EDITORIAL

Impact of Obstructive Sleep Apnea on Masticatory Muscle Function

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Obstructive sleep apnea (OSA) is a common and potentially serious sleep disorder characterized by repetitive episodes of complete or partial upper airway obstruction during sleep. These obstructions result in a reduction or cessation of airflow, leading to oxygen desaturation, and disruptions in sleep patterns.[1,2] Common symptoms of OSA include loud snoring, gasping or choking during sleep, excessive daytime sleepiness, morning headaches, and irritability. Obstructive sleep apnea is often associated with other medical conditions, such as obesity, hypertension, cardiovascular disease, and diabetes. Diagnosis typically involves polysomnography to assess the frequency and severity of apneic episodes.[3–5]

Masticatory muscles are a group of muscles responsible for the movements of the jaw during chewing, swallowing, and speech. These muscles include the masseter, temporalis, medial pterygoid, and lateral pterygoid muscles.[6–8] The temporomandibular joint (TMJ) facilitates the movement of the mandible and acts as the articulation point between the mandible and the skull. The masticatory muscles play a crucial role in mastication (chewing) by exerting forces to crush and grind food, which is essential for digestion.[9] Additionally, these muscles contribute to the maintenance of proper facial esthetics and support the structures of the oral cavity.[10] During normal masticatory function, the coordinated contraction and relaxation of masticatory muscles enable efficient chewing and swallowing of food. However, dysfunction or abnormalities in the masticatory muscles can lead to various oral health issues, including temporomandibular disorders (TMDs), jaw pain, muscle fatigue, and difficulty chewing or speaking.[11] Understanding the anatomy and function of masticatory muscles is essential for comprehending their role in oral health and their potential involvement in sleep-related disorders such as OSA.[10]

Obstructive sleep apnea is classified based on the frequency of apneic events per hour of sleep, measured by the apnea-hypopnea index (AHI). Mild OSA is defined as an AHI of 5–15 events per hour, moderate OSA as an AHI of 15–30 events per hour, and severe OSA as an AHI greater than 30 events per hour. The primary mechanism underlying OSA involves the collapse or narrowing of the upper airway during sleep, leading to partial or complete obstruction of airflow. This obstruction is often exacerbated by factors such as obesity, anatomical abnormalities (e.g., enlarged tonsils or adenoids), and decreased muscle tone during sleep.[12] During an apneic episode, the muscles of the pharynx relax, allowing soft tissues in the throat to collapse and obstruct the airway. This results in decreased oxygen levels in the blood and disruptions in sleep architecture, including frequent arousals from sleep.

Untreated OSA can have profound effects on multiple physiological systems, leading to significant health consequences. Chronic intermittent hypoxia and sleep fragmentation associated with OSA contribute to oxidative stress, systemic inflammation, and endothelial dysfunction, increasing the risk of cardiovascular diseases such as hypertension, coronary artery disease, and stroke.[13,14] Obstructive sleep apnea is also associated with metabolic disturbances, including insulin resistance, glucose intolerance, and dyslipidemia, which can predispose individuals to obesity and type II diabetes. Additionally, OSA has been linked

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to neurocognitive impairments, daytime sleepiness, mood disorders, and a decreased quality of life. Furthermore, untreated OSA may exacerbate existing medical conditions and increase the risk of accidents, particularly while driving or operating heavy machinery.[15]

The masticatory muscles are a group of muscles responsible for the movement of the jaw during chewing (mastication), swallowing, and speech. The primary muscles of mastication include the masseter, temporalis, medial pterygoid, and lateral pterygoid muscles.[16,17] These muscles originate from various cranial and facial bones and insert onto the mandible (lower jaw), allowing for the movement of the jaw in different directions. The TMJ, located just in front of the ear, acts as the articulation point between the mandible and the skull, facilitating jaw movement.

The masticatory muscles play essential roles in several important functions. The coordinated contraction and relaxation of masticatory muscles enable the grinding, crushing, and mixing of food during chewing, preparing it for swallowing and digestion. Masticatory muscles help move the bolus of food towards the back of the mouth and initiate the swallowing reflex, which involves the sequential contraction of muscles in the pharynx and esophagus to propel food into the stomach.[18–20] Masticatory muscles contribute to the precise movements of the tongue, lips, and palate during speech production, facilitating the articulation of sounds and words.[21,22] Additionally, masticatory muscles provide support for the structures of the face and oral cavity, maintain proper facial esthetics and aid in the stabilization of the TMJ during jaw movements. Dysfunction or abnormalities in masticatory muscle function can lead to difficulties in chewing, swallowing, speaking, and other oral health issues, such as TMDs and jaw pain. Understanding the anatomy and function of masticatory muscles is crucial for diagnosing and managing conditions affecting the jaw and surrounding structures.

Several studies have examined the effects of OSA on masticatory muscle activity during sleep.[23–25] These studies typically utilize electromyography to measure the electrical activity of masticatory muscles during different sleep stages and apneic events. Findings from these studies suggest that OSA may lead to alterations in masticatory muscle activity, including increased muscle activity during respiratory efforts to overcome airway obstruction and changes in muscle tone during sleep stages characterized by sleep fragmentation and arousals. Patients with OSA often exhibit changes in masticatory muscle tone and function compared to individuals without OSA. These changes may manifest as increased muscle fatigue, decreased muscle strength, and alterations in muscle coordination during masticatory tasks. Additionally, OSA-related factors such as chronic intermittent hypoxia and sleep fragmentation may contribute to oxidative stress, inflammation, and mitochondrial dysfunction in masticatory muscles, further impacting their function.[26]

Several potential mechanisms may underlie the relationship between OSA and alterations in masticatory muscle function. Chronic intermittent hypoxia, a hallmark feature of OSA, can lead to oxidative stress, inflammation, and alterations in mitochondrial function in masticatory muscles, contributing to muscle dysfunction.[27] Additionally, sleep fragmentation and disruptions in sleep architecture associated with OSA may affect the regulation of motor control and muscle tone, leading to changes in masticatory muscle activity and function.[28,29] Furthermore, OSA-related factors such as obesity, metabolic disturbances, and hormonal imbalances may also influence masticatory muscle function through systemic effects on muscle metabolism and physiology. Overall, understanding the relationship between OSA and masticatory muscle function is essential for elucidating the mechanisms underlying OSA-related symptoms and complications, as well as for developing targeted interventions to improve masticatory muscle health in patients with OSA.

Altered masticatory muscle function in patients with OSA can contribute to the symptoms and complications of the disorder. Dysfunction in masticatory muscles may lead to difficulties in chewing and swallowing, resulting in dietary modifications and nutritional deficiencies. Additionally, changes in masticatory muscle tone and coordination may exacerbate sleep-related breathing disturbances, including increased upper airway collapsibility and reduced pharyngeal muscle tone during sleep, further worsening OSA severity. Furthermore, masticatory muscle dysfunction may contribute to TMDs, jaw pain, and craniofacial abnormalities, which can impact quality of life and exacerbate OSA-related symptoms.

Several treatment modalities are available for managing OSA, including continuous positive airway pressure (CPAP) therapy, oral appliance therapy, surgery, and lifestyle modifications. While CPAP therapy is the gold standard treatment for OSA, oral appliances are increasingly being used as an alternative treatment option, particularly for patients with mild to moderate OSA or those who are unable to tolerate CPAP. Oral appliances work by repositioning the mandible and tongue to prevent airway collapse during sleep. Surgical interventions such as uvulopalatopharyngoplasty, maxillomandibular advancement, and hypoglossal nerve stimulation may be considered for patients with severe OSA who fail conservative treatments.[30,31] It's important to consider the potential effects of these treatment modalities on masticatory muscle function, as some interventions may exacerbate or alleviate existing masticatory muscle dysfunction.

Interdisciplinary collaboration between sleep medicine specialists, dentists, physical therapists, and other healthcare providers is essential for effectively managing OSA-related masticatory muscle dysfunction. Comprehensive treatment plans should address both the underlying causes of OSA and associated masticatory muscle dysfunction to optimize patient outcomes. This may involve a combination of therapies, including CPAP or oral appliance therapy, masticatory muscle exercises, lifestyle modifications (e.g., weight loss, dietary changes), and adjunctive therapies for TMDs, such as physical therapy, pain management, and occlusal splint therapy.[31,32] By adopting an interdisciplinary approach, healthcare providers can address the complex interplay between OSA and masticatory muscle function and provide personalized care tailored to the needs of individual patients.

The editorial highlights the significant impact of OSA on masticatory muscle function. Literature evidence has demonstrated alterations in masticatory muscle activity, tone, and coordination in patients with OSA, which may contribute to the symptoms and complications of the disorder. These changes in masticatory muscle function can exacerbate sleep-related breathing disturbances, impair chewing and swallowing function, and contribute to TMDs and jaw pain. Clinicians should be aware of the potential effects of OSA on masticatory muscle function and consider comprehensive evaluations of masticatory muscle health in patients with OSA. Interdisciplinary collaboration between sleep medicine specialists, dentists, physical therapists, and other healthcare providers is essential for effectively managing

OSA-related masticatory muscle dysfunction and optimizing patient outcomes. Future research should focus on elucidating the underlying mechanisms linking OSA to alterations in masticatory muscle function, as well as evaluating the efficacy of various treatment modalities in improving masticatory muscle health and alleviating OSA-related symptoms and complications. Additionally, longitudinal studies are needed to assess the long-term effects of OSA treatment on masticatory muscle function and overall oral health outcomes. By addressing these knowledge gaps, clinicians can enhance their understanding of the complex relationship between OSA and masticatory muscle function and develop more targeted and effective interventions for patients with OSA-related masticatory muscle dysfunction.

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