

# Obstructive sleep apnea and edentulism – role of complete dentures/oral appliance from prosthodontics perspective : a review

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## Abstract

**Background:** Edentulism results in decrease in size and tone of the pharyngeal musculature and may be an important risk factor for development of Obstructive Sleep Apnea (OSA). Epidemiological studies estimated that edentulism has been found to be present in about 18% of patients older than 60 years of age and that such prevalence would remain constant over the next 30 years. Considering the high prevalence of obstructive sleep apnea in the advanced age, it is conceivable that a consistent number of elderly people are at risk of edentulism induced worsening of obstructive sleep apnea and, consequently of morbidity and mortality due to this condition. Although cranio-mandibular abnormalities are well recognised risk factors for this manifestation, the role played by edentulism has never been investigated at length. The literature available on this issue was critically reviewed for the occurrence, etiology and prosthodontist's involvement in treating this condition.

**Objective:** The authors reviewed medical and dental literature dealing with edentulism and development of OSA and effect of complete denture/ oral appliances on the retropharyngeal space (smallest linear distance between anterior and posterior pharyngeal wall) and reduction in the incidence of OSA among apnea hypoapnea index (AHI).

**Results:** Edentulous patients tends to be higher than that of the general population. Loss or absence of teeth produces prominent anatomical changes that may influence upper airway size and function, such as loss of the vertical dimension of occlusion resulting into reduction of height of the lower face and mandibular rotation. Rehabilitation of edentulous patients with complete dentures is an integral part of prosthodontic treatment. A denture not only provides aesthetics and improves the phonetics but also restores the desired function of mastication and also provides adequate support to oro-facial structures by restoring altered vertical dimension of face. Besides, it also improves OSA/hypopnea.

**Keywords:** OSA, Oral appliances, Edentulism, Retropharyngeal space

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The loss of natural teeth produces anatomic changes in oro-facial structures that may influence the size and thereby the function of the upper airway. Loss of vertical dimension of occlusion causes reduction of height of the lower face and rotation of the mandible which may lead to obstructive sleep apnea. In a patient with obstructive sleep apnea, extraction of all the teeth manifests as worsening of the cardio-respiratory symptoms associated with almost doubling of the number of episodes of apnea/hyponea per hour (1). Obstructive sleep apnea is a common disorder, especially in elderly people. About 61% of this group is estimated to meet the minimum criteria for obstructive sleep apnea (2). Meyer and Knudson (3) in 1990, described the clinical and laboratory techniques which were used while fabricating a prosthesis to prevent sleep apnea in edentulous patients with OSA. The vertical and protrusive jaw position was provided about 5 to 8 mm open and anterior to physiologic rest position. Sufficient time was allotted to the patient to accommodate altered position. It was observed in cephalograph that there was a significant increase in linear space between the base of the tongue and the posterior pharyngeal wall. C J Robertson (4), in 1998, described about the fabrication of prosthesis to prevent obstructive sleep apnea in edentulous patients. The objective of treatment for a 62-year-old man was to provide a comfortable protrusive and vertical position to the mandible which had minimised hypopharyngeal obstruction nocturnally and stated that this "combination appliance" having increased vertical dimension and forward protrusion of mandible offers a treatment modality to a large group of otherwise forgotten patients. C Bucca et al (5), in 1999, studied 6 edentulous men with obstructive sleep apnea wearing complete dentures. Two polysomnographic studies were performed on 2 consecutive nights, one with dentures and other without dentures. "Without dentures in mouth, the apnea plus hypoapnea index (AHI) almost doubled as compared to the index with dentures in the mouth". Lateral cephalometry showed that removal of dentures lead to a striking decrease in the antero-posterior oro-pharyngeal wall distance from 1.5cm to 0.6 cm. Data confirmed that removal of denture significantly decreases the retropharyngeal space (smallest antero-posterior oropharyngeal wall distance), and that sleeping without dentures is associated with a significant increase in AHI, and decrease in mean and lowest arterial haemoglobin saturation. In 2001, C Bucca, et al(6) investigated the effect of complete dentures in edentulous

subjects. Spirometry was performed with and without dentures and they observed that significant changes were produced in lung volumes and airflow rates in patients using denture. The value of FVC, FEV1, PEF, FEF50%, and FIF 50% were recorded with and without dentures in 3 groups of edentulous subjects comprising; 36 asymptomatic subjects, 22 patients with chronic obstructive pulmonary disease and 18 patients with interstitial lung disease. In 14 subjects, retropharyngeal space with and without dentures was assessed by cephalometry. They observed that normal subjects as well as those with ILD (Interstitial Lung Disease) had significantly lower airflow rates without dentures whereas subjects with COPD had no significant decrease in spirometric values recorded with or without dentures. It was also noticed that retropharyngeal space was significantly decreased by removing dentures. These findings indicated that in edentulous subjects with a normal or restrictive pattern, the recording of flow-volume curves, with or without dentures produces small but significant differences. F Ergovigni et al(7), in 2005, performed a study to assess the effect of the removal of denture and modifications of prosthesis that can affect the pharyngeal collapse. 27 subjects with complete or partial loss of teeth and with loss of the vertical dimension were evaluated using cephalometry. The patient's radiographs of the cranium were taken in the supine position, to simulate the night condition, with the denture in intercuspal position (ICP), and in relaxed position both the with denture (D-RP) and without it (edentule-relaxed position, E-RP). The radiographs were analysed through specific measures for OSA evaluating the parameters that could be modified by the denture. He found that pharyngeal airway space (PAS) decreases, at the level of uvula, from ICP (6.7 mm) to RP (5.3 mm) ( $P < 0.05$ ). The distance between the base and the tip of the tongue significantly decreased both from ICP vs E-RP (7.35 mm vs 6.87 mm;  $P < 0.05$ ), both from D-RP to E-RP (7.22 mm vs 6.87 mm;  $P < 0.005$ ). He concluded that "wearing denture induces modifications in the position of the tongue, the jaw and of the pharyngeal airway space that can favour the reduction of apnea episodes."

In the year 2005, Nayar and Knox (8) described the management of obstructive sleep apnea in an edentulous patient with a mandibular advancement splint. The advantage of this technique was its simplicity, as the clinical procedures were similar to those for fabricating a conventional complete denture. Bucca et al(1), in 2006,

conducted a study to assess whether edentulism favours the occurrence of obstructive sleep apnea, and if this is related to changes in upper airway size, and to oral and airway inflammation. 48 edentulous subjects wearing complete dentures underwent polysomnography on two consecutive nights, one slept with, and the other slept without dentures. Upper airway size was assessed by cephalometry and by recording inspiratory airflow rates; inflammation was evaluated by measuring oral and exhaled nitrous oxide. They concluded that “edentulism might worsen obstructive sleep apnea, particularly in subjects who have no respiratory disturbances sleeping with dentures.” Edentulism might act by modifying anatomy and function of the pharyngeal airway and of tongue and by favouring inflammatory edema. Thus, they suggested that “the advantage of removing dentures during sleep should be weighed against the risk of favouring upper airway collapse”. Taner, et al (9), in 2007, described clinical and laboratory procedures to use in the fabrication of a modified oral appliance with artificial teeth in form of dentures to prevent sleep apnea in a maxillary edentulous and mandibular partially edentulous patient. The patient reported “an improvement in his daytime symptoms” and he was satisfied with the aesthetic look of the appliance. Polysomnographic evaluation showed that there was a significant decrease in his apnea-hypopnea index (AHI) with the appliance. He concluded that an oral appliance fabricated like a denture may be successful in treating sleep apnea patients.

In the year 2007, Hoekema, et al (10) described an implant-retained mandibular repositioner appliance (MRA) in the treatment of edentulous obstructive sleep apnea-hypopnea syndrome (OSAHS) patients. They suggested that an implant-retained MRA in the mandible is a viable treatment modality in edentulous OSAHS patients. Because the therapeutic effectiveness of this treatment may be compromised by excessive pressure of the MRA on the labial mucosa in the maxilla, they suggested that an implant-retained MRA in the maxilla be offered as a secondary treatment in selected patients. Kurtulmus and Cotert (11), in the year 2009, described a clinical and laboratory method for producing a new functional splint combining a mandibular advancement splint (MAS) and a tongue-retaining device with custom-made tongue-tip housing for edentulous patient with obstructive sleep apnea. They found an increase in space between the base of the tongue and the posterior pharyngeal wall with the appliance that was associated with improved sleep during the night.

Hirofumi et al (12), in year 2009, performed a study to investigate the effect of wearing complete dentures during sleep to notice improvement in the apnea-hypopnea index (AHI). Thirty four edentulous patients were studied. All patients wore complete dentures one night and slept without denture the other night. The occurrence of obstructive sleep apnea syndrome (OSAS) was calculated in edentulous patients, and the effect that wearing complete dentures during sleep had on AHI was evaluated. They concluded that wearing complete dentures during sleep improves the AHI of most edentulous OSAS patients. Prachi Gupta and Ram Thombare (unpublished data) in a study done in year 2010 at Sharad Pawar Dental College, Wardha, India, in 20 edentulous patients demonstrated that significant changes were observed in retropharyngeal space with wearing of complete dentures fabricated with acceptable vertical dimension of occlusion (mean increase of 2.16 mm with ‘p’ value < 0.05) in comparison to edentulous subjects. These changes were found to be more significant in same subjects after increasing vertical dimension of occlusion by 2mm using custom made acrylic jig (mean increase of 4.92 mm with ‘p’ value < 0.05) in comparison to edentulous subjects.

### **Advantages of complete dentures in OSA edentulous patients**

The advantage of using dentures in edentulous patient during sleep resulted in reducing apnea-hypopnea events in edentulous obstructive sleep apnea patient. This occurred due to the fact that wearing dentures induces modifications in the position of the jaw, tongue, soft tissue, and pharyngeal airway space that may contribute to the reduction of apnea events (7). Moreover, since wearing complete dentures might not change the horizontal mandibular position as effectively as oral appliances do, it might help restore the vertical mandibular position. Thus, the denture itself can act as an oral appliance and also provide aesthetic look to the patient.

### **Disadvantages of complete dentures in edentulous patients with OSA**

The disadvantages of wearing dentures during sleep are due to the fact that they are associated with chronic inflammatory changes, leading to irritation and alveolar bone resorption in the denture-supporting area (13). In addition, increasing the vertical dimension of occlusion can cause strain on temporomandibular joint and the patient may need more time for adaptation to the same.

## Conclusion

Edentulous patients having obstructive sleep apnea in which there are unusually small retropharyngeal and posterior airway spaces, complete dentures fabricated with acceptable and possible with increased vertical dimension of occlusion within limits of acceptability of tissues, can minimize the pharyngeal collapsibility, thereby reducing apnea-hypopnea events. Further research is needed in edentulous patients with OSA to explore the possibility of using modified complete dentures or providing permissible adjustments to increase vertical dimension of occlusion of complete dentures in order to use the same as an oral appliance such patients.

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