	Muscular TMD, joint TMD and combined TMD	DC-TMD OHIP-TMD	PSQI and DASS-21 OHRQoL	High levels of depression, anxiety, and stress were observed in the combined TMD group compared to the others (joint TMD and muscular TMD). There was statistical significance in the group with symptomatic combined TMD related to poor sleep quality.	Patients who have associated muscular and joint TMD have more evident levels of emotional disturbance and poor sleep quality than TMD groups alone.
2020	Cao et al.	830 DTM	Muscular TMD, joint TMD and combined TMD	DC-TMD	PSQI and DASS-21	High levels of anxiety, depression, stress, and poor sleep quality are related to TMD. There was a higher prevalence of pain in the group in which previous pain was reported, compared to joint disorders, with this group being statistically significant	Chronic TMD with reported pain is associated with high levels of psychological stress and reduced sleep quality.
2019	Kim et al.	1488	Muscular TMD, Joint TMD, Combined TMD	BPI PCS SCL-90R	PSQI	There were significant differences between pain experience, pain catastrophizing, and psychological stress in the three groups. Sleep quality was directly associated with TMD, with prevalence in females with intense pain catastrophizing.	The types of pain present in TMD reflect directly on the biopsychosocial characteristics, amplifying the perception of pain, causing greater stress, and reducing the quality of sleep of the individuals.
2018	Wagner et al.	80	Muscular TMD, Joint TMD, Joint disc dysfunction	VAS - 0 to 10	PSQI	They did not observe a relationship between sensory-type headache and	TMD and anxiety are associated with tension-type headaches.

						poor sleep quality, as well as with bruxism	
2018	Lee et al.	3276	45.9% joint disorders 40.6% muscle disorders 13.5% other conditions	VAS - 0 to 10	PSG	The greater the pain intensity, the greater the number of awakenings, the longer the latency to sleep, and the lower the sleep efficiency. It showed no correlation between pain intensity and total sleep time.	TMD patients suffer from sleep deprivation just like patients with other types of chronic pain. The vigil-sleep relationship and sleep quality are strongly associated with TMD and provincial pain Clinicians treating TMD should investigate sleep disturbances.
2018	Natu et al.	102 DTM 142 Healthy	32.4% Mild TMD 9.4% Moderate TMD 58.2% Healthy	OHIP-TMD	PSQI and DASS-21	Of the 142 participants who did not have TMD (48.5% had good quality sleep and 51.4% had poor quality sleep) Of the 102 participants with TMD, 30.3% have good quality sleep, while 69.6% have poor quality sleep. Comparing the groups with and without TMD, statistically significant differences were observed between the groups for the subjective sleep quality, sleep disturbance, daytime dysfunction and total PSQI scores. The OHIP-TMD demonstrated a statistically significant difference in the parameters functional limitation, physical pain, psychological discomfort.	TMD patients have poor sleep quality. The severity of TMD is related to poor quality of life, poor quality of sleep, and emotional states. Symptomatic TMD sufferers have higher rates of depression, anxiety and stress.
2017	Dubrovsky et al.	124 DTM 26 Controls	Muscular TMD	VAS	PSG and PSQI	TMD patients had worse subjective sleep quality compared to controls on the PSQI. High scores on the PSQI was predictive of more depressive symptoms. The rate of arousals in the total sample and the latency to REM in TMD patients are related to the increased PSQI scores. The presence of TMD and pain levels were not significantly related to the PSQI	The poor sleep quality reported by TMD sufferers on the PSQI is more related to depressive symptoms than to polysomnographic findings.
2017	Siqueira et al.	20 Bruxism and TMD	Muscular TMD	VAS	PSG	Patients with generalized pain had lower sleep efficiency and higher age compared to patients without generalized pain. Both Axis I and Axis II by RDC-TMD and BS parameters on PSG were similar in both groups	It is important to consider both age and the presence of generalized pain when evaluating patients with BS and TMD.
2016	Renner-Sitar et al.	609 DTM 88 Control	Muscular TMD TMD Articular	RDC-TMD	PSQI	DTM-PSQI = 7.0 Control-PSQI = 5.2 TMD without pain - PSQI = 5.1 (similar to control)	The quality of sleep is worse in patients who have TMD associated with pain, being worse in patients who have dysfunctional pain. This relationship between sleep and pain suggests that sleep quality should be

						TMD with pain - PSQI = 7.5	evaluated in patients with painful TMD, especially those with significant Axis II involvement.
						Although the number of TMD types and age influenced sleep quality, psychosocial status and pain-related impairment as assessed by DRC axis II were more associated with sleep quality, in particular chronic dysfunctional pain.	
2017	Haviv et al.	200 chronic pain	Articular (85) [42.7%]. Headache (47) [23.6%] Neuropathic (37) [18.5%] Trigeminal Neuralgia (16) [8.0%] Post-traumatic neuropathic pain (14) [7.0%]	VAS - 0 to 10	VAS - 0 to 10	Poor sleep quality is associated with poor quality of life and a higher number of prior interventions. It is positively associated with comorbidities in health, awakenings related to pain conditions, time off work due to pain, and shock pain. Multivariate analysis revealed that sleep quality is associated with shock pain and systemic conditions.	The multidisciplinary team must be aware of the biopsychosocial management of pain control, due to the complexity of these patients. Clinicians should be aware not only of the pain condition, but also of medical comorbidities, psychological and psychosocial conditions.
2016	Lei et al.	578	Muscular TMD Joint TMD	RDC-TMD	PSQI DASS-21	61.4% of the adolescents interviewed had TMD symptoms 30% had sleep disorders, depression, and stress. 62.5% had anxiety. Patients with symptomatic TMD also had more psychological changes and sleep disturbances than patients with non-symptomatic TMD Sleep disturbance, daily dysfunction, and anxiety are significantly related to TMD symptoms	Sleep disturbances and psychological changes are correlated with TMD.
2015	Dias et al.	45	Muscular TMD Joint TMD	RDC-TMD	PSQI	75.6% have poor sleep quality. The presence or absence of degenerative TMJ disease did not influence sleep quality.	Although it did not show significant results, TMD patients have poor sleep quality.
2014	Dubrovsky et al.	124 DTM 46 Control	Muscular TMD	RDC-TMD Likert Scale	PSG	TMD patients have increased N1; increased arousals associated with respiratory events, low sleep efficiency, increased RERA.	TMD of the myofunctional type is associated with greater sleep fragmentation, and in increased frequency of RSI.
2013	Raphael et al.	124 DTM 46 Control	Muscular TMD	VAS Pre and Post Sleep	PSG	The level of pre- and post-sleep pain in TMD patients were inversely proportional to the amount of bruxism events per hour of sleep. TMD patients who met a stricter definition of sleep bruxism had lower levels of pain in the pre-sleep stage compared to the other patients.	Patients with myofacial TMD associated with BS have fewer levels of pain.
2010	Quartana et al.	53 DTM	Muscular TMD	VAS	PSG ISI	The increase in insomnia scores provided an increase in pain levels, but the increase in pain levels did not lead to a worsening of the insomnia picture.	Natural fluctuations in the severity of insomnia symptoms are prospectively associated with fluctuations in the daily experience of pain in people with TMD.

2009	Smith et al.	53 DTM	Muscular TMD	RDC-TMD	PSG SIS-D	<p>75% reported having BS 17% presented BS at PSG</p> <p>43% of the patients had 2 or more sleep disorders.</p> <p>36% had insomnia</p> <p>26% had primary insomnia.</p> <p>28.4% had OSA.</p> <p>Patients with primary insomnia had reduced mechanical and thermal pain thresholds</p>	<p>Patients complaining of sleep disturbances should be referred for PSG, due to the high prevalence of OSA and primary insomnia in TMD patients.</p> <p>The association of primary insomnia and hyperalgesia at a non-orofacial site suggests that this type of insomnia may be linked to central sensitivity and play an etiological role in idiopathic pain disorders.</p>
2009	Edwards et al.	53	Muscular TMD	DNIC Questionnaires	PSG	<p>Higher sleep efficiency and longer total sleep time were positively associated with lower pain scores.</p>	<p>These results suggest the possibility that sleep fragmentation may serve as a risk factor for inadequate pain processing and suggest that aggressive efforts to treat sleep disturbance early in a painful condition may be beneficial in reducing the severity or impact of clinical pain.</p>

Abbreviations: VAS (Visual Analog Scale); OHIP-TMD (Oral Health Impact Profile for Temporomandibular Disorder); PSG (Polysomnography); PSQI (Pittsburgh Sleep Quality Index); DASS-21 (Depression Anxiety Stress Scales-21); ISI (Insomnia Severity Index); SIS-D (Structure Interview Sleep Disease); RDC-TMD (Research Diagnostic Criteria for Temporomandibular Disorders); BPI (Brief Pain Inventory); PCS (Pain Catastrophizing Scale); SCL-90R (Symptoms Checklist 90-Revised); OHRQoL (Oral-Health Related Quality of Life); DNIC (Diffuse Noxious inhibitory Control).

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