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# Dental sleep medicine: Bridging gaps in sleep-related breathing disorder care: A short review

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## Abstract

Sleep-related disorders, with a particular emphasis on obstructive sleep apnoea (OSA), exert a substantial impact on the overall well-being of affected individuals. Based on collaborative efforts across diverse disciplines, dental sleep medicine, orchestrated by dentists, assume a crucial role in the identification of these disorders through routine examinations, where they keenly discern indicative cues. The incorporation of dentistry into the realm of sleep medicine paves the way for fresh avenues in the diagnosis, management, and treatment of sleep-related breathing disorders. This multidisciplinary approach not only augments the quality of sleep but also bolsters overall well-being. As research continues to advance, dental sleep medicine is poised to assume a pivotal role in catering to the diverse needs of individuals grappling with these disorders.

**Keywords:** Obstructive sleep apnoea; Dental sleep medicine; Sleep related disorders

## 1. Introduction

A significant portion of our lives is devoted to sleep; however, regrettably, numerous individuals experience sleep issues that adversely affect their overall well-being(1). Dental sleep medicine is an interdisciplinary subject that necessitates specialized medical skills from a variety of disciplines, such as ear, nose, and throat specialists, neurologists, pulmonary disease specialists, internal medicine physicians, and psychiatrists(2). Oral and maxillofacial surgeons, orthodontists, specialists in oral medicine and oral pathology, orofacial pain specialists, and dentists specialized in dental sleep medicine are all involved in this complicated area of healthcare(3).

Lavigne *et al.*'s seminal work, dating back almost two decades, delineates the breadth of dental sleep medicine, encompassing facets such as orofacial pain, oral moistening concerns, gastroesophageal reflux disorder (GERD), sleep-related breathing conditions like snoring and obstructive sleep apnoea (OSA), and mandibular movement disorders, including dyskinesia, dystonia, and sleep bruxism(4).

## 2. Pathophysiological mechanisms

Unaddressed obstructive sleep apnoea (OSA) leads to considerable affliction, characterized by recurrent hypoxia resulting from airway constriction, concurrent activation of sympathetic neuronal activity (SNA), hemodynamic irregularities, and disturbances in sleep patterns(5–9).

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The activation of the sympathetic nervous system is associated with the release of catecholamines (epinephrine and norepinephrine), initiating vasodilation in the heart and brain or vasoconstriction in other organs, occurring repeatedly throughout the night in what is colloquially known as the 'fight or flight' response. Obstructive sleep apnoea (OSA) has been correlated with systemic inflammation, as evidenced by elevated levels of major inflammatory mediators such as tumour necrosis factor-alpha, C-reactive protein, and chemokines in OSA patients(10–15). Moreover, both intermittent and chronic hypoxia have been linked to glucose intolerance and insulin resistance, with hypoxia's adverse impact on glucose metabolism appearing to be mediated through the sympathetic nervous system. Beyond its physiological effects, sleep-disordered breathing (SDB) contributes to several detrimental consequences, including daytime sleepiness, cognitive impairment, depression, relationship challenges, and dementia. Additionally, it has been associated with appetite changes, obesity, and compromised immunity(10,16–27).

### 2.1. Complications

SDB is closely linked to several pivotal chronic diseases prevalent in Western societies, including arterial hypertension, congestive heart failure, arrhythmias, coronary artery disease, stroke, diabetes mellitus, chronic obstructive pulmonary disease, and cancer. The aforementioned adverse physiological effects of SDB are implicated in hastening the progression of each of these diseases(28).

## 3. Dental health effects of sleep-related breathing disorders

Sleep-related breathing disorders encompass a spectrum of conditions, with obstructive sleep apnoea (OSA) emerging as the most prevalent(2). OSA manifests when there is a partial or complete obstruction of the upper airway during sleep, resulting in recurrent breathing interruptions. These interruptions, recurring multiple times during the night, disrupt normal sleep patterns, contribute to increased daytime drowsiness, and elevate the risk of systemic health issues such as hypertension, heart disease, and diabetes(3). Within the realm of oral health, sleep-related breathing disorders can entail various ramifications including:

- **BRUXISM:** Individuals diagnosed with obstructive sleep apnoea (OSA) are at an increased risk of experiencing bruxism, a condition marked by teeth grinding and clenching during sleep. This can result in tooth wear, fractures, and issues with the temporomandibular joint (TMJ) (1).
- **XEROSTOMIA**: Respiration through the mouth, frequently observed in the context of sleep-related breathing disorders, can result in xerostomia or dry mouth. Decreased saliva production associated with mouth breathing may escalate the risk of dental caries, periodontal diseases, and other oral health complications(1)(3).
- **DENTAL EROSION**: There is a correlation between obstructive sleep apnoea (OSA) and gastroesophageal reflux disease (GERD), which could result in the reflux of acidic stomach contents into the oral cavity. This acidic environment poses the potential to induce dental erosion and various other oral health issues (3).
- **ORAL PAIN**: Orofacial pain can present in diverse manifestations, encompassing dento - alveolar issues related to teeth and supporting tissue, musculoskeletal challenges involving muscles or joints, and neuropathic conditions associated with nerve-related problems. This pain spectrum can further impact sleep patterns, giving rise to difficulties in falling asleep or nocturnal waking, ultimately contributing to fatigue, reduced energy levels, and potential emotional ramifications. Conversely, the interplay between poor sleep and orofacial pain is variable and individualized (1,3).

## 4. Dentist role in diagnosis and management

Dentists play a distinctive role in identifying indicators of sleep-related breathing disorders during routine dental examinations. Observable signs may encompass enlarged tonsils, dental misalignment (malocclusion), and oral manifestations such as bruxism and dry mouth, all of which have associations with sleep disorders(29). Upon recognizing these signs, dentists collaborate with sleep medicine specialists to deliver integrated care and accurate diagnoses for patients with sleep-related breathing disorders. This synergistic approach enhances the overall treatment and management of patients (1).

### 4.1. Management

Tailoring treatment to address the specific needs and severity of each patient's condition is imperative. A comprehensive evaluation by healthcare professionals specializing in dental sleep medicine is essential to discern and implement the most suitable and effective treatment approach.

*4.1.1. Continuous Positive Airway Pressure Therapy (CPAP)*

This therapeutic intervention entails the utilization of a device that administers a continuous, pressurized airflow through a mask, effectively maintaining an open airway during sleep (30) shown in figure 1.


**Figure 1** Patient using CPAP therapy (31)

*4.1.2. Mandibular Advancement Devices (MADS)*

A therapeutic oral device strategically positions the mandible forward during sleep, preventing the closure of the airway by the tongue and facilitating improved ease of breathing for the patient (32).

Oral appliances, alternatively referred to as mandibular advancement devices (MADs) or dental devices illustrated in Figure 2a, have garnered recognition as a therapeutic choice for mild to moderate cases of obstructive sleep apnoea (OSA) and for individuals who find continuous positive airway pressure (CPAP) therapy challenging. (30) These individually tailored devices reposition the lower jaw and tongue, maintaining an open airway during sleep (29). The benefits of oral appliances encompass comfort, adherence, portability, and potential enhancements in both sleep quality and overall quality of life. (29,30) However, the custom fabrication of these devices is essential to ensure effectiveness and patient comfort. (4) Mandibular Advancement Devices (MADs), employed in mild to moderate obstructive sleep apnoea (OSA) cases, are notably more user-friendly and comfortable than Continuous Positive Airway Pressure (CPAP) appliances, thereby contributing to higher patient compliance rates.

Continuous Positive Airway Pressure (CPAP) appliances are typically indicated for moderate to severe obstructive sleep apnoea cases. Mandibular Advancement Devices (MADs) present a viable option, even in severe cases, particularly when patients encounter challenges in adhering to CPAP therapy. Surgical interventions may be considered in specific instances, but their applicability is contingent upon a thorough patient selection process and adherence to specific indications.(32)

*4.1.3. Mechanism of action*

Oral appliances function by delicately repositioning the lower jaw and tongue forward during sleep.(30) This subtle adjustment serves to uphold an open airway, mitigating the risk of soft tissue collapse in the throat, as depicted in Figure 2b.

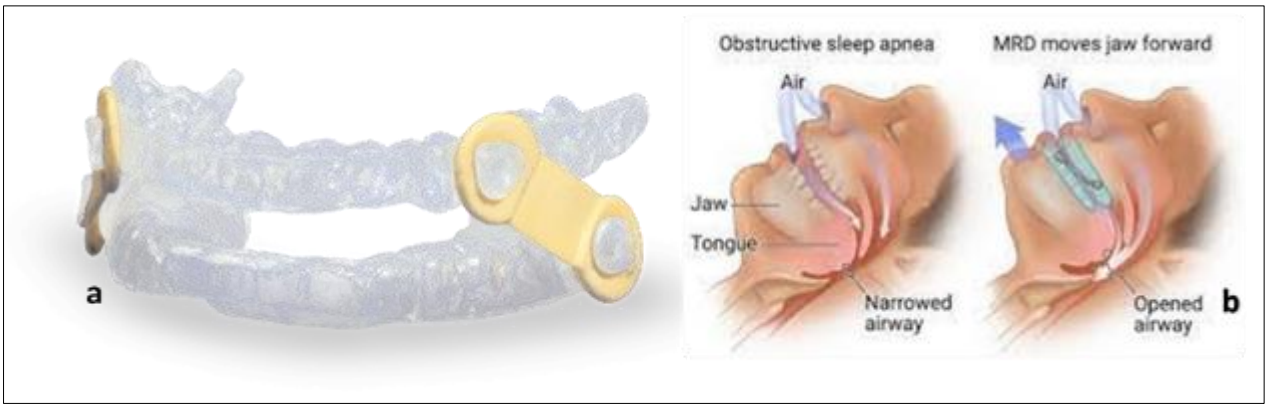


**Figure 2 a** Mandibular advancement device (33) **2b**: Action of mandibular repositioning device (34)

Implementing lifestyle modifications can be beneficial, encompassing practices such as weight management, positional therapy (adjusting sleep positions), and refraining from the consumption of alcohol and sedatives before bedtime. (29)

Surgical interventions, exemplified by uvulopalatopharyngoplasty (UPPP) depicted in Figure 3, genioglossus advancement (GA), and maxillomandibular advancement (MMA) illustrated in Figure 3, are designed to anatomically augment the airway. (4)

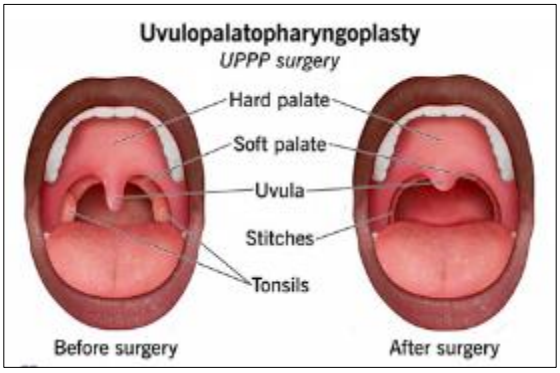


**Figure 3** Uvulopalatopharyngyoplasty (35)

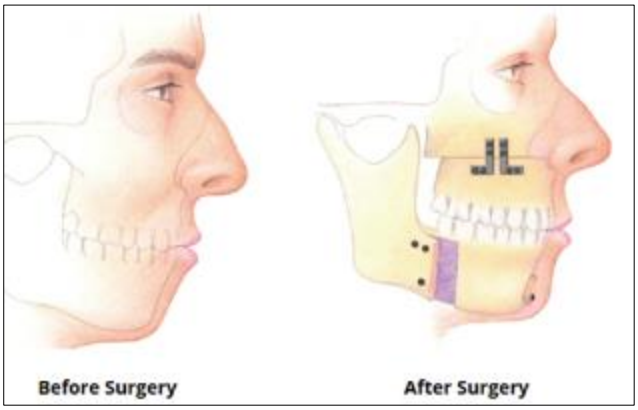


**Figure 4** Maxillomandibular advancement (36)

Combination therapy may be employed, as certain individuals derive advantages from a synergistic approach involving treatments such as combining CPAP therapy with oral appliances or surgical interventions. (3,29)

## 5. Sleep related disorders in children

The management of paediatric sleep apnoea hinges on precise identification of both the site and severity of obstruction. Although hyperplasia of the tonsils and adenoids accounts for a significant majority of cases, the array of potential pathologies causing sleep-related breathing disorders (SRBD) in children surpasses that seen in adults, affecting various sites within the upper respiratory tract. In young children, the limited distance between these sites can give rise to stertor or stridor, the origins of which may pose challenges in localization. In such scenarios, a thorough evaluation involving both flexible and rigid endoscopic examination of the airway under spontaneous ventilation becomes imperative for accurate diagnosis and intervention planning. (37)

In its mildest form, Sleep-Related Breathing Disorder (SRBD) manifests as Upper Airway Resistance Syndrome (UARS). Affected children exhibit symptoms such as heroic snoring, mouth breathing, sleep pauses or breath-holding, gasping, enuresis, and restless sleep. Daytime manifestations of sleep disturbance include hypersomnolence, behavioural disorders, morning headaches, dry mouth, and halitosis. Additional clinical indicators encompass audible breaths with an open-mouth posture, hypo nasal speech, and chronic nasal obstruction, with or without rhinorrhoea. Children with more pronounced obstruction may present with Obstructive Hypopnea Syndrome (OHS) or Obstructive Sleep Apnoea Syndrome (OSAS), as further defined. The most severely affected individuals may develop complications such as cor-pulmonale, right ventricular hypertrophy, congestive heart failure, alveolar hypoventilation, pulmonary hypertension, pulmonary oedema, or failure to thrive, exposing them to the risk of permanent neurological damage and even mortality. Polysomnography (PSG) remains the gold standard for objectively correlating ventilatory abnormalities with sleep-disordered breathing.(38)

### 5.1. Causes of sleep-related breathing disorders in children

**Table 1** Causes of sleep-related breathing disorders in children.(37)

| **Neonates and infants** | **Toddlers and older children** |
|---|---|
| Nasal aplasia, stenosis, or atresia | Rhinitis, nasal polyposis, septal deviation |
| Nasal or nasopharyngeal masses | Syndromic narrowing of nasopharynx (Hunter's, Hurler's, Down's, achondroplasia) |
| Craniofacial anomalies | Adenotonsillar hyperplasia |
| Hypoplastic mandible (Pierre Robin, Nager's, Treacher Collins) | Obesity |
| Hypoplastic maxilla (Apert's, Crouzons) | Macroglossia (Down's) |
| Macroglossia (Beckwith-Wiedemann) | Vascular malformations of tongue and pharynx |
| Vascular malformations of tongue and pharynx | Neuromuscular disorders |
| Neuromuscular disorders | Rhinitis, nasal polyposis, septal deviation |

### 5.2. Management of srbd in children

The therapeutic approach to Sleep-Related Breathing Disorder (SRBD) in children is meticulously tailored to the specific aetiology of airway obstruction. Medical management may be considered in milder cases or when surgical intervention proves inadequate in addressing the underlying pathology.

#### *5.2.1. Nasal and nasopharyngeal obstruction*

In instances where SRBD is attributed to nasal and nasopharyngeal masses, optimal resolution involves the surgical removal of the mass. The procedural strategy is contingent upon the nature of the pathology, ranging from a straightforward transoral, retropalatal approach for adenoidectomy or marsupialization of nasolacrimal duct cysts to more intricate procedures like an anterior craniofacial approach for addressing conditions such as encephalocele or malignancy (37).

#### *5.2.2. Hypoplasia of the midface and mandible*

Upper airway obstruction stemming from midface and mandibular hypoplasia is often linked to craniofacial syndromes. Micrognathia associated with Pierre Robin sequence may exhibit improvement without mandibular surgical

intervention. For mild cases of airway obstruction, children under vigilant care can be managed with prone positioning and nasopharyngeal stenting using a nasal trumpet or a similar device. As symptoms progress in severity, temporary repositioning of the ptotic tongue through labio-glossopexy is a suggested intervention. Temporary tracheotomy stands out as a dependable and minimally invasive approach to airway management, provided that signs of mandibular "catch-up" growth become apparent in the initial months. In cases where such growth is not observed, consideration of distraction osteogenesis becomes a viable option.(39–41).

*5.2.3. Macroglossia and the ptotic tongue*

Macroglossia in children is often associated with Beckwith-Wiedemann syndrome (characterized by macroglossia, omphalocele, visceromegaly, and cytomegaly of the adrenal cortex), Down syndrome, or vascular malformations of the tongue. Complications arising from macroglossia encompass abnormal dental eruption, malocclusion, maxillary and mandibular maldevelopment, excessive drying of the tongue leading to ulceration, and airway obstruction. Surgical reduction of the tongue, primarily effective for the first three indications, tends to be less successful in addressing airway obstruction. The procedure typically involves resection of the lingual margin or a wedge resection, possibly with aggressive resection at the foramen cecum, (42) .However, this approach may not effectively alleviate obstruction at the distal oropharynx and tongue base, allowing airway obstruction to persist in many cases.(43) Regrowth of tongue tissue post-surgery has also been reported. (44) Alternative strategies for managing macroglossia include suture suspension of the tongue, radiofrequency ablation, and intralesional laser therapy for vascular malformations (37).

*5.2.4. Adenotonsillar hyperplasia and oropharyngeal obstruction*

Adenotonsillectomy is commonly regarded as the primary therapeutic intervention for most individuals with Sleep-Related Breathing Disorders (SRBD), particularly those presenting with at least mild adeno-tonsillar hyperplasia. Historically, traditional methods such as guillotine and cold steel tonsil removal were associated with complications like bleeding and postoperative pain. The integration of electrocautery in these procedures successfully addressed surgical blood loss and reduced operating time, though postoperative pain remained a notable concern. The exploration of serial tonsillectomy with CO2 laser in an outpatient setting introduced the notion that partial tonsillectomy could be both safe and less painful than the conventional approach for patients with tonsil hyperplasia. Techniques for adenoidectomy encompass curettage, suction electrocautery ablation, and removal using power-assisted devices.(37,45,46).

## 6. Healthcare costs

Multiple studies have consistently revealed a correlation between Sleep-Disordered Breathing (SDB) and elevated healthcare expenses. Patients with Obstructive Sleep Apnoea (OSA) exhibit heightened direct medical costs for a duration of up to 10 years before receiving a diagnosis, as opposed to those without an OSA diagnosis. The extent of the disparity in these costs is directly proportional to the severity of Sleep-Disordered Breathing.(28).

### 6.1. Quality of life

Poor sleep quality in patients with Obstructive Sleep Apnoea (OSA) is linked to symptoms such as daytime sleepiness, fatigue, diminished concentration, memory impairment, and psychological disturbances, all contributing to a diminished quality of life. Individuals with OSA face higher rates of unemployment, lower incomes, earlier retirement, and an increased likelihood of divorce compared to those without OSA. Continuous Positive Airway Pressure (CPAP) therapy has demonstrated prompt and reliable enhancements in sleep architecture, symptom reduction, and overall quality of life. While patients with severe symptoms may derive substantial benefits from Positive Airway Pressure (PAP) therapy, even those with mild disease and minimal symptoms can exhibit significant improvements during CPAP therapy. This observation was evident in a UK study where individuals with confirmed OSA but deemed insufficiently symptomatic (as assessed by themselves and their physicians) for treatment were randomized to CPAP or standard care. Notably, patients treated with CPAP demonstrated clinically significant enhancements in both sleepiness and quality of life. These findings underscore the notion that clinical evaluations of OSA patients may not consistently identify all individuals likely to benefit from therapy, emphasizing the potential benefits of offering CPAP treatment to all patients with OSA, regardless of symptom presentation.(47–50).

## 7. Conclusion

The integration of dentistry into the domain of sleep medicine has ushered in new avenues for addressing sleep-related breathing disorders comprehensively, encompassing diagnosis, management, and treatment. Dentists occupy a pivotal role in the identification of individuals at risk, with the utilization of oral appliances emerging as a significant therapeutic

modality. This collaborative synergy between dental and sleep medicine experts offers a holistic solution, not only improving sleep quality but also enhancing oral health and overall well-being. As ongoing research advances in this field, dental sleep medicine is poised to assume an increasingly pivotal role in addressing the nuanced needs of individuals grappling with sleep-related breathing disorders.

## Compliance with ethical standards

*Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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