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Comparative Evaluation of the Patterns of Torus Mandibularis (TM) and Torus Palatinus (TP) in Malay and Chinese Patients Attending the AIMST Dental Clinic, Malaysia, with a Specific Focus on Age and Gender Distributions

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Abstract

This cross-sectional study aimed to compare the prevalence and patterns of Torus Mandibularis (TM) and Torus Palatinus (TP) among Malay and Chinese patients attending the AIMST Dental Clinic, Malaysia, with specific attention to age and gender distributions. Clinical examinations were performed on patients attending the clinic to assess the presence, size, shape, and location of TM and TP, and demographic data including age, gender, and ethnicity were recorded. The collected data were statistically analysed using the Chi-square test and Fisher's exact test to determine associations between these factors and the occurrence of tori. Of 60 participants, 23 (38.34%) presented with tori; 22 (36.67%) had TP and 1 (1.67%) had TM. No statistically significant association was found between the occurrence of tori and ethnicity, gender, or age group, although females and Malay patients showed a comparatively higher prevalence of TP. Most tori were large (greater than 6 mm) and lobular in shape and were located predominantly in the incisor-to-premolar region, and a statistically significant association was observed between tori location and age group. The study provides insight into the distribution of TM and TP among different ethnicities in Malaysia and highlights age- and gender-related trends that may aid early identification and management, while offering anthropological and genetic implications regarding oral bony exostoses. Further research with a larger sample is recommended to explore the underlying etiological factors.

Keywords: Age distribution, Chinese, Gender distribution, Malay, Torus mandibularis, Torus palatinus.

Introduction

Exostoses and tori are bony projections that are usually asymptomatic and are composed of firm, compact bone with little or no marrow. Surgical removal is generally not required unless the growth interferes with denture wear or causes ulceration (1). These benign outgrowths are classified according to their anatomical location: torus palatinus (TP) develops in the midline of the hard palate, whereas torus mandibularis (TM) develops on the lingual aspect of the mandible (2). Both lesions tend to become more prominent with advancing age and are usually first noticeable from the second decade of life onwards. The shape of TP has been described as lobular, spindle-shaped, nodular or flat, as illustrated in Figures 1A-1D, while TM is classified as bilateral combined, unilateral or bilateral multiple, or unilateral or bilateral solitary (3). A widely used size classification distinguishes tiny (TP < 3 mm), medium (TP 3–6 mm) and large (TP > 6 mm) TP, whereas TM shows comparatively little variation in size (4). Diagnosis relies on clinical and radiographic examination, but the precise aetiology of these lesions remains unclear. Tori are considered to have a multifactorial aetiology arising from a combination of genetic and environmental influences. A threshold theory has been proposed in which tori formation results from an autosomal dominant genetic predisposition interacting with environmental factors once a cumulative threshold is reached (5). Additional risk factors that have been implicated include trauma, medication use, infection, growth arrest, masticatory stress, dietary habits and nutritional disturbances. Figures 1A- 1D depicts the various shapes of Torus Palatinus , such as Flat, Lobular, Spindle and Nodular shapes.

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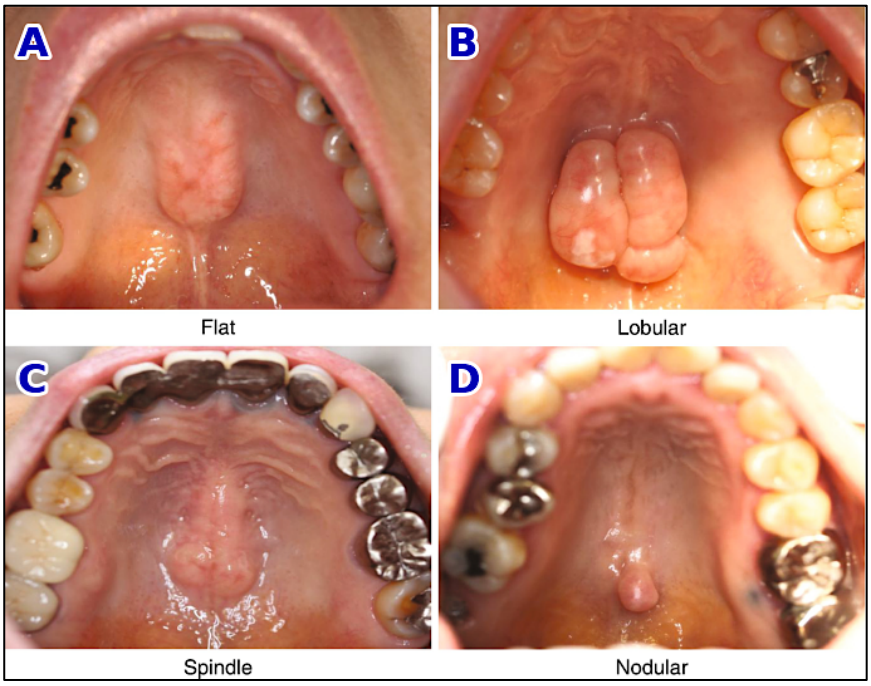

Figure 1: Various Shapes of Torus Palatinus. (A) Flat, (B) Lobular, (C) Spindle, (D) Nodular

Several studies have examined the occurrence of tori in Malaysian populations. A study of three ethnic groups in Malaysia (Malay, Chinese and Indian) reported a high prevalence of tori, consistent with earlier Malaysian data (6). Among the Malay population specifically, one study found that TP was most prevalent in the premolar-to-molar region and TM was most prevalent bilaterally in the canine-to-premolar region, with the second decade of life showing the highest overall prevalence, and noted differences between sexes and age groups (7). Another investigation found that the prevalence of TP and TM in the Malaysian population was comparable to that reported in other Mongoloid and Asian populations, with significant differences observed for sex and age in relation to prevalence and size (8). A further Malaysian study reported that the molar region was the most prevalent site and the spindle shape the most prevalent form for TP, that the canine region was the most prevalent site for TM, and that no significant association existed between the occurrence of TP or TM and age, gender or ethnicity (9). In a study of dental patients attending a government hospital in Karachi, the prevalence of tori was found to be comparatively low, the palatal tori were mostly lobular, the most common pattern was unilobulated tori bilaterally in the mandibular premolar region, and no significant relationship with age or gender was observed (5). Similarly, a study of outpatients in northern Malaysia reported a lower prevalence of TP (12%) than TM (2.8%) (10) while a cross-sectional survey of the general Malaysian population documented comparable rates of oral tori and exostoses (11), and comparable prevalence figures have also been reported outside South-East Asia, for example in a Nigerian population (12). Anatomical reviews have further described the wide morphological variability of TP, underscoring the difficulty of applying a single classification system across populations (13).

Although these studies collectively confirm that tori are common in Malaysian and other populations, most were conducted within a single ethnic group or did not stratify findings simultaneously by ethnicity, age and gender within the same clinical setting, and sample sizes were frequently modest. Consequently, a research gap remains regarding the comparative distribution and morphological pattern (shape, size and location) of TM and TP between two major ethnic groups — Malay and Chinese — attending the same dental facility, examined concurrently with respect to both age and gender.

The present study therefore aimed to compare the patterns of TM and TP among Malay and Chinese patients attending the AIMST Dental Clinic, Malaysia, with particular emphasis on age and gender distribution. The specific objectives were to

determine the prevalence, distribution and morphological variations (shape, size and location) of TM and TP among Malay patients attending the AIMST Dental Clinic; to evaluate the prevalence, distribution and morphological variations of TM and TP among Chinese patients attending the clinic; to compare the prevalence, distribution and morphological differences of TM and TP between the two ethnic groups; to examine how age influences the prevalence, size and morphological differences of TM and TP in Malay and Chinese patients; and to compare gender-related differences in the prevalence, size and morphology of TM and TP between the two groups. The novelty of the present study lies in its concurrent assessment of TM and TP morphology across both ethnicity and age-gender strata within a single dental-clinic population, an approach that has not been comprehensively addressed in previous Malaysian studies.

Materials and Methods

A cross sectional study was carried out over a period of 10 months in the AIMST Dental Clinic, which included Malay and Chinese patients who sought dental treatment. Participants were recruited using a convenient, consecutive sampling method: all Malay and Chinese patients who attended the reception and primary care clinics, Clinic 2 and Clinic 4, during the study period and who met the inclusion criteria were invited to take part in the order in which they presented, until the target sample size was reached. All positive cases were recorded in terms of location, shape and size with age and gender and morphological variations identified.

Ensuring Ethical Approval and Consent

The study was performed following ethical principles of the Declaration of Helsinki. Informed consent was ensured from all participants before clinical examination and all the data was kept confidential and only for research use. Ethical approval for the study was obtained from the AIMST University Human & Animal Ethics Committee (AUHAEC) AIMST UNIVERSITY-AUHAEC/2024/010 (Application No.: 31256781).

Inclusion Criteria

Participants were required to be 18 years of age or older, to ensure that oral structures were fully developed, and to be of Malay or Chinese ethnicity attending the reception and primary care clinics, Clinic 2 and Clinic 4, at the AIMST Dental Clinic during the study period. Eligible participants also had to have visited the AIMST Dental Clinic during the study period, provide informed consent to participate, have complete oral health records available for analysis (including previous dental radiographs and/or clinical examination notes), and be physically able to undergo the dental examination required to assess the presence and morphology of tori.

Exclusion Criteria

Participants were excluded if they were under 18 years of age, as this could indicate developing oral structures; did not identify as Malay or Chinese; had not provided informed consent; had partial or incomplete oral health records; had undergone any oral surgery that could alter the occurrence or shape of tori; had serious medical problems that could affect oral health, such as uncontrolled diabetes; or were taking medications that affect bone metabolism, such as bisphosphonates, cortisone or other steroids.

Methods

The cross-sectional method was used to study the distribution of tori in the Malay and Chinese population at the AIMST Dental Clinic, Bedong, Kedah (approximate GPS coordinates 5°43′48″N, 100°31′12″E — from July 2024 to April 2025. The desired number of patients was 60 or more patients in six age groups (18-80 years). The patient's gender, age, ethnicity, and clinical photos of tori patterns were recorded and taken with consent.

The study was based on history taking and clinical examination and simple examination equipment included a dental probe, mouth mirror and tweezers. Occurrence and shape, size and location of TP and TM were recorded. Tori shape was grouped by Thoma and Goldman classification (flat, nodular, lobular, and spindled for TP; unilateral/single, unilateral/multiple, bilateral/ single, and bilateral/multiple for TM) and tori size was grouped by the Reichart classification (small less than 3 mm, medium 3-6 mm, large greater than 6 mm; measured with a calliper). Tori location was divided into the following regions: premolar, molar, incisor-premolar, premolar-molar, and incisor-molar. Comparisons were made between Malay patients and Chinese patients including tori shape, size, location and age, gender and ethnicity.

Statistical analysis

The collected data were analysed statistically using the Chi-square test and Fisher's exact test as the statistical tools, at a 5% level of significance. The online calculator was used to perform the Chi-square test (14), and the calculator was used to perform Fisher's exact test (15).

Results

Of a total of 60 participants, 23 (38.34%) had a prevalence of either type of tori; 22 participants (36.67%) had TP and 1 participant (1.67%) had TM. No association was observed between ethnicity (Malay and Chinese) and the prevalence of tori (P = 0.9748) at the 5% level of significance, indicating that Malay and Chinese patients had a similar prevalence of TP and TM, as shown in Table 1.

Table 1: Prevalence of Tori (TM And TP) According to Ethnicity

Location	Chinese (n=21)	%	Malay (n=39)	%	Total (n=60)	%
Torus palatinus	7	33.33	15	38.46	22	36.67
Torus mandibularis	1	4.76	0	0.00	1	1.67
Total	8	38.09	15	38.46	23	38.34

Note: Chi-square = 0.001; P = 0.9748 at the 5% significance level.

Of the 60 participants, 30 were male and 30 were female. Among the 30 male participants, 10 (33.33%) had either TP or TM, while among the 30 female participants, 13 (43.33%) had either TP or TM. The Chi-square test showed no association between the prevalence of tori and gender (P = 0.4255) at the 5% level of significance, indicating that both genders had a similar prevalence of tori, as shown in Table 2.

Table 2: Prevalence of Tori (TM and TP) by Gender

Location	Male (n=30)	%	Female (n=30)	%	Total (n=60)	%
Torus Palatinus	9	30.00	13	43.33	22	36.67
Torus Mandibularis	1	3.33	0	0.00	1	1.67
Total	10	33.33	13	43.33	23	38.34

Note: Chi-square = 0.6350; P = 0.4255 at the 5% significance level.

The prevalence of tori by age group is shown in Table 3. In the 18–38 age category, 9 of 23 participants (39.13%) had TP or TM; in the 39–59 category, 9 of 23 participants (39.13%) had TP or TM; and in the 60–80 category, 5 of 14 participants (35.71%) had TP or TM. The Chi-square test showed no association between tori prevalence and age group (P = 0.9738).

Table 3: Prevalence of Tori by Age Group

Location	18–38 (n=23)	%	39–59 (n=23)	%	60–80 (n=14)	%	Total (n=60)
Torus palatinus	8	34.78	9	39.13	5	35.71	22
Torus mandibularis	1	4.35	0	0.00	0	0.00	1
Total	9	39.13	9	39.13	5	35.71	23

Note: Chi-square = 0.053; P = 0.9738 at the 5% significance level.

The distribution of tori location among Malay and Chinese patients is shown in Table 4. Considering both groups together, 10 of the 23 tori (43.48%) were located in the incisor-to-premolar region, 8 of 23 (34.78%) in the premolar-to-molar region, and 5 of 23 (21.74%) in the premolar region; no tori were found in the molar region or in the incisor-to-molar region. Using Fisher's exact test (Freeman–Halton extension), no association was found between ethnicity and tori location (P = 0.2059) at the 5% significance level.

Table 4: Distribution of Location of Tori Among Malay and Chinese Patients

Location of Tori	Chinese	Malay	Total (n=23)	%
Incisor to premolar region	4	6	10	43.48
Premolar to molar region	4	4	8	34.78
Premolar region	0	5	5	21.74
Molar region	0	0	0	0.00
Incisor to molar region	0	0	0	0.00
Total	8	15	23	

Note: Fisher's exact test (Freeman–Halton extension): P = 0.2059 at the 5% significance level.

Table 5: Distribution of Size of Tori Among Malay and Chinese Patients

Size of Tori	Chinese	Malay	Total
Small (less than 3 mm)	0	0	0
Medium (3–6 mm)	0	0	0
Large (greater than 6 mm)	8	15	23

The distribution of tori size among Malay and Chinese patients is shown in Table 5. All 23 patients with tori had large tori (greater than 6 mm); no small or medium tori were recorded.

The shape distribution of TP among Chinese and Malay patients is shown in Table 6, and that of TM in Table 7. For TP, 5 of 22 (22.73%) were flat, 14 (63.64%) were lobular, and 3 (13.64%) were spindle-shaped; no nodular cases were found. For TM, only one case was recorded, which was unilateral and single; no unilateral multiple, bilateral single, or bilateral multiple TM were found.

Table 6: Shape Distribution of TP Among Chinese and Malay Patients

Shape	Chinese	Malay	Total (n=22)	%
Flat	3	2	5	22.73
Lobular	3	11	14	63.64
Spindle	1	2	3	13.64
Nodular	0	0	0	0.00
Total	7	15	22	

Table 7: Shape distribution of TM among Chinese and Malay patients

Shape	Chinese	Malay	Total
Unilateral single	1	0	1
Unilateral multiple	0	0	0
Bilateral single	0	0	0
Bilateral multiple	0	0	0
Total	1	0	1

Table 8 shows the location of tori in relation to the three age-group categories, divided by ethnicity. Using Fisher's exact test, a significant association was found between location and age group (P = 0.01667). The highest frequency (5 patients) occurred in the 18–38 age group with tori in the incisor-to-premolar and premolar-to-molar regions. Tori located in the premolar region in the 60–80 age group had the second highest frequency (4). No premolar-to-molar tori were found in the 60–80 age group and no premolar-region tori were found in the 18–38 age group. No molar-region or incisor-to-molar-region tori were recorded in any age group.

Table 8: Distribution of Tori in Relation to Location and Age Group Among Chinese and Malay Patients

Location of tori	Chinese			Malay			Total (n=23)	%
	18–38	39–59	60–80	18–38	39–59	60–80		
Incisor to premolar region	2	2	0	2	3	1	10	43.48
Premolar to molar region	3	1	0	2	2	0	8	34.78
Premolar region	0	0	0	0	1	4	5	21.74

Molar region	0	0	0	0	0	0	0	0.00
Incisor to molar region	0	0	0	0	0	0	0	0.00
Total		8			15		23	

Note: Fisher's exact test: P = 0.01667 at the 5% significance level.

Discussion

Globally, reported prevalence rates for TP and TM vary considerably between populations, ethnic groups and study designs. Prevalence figures of approximately 13–43% for TP and 5–13% for TM have been reported in Croatian and Romanian cohort studies (16). A large multi-ethnic cohort study found that TP prevalence differed significantly by ancestry, being highest among individuals of East Asian descent (17), and genome-wide family-based analyses support a hereditary component to TP occurrence (18). Comparatively lower rates of TM have been reported among haemodialysis patients (19), while narrative reviews have summarised the wide epidemiological variability of both lesions across populations (20, 21). Studies from Sub-Saharan Africa have similarly documented tori, with prevalence estimates of approximately 4–14% reported among South African and Nigerian populations (22-24), and a study of the Iranian population reported comparable patterns of TP and TM distribution by age and sex (25). These global comparisons highlight substantial population-level variability in tori prevalence and further support the rationale for the detailed, ethnicity-stratified investigation undertaken in the present study.

The distribution of tori has been investigated in different populations throughout the world, including Malaysia. In the present study, the prevalence of TP was 36.67% and that of TM was 1.67%, whereas a study conducted among outpatients in northern Malaysia reported a TP prevalence of 12% and a TM prevalence of 2.8% (12). This is consistent with previous studies in which TP had a markedly higher prevalence than TM. The higher prevalence of TP in the present study may be attributable to the smaller sample size, while the prevalence of TM was comparable to that reported elsewhere. Whereas the Chinese group showed a higher prevalence of TP in that earlier study, the Malay group showed the higher prevalence of TP in the present study (comparing only Chinese and Malay patients). In the present study, the association between tori prevalence and ethnicity was tested using the Chi-square test, and no significant result was obtained at the 5% level of significance (P = 0.9748).

The prevalence of TP was also compared by gender, and females showed a higher prevalence (43.33%) than males (30.00%). This finding is in line with previous reports (5, 12) and could be related to the dominance of the X chromosome. It also corresponds with a study of the Malaysian population that found a higher prevalence of TP among females (8). The prevalence of TM has been reported to be higher in males in one study, while another study reported the opposite pattern (5, 12). Only one case of TM was observed in the present study (in a male patient) and could therefore not be meaningfully compared with other studies. When TP and TM were analysed together, no significant association was found between the prevalence of tori and gender using the Chi-square test.

The highest prevalence of tori has previously been reported in the 20–29-year age group, followed by the 30–39, 40–49 and 50–59-year age groups (6). In the present study, the 18–38 and 39–59-year age groups had the highest prevalence (39.13%), followed by the 60–80-year age group, which had the lowest prevalence (35.71%). Increasing age has been reported to correlate with the presence of tori in some studies; however, no significant correlation between age and tori occurrence was found in the present study, which is consistent with a similar finding reported elsewhere (3).

The present study revealed that the majority of tori occurred in the incisor-to-premolar region, while the premolar-to-molar region also showed a substantial proportion of tori, with none recorded in the molar region or the incisor-to-molar region. This contrasts with a study of the Malaysian population in which most tori were located in the molar area, with the premolar-to-molar area being the second most common site (8).

The size of tori was also assessed using the Reichart classification. Large tori were the most common size recorded in this study, consistent with a previous study (5). No small or medium tori were recorded in the present study, whereas another study reported small tori as the most

common size, followed by medium and then large tori (8); this discrepancy may be attributable to the small sample size of the present study.

TP can present as flat, lobular, spindle or nodular in shape, while TM can be unilateral single, unilateral multiple, bilateral single or bilateral multiple. In the present study, the lobular shape was the most frequent (63.64%), followed by flat (22.73%) and spindle (13.64%) tori, with no nodular tori observed. This contrasts with a previous study in which the flat shape was most prevalent, followed by the spindle shape (3). Only one case of TM was recorded in the present study, and it was of the unilateral single type.

A comparison was also made between the location of tori and age group. Table 7 shows that the age groups 18-38 years and 39-59 years had a higher prevalence of tori in the incisor to premolar or premolar to molar region respectively while the age group 60-80 years had a higher prevalence rate of tori in the premolar region. This study revealed that there was an association between age group and location, as determined by a Fisher's exact test.

Conclusion

Overview

This study demonstrated a high prevalence of TP and a low prevalence of TM among patients attending the AIMST Dental Clinic, consistent with earlier studies conducted in Malaysian populations. Malay patients showed a comparatively higher prevalence of tori than Chinese patients, a pattern opposite to that reported in some previous studies; this may be explained by the higher proportion of Malay patients among the 60 participants recruited, reflecting the predominantly Malay population served by the clinic and surrounding area.

Contribution and Clinical Implications

The findings contribute to the understanding of the distribution and morphological pattern of TM and TP among Malay and Chinese patients in Malaysia, with specific reference to age and gender, and may aid clinicians in the early identification of tori and in planning dental treatment. In most cases, tori do not adversely affect a patient's well-being; however, when planning a denture — particularly for older patients with tooth loss — the presence of tori may influence denture stability, retention and patient comfort, and should therefore be considered during prosthodontic assessment.

Limitations

The main limitation of this study was the relatively small sample size (n = 60), which may limit the generalisability of the findings and could account for some of the differences observed relative to larger, previously published studies.

Future research directions

Larger, multicentre studies with bigger and more representative samples are recommended to gain a clearer understanding of the aetiological influences, growth patterns and clinical significance of TM and TP in Malaysian and other populations.

Abbreviations

TM: Torus mandibularis, TP: Torus palatinus.

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Author Contributions

Ajimol Theresa Jose and Krishna Priya Balachandran: Study Conception, Design and Supervision; Lau Jun Yuen, Lee Choong Yik, Lee Jing Ling, Lee Miao Tian: Data Collection and Clinical Examination; all authors contributed to data analysis, drafting and critical revision of the manuscript, and approved the final version for submission.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of Artificial Intelligence (AI) Assistance

The authors do not use Artificial Intelligence (AI) and AI assisted technologies while writing this article.

Ethics Approval

This study was performed in accordance with the ethical principles of the Declaration of Helsinki and

was approved by the AIMST University Human & Animal Ethics Committee (AUHAEC) AIMST UNIVERSITY - AUHAEC/2024/010 (Application No.: 31256781). Informed consent was obtained from all participants prior to clinical examination.

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