

Morphological and clinical characteristics of the torus palatinus and torus mandibularis in a sample of young and adults' Romanian people

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Abstract

The oral exostoses are protuberance located on the alveolar surfaces of the jawbones with nodular, flat or pedunculated shape. The purpose of this study was to highlight the variability of the morphological and clinical characteristics of torus palatinus (TP) and torus mandibularis (TM) in a sample of young and adults' Romanian people. The study was conducted on 74 participants examined in Dental Prosthetics Clinic of the Faculty of Dentistry, University of Medicine and Pharmacy of Craiova, Romania, during October–December 2014. The morphological characteristics of the tori were non-metrical evaluated by the standard procedures of the clinical examination. Descriptive statistics only including means, averages and percentage incidence have been used to describe the results. Of the 74 study participants, 31 (41.89%) were males and 43 (58.11%) were females. Six had only TP, seven had only TM and three participants had both TP and TM. The most of the palatal tori had spindle shaped, located in all area of the hard palate. The round mandibular tori with big size were located in the area of both premolars, and those with elongate shape were located in the canine–premolars area. The palatal tori were more frequently in women and the frequency of mandibular tori was equally in men and women. Most of the palatal tori had spindle shape and most of the mandibular tori were solitary bilateral.

Keywords: torus palatinus, torus mandibularis, morphological characteristics, anatomical features, skull.

Introduction

The exostoses are non-pathological benign bony prominences with unknown etiology [1]. The oral exostoses are protuberance located on the alveolar surfaces of the jawbones with nodular, flat or pedunculated shape. These peripheral prominences of jawbones are named as torus palatinus (TP), torus mandibularis (TM) or oral exostosis (OE), according to their localization [1]. TP is a bone mass with sessile or nodular shape, which occurs along the midline of the hard palate. TM is a protrusion located on the lingual side of the mandible, usually in the canine and premolar area. OE occurs along the buccal aspect of the maxilla or mandible, usually in the premolar and molar areas and they appear less frequently than tori [2]. The histological characteristics of a torus or an OE are the same [2]. These anatomical entities are described as bone hyperplasia consisting of mature cortical bone and trabecular bone [3]. In the peripheral area of oral bone protuberances was highlighted lamellar bone covered by periosteum with the reduced osteoblast activity, while in the central area of these were revealed thin and anastomosed bone trabeculae between which there is a

small amount of bone marrow. Therefore, it is suggested that the central area of exostosis has a strong osteogenic potential relevant for potential growth in the primary centers of growth of the jaw and mandible [4].

It was shown that overgrowth bone is a reaction to increased or abnormal occlusal stress on the teeth located in the exostosis development area [3]. It was reported a significant correlation between the occurrence of tori and dental abrasion [5] and a relationship between attrition and oral tori presence in Thai subjects but not in German subjects [6]. It is commonly accepted theory that mechanical stress can cause various reactions such as inflammation of bone resorption, remodeling or deformation [7].

The purpose of this study was to highlight the variability of the morphological and clinical characteristics of torus palatinus and torus mandibularis in a sample of young and adults' Romanian people.

Subjects and Methods

The study was conducted on 74 participants examined in Dental Prosthetics Clinic of the Faculty of Dentistry, University of Medicine and Pharmacy of Craiova, Romania,

during October–December 2014. The study was approved by the Ethics Committee of University of Medicine and Pharmacy of Craiova. The subjects were informed about the objectives of the study and signed informed consent. The morphological characteristics of the tori were non-metrical evaluated by the standard procedures of the clinical examination [8]. The examination of the tori was performed by clinical inspection and palpation. The location of the TP and TM was established in relation to the remaining teeth: in canine area, premolar–molar area and molars area. Also, the TP was positioned according to the criteria of Sisman *et al.* [9], which defined the TP as a raised bony exostosis in the midline of the hard palate. The shape of TP was recorded as flat, nodular, spindle and lobular according to Jainkittivong *et al.* [10] classification.

In this study, the TM shape was recorded as rotund, when torus had only one round nodule and elongated when torus was extended over the end-points of two or more teeth. The end-points were defined according to Sellevold [11]. In terms of number of nodules, TM was recorded as a solitary protuberance when it was represented by a single nodule and as a multiple protuberance when there were two or more nodules [12]. It was, also, used TM classification as unilateral and bilateral solitary, unilateral and bilateral multiple and bilateral combined [13].

The frequency of the TP or TM was analyzed in relation with the shape and location of them and depending on the age and gender of the study participants.

Descriptive statistics only including means, averages and percentage incidence have been used to describe the results.

Results

Of the 74 study participants, 31 (41.89%) were males and 43 (55.40%) were females. The age range was between 22 to 80 years, with an average of 34.34 years (standard deviation – SD ± 13.61) for all participants, 33.67 years (SD ± 14.07) for male study participants and 34.88 years (SD ± 13.42) for female study participants (Table 1).

The TP and/or TM frequency analysis in study participants showed that most of them had a torus only on one jaw. Of the 74 participants examined, 16 (21.62%) had a torus on one of the jaws or on both, as follows: six had only TP, seven had only TM and three participants had both TP and TM. Of the 31 male participants, just one had only TP, four had only TM and just one had tori on both jaws. Of the 43 female participants, five had only TP, three had only TM and two had tori on both jaws (Figure 1).

Of the nine participants with TP, five were 20–29-

year-old and of the 10 participants with TM, four were 20–29-year-old. The gender distribution of the participants in the study showed similar values of the age average between those with and without torus (Figure 2).

Table 1 – The study participants distribution on gender and age

Age groups [years]	Males	Females	Total
20–29	19	22	41
30–39	2	9	11
40–49	6	8	14
50–59	2	1	3
60–69	1	1	2
70–79	0	1	1
80–89	1	1	2
Total	31	43	74

Two characteristics were examined for the clinico-morphological features of both types of tori: the side location and the shape.

The most of the palatal tori had spindle shape according to the data recorded as a result of the clinical examination of the study participants. From the point of view of localization, the TP was found to be located in all third of the midline of the hard palate: in the canine–premolars area, in the premolars area, in the premolar–molar area (Figure 3). Also, in one case, the TP with spindle shape was extended to anterior third of hard palate with a high width median raphe (Figure 4). The round-oval palatal tori were observed in two cases: one in the posterior third of hard palate and one in the premolars area of an edentate maxilla (Figure 5). All the examined palatal tori were located in the midline of the hard palate and most of them had clinically symmetrical shape. Only TP located on the edentate maxilla had an asymmetrical shape with left half bigger than the right. Most of the 20–29-year-old participants with TP also presented a type of malocclusion.

All mandibular tori were bilateral located on the lingual side of the mandible, above the mylohyoid line. The small round mandibular tori were located on the lingual surface in the first premolar area of the mandible. The round mandibular tori with big size were located in the area of both premolars, and those with elongate shape were located in the canine–premolars area (Figure 6). One of the male participants presented an elongated TM multiple type on left side and a solitary type on the right side. The examined mandibular tori were located on dentate and edentate mandibles. One of the female participants presented the round mandibular tori with bigger sizes on the right side than the left side (Figure 7).

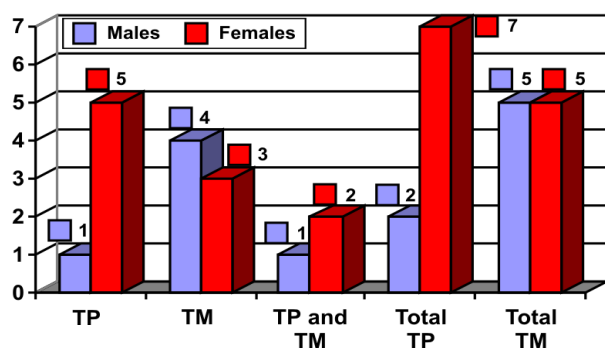


Figure 1 – Gender distribution of study participants with TP, TM and with both type of tori.

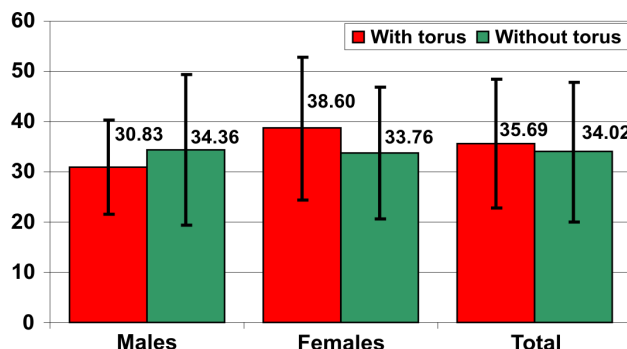


Figure 2 – Age average of the males and females study participants with and without torus.

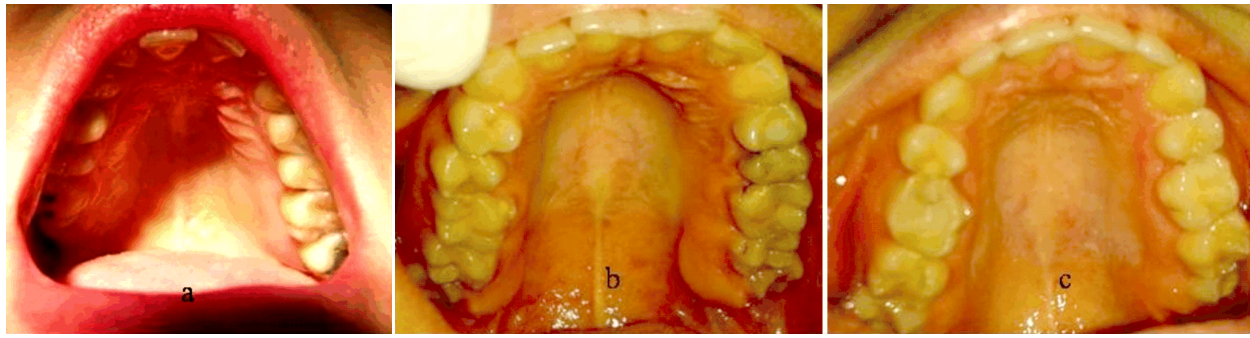


Figure 3 – Spindle TP located in every third of hard palatum: (a) TP positioned in the first third of the hard palatum midline; (b) TP positioned in the middle third of the hard palatum midline; (c) TP positioned in the posterior third of the hard palatum midline.

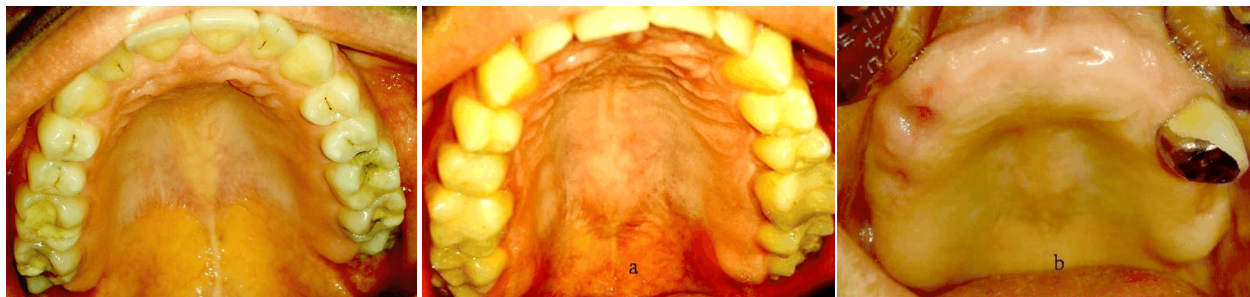


Figure 4 – TP extended with width median raphe.

Figure 5 – Round palatal tori: (a) Round TP with symmetrical shape; (b) Round TP with asymmetrical shape.

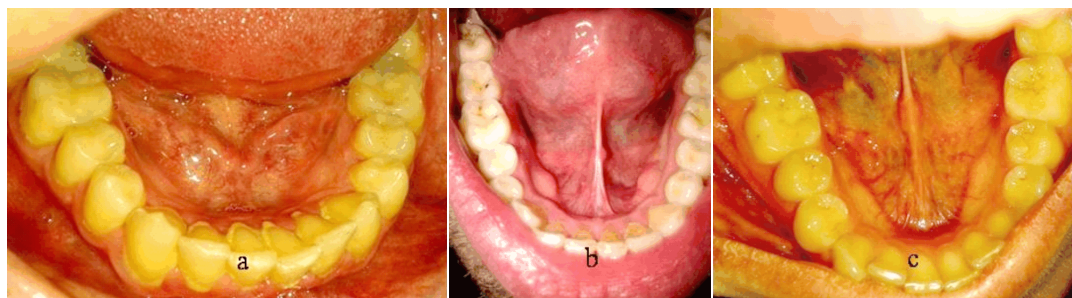
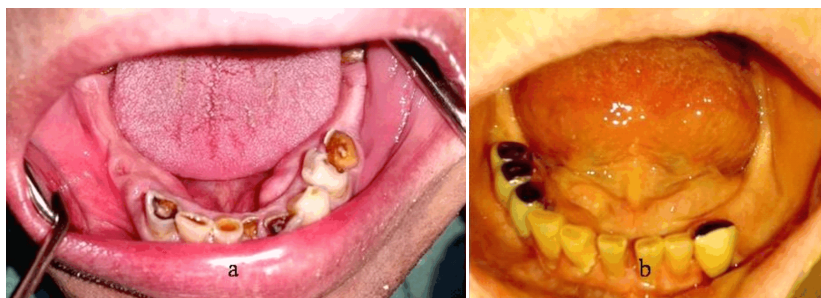


Figure 6 – TM with different shapes and sizes: (a) Small solitary TM positioned bilateral; (b) Solitary TM positioned bilateral with nodule shape; (c) Elongated TM positioned bilateral.

Figure 7 – Solitary and multiple TM: (a) TM with elongated nodule shape on the right side and TM with multiple nodules on the left side; (b) Solitary round TM with bigger sizes on the right side than the left side.



Discussion

The results of this study indicated a high prevalence of TP and TM in a predominantly young South-Western Romanian population. The prevalence of TP was higher in women and the prevalence of TM was almost equally in men and women. The other study on elderly Romanian population highlighted that the frequency of TP was significantly higher in both genders and the frequency distribution between genders for TM was statistically non-significant [14].

Generally, it is considered that the frequency of TP is more higher than TM [2]. Some authors sustain that the

prevalence of TP varies in different populations. A study comprised of 1679 Croatian subjects sustains these considerations. The authors highlighted that the TP was found in 42.9% subjects and TM in 12.6% of the subjects [13]. The TP is more common in Asian and Inuit populations [10, 15, 16]. On the contrary, the results of a study in an Indian population showed that the prevalence of TP was calculated to be 1.3%, while the prevalence of TM was 6.9% [17]. Al Quran & Al-Dwairi published that the overall prevalence of tori was 13.9% in Jordanian edentulous patients. In their study, the prevalence of TP was 29.8%, while that of TM was significantly higher 42.6% [18].

In 1520 Thai populations, the prevalence rates were 60.5% for TP and 32.2% for TM [10]. A previous comparative study between German and Thai populations showed that the TP was recorded in 13.5% of 1317 German patients and 23.1% of 947 Thai patients. The TM was recorded in 8.6% of the Germans men and 2.4% in the Germans women. In the Thai, 9.4% of the men and 9% of the women showed TM. The authors concluded there was a difference between the prevalence rates in Germans and Thai was significant [6]. The TP protuberance was observed in 21% of the entire sample of 1002 Israeli Jews, with non-significant differences among different age groups [19], in 20.9% of the United States population [20] and in 9.2% of the Norway population [8].

The prevalence may vary among similar ethnic groups living in different areas, or different ethnic groups living in same areas [21]. Also, many studies report a higher prevalence of palatal tori in women and a higher prevalence of mandibular tori in men [8, 22]. A study on the oral tori in 1520 Thai dental patients pointed out that women were more likely to have larger TP whereas men tended to have larger TM. This study showed high prevalence rates of TP and TM in dental patients and the occurrences were related to gender [10]. Analysis of prevalence of TM and TP revealed that the prevalence of TP was higher among women than men [23]. On the contrary, the results of a study in an Indian population showed that males more commonly presented the tori, when compared to females [17]. The finding of higher prevalence of tori in men is in concordance with Sonnier *et al.* [24]. A study realized on Singaporean population report the same frequency of TP in both genders [25].

Of the 74 participants included in this study, three had both TP and TM. Also, the results of study reported that the both types of tori were associated each other in 27.7% of cases analyzed in a Jordanian population [18]. In subjects who had both TP and TM was observed the highest concurrence between the occurrence of exostoses with the occurrence of tori [26].

The data on the relation of OE with age are different. Some of these showed that mandibular exostoses are statistically associated with the presence of teeth and a younger age onset [24]. Other papers mentioned a gradual decline of the palatal and mandibular tori after the age of 30 in the Habana population [27] and after the fourth decade of life in Norwegians [28]. A study in a Black South Africans population showed that the age range with the highest prevalence of torus mandibularis was the 40–60 years group. Thereafter, with senescence, its occurrence showed a decline [12]. Other study suggests that subjects who had larger TP or TM were older than those who had smaller TP or TM [10]. The prevalence of tori larger than 2 cm was much higher in the 21-year and older age groups than in the younger groups [19]. Finally, some researchers said that there was no relationship between age and the presence of TP or TM [29].

Regarding the position and shape of tori, the results of these study indicated that the most palatal tori were located in premolar–molar area of hard palate, and they had spindle shape. A study in 1002 Israeli Jews showed

that 53.8% of examined tori were located in the molar area only. The same authors mentioned that the prevalence of TP in the combined molar–premolar area increased with age, whereas in the molar area it decreased, expressing a significant relation between location and age [19]. About the shape of TP, there are studies which showed that flat TP is the most common type [30, 31]. Our findings are in accordance with results of the studies of Reichart *et al.* [6] and Jankittivong *et al.* [10], which reported spindle TP. There are possible ethnic differences in terms of shape or there are necessary further researches.

Regarding the mandibular tori, the present study indicated that most of them were solitary bilateral and two participants had mandibular tori with different shape for right and left side. The findings of the present study were in accordance with other studies that showed bilateral solitary type of TM to be the most commonly observed [13, 29]. Also, the prevalence of TM was not significantly different in males and females in a Malay population, but they occurred most commonly in bilateral multiple form, and was often located at the canine to premolar area [32].

Observations of anatomical features of TP on the skulls showed that most of them had an asymmetrical shape and they are located in middle third and posterior third of hard palate. On the contrary, examinations on living participants pointed out that most of the palatal tori had a symmetrical shape. Most of the palatal tori had spindle shape in both living and skeletal sample. The mandibular tori were more frequently solitary unilateral. The etiology of oral exostoses is still unclear, but are mentioned several possible factors: genetic factors, masticatory stress, developmental abnormalities, infections, malnutrition, discontinuous growth [33]. Currently, the development of the tori is considered an interaction between genetic and environmental factors [13, 19]. Some authors suggested that the occurrence of torus palatinus is an autosomal dominant transmission. They explained these by the high gene frequency of TP and the relatively high proportion of homozygous parents [34]. In 1995, Seah sustained the quasi-continuous genetic or threshold model theory. This theory proposes that the environmental factors responsible must first reach a threshold level before the genetic factors can express themselves in the individual. Hence, both genetic and environmental factors determine liability, making the system multifactorial [35].

Eggen *et al.* showed that the prevalence of TP appeared to be higher among natives, who consume the softer food. The higher prevalence being hypothesized to have some connection with nutrient substances present in saltwater fish, possibly omega-3 polyunsaturated fatty acids and vitamin D [23]. The same authors pointed out that the TP seemed to be a dynamic phenomenon capable of growth and subject to resorption remodeling.

Palatal or mandibular tori are usually asymptomatic exostoses, which normally require no treatment. The clinical importance of exostosis lies in surgical removal of these in order to permit the proper adaptation of the removable dentures and to the use of the tori as potential sources of autogenous cortical bone for grafting. The oral

tori can cause difficulties to capture details for final impression because of the impression trays interferences with these. Also, any oral bony protuberances may cause pain during the impression making, as there is often covered with a thin gingival mucosa which can be easily irritated [18]. Therefore, it was developed a new concept to taking impressions of OE, TM, TP and mal-positioned teeth, which incorporates the use of a disposable heat mouldable tray [36]. The impression trays often cannot be seated. Sometimes, when their sizes are big, there are necessary surgeries to reduce them in order to placement the denture base, the removable denture framework or oral appliances. The use of mandibular tori as a source of autogenous bone graft should be considered whenever a patient requires a bone grafting procedure [37] for the dental implants placement [38], or the alveolar ridge augmentation and the maxillary sinus lifting [39], the periodontal osseous defect correction [40] and other multiple facial reconstructions as the nasal reconstruction [41].

✉ Conclusions

The palatal tori were more frequently in women and the frequency of mandibular tori was equally in men and women. Most of the palatal tori had spindle and symmetrical shape. Most of the mandibular tori were solitary bilateral, but also, were found the mandibular tori with different shape and size for right and left side of the mandible.

Conflict of interests

The authors declare that they have no conflict of interests.

References

- [1] Smitha K, Smitha GP. Alveolar exostosis – revisited: a narrative review of the literature. *Saudi J Dent Res*, 2015, 6(1):67–72.
- [2] Neville BW, Damm DD, Allen CM, Bouquot JE. Developmental defects of the oral and maxillofacial region. In: Neville BW, Damm DD, Allen CM, Bouquot JE. *Oral and maxillofacial pathology*. 3rd edition, W.B. Saunders Co., Philadelphia, 2009, 1–53.
- [3] Regezi JA, Sciubba JJ. *Oral pathology: clinical pathologic correlations*. W.B. Saunders Co., Philadelphia, 1989, 386–387.
- [4] Kim YS. Pathogenetic growth potential in the central area of oral exostosis. *Korean J Oral Maxillofac Pathol*, 2013, 37(5): 201–210.
- [5] Matthews GP. Mandibular and palatine tori and their etiology. *J Dent Res*, 1933, 13(2):245.
- [6] Reichart PA, Neuhaus F, Sookasem M. Prevalence of torus palatinus and torus mandibularis in Germans and Thai. *Community Dent Oral Epidemiol*, 1988, 16(1):61–64.
- [7] Sasaki K, Yokoyama M, Yamaguchi K, Itoh M. Biological responses induced by mechanical stresses – bone metabolism by bone scintigraphy at residual alveolar bone beneath the denture and TMJs. *Int Congr Ser*, 2005, 1284:28–36.
- [8] Haugen LK. Palatine and mandibular tori. A morphologic study in the current Norwegian population. *Acta Odontol Scand*, 1992, 50(2):65–77.
- [9] Sisman Y, Ertas ET, Gokce C, Akgunlu F. Prevalence of torus palatinus in Cappadocia region population of Turkey. *Eur J Dent*, 2008, 2(4):269–275.
- [10] Jaikittivong A, Apinhasmit W, Swasdison S. Prevalence and clinical characteristics of oral tori in 1,520 Chulalongkorn University Dental School patients. *Surg Radiol Anat*, 2007, 29(2):125–131.
- [11] Sellevold BJ. Mandibular torus morphology. *Am J Phys Anthropol*, 1980, 53(4):569–572.
- [12] Ihunwo AO, Phukubye P. The frequency and anatomical features of torus mandibularis in a Black South Africans population. *Homo*, 2006, 57(4):253–262.
- [13] Simunković SK, Božić M, Alajbeg IZ, Dulčić N, Boras VV. Prevalence of torus palatinus and torus mandibularis in the Split–Dalmatian County, Croatia. *Coll Antropol*, 2011, 35(3): 637–641.
- [14] Muntianu LA, Comes CA, Rusu MC. Palatal and mandibular tori in a Romanian removable denture-wearing population. *Gerodontology*, 2011, 28(3):209–212.
- [15] Yoshinaka M, Ikebe K, Furuya-Yoshinaka M, Hazeyama T, Maeda Y. Prevalence of torus palatinus among a group of Japanese elderly. *J Oral Rehabil*, 2010, 37(11):848–853.
- [16] Kerdpon D, Sirirungrojying S. A clinical study of oral tori in southern Thailand: prevalence and the relation to para-functional activity. *Eur J Oral Sci*, 1999, 107(1):9–13.
- [17] Patil S, Maheshwari S, Khandelwal SK. Prevalence of torus palatinus and torus mandibularis in an Indian population. *Saudi J Oral Sci*, 2014, 1(2):94–97.
- [18] Al Quran FA, Al-Dwairi ZN. Torus palatinus and torus mandibularis in edentulous patients. *J Contemp Dent Pract*, 2006, 7(2):112–119.
- [19] Gorsky M, Raviv M, Kfir E, Moskona D. Prevalence of torus palatinus in a population of young and adult Israelis. *Arch Oral Biol*, 1996, 41(6):623–625.
- [20] Kolas S, Halperin V, Jefferis K, Huddleston S, Robinson HBG. The occurrence of torus palatinus and torus mandibularis in 2,478 dental patients. *Oral Surg Oral Med Oral Pathol*, 1953, 6(9):1134–1141.
- [21] King DR, King AC. Incidence of tori in three population groups. *J Oral Med*, 1981, 36(1):21–23.
- [22] Bouquot JE, Gundlach KK. Oral exophytic lesions in 23,616 white Americans over 35 years of age. *Oral Surg Oral Med Oral Pathol*, 1986, 62(3):284–291.
- [23] Eggen S, Natvig B, Gåsemeyr J. Variation in torus palatinus prevalence in Norway. *Scand J Dent Res*, 1994, 102(1):54–59.
- [24] Sonnier KE, Homing GM, Cohen ME. Palatal tubercles, palatal tori, and mandibular tori: prevalence and anatomical features in a U.S. population. *J Periodontol*, 1999, 70(3):329–336.
- [25] Chew CL, Tan PH. Torus palatinus. A clinical study. *Aust Dent J*, 1984, 29(4):245–248.
- [26] Jaikittivong A, Langlais RP. Buccal and palatal exostoses: prevalence and concurrence with tori. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 2000, 90(1):48–53.
- [27] Bernal Balaz A, Moreira Diaz E, Rodriguez Perez I. Prevalence of torus palatinus and torus mandibularis in the city of Havana. *Rev Cubana Estomatol*, 1983, 20(2):126–131.
- [28] Eggen S, Natvig B. Variation in torus mandibularis prevalence in Norway. A statistical analysis using logistic regression. *Community Dent Oral Epidemiol*, 1991, 19(1):32–35.
- [29] Chohayeb AA, Volpe AR. Occurrence of torus palatinus and mandibularis among women of different ethnic groups. *Am J Dent*, 2001, 14(5):278–280.
- [30] Schaumann BF, Peagler FD, Gorlin RJ. Minor craniofacial anomalies among a Negro population. I. Prevalence of cleft uvula, commissural lip pits, preauricular pits, torus palatinus, and torus mandibularis. *Oral Surg Oral Med Oral Pathol*, 1970, 29(4):566–575.
- [31] Bernaba JM. Morphology and incidence of torus palatinus and mandibularis in Brazilian Indians. *J Dent Res*, 1977, 56(5): 499–501.
- [32] Hiremath VK, Husein A, Mishra N. Prevalence of torus palatinus and torus mandibularis among Malay population. *J Int Soc Prev Community Dent*, 2011, 1(2):60–64.
- [33] Antoniadis DZ, Belazi M, Papanayiotou P. Concurrence of torus palatinus with palatal and buccal exostoses: case report and review of the literature. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 1998, 85(5):552–557.
- [34] Gorsky M, Bukai A, Shohat M. Genetic influence on the prevalence of torus palatinus. *Am J Med Genet*, 1998, 75(2): 138–140.
- [35] Seah YH. Torus palatinus and torus mandibularis: a review of the literature. *Aust Dent J*, 1995, 40(5):318–321.
- [36] Boksmann L, Carson B. Simplification of final impressions complicated by exostoses, tori palatinus, tori mandibularis and tooth mal-position: disposable heat mouldable trays. *Oral Health J*, October 2009, 8–12, <https://www.clinicalresearchdental.com/>.

- [37] Santhanakrishnan M, Rangarao S. Mandibular tori: a source of autogenous bone graft. *J Indian Soc Periodontol*, 2014, 18(6):767–771.
- [38] Barker D, Walls AW, Meechan JG. Ridge augmentation using mandibular tori. *Br Dent J*, 2001, 190(9):474–476.
- [39] Neiva RF, Neiva GF, Wang HL. Utilization of mandibular tori for alveolar ridge augmentation and maxillary sinus lifting: a case report. *Quintessence Int*, 2006, 37(2):131–137.
- [40] Puttaswamaiah RN, Galgali SR, Gowda VS. Exostosis: a donor site for autograft. *Indian J Dent Res*, 2011, 22(6):860–862.
- [41] Kiat-amnuay S. Nasal prosthesis for total rhinectomy patient. *J Prosthodont*, 2000, 9(3):173.

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