Case Presentation: Effect of Mandibular Tori Removal on Obstructive Sleep Apnea Parameters

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Abstract
The relationship between palatal and mandibular tori and obstructive sleep apnea (OSA) remains tenuous. While evidence on an association between sleep bruxism and OSA is beginning to emerge, there is a dearth of evidence linking palatal and mandibular tori to OSA. This case report is perhaps the first to document that the effect of surgical torus mandibularis removal improves parameters correlated with OSA, but further studies on the relationship between palatal and mandibular tori and OSA are needed.

Introduction
The etiology and significance of torus palatinus and torus mandibularis remains obscure. There are many notions on the formation and implications of tori (Drennan, 1937; Singh, 2010; Cantín et al., 2011), but these remain largely unsubstantiated to date. For example, according to Eggen and Natvig (1986), the number of functional teeth seems to be important for the maintenance of tori. This view lends credence to the concept that (abnormal) mechanical loading presumably is associated with the formation of tori.

In terms of clinical implications, prosthodontists and general dentists have reported difficulty in the provision of dentures where tori and other exophytes exist, such as buccal exostoses. In addition, Durrani and Barwise (2000) reported difficulty with endotracheal intubation associated with enlarged torus mandibularis. That report, however, was unable to extrapolate that upper airway restrictions, such as those associated with obstructive sleep apnea (OSA), might in some way be linked with tori.

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Indeed, to the best of our knowledge, there has only been one report in the medical literature on the association of mandibular tori and OSA (Saffran and Clark, 2004). Although those authors reported that the mandibular tori were removed, no data regarding the post-operative sleep indices were included. Therefore, the aim of this case report is to document the preliminary effects of torus removal on OSA parameters.

History
A 47-year-old male presented in the dental office with a chief complaint of excessive daytime sleepiness (i.e., hypersomnolence). His medical history was otherwise unremarkable with a body mass index (BMI) of 27.0 (weight = 172lb/78kg, height = 5'7"/170cm) and a neck circumference of 16" (40.6cm). Intra-oral examination revealed a worn dentition with extensive, bilateral mandibular tori and buccal exostoses (Fig. 1). Using radiographic assessment, no other intra-oral abnormalities were detected.

An ambulatory sleep study was conducted using a type IV device (WatchPAT, Itamar Medical Inc., Franklin, MA). The study was read and reviewed by a board certified sleep physician, and the patient was subsequently diagnosed with moderate OSA. Prior to continuous positive airway pressure or appliance therapy, it was agreed that the extensive mandibular tori and buccal exostoses should be removed.

Treatment
The patient was placed on 500 mg of amoxycillin, one tablet taken three times a day for 10 days, starting the day prior to surgery. After obtaining appropriate anesthesia bilaterally from the maxillary tuberosities to the maxillary canines, and from the mandibular canines to the mandibular retromolar pads, full thickness intrasulcular flaps were elevated to expose the large facial and lingual exostoses. The lingual tori and buccal exostoses were removed (Fig. 2) utilizing a piezo-surgical instrument (Piezo Surgery, Mectron, Matawan, NJ), and the flaps were repositioned and sutured with 4.0 chromic gut suture.

The patient was instructed to rinse with Peridex 0.5 oz. twice daily, starting the day following surgery for 10 days. The patient was given an IV loading dose of 30 mg of Toradol, and then 10 mg of Toradol was taken by mouth every eight hours for five days. The patient was seen for routine follow-up, and at 15 days there were no postoperative problems. A post-operative home sleep study was repeated five months after the surgical procedure.

Findings

Figure 1 shows the pre-operative condition with large mandibular tori evident. Figure 3 shows the same case five months post-operatively with good healing, and improved mandibular morphology. The pre-operative sleep study indicated an overall apnea-hypopnea index (AHI) of 21/hr (Table 1). The post-operative sleep study indicated a 15 percent reduction in overall AHI to 18/hr, allied with a 31 percent improvement in the oxygen desaturation index (ODI).

Table 1

	Baseline	Post Surgery	Change
AHI	21.4	18.2	-15%
ODI	12.6	8.7	-31%

Discussion

A review by Garcia et al. (2010) comments on the etiology of torus palatinus and torus mandibularis, concluding that the underlying cause of tori remains unresolved. In response, Singh (2010) posited a possible mechanism for the formation of maxillary and mandibular tori, including buccal exostoses. Singh (2010) suggests that site-specific formation of exophytes is an example of gene-environmental interactions. These predictions emanate from the Spatial Matrix hypothesis (Singh, 2004; Singh, 2007; Singh and Krumholtz, 2009). However, Cantín (2011) offers a different explanation for the formation of torus palatinus.

Despite the controversy regarding the formation of tori, there appears to be some association with upper airway restriction and the presence of large tori. Empirically, large bony masses occupying oral spaces reserved for other structures, such as the tongue, would decrease oral volume. In the presence of these exostoses the tongue would be displaced, presumably following the path of least resistance and, aided by gravity, end up occupying the oropharyngeal region; putatively precipitating various degrees of upper airway obstruction. This airway restriction could manifest as OSA, as measured by sleep study devices. Thus, surgical removal of large tori could provide more functional space for the tongue and alleviate airway obstruction by increasing oral volume. These changes, if detectable, could be assessed in a post-surgical sleep study.

Indeed, the proposed mechanism outlined above has been our experience in this present case study. The pre-operative AHI of 21/hr was reduced by 15 percent to 18/hr, and this improvement was associated with a 31 percent improvement in the ODI. Moreover, these physiologic changes appear to be correlated with an improved mandibular morphology (Fig. 2).

Therefore, based on these preliminary findings, we might suggest that removal or reduction of large tori ought to be considered in the management of patients diagnosed with OSA. While other methods of increasing oral volume, such as appliance therapy and restorative reconstruction, might also be considered, we conclude that further studies on the relationship between buccal exostoses, mandibular and palatal tori, and OSA are warranted.

Figure 1a
Pre-operative intra-oral presentation, showing a worn dentition with extensive, bilateral mandibular tori.

Figure 1b
Pre-operative intra-oral presentation, showing extensive buccal exostoses.

Figure 2
The excised lingual mandibular tori that were removed utilizing a piezo-surgical instrument.

Figure 3
Post-operative condition after 15 days, showing good healing and improved mandibular morphology.

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