Revival of the Eclipsed: The 5th Dimension of a Prosthodontist
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Abstract
A Prosthodontist’s role is not limited to removable, fixed or implant supported dentures. The treatment of sleep Apnoea with the use of oral appliances has been underutilized and traditionally, they have been provided mainly in a hospital setup. This article reviews the available options for the treatment of sleep-related breathing disorders with an emphasis on oral appliance therapy.

Key Words: Sleep Apnoea Appliances; Radiotherapy Appliances; Mouth Protectors.
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Introduction
Upper airway sleep disorders (UASDs) are conditions that occur in the upper airway that diminish sleep time and/or sleep quality, resulting in patients exhibiting symptoms that include day time sleepiness, tiredness and lack of concentration. Patients with UASD are more prone to accidents.(1) The treatment of sleep apnoea with the use of oral appliances has been provided mainly in a hospital setup. The role of dentistry in sleep disorders is becoming more significant, especially in co-managing patients with simple snoring and mild to moderate obstructive sleep Apnoea (OSA).(2)

Sleep Apnoea: Apnoea is defined as the cessation of airflow, a complete obstruction for at least 10 sec with a concomitant 2 to 4% drop in arterial oxygen saturation. Hypopnea is a reduction in airflow of at least 30 to 50% with a drop in oxygen saturation. The Apnoea-hypopnea index (AHI) is the average number of apnoea and hypopnea per hour of sleep.(3) Snoring is a sign of partial upper airway obstruction during sleep. Snoring and OSA are caused by abnormal airway (base of tongue and soft palate) anatomy and altered respiratory control mechanisms.(1)

OSA, the most prevalent of all the apnoea, is a disturbance in normal sleep patterns and when combined with excessive day time sleepiness is termed obstructive sleep apnoea syndrome (OSAS). In long standing cases of the syndrome, headache, systemic hypertension, dysrhythmias, depression, stroke, and angina are noticed.(3) The severity of OSA is classified on the basis of the patient's AHI index into three categories:(3)
1. Mild OSA (5 to 15 events per hour)
2. Moderate OSA (15 to 30 events per hour)
3. Severe OSA (more than 30 events per hour)

A diagnosis of sleep Apnoea is confirmed if at least 30 apnoeic episodes with airflow cessation of a minimum of 10 seconds each are observed during a 7 hour sleep period.(4) Treatment of sleep-disordered breathing (i.e. snoring, upper airway resistance syndrome, sleep Apnoea syndrome) can be divided into four general categories. These include: (1) Lifestyle modification i.e. weight loss, cessation of evening alcohol ingestion, sleep position training (2) Upper airway surgery (3) Oral appliances and (4) Continuous positive airway pressure (CPAP). Although the latter category provides the most reliable therapeutic modality and is the most widely used method to treat sleep disordered breathing today it is also the most cumbersome one.(4)

CPAP has become the standard of care for treating moderate to severe OSA. Airway obstruction is prevented by delivering air at a constant pressure via a nasal mask worn during sleep. However, nasal CPAP is not universally tolerated by patients. Reasons for noncompliance include air leakage from the mask, noise, the mask is objectionable to a bed partner, the unit is bulky for travel, or there is discomfort associated with wearing a standard mask. Proper fit of the mask and treatment of nasal conditions are important factors to ensure compliance because untreated side effects can result in discontinuation of treatment. Small nares may cause difficulty in wearing the small standard nasal mask, leading to discomfort, skin abrasion and air leaks. These problems may be overcome with a customized silicone elastomer nasal CPAP mask.(5)

Patients with mild to moderate OSA are candidates for placement of appropriate oral devices.(2) Dental appliances may prevent snoring and OSA by modifying the position of the upper airway structures so as to enlarge and/or reduce collapsibility of the airway.(3) The use of intra-oral appliances is simple, non-invasive, reversible and cost-effective and may
be the basis of definitive lifelong treatment. There are three concepts for a dental appliance to modify the airway which can be used alone or in combination depending on where the airway obstruction occurred: a) Soft palate lifting, b) Tongue retention and c) Mandibular repositioning.(2)

**Soft Palate Lifting:** The prosthesis lifts and/or stabilizes the soft palate, preventing vibration during sleep. Soft palate lifting appliance: An impression is made with irreversible hydrocolloid, with a posterior extension to the soft palate. The appliance is made with heat processed poly methyl methacrylate (PMMA) resin after incorporation of retentive elements. The tissue surface of the soft palate extension part is relined with soft liner and the appliance placed in the mouth. This appliance can be used in cases where incompetency of the soft palate is the cause for snoring, as it enables lifting of the soft palate.(3)

The soft palate lifting appliances have a limited applicability in patients exhibiting exaggerated gag reflex due to the contact of the appliance with the soft palate and uvula. The soft palate lifting design is not often used because of patient tolerance and the fact that tongue posture rather than soft palate position is considered to have a significant influence on the patency of the upper airway. An appliance similar to the soft palate lift appliance can also be fabricated called the Uvula lift appliance.(4)

**Uvula Lift Appliance:** Irreversible hydrocolloid impression of the maxillary arch is made with a posterior extension up to the uvula by a stainless stock tray, which is extended posteriorly, with extra-hard base plate wax. The uvula lift appliance is fabricated using the heat-processed PMMA resin, with the help of the compression mouldings technique, and retentive clasps are made with 18-8 stainless steel wires (21 gauges) which will aid in retaining the appliance intraorally. The appliance is placed in the oral cavity and the tissue surface of the uvula extension part of the appliance is relined with a soft liner. The appliance is placed in the mouth and examined for the position of the uvula lift extension and patient comfort. This appliance can be used in cases where elongated or bifid uvula was the cause for upper airway obstruction.(4)

**Tongue Retention:** Tongue retaining devices (TRDs) incorporate an anterior hollow bulb, which generates a negative pressure vacuum when the tongue is inserted. The tongue is held forward away from the posterior pharyngeal wall opening up the airway. Owing to muscle anatomy, this appliance simultaneously modifies the position of the mandible.(2)

TRD consists of a mouthpiece that covers the entire upper and lower dental arches with a defined mandibular protrusion. It pulls the tongue slightly forward due to the negative pressure created by the displacement of air from the lingual compartment of the device. The TRD is custom made from casts of the tongue and teeth using a soft copolymer. The initial mandibular protrusion is 50% to 75% of maximal protrusion. This protrusion distance is reduced if the patient complains of pain and is increased if snoring remains unchanged after a 3-week trial. Lateral holes facilitate mouth breathing. The TRD is the only appliance suitable in case of edentulism and can be used in this situation.(6)

**Mandible Repositioning Appliances:** It hold the mandible in an antero-inferior position, which indirectly brings the tongue forward opening up the posterior airway . The re-positioning may also stretch and reduce the collapsibility of the soft palate via its connection to the base of the tongue and increase the superior airway space. Appliances for the treatment of snoring and OSA have been described with different degrees of horizontal and vertical repositioning of the mandible. The most common mandibular repositioning dimension quoted is 50–75% of maximal protrusion (approximately 5–7 mm) with minimal vertical opening. The rationale for minimal opening is that, as the mandible opens, it rotates in an inferior and posterior direction. Example: herbst appliance, jasper jumper, twin block appliance, SNOAR, klearway, etc.(4)

**Mouth Protectors:** The greatest use of mouth protectors is the reduction of injuries in sports-related activities. However, mouth protectors are used with increasing frequency in other areas of therapeutic and preventive dentistry and medicine. (3) In contact sports mouth protectors minimize oral lacerations by holding the soft tissues away from the teeth and they decrease the force transmitted through the temporomandibular joint to the base of the skull.(6) Peroral endoscopy and orotracheal intubation can result in fracture or loss of teeth that could be subsequently aspirated. Concern for the teeth is increased because of medico
legal awareness and the liability of the endoscopist for iatrogenic trauma to the teeth. Complications of orotracheal intubation are not limited to the teeth. A custom mouth protector can provide protection during peroral endoscopy and orotracheal intubation. Advantages of the protectors are: they are thin and do not interfere with instrument manipulation, the hard palate component allows for distribution of stress over a large area, they do not move over mobile teeth, can be retained and used again in patients who undergo multiple procedures and they can be adjusted easily with scissors.(1)

Radiotherapy Appliances: A severe and debilitating effect of radiotherapy is radiation mucositis, the painful ulceration of the oral mucosa. Mucositis appears two to three weeks after the start of therapy and reaches a peak toward the end of treatment. It is most severe at the tumour site. Oral discomfort and dysphagia with resulting weight loss are common. When severe mucosal reactions could involve the lips, buccal mucosa, floor of the mouth or anterior part of the tongue, custom mouth protectors should be made. The flexible smooth protectors protect painful oedematous mucosal tissues from irritation by tooth surfaces and irritating foods. This protection aids the irradiated patient in maintaining weight and nutritional status during therapy.(1)

A simple means of reducing the radiation dose to the mandible is to increase the distance between the lingual surface of the mandible and the radioactive sources. In edentulous patients, there is no anatomic structure that can retain the spacer except the residual ridges and a denture duplication technique can be used for the construction of individualized replica denture-type spacers for edentulous tongue cancer patients. The use of these types of spacers eliminates the need to tie the spacer to a suture at the floor of the mouth. The effects of these spacers in reducing the radiation dose to the mandible have been examined experimentally and clinically and a dose reduction of about 60% to 70% was found for the thickness of 10 mm.(7)

Immobilization permits accurate repeated exposure of the desired treatment volume in such tissues as the tongue and lower jaw. Either jaw can be displaced from the treatment volume to spare exposure to teeth, bone, mucosa, and salivary gland tissues. The basic design includes a one-piece bite block formed around an acrylic resin tube with an attached tongue blade. Variations of this design are necessary in some instances depending on the location of the tumor.(8) An accurate, short method of fabricating an intraoral radio therapeutic prosthesis uses duplicates of the patient’s existing dentures for carrying the radioactive source. The patient will tolerate the prosthesis more easily during treatment as the form of the prosthesis is similar to his or her denture. The radiation appliances which have been introduced so far were able to reduce the radiation dose in the patients.

Conclusion
As dental professionals, we have a significant role to play in the early diagnosis, management and care of patients suffering from sleep Apnoea. Oral appliances play a major role in the non-surgical management of OSA and have become the first line of treatment in almost all patients suffering from OSA. The simplicity and cost of the custom mouth protector makes its use applicable to a wide range of patients for the potential preservation of oral structures. Hence, we should familiarize ourselves with this treatment modality.

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References


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