Sleep Science

REVIEW ARTICLE

Sleep quality in patients with temporomandibular disorder: a systematic review

A qualidade do sono em pacientes com disfunção temporomandibular: uma revisão sistemática

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ABSTRACT

Temporomandibular disorder (TMD) is a generic term for a group of musculoskeletal disorders of the masticatory apparatus. Patients with TMD present with several common symptoms: mandibular function pain, articular noise, headaches, bruxism and poor and unrestful sleep. Poor sleep quality can severely harm the patient's health, as it can be an etiological or perpetuating factor in TMD patients. The aims of this systematic review were to analyze the cause and effect relationship between sleep disorders and TMD and to determine the prevalence of this relationship. Studies were selected from the MedLine, Cochrane, PubMed, LILACS and BBO databases using keywords and predefined criteria. Studies published between 1990 and 2012 were included. The methods used in the articles were qualitatively analyzed, with special attention given to cross-section and case-control studies. After the inclusion criteria were applied, only 13 articles had the necessary methodological quality to be included in this systematic review. Eight of the articles analyzed sleep quality in TMD patients using validated questionnaires, two articles analyzed their sample groups using polysomnography, and three articles used only questions to collect data regarding sleep quality. Although the cause and effect relationship between sleep disorders and TMD has not been proven, there was a considerably high prevalence for the correlation of these disorders. Additional studies that use objective methods and analyze more representative patient groups are necessary.

Keywords: pain, sleep, sleep apnea syndromes, sleep disorders, temporomandibular joint dysfunction syndrome.

RESUMO

Disfunção Temporomandibular (DTM) é um termo genérico empregado a um conjunto de desordens musculoesqueléticas do sistema mastigatório. Os pacientes com DTM relatam como sintomas comuns: dor na função mandibular, presença de ruídos articulares, cefaleia, bruxismo e uma qualidade de sono ruim. A privação do sono de qualidade pode trazer significativos danos à saúde, podendo funcionar como fator etiológico ou perpetuador em pacientes com DTM. Utilizando as bases de pesquisas MEDLINE, Cochrane, Pubmed, Lilacs e BBO foi realizada essa revisão sistemática com o objetivo de avaliar a relação de causa e efeito entre os distúrbios do sono e as DTM, e a prevalência dessa associação. Foram considerados trabalhos publicados no período compreendido entre 1990 e 2012. A avaliação qualitativa da metodologia dos artigos foi empregada, com enfoque para estudos transversais e estudos caso-controle. Após a aplicação dos critérios de inclusão, apenas 13 artigos apresentaram qualidade metodológica para compor essa revisão sistemática. Oito avaliaram a qualidade do sono em pacientes com DTM por meio de questionários validados, dois submeteram suas amostras a exame de polissonografia e três utilizaram somente perguntas. Apesar de não comprovada a relação de causa e efeito entre os distúrbios do sono e as DTM, a associação das mesmas foi encontrada e com prevalência considerável. Novos estudos que utilizem métodos objetivos e que analisem casuísticas mais representativas se fazem necessários.

Descritores: dor, sono, síndrome da disfunção da articulação temporomandibular, síndromes da apneia do sono, transtornos do sono.

INTRODUCTION

Temporomandibular disorder (TMD) is a subgroup of musculoskeletal disorders and is the most common cause of pain in the facial region aside from dental causes. The most common complaints from people with TMD are pain or discomfort in the facial region and the temporomandibular joints (TMJ) that is caused or exacerbated by mandibular function. Symptoms include limited mandibular articulation with or without deviations during mouth opening, temporomandibular joint noise (pops and cracklings), headaches and changes in sleep quality[1]. TMJ disorders are classified as joint TMDs and mainly involve problems with the condyle-articular disk complex and structural incompatibilities of the joint surfaces. Disorders affecting the masticatory muscles are classified as muscular TMDs, of which myofascial pain syndrome is the main example[1].

It is estimated that 50% to 80% of the population has at least one sign or symptom of TMD. Almost 10% of individuals affected by TMD require treatment, as the disorder can cause severe functional limitations (the inability to chew and a limited ability to open one's mouth, for example) and an inability to work or participate in social activities[2]. Women aged 20

Study carried out at Universidade Federal do Paraná.
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to 50 years are five times more likely to present with TMD[2,3]. Our current understanding is that TMDs are clinical conditions with multifactorial etiologies, as one or more factors can contribute to their onset or continuation. These factors include anatomic changes, macrotrauma, microtrauma, occlusal imbalances, parafunctional habits and systemic conditions, such as emotional stress. How these factors interact and cause a TMD in each individual is still unknown[1,4]. In addition to mandibular function pain, TMD patients commonly report joint noise, headaches, bruxism and poor, unrestful sleep[2,5].

Sleep, the opposite of wakefulness, is essential for health because the body physically renews during sleep, thus protecting human beings from the natural wear that occurs when they are awake. Every human being needs to sleep for several hours within a 24 hour span. This need is met not only by the number of hours slept but also by the quality of the sleep. A large number of cerebral and organismal functions are influenced by sleep, as the conditions of the brain during the preceding period of wakefulness are reestablished during sleep[6]. Disturbing the sleep-wake cycle results in significant harm to one's health and well-being and can even increase the risk of death in the most severe cases. Because of the consequences and incidence of disorders that affect the sleep-wake cycle, they are considered a public health problem. The most common causes of sleep problems are restricted sleep, which is usually caused by excessive work, family responsibilities, medication use or other personal factors and fragmentation, which can arise from certain medical conditions or environmental factors that harm both the quantity and quality of sleep. Changes in sleep patterns can lead to reduced cognitive function, increased reaction time, memory loss, increased irritability and metabolic, endocrine and cardiovascular changes[6]. According to data from the Epidemiologic Sleep Study (Episono), approximately 32% of the studied individuals had obstructive sleep apnea syndrome (OSAS)[7].

Previous studies have shown a prevalence of TMD among individuals with OSAS[8]. Many studies have correlated poor sleep quality with chronic pain, episodes of severe pain, psychological stress and lower perceptions of self-care[9]. In addition, the prevalence of sleep disorders and TMD in the general population is high[2,10-12], suggesting that superposition of these conditions may occur frequently. In this context, a better understanding of the relationship between sleep disorders and TMD is needed. The present study seeks to evaluate the available scientific evidence regarding sleep disorders in TMD patients.

METHODS

A computer search of the MedLine, Cochrane, PubMed, LILACS and BBO databases was performed between May 20 and June 1, 2012. The following search words were used in various combinations: "temporomandibular disorders", "TMD, orofacial pain", "sleep disorders", "apnea" and "sleep quality". The initial list of articles was provided to two reviewers, who analyzed the titles and abstracts to create the final sample of studies based on the following inclusion criteria: studies that evaluated sleep quality in adult TMD patients, studies that were cross-sectional or case-control epidemiological studies and articles that were published between January 1990 and June 2012 in English, Spanish or Portuguese.

Longitudinal studies evaluating TMD or sleep disorder treatments were excluded. Both sleep disorders and TMD have many different treatments that have been described and developed in the literature. Therefore, longitudinal studies that discuss treatments could not be adequately grouped in this systematic review without introducing methodological biases that would impair comparisons between studies.

RESULTS

After the inclusion criteria were applied, 13 studies were selected. There was concordance between the reviewers for study selection. The selected studies were grouped according to the method that they used to evaluate sleep quality in TMD patients. Eight used validated questionnaires, two had patients undergo polysomnography, and three used nonstandardized questions to evaluate sleep quality in TMD patients (Figure 1). Table 1 shows 13 studies included in the final sample with their groups, evaluation methods and results.

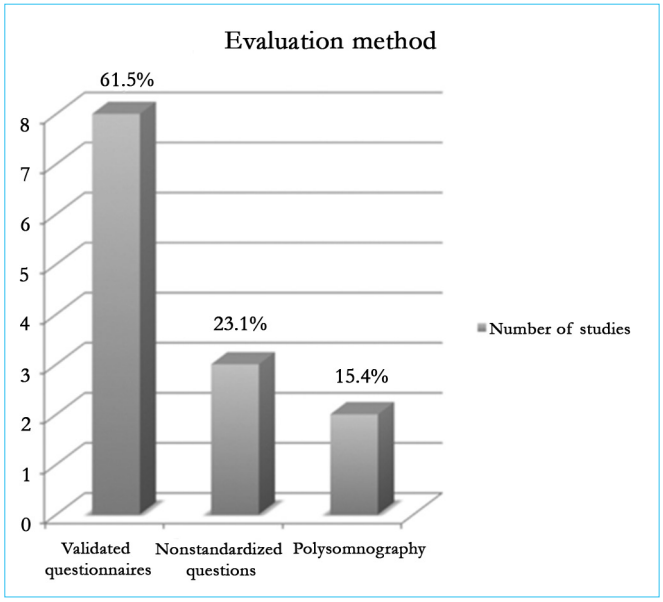

Figure 1. Methods used to evaluate sleep quality in the selected studies.

DISCUSSION

The relationship between sleep disorders and TMD patients must be investigated in a dental context based on evidence, and a critical reading of the methods used in the studies should guide discussions about the results obtained.

Sleep disorders can be diagnosed by clinical evaluation using objective and subjective measurements. Of the objective measurements, polysomnography is very important because it allows for an evaluation of the sleep architecture. It is considered the gold-standard for diagnosing most sleep disorders. Polysomnography uses various means to obtain diverse physiological measurements, such as recording the patient's electroencephalogram, electrooculogram, electromyogram, nasal airflow

Table 1. Final sample of studies and their sample groups, evaluation methods and results

Author	Sample	Evaluation Methods	Results
Hagberg et al., 1994[13]	80 TMD patients 174 members of the general population	Non standardized questions	Men with TMD had higher scores than men in the general population.
Carlson et al., 1998[14]	35 patients with jaw muscle pain 35 control patients Total = 70	Pittsburgh Sleep Quality Index	Patients experiencing pain in their masticatory muscles had more fatigue and sleep disorders than the control group did.
Yatani et al., 2002[15]	137 TMD patients	Pittsburgh Sleep Quality Index	Supports the comorbidity of reported sleep disorders, perceived pain severity stress in TMD patients.
Lindroth et al., 2002[16]	435 patients with muscular pain 139 patients with joint pain Total = 574	Pittsburgh Sleep Quality Index	The group with muscular pain had worse sleep quality than the group with joint pain did.
Vasquez-Delgado et al., 2004[17]	67 patients with daily chronic headaches, 67 with myofascial pain (MP), 67 with joint pain Total = 201	Pittsburgh Sleep Quality Index	Sleep quality was significantly worse in patients with MP than in patients in the other groups.
Selaimen et al., 2006[5]	72 TMD patients 30 controls	Sleep Analysis Questionnaire (SAQ) Beck Depression Questionnaire	Patients with TMD had high depression and sleep interruption index scores. Spontaneous pain and pain with palpation were more frequently present in the TMD patients.
Smith et al., 2009[18]	53 TMD (primary myofascial) patients	Polysomnography (PSG), Pittsburgh Sleep Quality Index, Epworth sleepiness scale	43% of TMD patients were diagnosed with two or more sleep disorders. Insomnia (36%) and sleep apnea (28.4%) were the most frequent. 75% met the self-reporting criteria for sleep bruxism, but only 17% met the PSG criteria for active sleep bruxism.
Edwards et al., 2009[19]	53 chronic TMD patients	Polysomnography and laboratory tests.	
Poveda et al., 2009[20]	850 TMD patients	Non standardized questions	Sleep disorders are among the statistically significant variables for diagnosing TMD.
Martins et al., 2010[21]	180 TMD patients	Pittsburgh Sleep Quality Index	There is a significant correlation between sleep quality and stress in individuals with TMD.
Quartana et al., 2010[22]	53 TMD patients	Insomnia Severity Index	Changes in the severity of insomnia symptoms were correlated with increased pain in TMD patients.
Davis et al., 2010[23]	251 muscular TMD patients	Non standardized questions	Significant correlation between stress, agitation and sleep problems and pain symptoms.
Porto et al., 2011[24]	81 patients with orofacial neuropathic pain 81 patients with chronic masticatory muscle pain	Pittsburgh Sleep Quality Index	Patients with neuropathic pain had more severe pain and more interference with daily life, but patients with muscular pain had more psychological problems. patients

and pulse oximetry on a polygraph. However, this test requires a location with adequate equipment and specifically trained human resources, thus requiring large financial investments and restricting the test's availability[25].

Only two of the selected studies (15.4%) used polysomnography to evaluate sleep disorders in patients. The study with the most evidence was performed by Smith et al.[18] in 2009. They analyzed patients using polysomnography and questionnaires. Forty-three percent of their patients were diagnosed with two or more sleep disorders, the most frequent of which were primary insomnia (PI; 36%) and apnea (28.4%). Some individuals experienced both problems concomitantly. Primary insomnia was associated with hyperalgesia, both in areas affected by TMD and in distinct regions (forearm), suggesting that primary insomnia could share a common underlying cause with central sensitivity and/or play a causative role in the development of hyperalgesia. Neither sleep bruxism nor sleep apnea were correlated with hyperalgesia in this study[18].

Subjective evaluation tools can be used both in the clinic and in research protocols. Some of these, such as the Sleep Disorder Questionnaire, evaluate the general aspects of sleep using quantitative and qualitative questions about sleep. Another example is the Pittsburgh Sleep Quality Index (PSQI), which provides a score for the severity and nature of the sleep disorder[25]. Other subjective instruments are more directed towards specific changes; examples include those used to evaluate excessive daytime sleepiness (EDS), such as the Epworth Sleepiness Scale[26]. For these questionnaires to have diagnostic value, they must be validated and tested in the study population[25]. They then become important tools for rapid and reliable diagnosis.

Most of the authors of the studies we selected used subjective evaluation methods. Sixty-one percent of the selected studies used validated questionnaires, and 23% of the studies used nonstandardized questions to evaluate sleep quality in patients with various TMD diagnoses. The number of studies based on patient self-reports limits the accurate determination of the real impairment of their sleep.

The Pittsburg Sleep Quality Index (PSQI) was the most commonly used scale for subjective evaluations (60%). This questionnaire has been shown to be a safe and reliable method for determining sleep quality and disturbances, and it has good test-retest reliability (r = 0.85) and internal consistency (alpha = 0.83)[27].

The results obtained in all of the studies reviewed here were similar: TMD patients had poor sleep quality independent of the evaluation method used[5,14,15,18]. There is also a consensus between the authors that the cause and effect relationship between pain and poor sleep is not known. Both pain and poor sleep appear to be part of a complex and bidirectional interaction that is not well understood. The authors focus on the possibility that sleep problems may directly contribute to central sensitization and pain amplification[18,19].

Quartana et al.[22] investigated the temporal and reciprocal relationship between insomnia and the severity of TMD pain over a month. They observed that insomnia was followed by increased pain and that treating the pain altered insomnia, but the inverse relationship was not found. The authors suggest that inflammatory molecules are released in response to sleep fragmentation and the sensitization of the nociceptors by problems in the control system. Future studies should evaluate the relationship between changes in insomnia symptoms, pain and inflammatory markers.

In a study on the role of central sensitization, Edwards et al.[19] suggested that more effective sleep and longer total sleep time were positively correlated with better diffuse noxious inhibitory control (DNIC).

Obstructive sleep apnea syndrome (OSAS) was analyzed in only one study[18]. Polysomnography tests showed that approximately one-third of the patients with TMD (28%) had OSAS. This result shows the need for systematic investigations of the occurrence of OSAS in TMD patients because of the cardiovascular effects of this sleep disorder[28,29]. However, the study did not include a matched control group to determine more clearly whether the apnea rate of 28% is in fact elevated in the TMD population. The estimated rate of sleep apnea in middle-aged adults is approximately 4% for men and 2% for women[29]. More recent studies found a 17% incidence rate for apnea in the general population, which appears to be linked to increased obesity rates[30]. Santos-Silva et al.[7] found an even higher prevalence of OSAS (approximately 32% of the studied individuals). It should also be noted that the study population in Smith et al.[18] consisted of mainly young women with relatively low body mass index (BMI) scores. Although it is unknown why sleep apnea rates would be higher in TMD populations, a recent epidemiological survey of the general population found a strong link between a diagnosis of sleep apnea and self-reported sleep bruxism[31].

The psychoemotional variables correlated with sleep disorders have been the object of several studies and were analyzed in this review. Vazquez-Delgado et al.[17] and Lindroth et al.[16] compared sleep quality and other emotional variables between patients with muscular TMD and patients with joint TMD. Both studies found similar results: patients with muscular problems had very poor sleep quality, were more stressed and had greater diurnal dysfunction. The link between stress and sleep disorders in muscular TMD patients can cause or result from the hypothalamus-pituitary-adrenal (HPA) axis and the autonomic nervous system[17].

Other studies have also investigated the connection between emotional changes (stress, anxiety, depression) and sleep quality. This review presented three case-control studies[5,13,14]. The authors of these studies found a higher incidence of emotional problems in patients with TMD. According to Selaimen et al.[5], poor sleep was a more important risk factor than depression for developing TMD. Analyzing only TMD patients, the authors found a higher prevalence of psychoemotional problems in people with poor sleep quality[15,18].

The authors unanimously agree that the management of chronic patients should include paying attention to sleep disorder complaints and referring patients with high levels of impairment to a comprehensive examination by a sleep specialist that includes polysomnography.

FINAL REMARKS

The available scientific evidence on sleep disorders and TMD was incomplete. Despite differing methodologies, the selected studies, despite different methodologies, found frequent associations between sleep disorders and TMD. Although the cause-effect relationship between pain and poor sleep is not well established, both appear to be part of a complex and bidirectional interaction that is still not well understood.

We suggest that future studies incorporate objective diagnostic methods, such as polysomnography, for sleep disorders and that validated indices, such as the RDC/TMD, be used for TMD diagnosis. This methodological rigor applied to larger sample sizes may lead to more consistent results.

Integrated management may improve sleep continuity and contribute to successful treatments for TMD and other pain disorders.

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