Prevalence and clinical characteristics of oral tori among outpatients in Northern Malaysia

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ABSTRACT

Objectives: The objectives of this study were to determine the prevalence and clinical characteristics of torus palatinus (TP) and torus mandibularis (TM) in Malaysian dental patients.

Methods: Thousand five hundred and thirty-two dental patients were examined for the presence of oral tori at the Faculty of Dentistry outpatient clinic, AIMST University. Factors such as race, age, sex, size, and shape of tori were studied.

Results: The prevalence rates were 12% for TP and 2.8% for TM. A variation in the presence of tori among the three races in Malaysia—Chinese, Malays, and Indians—was noted, where the Chinese significantly had a higher prevalence of TP (17.9%) and TM (4.6%). Predominantly, tori were observed >40 years and older age group, and further both TP and TM were seen more commonly in women. Most TP were of smooth type (52.2%) and >2 cm (67.4%), while all TM were bilateral and nodular, plus most were <2 cm (67.4%).

Conclusion: Presence of tori (TP and TM) was detected in 12.5% of the participants. The variations noted in the prevalence and clinical characteristics of tori among people of different races living in the same country reflect its multifactorial etiology. Both genetic and environmental factors are responsible for its occurrence, and particular races are more prone genetically where its expression is enhanced by environmental factors.

Keywords: *Tori, torus mandibularis, torus palatinus.*

INTRODUCTION

Tori are non-pathologic, localized bony protuberances of the jaws, which are characterized into torus palatinus (TP) and torus mandibularis (TM) depending on their anatomic location. Torus palatinus occurs along the midline of the hard palate, and TM presents on the mandibular lingual aspect, often bilateral in the canine–premolar area.¹ These developmental anomalies are considered as normal anatomic variations rather than pathologic conditions.²

The prevalence varies widely from 0.4% to 61.7% for TP and 1–64% for TM in various population studies performed on live subjects.^{3–16} However, studies have also been conducted on skulls by many researchers,^{17,18} and Woo² in 1950 reported a high prevalence rate of 66% for TP

among adult skulls, while some studies of TM on skulls have revealed 100% prevalence rates.^{17,18}

The etiology of tori has been constantly under debate for several years. Their presence was previously regarded as evolution² or continued growth,¹⁸ but research has shown that its occurrence is relatively multifactorial, where there is an interaction of genetic and environmental factors.^{4,8,14} An autosomal-dominant pattern of inheritance was noted by Gorsky et al⁷; however, a quasi-continuous genetic or threshold theory has been considered to give the best explanation for etiology of tori. According to this theory, 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 expressivity.^{4,13,14} Supplementing this,

other causative factors such as dietary habits, nutritional disturbances, and stress from masticatory hyperfunction have also been suggested.^{4,8,10,11,19}

OBJECTIVES

The purpose of this study was to determine the prevalence of TP and TM in the Malaysian population. In addition, possible associations between tori and the three predominant races (Malays, Chinese, and Indians) in Malaysia were explored. Size, shape, sex predilection, and age relationship were also investigated.

MATERIALS AND METHODS

Our study sample consisted of 1532 dental patients of the Faculty of Dentistry outpatient clinic at AIMST University. All subjects were clinically examined for the presence of tori. Torus palatinus and TM were diagnosed by careful inspection and palpation. Demographic details of the subjects examined, location of tori, their size, shape, and other relevant factors if any were recorded in a detailed spread sheet prepared for the study. The data were statistically analyzed using the χ^2 test of significance.

RESULTS

Of the 1532 subjects studied, 191 (12.5%) presented with tori. Torus palatinus was detected in 184 subjects with a prevalence rate of 12%, while TM was seen in 43 subjects showing a prevalence of 2.8%. Thirty-six (2.3%) subjects showed concurrent TP and TM.

Table 1 summarizes the distribution of tori according to the three races studied. Among the subjects examined, 502 were Chinese of which 94 (18.7%) were affected. Five hundred

and ten Malays were examined of which 61 (12%) were affected, and of the 520 Indians examined only 36 (6.9%) were affected. There was a significant association between the races and the occurrence of TP ($P < 0.001$) and TM ($P < 0.01$).

Table 2 shows the distribution of tori according to sex. Among the 1532 subjects examined for tori, 757 were women and 775 were men. On the whole, women (16.4%) showed a higher prevalence of tori compared with men (8.6%), and the presence of both TP ($P < 0.001$) and TM ($P = 0.037$) in women was significantly more. This higher prevalence in women was seen in the Chinese and Malays, but not in the Indians where the occurrence was almost equal.

Table 3 shows the distribution of tori among different age groups. The highest incidence was found in the 40 years and older age group where 82 (20.7%) were affected of the 395 examined, while the lowest frequency of occurrence was seen in the 10–19 years old age group where only 16 (4.4%) of the 365 examined were affected. A significant association was present between the occurrence of TP with age ($P < 0.001$), while there was no significant relation between TM occurrence and age.

Tables 4 and 5 summarize the appearance of tori in this study. Torus palatinus > 2 cm were noted in 67.4% of the cases examined. Chinese (33.7%) tended to have larger TP compared with the Malays (22.3%) or the Indians (11.4%). This higher level of occurrence of large tori in the Chinese was statistically significant ($P < 0.001$). The shapes of TP were classified by Neville et al¹ into four types—flat, spindle, nodular, and lobulated. In this study, we broadly classified them into smooth or lobulated and found that 96 (52.2%) were smooth while the remaining 88 (47.8%) were lobulated in appearance. Number of lobules in TP varied from 2 (31.5%), 3 (7.1%), 4 (8.7%), and 5 (0.5%).

Forty-three subjects were found with bilateral TM, where 14 (32.6%) were > 2 cm in diameter on either side. Torus mandibularis were classified based on the number of nodules or lobules by Kolas et al²⁰ into four categories—bilateral single, bilateral multiple, unilateral single, and unilateral multiple. In our study, all TM were bilateral, and they had multiple lobules, the number of which varied from 2 to 4 on each side.

Table 1 Distribution of torus palatinus and torus mandibularis in different ethnic groups

Race	No. examined	Subjects with tori		TP		TM		TP and TM	
		No.	%	No.	%	No.	%	No.	%
Chinese	502	94	18.7	90	17.9	23	4.6	19	3.8
Malays	510	61	12	61	12	13	2.5	13	2.5
Indians	520	36	6.9	33	6.3	7	1.3	4	0.8
Total	1532	191	12.5	184	12	43	2.8	36	2.3

TM=torus mandibularis; TP=torus palatinus.

Table 2 Distribution of torus palatinus and torus mandibularis in relation to sex

Sex	No. examined (%)	Subjects with tori (%)	TP (%)	TM (%)	TP and TM (%)
<i>Chinese</i>					
Men	260 (100)	28 (10.8)	27 (10.4)	8 (3.1)	7 (2.7)
Women	242 (100)	66 (27.3)	63 (26.0)	15 (6.2)	12 (4.9)
Total	502	94	90	23	19
<i>Malays</i>					
Men	257 (100)	21 (8.2)	21 (8.2)	5 (1.9)	5 (1.9)
Women	253 (100)	40 (15.8)	40 (15.8)	8 (3.2)	8 (3.2)
Total	510	61	61	13	13
<i>Indians</i>					
Men	258 (100)	18 (7.0)	17 (6.6)	2 (0.8)	1 (0.4)
Women	262 (100)	18 (6.9)	16 (6.1)	5 (1.9)	3 (1.1)
Total	520	36	33	7	4
<i>Total</i>					
Men	775 (100)	67 (8.6)	65 (8.4)	15 (1.9)	13 (1.7)
Women	757 (100)	124 (16.4)	119 (15.7)	28 (3.7)	23 (3.0)
Total	1532	191	184	43	36

TM=torus mandibularis; TP=torus palatinus.

Table 3 Distribution of torus palatinus and torus mandibularis in relation to age

Age group (yr)	No. examined	Subjects with tori (%)	TP	TM	TP and TM
10–19	365	16 (4.4)	16 (4.4)	7 (1.9)	7 (1.9)
20–29	378	44 (11.6)	43 (11.4)	12 (3.2)	11 (2.9)
30–39	394	49 (12.4)	46 (11.7)	13 (3.3)	10 (2.5)
≥ 40	395	82 (20.7)	79 (20.0)	11 (2.8)	8 (2.0)
Total	1532	191	184	43	36

TM=torus mandibularis; TP=torus palatinus.

Table 4 Torus palatinus and torus mandibularis in relation to size

	TP (n=184)		TM (n=43)	
	<2 cm No. (%)	≥2 cm No. (%)	<2 cm No. (%)	≥2 cm No. (%)
<i>Chinese</i>	28 (15.2)	62 (33.7)	14 (32.6)	9 (20.9)
<i>Malays</i>	20 (10.9)	41 (22.3)	11 (25.6)	2 (4.7)
<i>Indians</i>	12 (6.5)	21 (11.4)	4 (9.3)	3 (7)
<i>Total</i>	60 (32.6)	124 (67.4)	29 (67.4)	14 (32.6)

TM=torus mandibularis; TP=torus palatinus.

Table 5 Torus palatinus and torus mandibularis in relation to shape

No. of lobules	TP (n=184)	TM (n=43)	
		L	R
2	58 (31.5)	24 (55.8)	27 (62.8)
3	13 (7.1)	16 (37.2)	12 (27.9)
4	16 (8.7)	3 (7.0)	4 (9.3)
5	1 (0.5)	0	0
Total lobulated	88 (47.8)	43 (100)	

TM=torus mandibularis; TP=torus palatinus.

DISCUSSION

We found a prevalence rate of 12% for TP and 2.8% for TM among the Malaysians. A previous study by Hashim et al¹² reported prevalence rates of 24.4% for TP and 2.2% for TM in the same population. Studies conducted in the people of

Mongoloid origin have shown different prevalent rates as shown in Table 6.^{2,6,9,11,12,15,21,22}

Malaysia is a country predominantly populated by three main ethnic races—the Chinese, Malays, and the Indians. When comparing the prevalence rates for oral tori among these races, a significant predominance was noted in the

Table 6 Prevalence of tori among people of Mongoloid race

<i>Prevalence of torus palatinus</i>		
<i>Population</i>	<i>Researcher</i>	<i>Prevalence %</i>
Japanese	Woo, 1950	46.6
Malaysian	Hashim et al, 1983	24.4
Chinese	Chew and Tan, 1984	48
Thai	Reichart et al, 1988	23.1
Indian	Shah et al, 1992	9.5
Vietnamese	Nair et al, 1996	6
Southern Thailand	Kerdpon and Sirirungrojying, 1999	61.7
<i>Prevalence of torus mandibularis</i>		
Malaysian	Hashim et al, 1983	2.2
Thai	Reichart et al, 1988	9.2
Indian	Shah et al, 1992	1.4
Vietnamese	Nair et al, 1996	3
Southern Thailand	Kerdpon and Sirirungrojying, 1999	29.9
Chinese	Pechenkina and Benfer, 2002	19.7

Chinese race (18.7%) when compared with the Malays (12%) or the Indians (6.9%). This high prevalence among the Chinese was noted for the occurrence of both TP (17.9%) and TM (4.6%). However, further studies may be required to prove any genetic, environmental, or functional associations for this increased occurrence in the Chinese group of the Malaysian population, who are living in the same country as the other two ethnic groups. Previously done studies have also shown ethnic or racial differences among populations (Israeli and Malaysian) for TP and TM.^{8,12} In Thai population, Reichart et al⁶ and Jainkittivong and Langlais¹³ correlated the occurrence of tori to dental attrition; in addition, Kerdpon and Sirirungrojying¹¹ found an association of tori with occlusal stress. Nery et al²³ in their study on human skulls reported highest prevalence of palatal exostoses in the Mongoloid specimens, and concluded that a particular gene may play a role in the causation of these bony overgrowths. Therefore, environmental or functional changes may ensue the development of tori in genetically predisposed population as concluded in previous studies.^{6,11,13} We also observed the attrition of teeth in 52% of the subjects who exhibited tori.

In this study, both TP and TM were significantly more prevalent in women than in men. In previous studies, many have shown TP to be more common in women while TM occurred more in men.^{4,6,9,12,13,15}

Jainkittivong and Langlais¹³ noted a slight increase of tori with age. In our study, the occurrence of tori was seen

more in individuals >40 years which is conclusive of the finding that the occurrence of tori is frequently observed in the middle phase of life similar to previous reports by Haugen⁴ and Eggen et al.¹⁰ The youngest individual with tori in our study was 12 years old, and tori were comparatively smaller in the 10–19 years age group when compared with the older age group 40 years and above. This may also prove that tori tend to grow with age, which might be related to continuous and increased functional occlusal stresses from teeth to the underlying alveolar bone. This phenomenon was concluded to be similar to subpontic hyperostosis by Jainkittivong and Langlais,¹³ which states that stress causes crestal alveolar bone to grow under the pontic along a vector opposing the forces of occlusion.²⁴ Further, masticatory stress increased from adolescence to adulthood and decreased during senescence,⁴ relating to this phenomenon—tori regressing after 60 years due to edentulism was observed by Sonnier et al.²⁵ Altogether, these findings may explain the dynamic nature of oral exostoses and further longitudinal studies could be conducted to conclude on their age changes.

When size was studied, we noted that the prevalence of TP >2 cm (69%) was much greater than that of smaller. Similar findings were reported by Hashim et al¹² in Malaysia. In addition, subjects belonging to the Chinese race had larger TP and TM, which was similar to that reported by Chew and Tan⁹ in Singapore. This finding may suggest any association between tori and dietary habits of a particular race, as proved by Eggen et al¹⁰ who found a correlation with consistency of the diet and nutrient factors among the natives in Norway. The size of TM in our study was predominantly <2 cm (67.4%) either side, and large TM were observed among the Chinese race.

With regard to the shape of tori, we found a slight predominance in the smooth type of TP (52.2%) when compared with the lobulated or nodular variety. This finding was similar to that done by Gorsky et al⁸ where the smooth variety of TP was predominant in the Israeli population. We also observed that all TM were bilateral and had multiple nodules or lobules. This finding is in line with the study by Ihunwo and Phukubye¹⁷ on the skeletal specimens of South African population where tori were predominantly bilateral. Reichart et al⁶ and Haugen⁴ in their study reported single nodular variety as the most common type which contrasts with our study where most of them had two lobules (55.8% on the left side and 62.8% on the right side) on either side. We also found that most TM were predominantly symmetrical, situated in the canine–premolar region.

All these findings support the fact stated by Haugen⁴ that the occurrence of tori involves a dynamic phenomenon. Thus, during life, the environmental and functional factors

interplay with genetic factors, making the expression of characteristics like oral tori multifactorial. The environmental factors that could play a role in the development of tori could be occlusal stress and dietary habits; further, it could enhance the genetic potential of an individual in expressing this feature. Racial factors could also be considered as certain races like the Chinese belonging to the Mongoloids show increased occurrence as shown in our study.

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