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Evaluation of Taurodont and Pyramidal Mandibular Molars Prevalence in a Group of Turkish Cypriot Population by Cone Beam Computed Tomography

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Abstract

BACKGROUND/AIMS: The purpose of this retrospective study was to determine the prevalence of taurodont and pyramidal mandibular molars among a Turkish Cypriot population.

MATERIALS AND METHODS: This study involved a retrospective evaluation of cone beam computed tomography (CBCT) scans from 285 adult patients (148 males and 137 females, aged, 18-80). A total of 902 molar teeth (including third molars) were evaluated using CBCT images. The recorded data were statistically analyzed to compare the incidence of taurodont and pyramidal teeth between genders and tooth types.

RESULTS: Fifty-seven patients were found to have at least one taurodont tooth (32 males and 25 females), with an incidence of 20%. Among the 902 teeth, 100 (11.1%) mandibular molar teeth exhibited taurodontism, with 51 (11.4%) on the left side and 49 (10.7%) on the right side. Taurodontism occurred in 51 of the 429 teeth from female patients (11.8%) and 49 of the 473 teeth from male patients (10.3%), without statistically significant differences ($p>0.05$). Third molars were the most commonly affected teeth (23.1%), followed by second molars (12.3%) and first molars (3.36%). A statistically significant difference was found in tooth type ($p<0.05$). Pyramidal teeth were detected in 7 patients, representing a prevalence of 2.5%. Of these, 4 patients (2.9%) were females and 3 patients (2%) were males.

CONCLUSION: Taurodont molars exhibited a high prevalence among Turkish Cypriots, particularly in the second and third molars of mandibular teeth. Dental practitioners should be aware of this dental anomaly.

Keywords: Taurodontism, CBCT, pyramidal molar tooth

INTRODUCTION

Dental anomalies may affect both crown and root structures. Crowns often exhibit deviations in shape, size, color, or number, and teeth may appear in abnormal positions or display irregular eruption patterns.[1] Common root abnormalities include taurodontism, pyramidal shapes, dilaceration, short roots, and root fusion.[2,3] Extensive research has demonstrated that various dental anomalies often manifest concurrently in different combinations.[4] Taurodontism was first described by Keith[5] in 1913 and refers to the molar teeth with an extended pulp chamber below the cementoenamel junction (CEJ) and apical displacement of the root bifurcation or trifurcation. Taurodont teeth, which exhibit a rectangular shape, are subclassified by Shaw[6] into mild, moderate, or severe [hypotaurodontism (HT), mesotaurodontism (MT), and hypertaurodontism (HYT), respectively] based on relative degree of pulp

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chamber displacement. Teeth with normally sized pulp chambers are referred to as cynodonts (CD).[6] The root configurations of these molar teeth may exhibit separate roots, or partially or completely fused roots. Completely fused roots with a single, wide root canal are attributed to deep taurodontism and pyramidal molars (PM).[3] Theories regarding the origins of taurodontism vary widely, but it is often attributed to early invagination of the epithelial root sheath, which is critical for the development of dental structures.[7] Taurodontism occurs more frequently in permanent teeth, and may be observed in individual teeth or bilaterally. Studies in the literature indicate a higher prevalence of taurodontism among some specific ethnic groups, including the Inuit of Alaska, Aborigines in Australia, and the indigenous populations of Central America.[8,9]

The endodontic management of taurodont teeth presents some challenges in terms of canal identification, cleaning, shaping, and obturation, and requires an approach that differs from that used for typical teeth. Radiographic imaging is required to diagnose these anomalies, as the clinical appearance of taurodont or pyramidal teeth cannot be distinguished from that of other teeth.[10] In 1978, Shifman and Chanannel[11] described an index to determine the severity of taurodontism on radiographic images. Previous studies on the prevalence of taurodontism and PM have mostly relied on two-dimensional (2D) imaging such as panoramic or bitewing radiographs.[4,10,12] However, cone beam computed tomography (CBCT) is a reliable three-dimensional (3D) imaging modality for determining the prevalence of taurodontism and PM, their diagnosis and classification, making accurate measurements, and managing the treatment processes. A comprehensive literature review has revealed only a few studies using CBCT to examine the prevalence of taurodontism,[13,14] and no study was found for the Turkish Cypriot population. Hence, the present study was conducted to identify taurodont and pyramidal mandibular molars in a group of the Turkish Cypriot population using CBCT.

MATERIALS AND METHODS

The study protocol was approved by the Near East University, Scientific Research Ethics Committee (approval number: YDU/2019/70-851, date: 27.06.2019). This study involves the retrospective evaluation of CBCT scans obtained from 285 adult (137 female and 148 male) patients aged 18-80 years from 2020 to 2024. CBCT images were obtained for various purposes such as implant planning, impacted tooth assessment, maxillary sinus evaluation, and cysts. The CBCT images were obtained using the Sirona Orthophos XG 3D system with the following parameters: a field of view of 80x80 mm or 110x100 mm, 85 kV, 6 mA, 14.4 seconds of scanning time, and 0.027 mm^3 voxel size.

CBCT images, of healthy mandibular molar teeth without endodontic treatment, filling restoration, fixed prosthodontic treatment, open apex, periapical lesion, and root resorption were included in the study. After recording the demographic information of the patients, cross-sectional images were assessed independently by two observers (N.I. and D.K.). The assessment of taurodont mandibular molars was conducted using the Taurodont index (TI), as modified by Shifman and Chanannel.[11] In this method, the vertical height of the pulp chamber, defined as the distance from the roof's lowest point to the floor's highest point, is divided by the total distance from the roof's lowest point to the apex of the longest root. This ratio was then multiplied by 100. A tooth was classified as taurodont if the calculated value reached 20 or more, and the distance between the CEJ and the highest point of the pulp chamber floor measured greater than 2.5 mm. Each taurodont tooth was categorized by severity: hypotaurodont (TI between 20% and 29.9%), mesotaurodont (TI between 30% and 39.9%), and hypertaurodont (TI between 40% and 75%). Mandibular molars with a single, wide canal and completely fused roots were classified as pyramidal mandibular molars.

Statistical Analysis

The gender distribution, anatomical location, and severity levels of taurodont molars, along with their association with pyramidal teeth, were statistically analyzed. All data were analyzed using IBM SPSS Statistics (version 22). Descriptive analyses were performed for all variables. The differences in the frequency of taurodontism anomaly between groups were assessed using the chi-square (χ^2) test for categorical data. A p-value below 0.05 was regarded as indicative of statistical significance.

RESULTS

A total of 902 teeth from 285 patients were evaluated, comprising 148 females and 137 males. The average age of the participants was 36 years. Taurodontism was identified in 57 out of the 285 patients (20%). At least one taurodont tooth was observed in 32 males (21.62%) and 25 females (18.25%). Gender differences in the number and percentages of CD and taurodont teeth subgroups are summarized in Table 1. HT was the predominant type of taurodontism observed, followed by MT; no cases of HYT were detected in either gender. No statistically significant differences were noted between genders ($p>0.05$); however, taurodontism was present in 51 teeth from female participants (11.8%) and 49 teeth from male participants (10.3%) as shown in Figure 1. Taurodontism occurred most frequently in third molars (23.12%), followed by second molars (12.30%) and first molars (3.86%), revealing statistically significant differences ($p<0.05$). Of the 902 mandibular molars assessed, 100 exhibited taurodontism, with 51 (11.4%) on the left side and 49 (10.7%) on the right side, as detailed in Table 2. Furthermore, 86% of the taurodont teeth were classified as HT, and 14% as MT, according to the data presented in Figure 2. Only 7 patients showed evidence of PM, yielding a prevalence rate of 2.5%. Of these, four were female (2.9%) and three were male (2%). Concerning tooth type, five of the identified pyramidal teeth were second molars, and only two were third molars. Notably, none of the teeth evaluated exhibited pyramidal characteristics in the first molars (Table 2).

DISCUSSION

"Taurodontism" combines the Greek terms "tauros," meaning "bull," and "dontia," meaning "teeth," which implies "bull-like teeth". This condition describes teeth characterized by a vertically enlarged pulp chamber and altered root canal structures.[15] Although taurodontism typically presents with a clinically normal appearance and does not

Table 1. Gender differences in the number and percentages of cynodont and taurodont teeth subgroups

	CD (n)	HT (n)	MT (n)	%	PM (n)	%
Male	421	42	7	10.3	3	2.00%
Female	374	44	7	11.8	4	2.90%
Total	795	86	14	11.1	7	2.50%
p=0.533						

CD: Cynodont, HT: Hypotaurodont, MT: Mesotaurodont, PM: Pyramidal molars.

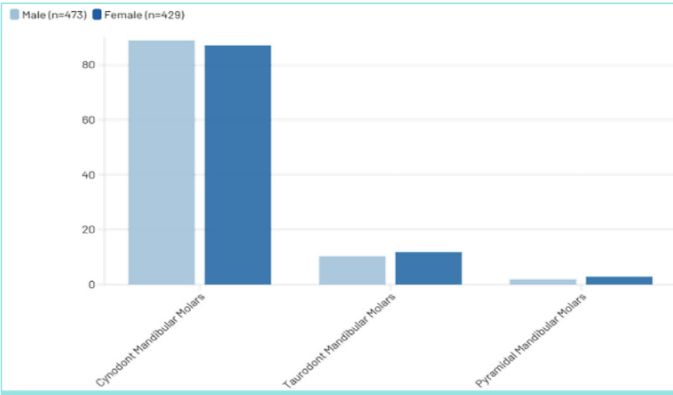

Figure 1. Distribution percentages of cynodont, taurodont and pyramidal mandibular molars according to gender.

Table 2. Distribution of taurodontism and pyramidal mandibular molar teeth according to their localization

		Taurodontism				Pyramidal	
	Total (n)	**CD (n)**	**HT (n)**	**MT (n)**	**%**	**n**	**%**
Right	457	406	39	10	10.70	2	0.40
Left	445	389	47	4	11.40	5	1.10
		CD (n)	**HT (n)**	**MT (n)**			
1. Molar	336	323	13	0	3.86	0	0.00
2. Molar	406	351	41	9	12.30	5	1.20
3. Molar	160	121	32	5	23.12	2	1.30
p=0.805, p>0.05							

CD: Cynodont, HT: Hypotaurodont, MT: Mesotaurodont.

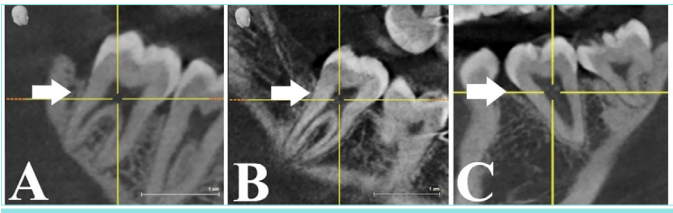

Figure 2. Representative sagittal CBCT sections demonstrating the mandibular molar (white arrow) exhibiting hypotaurodontism (A), mesotaurodontism (B), and pyramidal morphology (C), as observed in the present study.

CBCT: Cone beam computed tomography.

generally affect aesthetics, its presence may complicate endodontic treatment procedures.[13]

Moreover, the occurrence of taurodontism differs across ethnic populations, with these variations potentially linked to disparities in diagnostic methods and criteria.[16] Research on taurodontism prevalence has reported rates ranging from 0.26% to 48%. Sarr et al.[17] observed the highest prevalence in an adult Senegalese population, with taurodontism identified in 48% of individuals. Furthermore, 48.6% of the patients exhibited both taurodontism and pyramidal teeth.[17] MacDonald-Jankowski and Li[9] reported the second highest prevalence at 46.4% among the young adult Chinese population. Earlier studies in the Turkish population documented prevalence rates varying from 0.26% to 22.8%.[18-20] In the present study, taurodontism prevalence was 20%, which is quite similar to the incidence reported by Topçuoğlu et al.[20]. Previous studies within the Turkish population predominantly employed panoramic radiography.[18-20] In contrast, the present study utilized CBCT for assessment. Due to its 2D imaging and inherent magnification issues, a 3D evaluation method was preferred over panoramic radiography in the present study. Typically, earlier studies have included maxillary molars, premolars, and mandibular premolars, with some indicating that taurodontism is significantly more commonly observed in the maxillary molars. Consequently, a plan is in place to include premolar and maxillary molar teeth in future research, which is anticipated to reveal a higher prevalence of taurodontism in our population.

Study Limitations

The limitations of this study are as follows: Unlike previous studies that included maxillary molars, premolars, and mandibular premolars, the current evaluation is restricted solely to permanent mandibular molars. Additionally, this study was conducted at a single center in North Cyprus and did not represent the whole population.

CONCLUSION

In conclusion, the North Cyprus population has a 20% incidence of taurodontic mandibular molars and 2.5% incidence of pyramidal mandibular molars, indicating the need for a meticulous clinical approach in their endodontic treatment. CBCT is more effective for precise diagnosis, classification, and treatment planning. This study establishes a foundation for improving endodontic processes and patient care in North Cyprus.

MAIN POINTS

- This study identifies a 20% prevalence of taurodontism and a 2.5% prevalence of pyramidal molars (PM) in the Turkish Cypriot population.
- Hypotaurodontism is the predominant subtype observed, with no cases of hypertaurodontism reported.
- Cone beam computed tomography has been demonstrated to be superior to conventional 2D imaging techniques for the accurate diagnosis and classification of taurodont and PM.
- The findings emphasize the necessity for individualized endodontic treatment protocols and the importance of precise diagnostic imaging in clinical practice.

ETHICS

Ethics Committee Approval: The study protocol was approved by the Near East University, Scientific Research Ethics Committee (approval number: YDU/2019/70-851, date: 27.06.2019).

Informed Consent: Retrospective study.

FOOTNOTES

Authorship Contributions

Concept: U.A., S.A., K.O., Design: U.A., S.A., Data Collection and/or Processing: D.K., N.İ., Analysis and/or Interpretation: U.A., S.A., Literature Search: D.K., N.İ., Writing: D.K., S.A.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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