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Sleep APNOEA: A Rising Menace And Its Prosthodontic Management – A Review

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Abstract:
Sleep apnea is a multifactorial sleep disorder characterized by recurrent episodes of airflow cessation or reduction during sleep. Obstructive sleep apnea (OSA) arises from upper airway collapse, while central sleep apnea (CSA) results from impaired brainstem respiratory drive. Patho-physiologically, apnoeic events cause intermittent hypoxemia, hypercapnia, and sleep fragmentation, leading to cardiovascular, metabolic, and neurocognitive complications. Clinically, patients present with loud snoring, witnessed apneas, excessive daytime sleepiness, and impaired concentration, while children may exhibit hyperactivity and poor school performance. Diagnosis relies on polysomnography and the apneahypopnea index (AHI). Continuous positive airway pressure (CPAP) remains the gold standard, but oral appliances (OA) offer a safe, effective alternative, particularly for mildtomoderate OSA. Prosthodontists play a pivotal role in oral appliance therapy, underscoring the importance of interdisciplinary collaboration.

Background: *Sleep apnea is a common sleep-related breathing disorder characterized by recurrent episodes of airflow obstruction or cessation during sleep, leading to intermittent hypoxia and sleep fragmentation. Untreated obstructive sleep apnea is associated with serious cardiovascular, metabolic, and neurocognitive complications. Although continuous positive airway pressure remains the gold standard treatment, poor patient compliance has increased interest in alternative therapies such as oral appliances. Prosthodontists play a significant role in the fabrication and management of these appliances, emphasizing the importance of interdisciplinary care in sleep apnea management.*

Keywords: *Sleep apnea; Obstructive sleep apnea (OSA); Central sleep apnea (CSA); Polysomnography; Apneahypopnea index (AHI); Continuous positive airway pressure (CPAP); Oral appliances; Prosthodontics*

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I. Introduction

Sleep is a fundamental biological process essential for neuronal regeneration, behavioural regulation, and metabolic recovery. [1], [2] It progresses through five stages—1, 2, 3, 4, and rapid eye movement (REM)—in cycles lasting 90–110 minutes. Early cycles are dominated by deep sleep, while later cycles feature prolonged REM phases. [1], [2] Disruption of this architecture can result in significant physiological and cognitive consequences.

Sleep disorders, including insomnia, parasomnias, and sleepdisordered breathing, affect millions worldwide. [1], [3] Among these, sleep apnea is particularly concerning due to its prevalence, systemic impact, and potential lifethreatening complications. [3], Sleep apnea is defined by recurrent episodes of apnea (cessation of breathing) or hypopnea (reduction in airflow) during sleep, leading to oxygen desaturation and sleep fragmentation. [3]

This paper explores the etiology and pathophysiology, clinical features, diagnostic approaches, and management strategies for sleep apnea, with emphasis on the role of prosthodontists in oral appliance therapy.

II. Etiology And Pathophysiology

Sleep apnea arises from complex interactions between anatomical, neuromuscular, and systemic factors. The most common form, obstructive sleep apnea (OSA), results from recurrent collapse of the extra thoracic upper airway during sleep. [1], [2] Contributing factors include:

- Anatomical narrowing: Enlarged tonsils, adenoids, retrognathia, or craniofacial abnormalities reduce airway patency. [1]
- Obesity: Excess fat deposition around the neck and pharynx increases airway collapsibility. [2]
- Neuromuscular dysfunction: Reduced tone of pharyngeal dilator muscles during sleep contributes to airway obstruction. [2]

Central sleep apnea (CSA) differs in etiology, arising from impaired brainstem respiratory drive, leading to cessation of ventilatory effort. [3] Mixed apnea combines features of both OSA and CSA.

Patho physiologically, apneic episodes cause intermittent hypoxemia and hypercapnia, triggering sympathetic activation, oxidative stress, and systemic inflammation. These changes contribute to cardiovascular morbidity, including hypertension, arrhythmias, myocardial infarction, and stroke. Sleep fragmentation impairs restorative sleep, leading to neurocognitive deficits such as poor concentration, memory impairment, and mood disturbances.

Thus, sleep apnea is not merely a nocturnal breathing disorder but a systemic condition with farreaching consequences.

III. Clinical Features

The hallmark symptom of OSA is loud, habitual snoring, often punctuated by witnessed apneas, choking, or gasping. [1]

- Patients frequently report

1. Excessive daytime sleepiness
2. Morning headaches
3. Iritability
4. Impaired concentration due to fragmented sleep. [2]

- Nocturnal features include restless sleep, frequent awakenings, nocturia, and xerostomia. [3]
- In children, sleep apnea may manifest as hyperactivity, poor school performance, or behavioral disturbances rather than overt sleepiness.
- Physical examination may reveal obesity, retrognathia, enlarged tonsils, or a crowded oropharynx.

Longterm consequences include systemic hypertension, insulin resistance, cardiovascular disease, and increased risk of accidents due to impaired vigilance. CSA presents differently, with periodic breathing patterns such as Cheyne–Stokes respiration, often associated with heart failure or neurological disease.

Importantly, many patients are unaware of their nocturnal symptoms, making bedpartner observations crucial. Sleep apnea significantly reduces quality of life, impairing work productivity and social functioning.

IV. Diagnosis

Diagnosis requires integration of clinical evaluation and objective sleep studies. A detailed history of snoring, witnessed apneas, and daytime somnolence is essential. [1] Screening tools such as the Epworth Sleepiness Scale quantify daytime sleepiness. [2] Physical examination focuses on BMI, neck circumference, craniofacial structure, and airway anatomy. [3]

The gold standard diagnostic test is polysomnography (PSG), which records EEG, airflow, respiratory effort, oxygen saturation, and limb movements overnight. the apneahypopnea index (AHI), defined as the number of apneas and hypopneas per hour of sleep, determines severity: mild (5–15), moderate (15–30), and severe (>30).

Home sleep apnea testing (HSAT) offers a simplified alternative for suspected moderatetosevere OSA. Differential diagnosis includes primary snoring, insomnia, restless legs syndrome, and CSA. Imaging (cephalometry, MRI) may be used to assess airway anatomy in selected cases.

Ultimately, diagnosis requires integration of symptoms, risk factors, and PSG findings to guide appropriate management.

Management of sleep apnea is multidisciplinary, aiming to restore airway patency, improve sleep quality, and reduce comorbid risks.

- Lifestyle modification: Weight loss, avoidance of alcohol and sedatives, and positional therapy form the foundation. [1]
- Continuous Positive Airway Pressure (CPAP): The gold standard for moderatetosevere OSA, CPAP splints the airway open during sleep. [2] Despite efficacy, adherence is limited due to discomfort. [3]
- Oral appliances (OA): Mandibular advancement devices reposition the jaw or tongue to maintain airway patency. Prosthodontists play a crucial role in prescribing and adjusting these appliances, which are portable, economical, and patientfriendly.
- Surgical options: Uvulopalatopharyngoplasty (UPPP), maxillomandibular advancement, and hypoglossal nerve stimulation are reserved for refractory cases.
- CSA management: Focuses on treating underlying conditions (e.g., heart failure) and may involve adaptive automatic, feedback-controlled ventilation.

Longterm followup is essential, as untreated OSA increases cardiovascular and metabolic risks. Collaboration between physicians and dental specialists ensures comprehensive care, with prosthodontists contributing significantly to oral appliance therapy.

Summary of Oral Appliances in Sleep Apnea Management: -

Oral appliances (OAs) have emerged as a significant alternative to continuous positive airway pressure (CPAP) therapy, particularly for patients with mild to moderate obstructive sleep apnea (OSA) or those intolerant to CPAP. While CPAP remains the gold standard, randomized trials show that patients often prefer OAs due to comfort, portability, and ease of use, even when CPAP is more effective in eliminating disordered breathing events [10,11]. Oral appliances are also considered for patients who fail surgery or continue to experience snoring and retroglossal collapse, as surgery primarily reduces retropalatal obstruction whereas OAs target retroglossal collapse [12].

General Efficacy and Considerations: -

OAs reduce apnea–hypopnea index (AHI), arousals, and improve minimum oxygen saturation. Some evidence suggests they may lower blood pressure, though replication is needed. They are simple, non-invasive, reversible, and cost-effective, making them suitable for lifelong treatment. Ethical concerns exist regarding placebo controls in trials, but sham CPAP has demonstrated measurable placebo effects in OSAH studies. Placebo OAs without mandibular repositioning are considered the best control design [13].

Appliance Concepts: -

Three primary mechanisms are used to modify the airway:

- **Soft palate lifting**: stabilizes the soft palate to prevent vibration and snoring. Fabricated with PMMA resin and soft liners, though limited by gag reflex tolerance [14].
- **Uvula lift appliances**: extend posteriorly to support elongated or bifid uvula, reducing obstruction [15].
- **Tongue retention devices (TRDs)**: use suction to hold the tongue forward, opening the airway. Suitable for edentulous patients [16]
- **Mandibular repositioning appliances (MRAs)**: advance the mandible antero-inferiorly, indirectly bringing the tongue forward and reducing collapsibility of the soft palate. Common designs include Herbst, Jasper Jumper, Twin Block, SNOAR, and Klearway [16].
- **Hybrid devices**: e.g., Luco Hybrid OSA Appliance, combining cast metal and acrylic for mandibular advancement and tongue stabilization, FDA-cleared for OSA and snoring[17].
- **Tongue stabilizing devices (TSDs)**: e.g., Aveo- TSD, made of silicone, holding the tongue forward by suction without attaching to teeth. FDA-approved for snoring, with ongoing trials for OSA [18].
- **Clasp Retained Mandibular Positioner (CRMP)**: locks the mandible into position with clasps, controlling vertical dimension [18].
- **CPAP Pro**: integrates nasal pillows with mandibular repositioning appliances, FDA-approved for OSA [19].
- **Elastic Mandibular Advancement Appliance (EMA)**: uses interchangeable elastic straps to advance the mandible, offering TMJ comfort and lateral movement [20].
- **Elastomeric Sleep Appliance**: soft silicone, tooth-retained, effective for partially edentulous patients [21].
- **Full Breath Appliance**: inhibits tongue movement to prevent airway obstruction, improving airflow consistently [22].
- **Herbst Telescopic Appliance**: adjustable mandibular repositioner allowing incremental advancement, effective for mild to moderate OSA [23].
- **Hilsen Adjustable Appliance**: thermoplastic bases with Velcro-like attachments, offering wide range of adjustments [23].
- **Klearway TM Appliance**: Thermoactive acrylic, fully adjustable, allowing small increments of mandibular advancement [24].
- **Lamberg Sleep Well Device (LSWD)**: mandibular advancement device with anterior stop, reducing bruxism and clenching, FDA-accepted for snoring.[25]
- **Mandibular Advancement Splints (MAS)**: fixed or adjustable, holding the jaw forward to relieve apnea.[26]
- **Mandibular Inclined Repositioning Appliance (MIRS)**: uses incline flange to hold mandible forward, with anterior breathing hole.
- **Medical Dental Sleep Appliance (MDSA)**: titratable mandibular advancement device, proven effective in crossover trials against CPAP, with higher compliance.[24]
- **Narval CC Appliance**: CADCAM-designed mandibular repositioner, highly customizable, with >80% efficacy in snoring reduction and strong patient acceptance.[26]
- **Nocturnal Airway Patency Appliance (NAPA)**: rigid acrylic, non-adjustable, with anterior breathing beak. [26]

- **OASYS Oral/Nasal Airway System**: FDA-approved as both mandibular repositioner and nasal dilator, reducing nasal resistance and improving breathing (FDA). [26]
- **PM Positioner and Adjustable PM Positioner**: thermoplastic devices linking upper and lower splints, FDA-approved.[27]

V. Discussion

Sleep apnea is a chronic, progressive disorder with systemic consequences if untreated. Its etiology involves anatomical, cardiovascular, physical, physiological, metabolic, and neurocognitive complications, while clinical manifestations range from snoring and daytime sleepiness to cardiovascular and neurocognitive complications. Accurate diagnosis through polysomnography and careful clinical evaluation is essential to guide therapy.

While CPAP remains the most effective therapy, adherence challenges necessitate alternative approaches. Oral appliances provide a patientfriendly solution, particularly in mildtomoderate OSA, and highlight the role of dental specialists in interdisciplinary care. Prosthodontists contribute significantly to diagnosis, appliance fabrication, and monitoring, bridging medical and dental management.

The literature emphasizes that oral appliance therapy, though effective, may cause occlusal side effects during longterm use. Therefore, prosthodontists must exercise judicious use, balancing efficacy with preservation of occlusal function.

VI. Conclusion

Sleep apnea requires timely diagnosis and effective management to prevent cardiovascular and neurocognitive complications. Oral appliances represent a viable alternative to CPAP, especially for patient's intolerant to positive airway pressure therapy. Prosthodontists play a pivotal role in oral appliance therapy, underscoring the importance of interdisciplinary collaboration to optimize patient outcomes and quality of life.

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