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Prevalence of oral tori among medical and dental Students at the University of the West Indies

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Abstract

Objective: To determine the prevalence and gender variation of torus palatinus (TP) and torus mandibularis (TM) amongst medical and dental students at the Mona campus of the University of the West Indies. **Subjects and Methods:** The study observed 335 medical and dental students from the Mona campus of the University of the West Indies. Routine dental examinations were conducted to check the presence/absence of TP and TM by inspection and palpation. **Results:** The overall prevalence of TP and TM was 27.76%. The oral torus prevalence was as follows, torus palatinus was 44.08%, torus mandibularis was 36.55% and individuals with both torus palatinus and mandibularis was 19.35%. The study observed that the prevalence of TP and TM in females was 16.11% (54/335), and males 11.64% (39/335). It was also found that bilateral torus mandibularis (40.38%) was more prevalent than unilateral right torus mandibularis (36.53%) and unilateral left torus mandibularis (23.07%) **Conclusions:** The prevalence of TP and TM are comparatively higher than neighboring Caribbean nations and West African countries. Our observations also highlighted that TP is highly prevalent among various types of oral tori. The study also recorded higher prevalence of oral tori among females. Due to higher prevalence of oral tori among the study group, Jamaican dentists need be knowledgeable about the high prevalence and clinical significance of TP and TM for dental treatment.

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Introduction

Torus palatinus [TP] and torus mandibularis [TM] are normal anatomical variants, which are categorized under developmental alterations of the jaw bone. TP and TM are slow growing osseous outgrowths (exophytic) in the midline of the hard palate (torus palatinus) and in the lingual cortical bones of mandible (torus mandibularis). It is a non-pathological condition and in most cases they remain asymptomatic [1]. TP and TM are clinically identified as a hard palpable bony mass localized in the mid-palatal region specifically posterior hard palate and/or lingual cortical bone of mandibular jaw [2]. TM can be either unilateral or bilateral, where as TP are solitary and usually occurs over the posterior hard palate in the mid-palatal suture region [3]. Morphologically TP and TM present either a smooth bony projection or multi-nodular/lobular bony projections. The shapes of TP and TM are categorized as flat, spindle, nodular, or lobular. TP and TM are considered to be a variant of exostoses. Exostoses are benign bony projections arising from the cortex of the maxillary or mandibular alveolar region [4]. TP and TM shows female predilection, and the size may vary between less than 1cm to greater than 4 cms in the greatest diameter [5].

Table 1. Etiology of torus palatinus and torus mandibularis

A. Widely accepted etiological factor of TP and TM
1. Genetic influence

B. Moderately accepted etiological factors of TP and TM
1. Environmental factors
2. Marine dietary habits
3. Masticatory forces
4. Para-functional habits

C. Less accepted etiological factors of TP and TM
1. Drugs (Phenytoin)
2. Number of existing teeth
3. Abraded teeth due to occlusion
4. Superficial injuries.

Etiology of TP and TM are not clear, but the majority of investigators believed that it was either genetic or environmental making the etiology multifactorial. Studies stated the etiology of TP and TM were related to genetics, superficial injuries, environmental factors, masticatory forces, marine diets, drugs, parafunctional habits and number of existing teeth or abraded teeth due to occlusion [4]. The most widely accepted etiological association of TP and TM was of a genetic cause. Autosomal dominant inheritance pattern was proposed for TP and TM, due to the higher vertical transmission rate and penetrance [6]. Another theory hypothesized that TP and TM was a functional response in individuals with well developed masticatory muscles. This theory suggested that masticatory forces transmitted to the mid-palatine sutural region leads to increased bony growth,[7] and probably proximity of ossification center in maxillary bone may contribute in initiation of osseous growth. Marine dietary habits such as consumption of fish or salted fish promote a higher prevalence of TP and TM due to the nutritional substances (polyunsaturated fatty acid and vitamin D) that can enhance osseous growth [8]. Drugs such as Phenytoin were linked with occurrence of TP and TM because of the influence of the drug with calcium homeostasis and initiating osteogenesis [9]. One study mentioned that ratio of un-erupted mandibular canines were higher among individuals with TM [10]. Theories have mentioned that Parafunctional habits such as thumb sucking or tongue thrusting influences occurrences of TP due to the increased pressure over the mid-palatine suture which triggers osteogenesis [11]. Etiological factors of TP and TM are summarized in table 1.

The importance and significance of TP and TM are extensively discussed in dental literature. TP and TM are considered to be an obstruction while fabricating removable (partial or complete) dentures for dental rehabilitation procedures [12]. Presence of TP and/or TM provides a significance in forensic investigations contributing to personal identification procedures [13]. TP and TM osseous tissue are useful as autogenous or osseous coagulum during osseous replacement in periodontal procedures or alveolar ridge defect correction surgeries [14,15]. TM can also be used to indicate the risk of appearance of temporomandibular disorders [16]. A significant relationship between the duration of renal dialysis and the size of TP has been reported [17]. One published report revealed a relationship between autosomal dominant osteosclerosis with TP and TM [18]. Recently TP has been associated in a new anatomical correlation with bone density in postmenopausal women [19]. Clinical significance of Torus palatinus and torus mandibularis are summarized in table 2.

Epidemiological studies of TP and TM from Caribbean and West African countries revealed higher prevalence in their geographic location. Therefore the purpose of the present study is to determine the prevalence of torus palatinus and torus mandibularis and gender variation in their distribution among medical and den-

Table 2. Clinical significance of Torus palatinus and torus mandibularis	
1.	Interrupts in the fabrication of removable(partial/complete) denture.
2.	Contributes in personal identification procedures in forensic investigation.
3.	Osseous tissue from TP and TM can be used as autogenous or osseous coagulum during osseous replacement in periodontal or minor oral surgical procedures
4.	Indicates the risk of appearance of temporomandibular disorders
5.	Provides significant relationship between duration of renal dialysis and size of TP.
6.	New anatomical correlation with bone density in postmenopausal women.
7.	Overlying oral mucosa is thinner and linked with traumatic oral ulcerations.
8.	Phonetic disturbance specifically palatal sounds while pronouncing the words by the articulation of the body of the tongue towards the hard palate
9.	Extremely large TP/TM may cause limitation in mastication process.
10	Compromised esthetic appearance.
11	Related sleep obstructive apnea

tal students at the Mona campus of the University of the West Indies, in Kingston, Jamaica.

Materials and methods:

The study was approved by ethics committee of the University of the West Indies, Mona campus. The study obtained written consent from all participants involved in the present study; also ethics committee of the University of the West Indies approved the consent form that was used in the present study. The present study has been conducted in full accordance with the World Medical Association Declaration of Helsinki.

Dental examination was conducted in the Dental Teaching Laboratory at the Faculty of Medical Sciences Teaching and Research Complex in the Mona campus of the University of the West Indies, Jamaica. During this study a routine dental and oral examination were done on 335 Medical and Dental students by the dental surgeons and the findings were systematically recorded. For the diagnosis of TP and TM, TP was defined as a bony outgrowth situated on mid palatal region and TM was defined as a bony outgrowth situated on lingual cortical bone at premolar-molar region of mandibular jaw bone. The size and shape of the TP and TM were not considered and any questionable bony outgrowths on mid-palate/lingual cortical bone of mandibular jaw were excluded. Study participants were aged between 19-30 years and the study was conducted during the period of April-May, 2015. All the data were transferred to Microsoft Excel data sheet and subjected for descriptive analysis.

Results

A total of 335 participants were identified in the present study, 230 (68.65%) were female and 105 (31.34%) were male. The prevalence of all tori was 27.76% (93 out of 335 participants). Higher prevalence of tori was observed among females 16.11% (54 out of 335 participants), than the males 11.64% (39 out of 335 participants) (Table 1)

Descriptive analysis of the study population according to torus type showed that TP was observed in 12.23% (41 out of 335 participants), TM 10.14% (34 out of 335 participants), participants with both TP and TM was 5.37% (18 out of 335 participants). The distribution of the study population according to gender showed that TP in males was 18.09% (19 out of 105 male participants), and TP in females was 9.56% (22 out of 230 female participants); TM in males was 13.33% (14 out of 105 male participants), and TM in females was 8.69% (20 out of 230 female participants); males with both TP and TM was 5.71% (6 out of 105), and females with both TP and TM was 5.21%(12 out of 230 female participants). (Table 3)

Table 3. Distribution of study population according to torus type and gender variation.

Torus type	Study population		Male population in the study		Female population in the study	
	Total population in the study (n =335)	Total population with oral tori (n =93) 27.76%	Male (Total population n=105)	Male population with oral tori (n=39) 41.93%	Female population in the study (n=230)	Female population with oral tori (n=54) 58.06%
Individuals with torus palatinus only	41 (12.23%)	41 (44.08%)	19 (18.09%)	19 (48.71%)	22 (9.56%)	22 (40.74%)
Individuals with torus mandibularis only	34 (10.14%)	34 (36.55%)	14 (13.33%)	14 (35.89%)	20 (8.69%)	20 (37.03%)
Individuals with both Torus Palatinus and Torus Mandibularis	18 (5.37%)	18 (19.35%)	6 (5.71%)	6 (15.38%)	12 (5.21%)	12 (22.22%)
Total	93 (27.76%)		39 (11.64%)		54 (16.11%)	

The prevalence of torus type and gender variation analysis showed that TP was observed in 44.08% (41 out of 93 participants), TM 36.55 % (34 out of 93 participants), participants with both TP and TM was 19.35% (18 out of 93 participants). The distribution of the study population according to gender showed that TP in males was 48.71% (19 out of 39 male participants), and TP in females was 40.74% (22 out of 54 female participants); TM in males was 35.89% (14 out of 39 male participants), and TM in females was 37.03% (20 out of 54 female participants); males with both TP and TM was 15.38% (6 out of 39), and females with both TP and TM was 22.22%(12 out of 54 female participants). (Table 3)

Analysis of the TM occurrence type and gender distribution showed that unilateral right TM was observed in 36.53% (19 out of 52 participants); unilateral left TM was observed in 23.07% (12 out of 52 participants); bilateral TM was observed in 40.38% (21 out of 52). TM distribution according to gender showed that unilateral right TM in males was 30% (6 out of 20 male participants), and unilateral right TM in females was 40.62% (13 out of 32 female participants);

Table 4. Distribution of torus mandibularis in study population according to occurrence type and gender.

Torus mandibularis distribution	Individuals with torus mandibularis (n=34) and individuals with both torus palatinus and mandibularis (n=18) (n=34+18=52)	Males (n=20)	Females (n=32)
Unilateral right torus mandibularis	19 (36.53%)	6 (30%)	13 (40.62%)
Unilateral left torus mandibularis	12 (23.07%)	5 (25%)	7 (21.87%)
Bilateral torus mandibularis	21 (40.38%)	9 (45%)	12 (37.5%)

unilateral left TM in males was 25% (5 out of 20 male participants), and unilateral left TM in females was 21.87% (7 out of 32 female participants); and bilateral TM in males was 40.38% (21 out of 52 male participants), and bilateral TM in females was 37.5% (12 out of 32 female participants) (Table 4)

Discussion

Our observations recorded that overall prevalence of TP and TM was 27.76% (93 out of 335 study participants) and the most common type of oral tori is TP 44.08%, and females (58.06%) were more commonly observed with oral tori than males (41.93%.) A higher prevalence of oral tori was recorded in the present study while comparing previous reports on Jamaican blacks, Trinidad and Tobago or West African population studies.(Table 5) Ogunsalu reported a prevalence of oral tori as 6.6 percent among Jamaican blacks [20]. The prevalence of oral tori is 12.3% among Trinidad and Tobago population [7]. The overall prevalence rate of West African population from the Ghanaian community was 14.6% [21]. The variation in the prevalence could be related to the diverse ethnic group in the present study. The prevalence rate of the present study results may not be generalized to the Jamaican population as our findings demonstrate University students come from areas other than Jamaica, which include most of Caribbean countries, Latin or central American countries and the North American mainland. Further, the present study did not attempt to distinguish between ethnic variations as the previous study from Trinidad and Tobago did which, mentioned that oral tori did not show any ethnic difference. However, higher prevalence of oral tori could be possibly due to the rich salt fish in the diet of Jamaican and other Caribbean countries and well developed masticatory muscles among the Jamaican population. Trinidad and Tobago study also mentioned that higher prevalence of oral tori could be possibly due to the marine diet [7].

In this study oral tori was more prevalent in females (58.06%), and sub group analysis of torus type also showed higher female prevalence of all torus

Table 5. Comparative table showing the prevalence rate of oral tori in various geographic areas.

Study	Population	Sample	Prevalence	Gender	Reference
Woo JK. 1950	Eskimos	-	66%	-	[23]
Kolas et al. 1953	United states	2478	20.9%	-	[24]
Vidic B. 1966	Yugoslavian	-	49.7%	-	[25]
Bernaba JM. 1977	Brazilian Indian	200	10%	-	[26]
Chew CL et al. 1984	Singapore	-	48%	Equal distribution	[27]
Axelsson G et al. 1985	Icelandic, south –	763	33.3%	-	[28]
Axelsson G et al. 1985	Icelandic, North –	213	14.6%	-	[29]
Bouquot et al. 1986	White Americans	23616	2.7%	-	[30]
Salem G et al. 1987	Saudi Arabia	1932	1.4%	-	[31]
Reichart et al. 1988	German	1317	13.5%	-	[32]
Reichart et al. 1988	Thailand	947	32.3%	Male predilection	[32]
Eggen et al. 1989	Norway	326	31.3%	-	[33]
Haugen LK et al. 1992	Norway, Oslo area	5000	9.2%	Female predilection	[34]
Shah DS et al. 1992	India	1000	10.9%	Female predilection	[35]
Eggen et al. 1994	Norway, Lofoten	1181	38.2%	Female predilection	[36]
Ogunsalu CU. 1994	Jamaica	958	6.6%	-	[21]
Eggen et al. 1994	Norway, Gudbrandsdalen	829	32.7%	Female predilection	[36]
Nair et al. 1996	Vietnam	550	1.44%	Female predilection	[37]
Gorsky M et al. 1996	Israel	1002	21.0%	Female predilection	[38]
Gorsky M et al. 1998	Israel	168	38.7%	Female predilection	[39]
Kerdpon et al. 1999	Southern Thailand	609	61.7%	Female predilection	[22]
Sonnier et al.1999	United States (African	328	47.20%	Female predilection	[40]
Sirirungrojying et al.1999	Thailand	412	27.8%	-	[22]
Gozil R et al. 1999	Turkish	86	45.4%	-	[41]
Jainkittivong et al. 2000	Thailand	960	26.9%	-	[42]
Al-Bayaty et al in 2001	Trinidad and Tobago	667	12.3%	-	[7]
Aphinhasmit W et al.	Thailand	1200	58.1%	Female predilection	[43]
Virgina G et al. 2003	Spanish	278	20.3%	Female predilection	[44]
Bruce I et al. 2004	Ghana	926	14.6%	Female predilection	[20]
Cagirankaya LB et al.	Turkish	253	20.9%	Female predilection	[45]
Yildiz E et al. 2005	Turkish	1943	30.9%	Female predilection	[46]
Al Quran FA et al. 2006	Jordan	338	29.8%	Female predilection	[47]
Jainkittivong A et al. 2007	Thailand	1520	60.5%	Female predilection	[48]
Sisman et al. 2007	Turkish	2660	4.1%	Female predilection	[49]
Hiremath VK et al. 2011	Malay	65	55.4%	Female predilection	[50]
Santosh Patil et al. 2014	India	3087	6.9%	Male predilection	[51]
Present study	Jamaica	335	27.76%	Female predilection	Present

types TP (40.74%), TM (37.03%), both TP and TM (22.22%)). Interestingly similar female predilection was also observed in the studies from Jamaica, Trinidad and Tobago, Ghana and Thailand [7,20,21,22]. Certain prevalence with respect to age has also been observed. Tori tend to appear more frequent during middle age of life [4]. In the present study, we could not conclude on age frequency of tori, due to population involved in the present study were medical and dental students who fall in the age range of 19-30 years. The onset of TP appears to be earlier than TM and the cases have been described from birth and the first decade of life. In contrast, appearance of TM is rare before the first decade of life [4,42]. It is worth noting that present study is documenting prevalence of TM as 37.03% with the age range of 19-30 years. Most published reports suggested that TP appears to have female predilection and it is believed that there may be dominant type linked to the X chromosome. Although most studies reported female predilection of TP, the difference was not statistically significant. On other hand TM was also reported to have higher predilection in males, the difference had no statistical significance.

Consistently, epidemiological studies are reported from 1950 to current date regarding oral tori from various geographical areas. Comparing prevalence rates among our literature search from the countries Alaska, Southern Thailand, Malaysia, Yugoslavia, Singapore, United States, Turkey, Israel, Norway, Jordan, Jamaica, Spain, Iceland, Ghana, German, Trinidad and Tobago, India, Vietnam and Saudi Arabia revealed a higher prevalence rate of oral tori in Eskimos and the least in Saudi Arabians. (Table 5) A true conclusion about a country having a high or low prevalence rate of oral tori, could not be made from the comparison table because the sample size between each study shows great variation. Interestingly, most countries reported a higher prevalence of oral tori among females. Hence, it can be concluded that oral tori is a common normal anatomical variant that can be seen in most of geographical areas and female predilection is strongly supported. Further, from Caribbean and West African studies, the present study from Jamaica seems to have high prevalence of oral tori.

Clinical diagnosis of tori is usually straight forward and investigations are generally not required. Dental clinicians should note that tori can have slow and continuous growth in later age. However, although growth is slow and continuous, it may stop spontaneously. It is also worth to note that differential diagnosis of bony and unilateral growing lesion includes tori, peripheral ossifying firboma, osteoma, osteochondroma, osteoid osteoma, osteoblastoma and osteosarcoma. The presence of pain or paresthesia in bony unilateral growing should prompt further investigation [52].

Conclusion

The prevalence of TP and TM are higher in our observation. Our results showed a female predilection among gender and similar interpretation was observed from previous studies from various geographic locations. The present study supports that etiology of TP and TM being multifactorial, specifically genetic, marine diet, and well-developed masticatory muscles. Due to the higher prevalence of TP and TM in the present study, Jamaican dentists need to be knowledgeable about the high prevalence and clinical significance of TP and TM on dental treatment.

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