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Interrelationship Between Temporomandibular Disorder and Obstructive Sleep Apnea - A Review

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ABSTRACT

Obstructive Sleep Apnea (OSA) and Temporomandibular Joint Disorders (TMD) are two widespread medical conditions that reduce one's overall life quality. In the context of sleep disorders, the relationship between OSA and TMD is intricate and multifactorial. TMD or temporomandibular disorder is an umbrella term for musculoskeletal or neuromuscular disorders that affect the temporomandibular joint, the masticatory muscles, and related structures, often accompanied by muscular pain, limited jaw movement, and abnormal joint sounds. Obstructive sleep apnea, on the other hand, is the leading sleep-related breathing disorder. Individuals with obstructive sleep apnea experience multiple breathing cessations during sleep. This review summarizes the relation of TMD with OSA, including the pathophysiology, clinical impact, associated complications, and their treatment and management. An in-depth review of the published papers has been carried out through databases including PubMed, Scopus, and Google Scholar. The papers were chosen based on relevance and the level of evidence provided. Numerous articles focus on the OSA related factors including bruxism, muscular hyperactivity, and airway changes that could cause and worsen the TMD. In essence, TMD pain can disrupt the normal sleep pattern.

Keywords: Temporomandibular joint, obstructive sleep apnea, Upper airway obstructions, Bruxism, mandibular advancement devices, oral appliances.

INTRODUCTION

Temporomandibular disorders (TMD) affect the temporomandibular joints (TMJ), the masticatory muscles, and the other soft tissues. TMD more often than not is responsible for facial pain, jaw limitation, and joint sounds. [1] Obstructive sleep apnea (OSA), on the other hand, is an obstructive sleep respiratory disorder that is defined by repeated events of upper airway obstruction occurring during sleep. The condition causes sleep fragmentation and cycles of intermittent hypoxia. [2] There has been evidence of a possible interrelationship between temporomandibular disorders (TMD) and obstructive sleep apnea (OSA) from a recent study. Lee et al. derived an artificial intelligence algorithm from a multimodal clinical dataset that was able to determine the presence of OSA with high accuracy in patients diagnosed with TMD. [1] This indicates the presence of numerous anatomical, physiological, and neurological mechanisms between the two conditions. From the systematic review by Mendes et al., patients with TMD are predisposed to have comorbid sleep disorders, and thus the probability of an interrelationship between the two conditions. [2]

Debnath et al., in their case-control study, highlighted the frequency of TMD symptoms among patients with OSA, with evidence of bidirectional interaction. [3] This clinical finding suggests that not only are OSA and TMD comorbid, but they also have the potential to exacerbate each other. Kang and Lee corroborated this relationship in their systematic review by highlighting the frequent occurrence of painful TMD among OSA patients.[4] Pain sensitivity is also an important factor. Smith et al. discovered that sleep-disordered patients with TMD had dramatically changed laboratory pain thresholds, implying common core pain processing pathways.[5] The use of mandibular advancement devices for treating OSA may have effects on the TMJ. Giannasi and colleagues observed the long-term changes in the temporomandibular joint among patients who received oral appliance therapy for obstructive sleep apnea.[6]

In a meta-analysis, Machado and colleagues found that individuals with obstructive sleep apnea have a higher likelihood of developing temporomandibular disorders.[7] Wickwire and colleagues demonstrated a connection between objective sleep disturbances and the severity of TMD signs and symptoms. [8] Patel and colleagues highlighted the importance of grasping this relationship for better management in clinical settings. [9]

This review aims to perform an extensive review of the complex interaction between temporomandibular joint disorders and obstructive sleep apnea. It aims to analyze the current body of evidence regarding epidemiological overlap, shared risk factors, underlying pathophysiological processes, diagnostic complexity, and the implications these provide for treatment practices. The aim of this review within dental and sleep medicine is to provide an overview that will be informative of treatment practices. This will be accomplished through the synthesis of evidence from systematic and clinical research, thus providing an extensive overview of the literature.

EPIDEMIOLOGICAL CORRELATION

Research findings provide compelling support for the connection between TMD and OSA. In the study by Lee et al., machine learning uncovered a significant presence of OSA markers within TMD datasets, indicating that TMD could serve as a clinical sign of potential sleep apnea.[1] Mendes and colleagues observed similar results in various studies, indicating that people with TMD tend to experience more sleep issues. Debnath et al. confirmed that patients with OSA have considerably increased incidence of TMD, particularly those with moderate-to-severe apnea. [3] The prevalence of OSA is higher in individuals with painful TMD compared to the general population, as pointed out by Kang and Lee.[4]

Smith and colleagues pointed out that the overlap might be underestimated because of underreporting and underdiagnosis, particularly in communities with limited access to healthcare. [5] Research conducted by Giannasi and colleagues on oral appliances has revealed cases of previously undiagnosed TMD that surfaced during the treatment of OSA.[6] In their meta-analysis, Machado and colleagues examined data from more than 5,000 individuals, revealing a meaningful link between obstructive sleep apnea and temporomandibular disorders, with an odds ratio greater than 2.0.[7] Wickwire and colleagues found that a higher Apnea-Hypopnea Index (AHI) is linked to greater severity of TMJ pain [8] Figure 1.

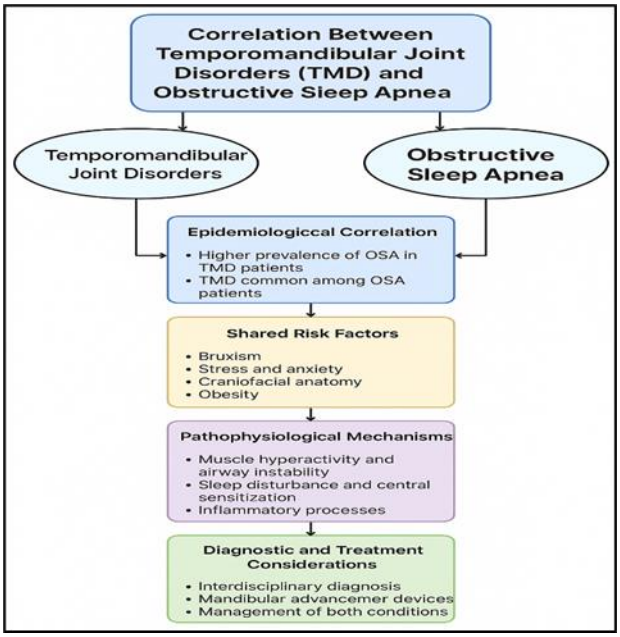

Figure-1: This flowchart represents the relationship between Temporomandibular Joint Disorders (TMD) and Obstructive Sleep Apnea (OSA).

SHARED RISK FACTORS

Table 1 Includes a summary of common risk factors TMD and OSA Smith et al. found that numerous individuals with TMD also experience high stress levels, anxiety, and poor sleep quality that also influence their pain perceptions and how they manage their airway. [5] TMD and OSA have been connected with obesity and upper airway resistance in the literature, according to Patel et al. [9] Zhang et al. suggested that various genetic predispositions could include polymorphisms that may affect inflammatory markers and pain threshold level, augmenting the risks of developing both of these conditions.[10] Mishra and Chowdhary have suggested that malpositions of the lower jaw, such as either micrognathia or retrognathia, can obstruct the airway and impair breathing. [11]

Table-1: Shared Risk Factors in TMD and OSA

Risk Factor	TMD Involvement	OSA Involvement	Source
Bruxism	Contributes to muscle fatigue, TMJ strain	Triggered by arousals in OSA	[1], [2], [3]
Stress and Anxiety	Increases muscle tone and sensitivity	Disrupts sleep and airway tone	[4], [5]
Craniofacial Anatomy	Mandibular asymmetry and retrognathia	Narrow airway, tongue position	[6], [7]
Obesity	Inflammatory cytokines affect TMJ	Increases upper airway resistance	[7], [8], [9]

MECHANISMS OF PATHOPHYSIOLOGY

The physiological connection between obstructive sleep apnea and temporomandibular dysfunction include complex interactions of neuronal, muscle and joint impulses. The research suggests that TMD inhibits jaw movement during sleep, which in turn affects airway patency.[1] Breath affects during sleep are due to the eruption of the stressors stimulating the masticatory muscles and creating an unstable jaw. [2] An important contributor to both bruxism and TMJ pain is rhythmic masticatory muscle activity, which is commonly connected to frequent nightly awakenings in persons who suffer from obstructive sleep apnea.[7] Wickwire and colleagues [8] subsequently determined that central sensitivity syndrome is prevalent and

that insufficient sleep exacerbates peripheral pain. Takizawa and co-authors observed that mandibular advancement devices for oral appliance therapy for sleep apnea potentially adds to jaw function symptoms, particularly temporomandibular joint pain which may lead to referred orofacial pain. [12] Sagl et al built a dynamic jaw model with a finite-element model of the temporomandibular joint which allowed for jaw movement simulations and mechanical effects relevant to oral appliance therapy for obstructive sleep apnea. [13] Li and coworkers examined the role of inflammation and found that the inflammatory cytokines IL-6 and TNF-α, which are positively correlated to obstructive sleep apnea (OSA), also stimulate the breakdown of the TMJ [14], and their findings were supported by genetic studies which indicated that the same activity of the FTO gene was present in the two disorders.

DIAGNOSTIC CONSIDERATIONS

Diagnosing both TMD and OSA can be difficult because their symptoms often overlap. Lee and colleagues suggested a model in which clinical signs of TMD, like limited mouth opening and pain when touched, can lead to screening for OSA [1]. PSG, or polysomnography, is still the best method for diagnosing OSA, and the DC/TMD criteria are used for TMD. Patel and colleagues pointed out the importance of teamwork between dentists and sleep doctors to avoid misdiagnosis [9]. Sagl and colleagues developed a dynamic jaw model incorporating a finite-element representation of the temporomandibular joint, enabling simulation of jaw movements and analysis of mechanical impacts relevant to oral appliance therapy in obstructive sleep apnea. [13] The research of Li et al. and Attia et al. also emphasizes the interconnection between OSA and TMJ health, with both conditions sharing molecular pathways and with possibilities for targeted treatment interventions for both conditions. [14,15] In the study conducted by Doff and others, they showed the importance of evaluating the temporomandibular joint before beginning mandibular advancement therapy to prevent treatment related complications in obstructive sleep apnea. [16] Wickwire and others discussed that evaluation of joint pain is important in evaluating OSA, as there are many overlapping symptoms between the two conditions. [8]

TREATMENT OVERLAP AND COMPLICATIONS

Table 2 Includes a summary of the treatment modalities, potential benefits for OSA, and potential effects on TMD. Research has emphasized a consideration in design of appliances and monitoring of the patient, in order to mitigate TMJ damage during oral appliance therapy. [16, 12] Other studies show that the inappropriate use of devices in OSA patients may enhance the inflammatory degeneration of the joint. [14] Attia et al. addressed the outcomes of patients who had dual-focus treatment, which demonstrated simultaneous improvements in both the quality of sleep and the function of the TMJ. [15] In a similar manner, De Felício and colleagues showed that orofacial myofunctional therapy can increase airway muscle strength, reduce muscle-related tension of the temporomandibular joint, and improve function and relieve symptoms. [17] In a case reported by Al-Nuumani and associates, untreated temporomandibular joint ankylosis and a concurrent state of mandibular retrognathia led to the ultimate development of severe obstructive sleep apnea.[18]

Table-2: Treatment Strategies and Considerations

Treatment	Benefit for OSA	Risk/Impact on TMD	Source
Mandibular Devices	Advances jaw, reduces apneas	May strain TMJ, worsen symptoms	[6,13,16]
CPAP	Keeps airway open	May induce muscle tension	[3,4]
Physiotherapy	Relieves joint/muscle pain	No effect on apnea directly	[9,11,17]
Cognitive Therapy	Improves sleep/stress	Reduces muscle bracing, pain	[5,7]

CONCLUSION

Recent evidence shows a strong and complex connection between temporomandibular disorders and obstructive sleep apnea. The overlap of shared risk factors, inflammatory pathways, and biomechanical stressors makes it difficult to clearly diagnose and treat conditions. When dental and sleep specialists work together, using advanced tools and shared protocols, it can lead to better results and help avoid complications from treatment.

LITERATURE CRITIQUE

In the current pool of studies exploring the relation between temporomandibular disorders (TMD) and obstructive sleep apnea (OSA), there are several limitations that can be pointed out. To illustrate, Lee et al. [1] applied machine learning to retrospective datasets without applying any external validation, thus casting doubt on the model's generalizability. A similar case-control study has been conducted by Debnath et al. [3] which, although it is informative, does not represent a causal relationship. Kang and Lee [4] based their findings on a range of diagnostic methods among the studies included in this review, which could have resulted in the heterogeneity of reporting prevalence. Throughout the oral appliance therapy, Giannasi et al. [6] highlighted the lack of criteria that had been agreed upon for the diagnosis of TMD. In general, most of the included studies within this review were cross-sectional in nature, and this limited their ability to make conclusions regarding temporal relationships. [2, 7]

RESEARCH GAPS

While much of what has been written in the past address's adult populations, there is a clear under-representation for pediatric and adolescent populations. TMJ ankylosis has been considered a contributing factor to OSA in young patients and may represent a distinct developmental cause that deserves further study. [18] Moreover, there is a notable lack of research exploring gender differences, even though we are aware of the existing disparities in the prevalence of both TMD and OSA. [5, 7] Limited studies, like the one conducted by Mishra and Chowdhary [11] examine the differences in diagnosis and treatment access across various regions or ethnic groups. To address these knowledge gaps and enhance personalized treatment strategies, it is essential to conduct more inclusive, population-based longitudinal studies. [9]

TOOLS FOR CLINICAL SCREENING

Screening instruments such as the STOP-BANG questionnaire, while relevant in general OSA populations, have not been validated individually in a TMD cohort. Elements of TMD-specific clinical signs (palpation pain scores, mandibular range of motion) and emerging diagnostic models incorporating AI, as demonstrated by Lee et al. [1] will aid in discriminating TMD as well as stratifying severity which may be key for earlier detection. Sagl et al. [13] offered a biomechanical perspective by way of simulation models estimating TMJ stress during oral appliance therapy. Doff et al. [16] provided commentary on the need for TMJ assessment prior to initiating mandibular advancement devices, and Patel et al. [9] highlighted the importance of collaborative diagnostic pathways between dental and sleep medicine specialists.

Lastly, Li et al. [14] identified genetic and inflammatory mechanisms including FTO-related pathways that may account for individual patient susceptibility to TMJ. These findings lend support for a multidimensional screening approach that includes biomechanical modeling, multifactorial clinical assessments, molecular profiling, and the use of new wearable monitoring devices in screening. Together with some of the insights of Giannasi et al. [6] and Doff et al. [16] related to TMJ pathology in patients undergoing oral appliance therapy, it is clear that the assessment of patients at risk for TMD requires a collective approach.

FUTURE RESEARCH DIRECTIONS

Future research needs to be on interventional trials assessing whether treatment of TMD reduces the severity of OSA. Alternatively, assessing the influence of CPAP or mandibular devices on TMJ pathology, as demonstrated by Giannasi et al. [6] and Doff et al. [16], would be revealing. Li et al. [14] referred to the importance of research on gene-environment interactions, especially in the case of the FTO gene, potentially playing a common inflammatory role in both conditions. Furthermore, Lee et al.'s [1] suggested wearable monitoring devices and AI-assisted diagnostic methods have the potential to revolutionize early detection strategies.

Declaration by Authors

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REFERENCES

1. Lee YH, Jeon S, Auh QS, Chung EJ. Automatic prediction of obstructive sleep apnea in patients with temporomandibular disorder based on multidata and machine learning. Sci Rep. 2024;14(1):19362. doi:10.1038/s41598-024-70432-4
2. Pala Mendes, A. T., Tardelli, J. D. C., Botelho, A. L., & Dos Reis, A. C. (2025). Is there any association between sleep disorder and temporomandibular joint dysfunction in adults? - A systematic review. Cranio: the journal of craniomandibular practice, 43(3), 426–437. https://doi.org/10.1080/08869634.2022.2154022
3. Debnath S, Kumar S, Sangra V, et al. Investigating the Association between Obstructive Sleep Apnea and Temporomandibular Joint Disorders: A Case-Control Study. J Pharm Bioallied Sci. 2024;16(Suppl 1):S663-S665. doi: 10.4103/jpbs.jpbs_924_23
4. Kang JH, Lee JK. Associations between obstructive sleep apnea and painful temporomandibular disorder: a systematic review. J Korean Assoc Oral Maxillofac Surg. 2022;48(5):259-266. doi:10.5125/jkaoms.2022.48.5.259
5. Smith MT, Wickwire EM, Grace EG, et al. sleep disorders and their association with laboratory pain sensitivity in temporomandibular joint disorder. Sleep. 2009;32(6):779-790. doi:10.1093/sleep/32.6.779
6. Giannasi LC, Almeida FR, Magini M, et al. Systematic assessment of the impact of oral appliance therapy on the temporomandibular joint during treatment of obstructive sleep apnea: long-term evaluation. Sleep Breath. 2009;13(4):375-381. doi:10.1007/s11325-009-0257-3
7. Machado CAO, de Resende CMBM, Stuginski-Barbosa J, et al. Association between obstructive sleep apnea and temporomandibular disorders: A meta-analysis. J Oral Rehabil. 2024;51(10):2220-2233. doi:10.1111/joor.13794
8. Wickwire E, Bellinger K, Kronfli T, Grace E, Sarlani E, Wang K, Buenaver L, Smith M. Relations between objective sleep data, sleep disorders, and signs and symptoms of temporomandibular joint disorder (TMD). J Pain. 2008 Apr;9(4):14. doi:10.1016/j.jpain.2008.01.073.
9. Patel, M., Demerjian, G.G., Sims, A.B. (2018). The Relationship of Temporomandibular Joint, Orofacial Pain, and Sleep Apnea. In: Demerjian, G., Barkhordarian, A., Chiappelli, F. (eds) Temporomandibular Joint and Airway Disorders. Springer, Cham. https://doi.org/10.1007/978-3-319-76367-5_7
10. Yuxiao Zhang, Ahsawle Ozathaley, Xiangyao Wang, Yaxin Wu, Kehan Zhang, Yuanyuan Li, et al. Causal effects of sleep behaviors on temporomandibular disorders and pain: a bidirectional mendelian randomization study. Journal of Oral & Facial Pain and Headache. 2025; 39(2): 101-111. doi: 10.22514/jofph.2025.029.
11. Mishra SK, Chowdhary R. Current evidence on the association of sleep apnea and temporomandibular joint disorders. Int J Prosthodont Restor Dent. 2025;15(2):67-68. doi:10.5005/jp-journals-10019-1499.
12. Takizawa K, Ozasa K, Wu S, Yan Z, Young A, Noma N. The impact of oral appliance therapy and mandibular advancement devices on jaw function symptoms in sleep

apnea: a narrative review. J Oral Maxillofac Anesth 2024;3:26.
13. Sagl B, Schmid-Schwap M, Piehslinger E, Kundi M and Stavness I (2019) A Dynamic Jaw Model With a Finite-Element Temporomandibular Joint. Front. Physiol. 10:1156. doi: 10.3389/fphys.2019.01156
14. Li B, Wang L, Du M, He H. FTO in oral diseases: Functions, mechanisms, and therapeutic potential. FASEB J. 2024;38(20):e70115. doi:10.1096/fj.202401406RR
15. Attia, A.A., Awad, S.S., Mansour, M. et al. Effects of different treatments for obstructive sleep apnea on temporomandibular joint: a randomized clinical trial. BMC Oral Health 24, 931 (2024). https://doi.org/10.1186/s12903-024-04623-w
16. Doff MH, Veldhuis SK, Hoekema A, et al. Long-term oral appliance therapy in obstructive sleep apnea syndrome: a controlled study on temporomandibular side effects. Clin Oral Investig. 2012;16(3):689-697. doi:10.1007/s00784-011-0555-6
17. de Felício CM, de Oliveira MM, da Silva MA. Effects of orofacial myofunctional therapy on temporomandibular disorders. Cranio. 2010;28(4):249-259. doi:10.1179/crn.2010.033
18. Al-Nuumani IK, Bakathir A, Al-Hashmi A, et al. A Triad of Temporomandibular Joint Ankylosis, Mandibular Retrognathia and Severe Obstructive Sleep Apnoea: Case report. Sultan Qaboos Univ Med J. 2018;18(3): e379-e382. doi:10.18295/squmj.2018.18.03.019

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