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Prevalence and Morphology of Torus palatinus and Torus mandibularis in Malaysian Patients

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Abstract

Aim

The purpose of the present studywere to determine prevalence of torus palatinus (TP) and torus mandibularis (TM), association of TP and TM with the age, gender and ethnicity and to describe size, shape, location and number of the TP and TM among Malaysian patients.

Materials and Method

A total of 108 patients were screened during the study taking into account of the inclusion and exclusion criteria. Demographic details such as age, gender and ethnicity were recorded.

Intra-oral examination was done and clinical diagnosis was given based on presence of palatal torior mandibular tori. Patient with torus, alginate impression was made, and cast was fabricated.Shape, size and location of tori were observed for each patient. The data were statistically analysed using Chi square test and Fisher Exact test. Significance level was set at 0.05.

Results

Overall prevalence of TP was 47.22% and that of TM was 6.48%. Majority of TP are spindle shaped, falls into size of less than 3mm and found mainly in the molar region. Majority of TM falls under unilateral single and bilateral single and mainly located in the canine premolar region. There was no significant association between age and gender with tori. No significant association was present between TP and TM with ethnicity. (P=0.146 and P=0.734 respectively)

Conclusion

Prevalence of TP was high, and TM was low in Malaysians. However, there were differences among the shape, size and location of tori among the Malays, Chinese and Indians and this may reflect multifactorial etiology such as genetic factors as well as environmental factors.

Clinical significance

Both adults and children must be screened for palatal and mandibular tori as these could be manifestations of sleep disordered breathing which are not diagnosed yet. Such cases need a referral to a sleep physician for diagnosis and further management.Moreover, huge tori may necessitate the need for modifications during fabrication of complete denture.

Introduction:

Tori are asymptomatic, localized bony exostoses of the jaws. The terminology "tori" originates from the Latin word torus which literally means something which stands out or appears as a lump.[1]They are formed due to excessive deposition of bone by osteoblasts.Torus is a benign anomaly, and often continues to grow slowly throughout life. There are a few proposed etiologies like masticatory muscle hyperfunction, familial inheritance, dietary factors and environmental factors.[2.]

Tori is basically classified into Torus palatinus and torus mandibularis. Torus palatinus is normally encountered on the midline of the roof of the mouth or the palate, existing as a single growth or in clusters. They vary

greatly in size, ranging from a small elevated protruberance to a large bulbous mass.[3,4]On the other hand, torus mandibularis is a bony exostoses which resides on themandibular lingual surfaceusuallyadjacent to the canine and premolar region.[1]

Haugen was the first person who classified oral exostosis. Based on size, the oral exostoses was classified into small, medium and large. He found that majority of the tori belonged to small and medium.

(1) Small: < 2mm in their largest diameter.

(2) Medium: 2 – 4 mm in their largest diameter.

(3) Large: >4 mm in their largest diameter.

Reichart then made some modifications on Haugen's classification.

Grade I – Tori up to 3 mm in their largest dimension

Grade II – Tori up to 6 mm in their largest dimension

Grade III – Tori above 6 mm in their largest dimension[1]

According to Hiremath et al, Neville classified torus palatinus into flat, spindle shaped, nodular and lobulated. Mandibular tori were graded based on classification proposed by Kolas et al. given as bilateral single, bilateral multiple, unilateral single and unilateral multiple.[4]

Generally, oral tori is a benign, asymptomatic and patients are not aware of its presence. However, interference of oral tori with complete dentures have been observed especially with context to fabrication, retention and function. Oral tori, especially,torus palatinus may cause interferences during intra-oral radiographic techniques, thus limiting the use of certain intra-oral radiographic devices for such patients.They may obscure radiographic details of maxillary sinuses and lower premolars, thus compromises interpretation and hinders accurate diagnosis.[5,6]

Prevalence of tori had exhibited varied range among diverse races and based on geographical location. The prevalence for torus palatinus (TP) was 0.4%-66.5% and 0.5%-63.4% for torus mandibularis (TM). In a Malaysian study by Singh et al, the overall prevalence of oral tori was 33%.[3] In another Malaysian study by Hiremath et al, which included only Malay population, TP was observed in 50.8% and TM in 4.6%.[4]

Racial differences appear significant, with high prevalence in Asian and Eskimo populations. Differences in the prevalence of tori between gender have also been reported.[7-9]

According to the study that has been done by K. Sathya et al, the prevalence rate for torus palatinus was 12% and 2.8% for torus mandibularis. Most torus palatinus were of smooth type (52.2%) while all torus mandibularis were bilateral or nodular.[10]

There is paucity of literature regarding prevalence and characteristics of tori in the southern part of Malaysia, especially from Melaka. Hence, the present study was carried out to estimate the prevalence of torus palatinus (TP) and torus mandibularis (TM), and to describe size, shape, location and number of the torus palatinus and torus mandibularis and to determine the association with age, gender and ethnicity in patients attending outpatient department, Melaka-Manipal Medical College, Melaka, Malaysia.

Materials and Methods:

An observationalstudy was carried out in outpatient department, Faculty of Dentistry in Melaka-Manipal Medical College, Malaysia. After obtaining the institutional ethical committee clearance,Malay, Chinese and Indian patients above 20 years old who have visited the outpatient department were screened for a period of one year for the presence of both palatal and mandibular tori.Both tori were examined by visual inspection and palpation. Tori was examined by three investigators and diagnosis of tori was confirmed by specialist.Patient was informed about the details of the study and written consent was obtained. A total of 108 patients were screened and examined for the presence of tori [Figure 1]. Alginate impression was made for patients with torus and cast was fabricated [Figure 2 and 3]. Dependant variables like shape, size and location of tori and independent variables which include gender, age and ethnicitywere recorded into an excel spreadsheet The largest diameter of the torus was measured using a pair of dividers on the fabricated cast [Figure 4]. Inclusion criteria were all patients who were aged above 20 years.

Exclusion criteria of the study were all patients who registered as Non-Malaysians.

The subjects were segregated into 6 age groups: 21-30, 31-40, 41-50, 51-60, 61-70, and 71-80. The size of torus palatinus were graded based onReichart et al classification: Grade 1(<3mm), Grade 2 (3-6mm) and Grade 3 (>6mm). The shape of torus palatinus were assessed according to the classification given by Neville et al into four types – flat, spindle, nodular and lobular. The locations of torus palatinus were classified as incisor-premolar, incisor-molar, canine-molar, premolar, and premolar-molar, molar. Mandibular tori were graded based upon the number of nodules by Kolas et al – bilateral single, bilateral multiple, unilateral single and unilateral multiple. Locations of torus mandibularis were recorded as incisor, incisor to canine, incisor to premolar, incisor to molar, incisor& premolar, canine, canine to premolar, canine to molar, premolar, and premolar to molar areas.[1, 4] All the required data were recorded in Excel spreadsheet and summarised using Descriptive statistics. Epi info software Version 7 was used for data analysis and Chi square test and Fisher Exact test were applied. Significance level was set at 0.05.

Results:

Prevalence

108 subjects were screened and 51 of them were found to have torus palatinus (TP) and 7 subjects were found to have torus mandibularis(TM).Our study showed a prevalence of 47.22% for TP and 6.48% for TM [Table 1].

Table 1: Prevalence of Torus Palatinus (TP) and Torus Mandibularis (TM) (n=108)

Variables	Frequency	Percentage (%)	95% Confidence Interval
Torus palatinus			
Present	51	47.22	37.54 – 57.06
Absent	57	52.78	42.94 – 62.46
Torus mandibularis			
Present	7	6.48	2.65 – 12.90
Absent	101	93.52	87.10 – 97.35

Table 2: Size, Shape and Location of Torus Palatinus (TP)

Variables	Frequency	Percentage (%)	95% Confidence Interval
Size			
Grade 1	48	94.12	83.76 – 98.77
Grade 2	3	5.88	1.23 – 16.24
Grade 3	0	0.00	0.00
Location			
Incisor - Premolar	0	0.00	0.00
Incisor - Molar	0	0.00	0.00
Canine - Molar	2	3.92	0.48 – 13.46
Premolar	2	3.92	0.48 - 13.46
Premolar - Molar	15	29.41	17.49 – 43.83
Molar	32	62.75	48.08 – 75.87
Shape			
Flat	9	17.65	8.40 – 30.87
Spindle	27	52.94	38.46 – 67.07
Nodular	1	1.96	0.05 – 10.45
Lobular	14	27.45	15.89 – 41.74

Table 3: Location and Number of Torus Mandibularis (TM)

Variables	Frequency	Percentage (%)	95% Confidence Interval
Location			
Incisor	0	0.00	0.00
Incisor - Canine	0	0.00	0.00
Incisor - Premolar	0	0.00	0.00
Incisor and Premolar	0	0.00	0.00
Canine	2	28.57	3.67 – 70.96
Canine and Molar	1	14.29	0.36 – 57.87
Canine - Premolar	3	42.86	9.90 – 81.59
Premolar	1	14.29	0.36 – 57.87
Number			
Uni-Single	3	42.86	9.90 – 81.59

Uni-Multiple	0	0.00	0.00
Bi-Single	3	42.86	9.90 – 81.59
Bi-Multiple	1	14.29	0.36 – 57.87

Table 4: Association between presence/ absence of torus palatinus and age, gender and ethnicity

Variables	Absent Frequency (%)	Present Frequency (%)	X^2	P value
Age (Decade)				
3	29 (43.94)	37 (56.06)	-	0.135
4	5 (62.50)	3 (37.50)		
5	4 (66.67)	2 (33.33)		
6	13 (59.09)	9 (40.91)		
7	4 (100.00)	0 (0.00)		
8	2 (100.00)	0 (0.00)		
Gender				
Male	22 (61.11)	14 (38.89)	1.504	0.219
Female	35 (48.61)	37 (51.39)		
Ethnicity				
Chinese	38 (56.72)	29 (43.28)	3.845	0.146
Indian	9 (64.29)	5 (35.71)		
Malay	10 (37.04)	17 (62.96)		

Table 5: Association between presence/ absence of torus mandibularis and age, gender and ethnicity

Variables	Absent Frequency (%)	Present Frequency (%)	X^2	P value
Age (Decade)				
3	60 (90.91)	6 (9.09)	-	0.479
4	8 (100.0)	0 (0.00)		
5	5 (83.33)	1 (16.67)		
6	22 (100.0)	0 (0.00)		
7	4 (100.0)	0 (0.00)		
8	2 (100.0)	0 (0.00)		
Gender				

Male	34 (94.44)	2 (5.56)	0.076	0.782
Female	67 (93.06)	5 (6.94)		
Ethnicity				
Chinese	62 (92.54)	5 (7.46)	-	0.734
Indian	14 (100.0)	0 (0.00)		
Malay	25 (92.59)	2 (7.41)		

Fig.1: Patients attending outpatient department were screened for the presence of torus palatinus (TP) and torus mandibularis (TM)

Fig. 2: Alginate impression was made for TP and TM

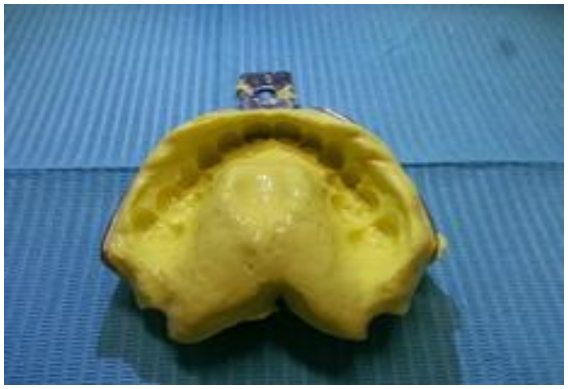
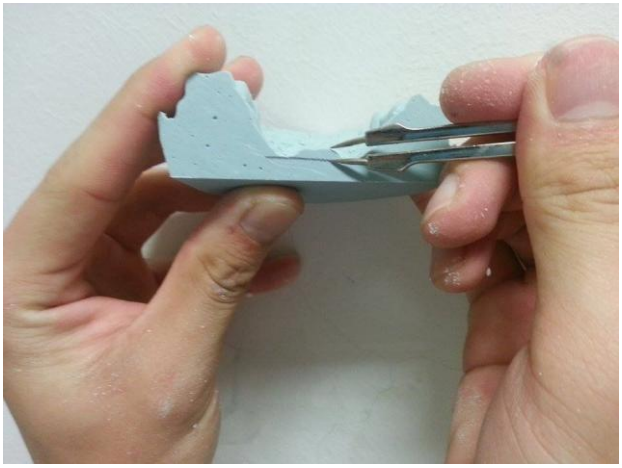


Fig. 3: Cast was fabricated using dental stone

Fig. 4: Largest dimension was recorded using a divider



Size, Location and Shape of TP

94.12% showed grade 1 TP (0-3mm) which is the commonest size, followed by 5.88% of grade 2 TP (3-6mm) while none was found to have grade 3 (>6mm) torus palatinus. No patient was found to have TP in the region of incisor-premolar and incisor-molar region. 3.92% subjects had TP in the region of canine-molar and premolar. 29.41% subjects had TP in the premolar-molar region and 62.75% subjects had TP in the molar region. The commonest shape of TP was spindle shape (52.94%). Other shapes such as lobular, flat and nodular varieties were observed in 27.45%, 17.65% and 1.96% subjects respectively [Table 2].

Location and Number of TM

The commonest location of TM was found in the region of canine-premolar seen in42.86%, followed by 28.57% in the canine region and 14.29% of TM were found in the canine - molar region and premolar region. No torus was

found in the region of incisor, incisor-canine, incisor-premolar as well as incisor and premolar. 42.86%of TM were found in a unilateral-single and bilateral-single fashion, followed by 14.29% bilateral-multiple and none in unilateral multiple pattern [Table 3].

Association of TP with age, gender and ethnicity

The association between presence or absence of torus palatinus and age, gender and ethnicity were determined [Table 4]. The highest frequency of TP was found in the third decade (56.06%)while the lowest incidence was seen in the 5th decade. No TP were reported in the 7th and 8th decade. There was no association found between the occurrence of TP with age (P=0.135).Out of the 108 subjects studied, females (51.39%) showed a higher prevalence of tori compared to males(38.89%). However, there was no association between TP and gender (P=0.219). Malays showed the highest prevalence of TP (62.96%), followed by Chinese 43.28% and Indians (35.71%). However, no association was found between TP and ethnicity (P=0.146).

Association of TMwith age, gender, and ethnicity.

Table 5 shows the association between presence or absence of torus mandibularis (TM) and age, gender and ethnicity. The highest occurrence of TM was found in the third decade (9.09%), followed by fifth decade(16.67%). No association was found between TM and age (P=0.479).Females (6.94%) shows higher prevalence of TM compared to male (5.56%). The difference in the prevalence rates of TM among gender was not statistically significant. There was no association between TM and gender (P=0.782). Based on ethnicity, the Chinese had the highest prevalence for TM (7.46%), followed by Malays(7.41%). However, the Indians did not show presence of TM.In our study, we did not find any associationbetween TM and ethnicity (P=0.734).

Discussion:

We observed a prevalence of 47.2% for Torus Palatinus (TP) and 6.5% for Torus Mandibularis (TM). A previous study done by K Sathya et al reported a prevalence rates of 12% for TP and 2.8% for TM among outpatients in Northern Malaysia. [9]Malaysia has a multiracial society predominantly populated by the Malays, followed by Chinese and Indians. For TP, Malays

(62.96%) have been found to have the highest prevalence, followed by Chinese (43.3%) and Indians (35.71%). The high prevalence rate for TP in Malays is not in accordance with K Sathya et al. For TM, Chinese had shown a prevalence rate of 7.46%compared to Malays (7.41%) and Indians (0%) and this coincides with the study of K Sathya et al. Our study is also in accordance with Hiremath V.K et al where their study showed 50.8% prevalence for TP and 4.6% for TM in Malay population.[4]

Our results showed that both TP and TM are more common in females (51.39%, 6.94%) than males (38.89%, 5.56%). These results were different from the studies done by A.Jainkittivong et al on Thai dental patients[11] and Hiremath V.K et al,[4] both which showed that TP was more common in females but TM was more predominant in men. However, study done by Derar.A on Jordanian population is in accordance with our study where TP and TM are more prevalent in females.[12] A Singaporean study is the only study that shows the same frequency of TP in both sexes. There is no explanation for the higher prevalence of tori in females, but genetic factor may be one of the reasons.[13]

With regards to age, it was found to be the 20-30 age group which has the highest prevalence of TP (56.06%). However, TM was more prevalent in the 5^{th} decade which has a percentage of 16.67%.

In the literature, many authors have shown that tori had a significant association with age. Higher prevalence rates were found in second and third decade.[11]Our study also showed a similar prevalence rate, however we did not find a significant association between presence of tori and age.

When size was studied, we found that majority (94.12%) of the TP falls into Grade 1 (<3mm) and the remaining 5.88% is of Grade 2 (3-6mm). We have not seen any Grade 3 TP which is more than 6mm. V.K. Hiremath et al found that most of the TP were of Grade 2 (60.6%) followed by Grade 3 (24.2%) and Grade 1 (15.2%).[4]

TP were mainly found at Molar region (62.75%) on the palate followed by Premolar-Molar (29.41%), Canine-Molar and Premolar region

(3.92%).Similar findings were reported by Wandee A et al.[14]On the other hand, A. Jainkittivonget al stated that the occurrence of TP in Premolar region (47.4%) was highest followed by Molar region (46.4%).[11] and V.K. Hiremath et al found TP mainlyat Premolar-Molar region(63.7%) and Molar region (33.30%).[4] These results are not in accordance with our results.

We found that spindle shaped TP is of the highest percentage which is 52.94%, followed by lobular (27.45%), flat (17.65%) and nodular (1.96%) shape. Nodular TP (12.1%) was found with the least frequency in a study done by Hiremath V.K et al [4] which is in accordance with our study. On the other hand, spindle shaped TP (56%) was found to be most common according to A. Jainkittivong et al which is similar with our result but it was then followed by nodular (34.3%), lobular (6.4%) and flat (3.3%).[11]Simunković et al and Reichart et al also showed a higher prevalence of spindle-shaped tori in their study.[15,8] K. Sathya has stated a slight predominance in the smooth type of TP (52.2%) when compared with lobulated or nodular variety.[10]

For TorusMandibularis (TM), two aspects we have studied which are the number and location. Unilateral single (42.86%) and bilateral single (42.86%) TM were the majority of TM presented in our study with remaining 14.29% as bilateral multiple TM. K. Sathya et al have observed that all TM were bilateral and multiple in their study.[10] A. Jainkittivong et al have also detected the predominance of bilateral multiple TP (59.3%), followed by bilateral single (27.2%), unilateral single (10.4%) and unilateral multiple (3.1%).[11] Bilateral multiple TM was found to be the least in our study thus it is not consistent with their studies.

When site was studied, Canine-Premolar (42.86%) region was found to be the most frequent region where TM were present. Canine region (28.57%) was second and followed by Canine and Molar (14.29%) and Premolar (14.29%). Our results are in accordance with study done by K. Sathya et al regarding location of TM.[10] Nevertheless,Hiremath V.K eta al has also found 66.7% of TM presented in Canine-Premolar region followed by Incisor-Premolar (33.3%) region.[4]

Clinical Significance

The clinical characteristics such as size, shape and location have been taken into significant consideration during prosthodontic treatment planning. Huge tori may affect the stability of dentures. For patients with large size tori, they requires essential alteration in the design of removable partial dentures and thus the treatment options have to be tailored to best fit the patients with palatal tori.[6,16] The presence of oral tori is generally benign and occasionally encounters ulceration if traumatised.

The presence of oral tori had been found beneficial as it serves as a reservoir of autogenous bone graft and was successful in the field of periodontal surgery where it aids in restoring the lost alveolar bone support and reconstruction purposes.[17,18]

Often, huge palatal tori may become an obstacle during routine intra-oral radiographic techniques. For such patients, the routine radiographic technique have to be modified and applied based on the location and size of tori.[1]Interpretation of intra-oral radiographs also becomes difficult in the presence of huge tori, as it may obscure diagnostic details and other important anatomical landmarks.[19]

Higher incidence of palatal and mandibular tori has been reported in patients with obstructive sleep apnoea. Children with nocturnal bruxism associated with sleep disturbances may clench their teeth and may develop tori secondary to bruxism. Adults should also be screened for both palatal and mandibular tori and presence of huge tori may warrant an association with disturbed sleep breathing that may not be diagnosed at the time of presentation. A referral to sleep physician is essential for such patients for further workup and management.[20,21]

The findings from our study show that predilection of tori is higher in females compared to males and the prevalence of TP is 47.2 % which is comparatively higher when compared to other studies. Dentists need to give consideration for the same and tailor or modify dental treatment accordingly. At the same time,

we also suggest that oral physicians and general dental practitioners should be mindful if they encounter bony swellings on the palate which increase in size.In such cases, the possibility of other intra-oral bony lesions such as osteoma or ossifying fibroma should not be neglected and must be sent for further investigations to rule out.

Conclusion:

In our study, we found that the prevalence of TP was high, and TM was low in Malaysians. There was no significant association between the presence of tori and age, gender and ethnicity. However, there were variations in clinical characteristics of oral tori among different ethnic groups. This could be attributed to the geographical location, dietary habits and genetic influence.

References

Kalaignan P, Mohan J. S, Jayakumar A. Determination of Grading for Maxillary and Mandibular Tori- an in Vivo Study. Biomed Pharmacol J 2018;11:679-88.

Andres.S, Garcia, Jose.M, Rafael.G.F, Angeles.S.R, Lucia.O.R. Current status of the torus palatinus and torus mandibularis. Med Oral Patol Oral Cir Buccal 2010;15:353-60.

Kumar Singh A, Sulugodu Ramachandra S, Arora S, Dicksit DD, Kalyan CG, Singh P. Prevalence of oral tori and exostosis in Malaysian population - A cross-sectional study. *J Oral BiolCraniofac Res* 2017;7:158-60.

Hiremath V.K., Husein A., Mishra N. Prevalence of torus palatinus and torus mandibularis among Malay population. J IntSocPrevCommun Dent 2011;1:60–64.

Smitha K., Smitha G.P. Alveolar exostosis −revisited: a narrative review of the literature. Saudi J Dent Res 2015;6:67–72.

AlZarea BK. Prevalence and pattern of torus palatinus and torus mandibularis among edentulous patients of Saudi Arabia. *ClinInterv Aging* 2016;11:209-13.

Haugen LK. Palatine and mandibular tori. A morphologic study in the current Norwegian population. ActaOdontolScand 1992; 50: 65-77.

Reichart PA, Neuhaus F, Sookasem M. Prevalence of torus palatinus and torus mandibularis in Germans and Thai. Community Dent Oral Epidemiol 1988; 16: 61-64.

García-García AS, Martínez-González JM, Gómez-Font R, Soto-Rivadeneira A, Oviedo-Roldán L. Current status of the torus palatinus and torus mandibularis. Med Oral Patol Oral Cir Bucal. 2010;15:e353–e360.

Sathya K., Kanneppady S.K., Arishiya T. Prevalence and clinical characteristics of oral tori among outpatients in Northern Malaysia. J Oral BiolCraniofac Res. 2012;2(1):15–19.

Jainkittivong A., Apinhasmit W., Swasdison S. Prevalence and clinical characteristics of oral tori in 1,520 Chulalongkorn University Dental School patients. SurgRadiolAnat 2007;29:125-31.

Derar.A.S, Mashoor.A, Prevalence of Torus Palatinus and Torus Mandibularis in Jordanian Population, Pakistan Oral and Dental Journal 2011;31:214-16.

Chew CL, Tan PH. Torus palatinus. A clinical study. Aust Dent J 1984; 29:245-48.

Wandee A, Aree J Somporn, Torus palatinus and Torus mandibularis in a Thai population. Sci Asia 2002; 28:105-11.

Simunković SK, Bozić M, Alajbeg IZ, Dulcić N, Boras VV. Prevalence of torus palatinus and torus mandibularis in the Split-Dalmatian County, Croatia. CollAntropol2011; 35:637–41.

Al Quran FAM, Al-Dwairi ZN. Torus palatinus and torus mandibularis in edentulous patients. J Contemp Dent Pract2006; 7:112-19.

Chohayeb AA, Volpe AR. Occurrence of torus palatinus and mandibularis among women of different ethnic groups. Am J Dent 2001; 14:278-80.

MuthukumarSanthanakrishnan, Suresh Rangarao. Mandibular Tori: A source of autogenous bone graft. J Indian SocPeriodontol2014; 18:767–71.

Telang LA, Telang A, Nerali J, Pradeep P. Tori in a Malaysian population: Morphological and ethnic variations. J Forensic Dent Sci. 2019;11(2):107-112.

Singh GD. On the etiology and significance of palatal and mandibular tori. Cranio. 2010 Oct;28(4):213-5

Ruangsri S, Jorns TP, Puasiri S, Luecha T, Chaithap C, Sawanyawisuth K. Which oropharyngeal factors are significant risk factors for obstructive sleep apnea? An age-matched study and dentist perspectives. Nat Sci Sleep. 2016;8; 8:215-9. J Histotechnol 2014 Mar;37(1):21-25.