Journal of
Oral Health and Oral Epidemiology

https://johoe.kmu.ac.ir
10.34172/johoe.2022.02
Vol. 11, No. 3, 2022, 134-139

Original Article

Prevalence of taurodontism and its associated anomalies in dental patients in Kerman

Mansoureh Darijani[1], Hamed Ebrahimnejad[2], Jahangir Haghani[3*], Maryam Sharifi[4], Moein Jazinizadeh[5]

[1]Oral and Maxillofacial Radiologist, Dental school, Kerman University of Medical Sciences, Kerman, Iran
[2]Oral and Dental Diseases Research Center, Kerman University of Medical Sciences, Kerman, Iran
[3]Department of Oral and Maxillofacial Radiology, Oral and Dental Diseases Research Center, Kerman University of Medical Sciences, Kerman, Iran
[4]Department of Pediatric Dentistry, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran
[5]General Dentist

Abstract

Background: Taurodontism is an anomaly that can cause problems in dental treatment. It is essential for clinicians to accurately determine the prevalence of this anomaly. This study aimed to determine the prevalence of taurodontism and its associated anomalies in patients visiting clinics in Kerman in 2019.

Methods: This cross-sectional study was conducted on 424 digital panoramic radiographs of patients who visited private clinics in Kerman in 2019. The panoramic radiographs were evaluated for the presence of taurodont molars and possible related anomalies such as microdontia, severe hypodontia, as well as enamel and dentin hypoplasia. The statistical analysis was performed using SPSS 21 and chi-square test. The significance level was set at 0.05.

Results: The findings of this study showed there were 82 taurodont teeth in 33 (7.78%) out of a total of 424 panoramic radiographs (6.6% in males and 9.0% in females with an age range of 18-52(. There was no significant relationship between sex and taurodontism ($P=0.36$). Of 82 taurodont molars, 34.1% were in the mandible and 65.9% in the maxilla. The most involved teeth were the mandibular second molars. There was no significant relationship between maxilla and mandible concerning the infected teeth ($P=0.74$). Taurodontism and hypodontia were observed simultaneously in only one man who had 4 taurodont teeth.

Conclusion: The prevalence of taurodont molars in this study was 7.78% and it was more common in second molars and in the mandible. Moreover, hypotaurodontism was found as the most common type of anomaly.

Keywords: Prevalence; Taurodontism; Anomaly; Panoramic radiography

Citation: Darijani M, Ebrahimnejad H, Haghani J, Sharifi M, Jazinizadeh M. Prevalence of taurodontism and its associated anomalies in dental patients in Kerman. *J Oral Health Oral Epidemiol*. 2022;11(3):134-139. doi:10.34172/johoe.2022.02

Received: April 17, 2021, **Accepted**: July 11, 2022, **ePublished**: October 4, 2022

Introduction

Taurodontism is one of the abnormalities in the tooth morphology. The term taurodontism was first introduced by Sir Arthur Keith derived from the Latin word *tauros* which means bull and the Greek term *odus* for tooth.[1] This abnormality results in a change in the shape of the tooth. Taurodont teeth have large pulp chambers and apically positioned furcation.[2] As a result, the roots are shortened and the tooth is enlarged and becomes rectangular.[3]

The basic mechanism of taurodontism is the failure or late invagination of Hertwig's epithelial root sheath, which is responsible for the formation of the root and its shape.[4]

There have been many theories about the etiology of taurodontism. Some studies have suggested that this abnormality represents a primitive pattern, a mutation, a particular or retrograde character, an atavistic feature, an X-linked trait, and a familial or an autosomal dominant trait.[3] Although this anomaly has been suggested to be related to some syndromes and genetic defects, its etiology is still unclear.[5]

Taurodontism appears to be an independent anomaly but can be related to some abnormalities, syndromes, and genetic disorders that affect tooth morphogenesis.[6]

Some of these disorders are microdontia, severe hypodontia, dentin dysplasia, enamel hypoplasia, tooth agenesis, and root dilaceration.[6-10]

In 1928, Shaw classified taurodontism into three types in increasing order of severity as hypotaurodontism, mesotaurodontism, and hypertaurodontism based on the degree of displacement of the floor of the pulp chamber.[11] Later, Seow and Lai proposed an objective classification

*Corresponding Author: Jahangir Haghani, Email: j_haghani114@yahoo.com

based on the length of the crown and crown-body/root ratio.[12]

On clinical examination, the taurodont teeth have normal morphology; thus, taurodontism is diagnosed using radiographic images.[2] In radiography, the appearance of taurodont tooth is very characteristic. This tooth has a rectangular shape rather than tapering towards the roots. The pulp chamber is too large, with a higher occlusoapical height than normal, and very short roots.[13]

Taurodontism mostly affects the molars, however, the premolars have also been reported to be involved. The prevalence of taurodontism varies among different populations.[14] Based on previous studies, the prevalence of taurodontism was 11.3% in Saudi Arabia,[15] 46.4% among young Chinese adults,[16] and 8% in Jordan.[17] A few studies were conducted on the prevalence of taurodontism in Iran. In a study by Jamshidi et al, the prevalence of hypotaurodontism, mesotaurodontism, and hypertaurodontism was 84.13%, 11.7%, and 4.8%, respectively.[18] In another study in south of Iran, taurodontism was reported in 5.5% of the participants.[13]

Given that taurodontism can cause problems in endodontic (challenges in access cavity preparation, instrumentation, and obturation), prosthetic, and orthodontic treatments and surgery, it is essential for clinicians to accurately determine the prevalence of this anomaly in different regions. Therefore, this study aimed to investigate the prevalence of taurodontism and its associated anomalies in patients visiting private clinics in Kerman in 2019.

Methods

This study was approved by the ethics committee of Kerman University of Medical Sciences under the code IR.KMU.REC.1398.502. The sample size was determined based on a study in Iran (18), in which the prevalence of taurodontism was 22.9%.

$P = 0.229$, $q = 0.771$, $d = 0.04$, $Z = 1.96$, $\alpha = 0.05$

$N = p * q * z2 / d2 = 424$

Due to the possibility of excluding images based on the exclusion criteria, 700 digital panoramic radiographs were randomly selected from 6 radiology centers (considering that at least one clinic from each region is included in the study). Finally, 424 images (212 images of males and 212 images of females) were included in this study.

The inclusion criteria for panoramic images were high quality panoramic images and the presence of at least 5 healthy molars (other than those with dental anomalies such as hypodontia). Low quality panoramic images and those of patients' with systemic diseases with visible signs in the panoramic radiography were excluded from this study.

The selected panoramic images were assessed by a trained dental student under the direct supervision of a radiologist. If necessary, the opinions of a second radiologist were also asked.

The inclusion criteria for taurodont molars were having complete root, having a large pulp chamber in proportion to outer tooth configuration, no prominent cervical constriction compared to normal tooth, apical displacement of the pulp chamber, and apical furcation. Carious, restored, fractured, and impacted teeth, incomplete apical foramen formation, undetectable furcation, fused root, and endodontically treated teeth were excluded.[18]

All panoramic images were examined by a suitable, high-resolution monitor in a room with adequate lighting. Images that had taurodont teeth according to the criteria proposed by Seow and Lai were selected and re-examined for the possibility of the simultaneous presence of other developmental anomalies such as microdontia, severe hypodontia, enamel and dentin hypoplasia. Then, the taurodont teeth were divided into three subgroups including hypotaurodont, mesotaurodont, and hypertaurodont.

The biometric method developed by Seow and Lai was used to measure taurodontism in panoramic radiographs. Standard landmarks of this method are as follows:

- Crown (C) - from the deepest part of occlusal surface to the cementoenamel junction (CEJ) Body (B)-from the CEJ to the root furcation
- Root (R)- from the root furcation to the apices
- CB: The lengths of the crown plus body

Based on their criteria, in taurodont teeth, CB:R ratio (Crown body (CB)) / (root (R)) is greater than 1: 1.10.

Taurodont teeth were classified into three groups as CB/R 1.10-1.29 (Hypotaurodont), CB/R 1.30-2 (Mesotaurodont), and CB/R > 2.00 (Hypertaurodont).[12]

Data were analyzed using SPSS 21. Tables and figures were used to describe the data. Frequency and percentage were also measured for taurodontism. Chi-square test was used to compare the prevalence of taurodontism between men and women. The significance level was set at $P \leq 0.05$.

Results

This study analyzed 424 panoramic images (212 images of males and 212 images of females). Of 424 radiographs, 33 (7.78%) had taurodontism, 19 images of which (9.0%) were for females and 14 (6.6%) for males. This difference was not significant ($P = 0.36$) (Table 1).

The results of this study showed that there were 82 cases of taurodont teeth, of which 76 cases (92.98%) had hypotaurodontism, 5 cases (6.1%) had mesotaurodontism, and 1 case (1.22%) had hypertaurodontism (Figures 1 and 2).

Out of 82 taurodont teeth, 47 (57.5%) were seen in females and 35 (42.5%) in males. The distribution of taurodont teeth based on the type of taurodontism and sex is shown in Figure 3. There was no significant

Table 1. The frequency of taurodontism in females and males

Taurodont	Male		Female		*P* value*	Total	
	No.	Percent	No.	Percent		No.	Percent
Yes	19	8.96	14	6.6		33	7.78
No	193	91.04	198	93.4	0.36	391	92.22
Total	212	100	212	100		424	100

*Chi-square test.

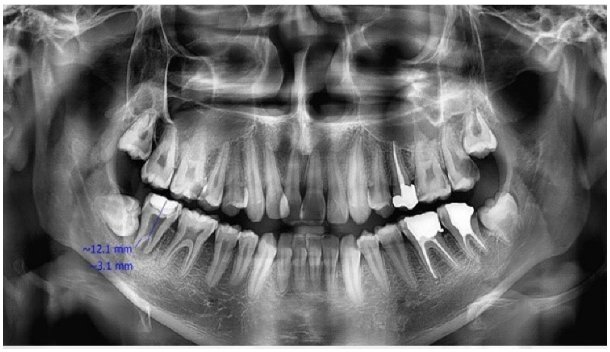

Figure 1. Panoramic image of hypertaurodontism (second molar) in a male participant.

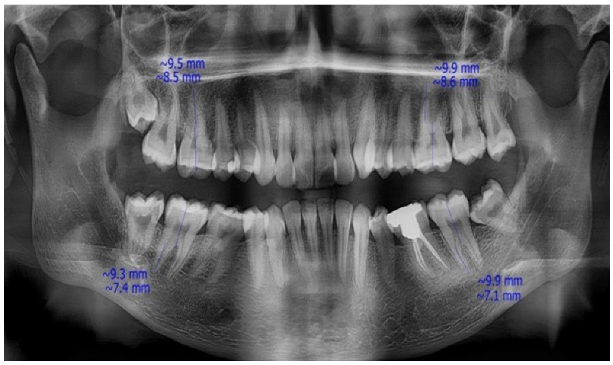

Figure 2. Panoramic image of multiple hypertaurodontism in a male participant.

difference between females and males based on the type of taurodontism ($P=0.33$).

The distribution of taurodont molars in the maxilla and mandible is shown in Table 2. The most involved teeth were the mandibular second molars. There was no significant relationship between maxilla and mandible concerning the infected teeth ($P=0.74$). The prevalence of taurodontism in the mandible was higher than in the maxilla (62.20% vs 37.80%).

The distribution of taurodont teeth in the mandible and maxilla according to taurodontism and tooth type is shown in Figure 4.

In this study, 78 taurodont teeth (97%) were not associated with another anomaly. Taurodontism and hypodontia were seen simultaneously in only one man (Figure 5). Therefore, no significant relationship was observed between the simultaneous presence of taurodontism and other dental anomalies.

Figure 5 shows this patient had 4 taurodont teeth (3%). The first molars (left maxilla and right mandible) were classified as mesotaurodontism and the first molars (right maxilla and left mandible) as hypotaurodontism.

Discussion

Taurodontism is a dental malformation, which occurs in both maxilla and mandible and both primary and permanent teeth. The results of the present study revealed the prevalence of taurodontism in molars was 7.78%. This finding is approximately in line with the results of some studies conducted in Iran including those carried out in Yazd (7.5%),[19] Tehran (6.41%) (20), southern Iran (5.5%) (13), and Ahwaz (5.8%).[18] However, this value was much less than the one reported in the study by Jamshidi et al which evaluated the prevalence of taurodontism in several cities of Iran. According to this study, the overall

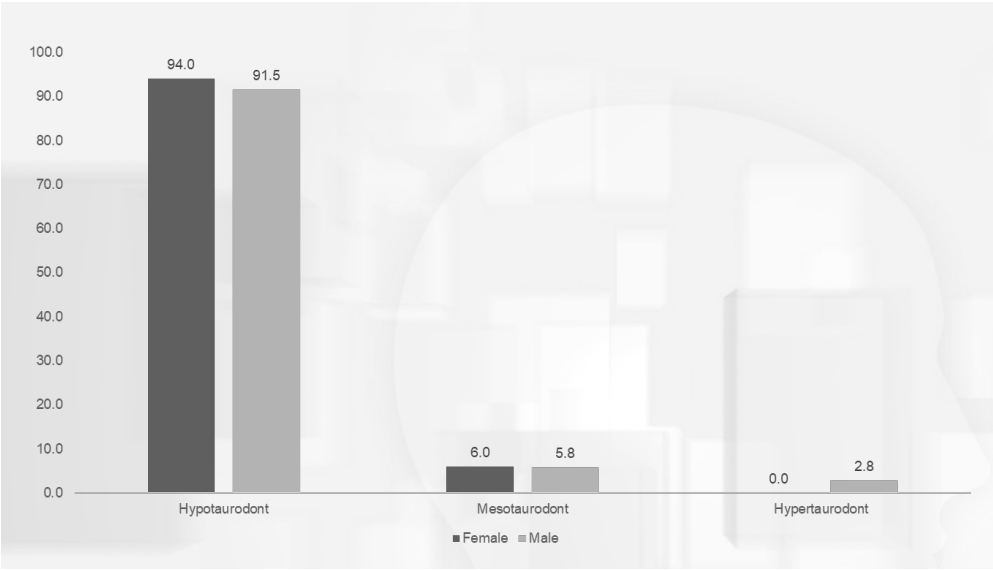

Figure 3. Distribution of taurodont teeth based on the type of taurodontism in males and females.

Table 2. Distribution of taurodontism among molars in maxilla and mandible

Teeth	Jaw				*P* value*	Total	
	Maxilla		Mandible				
	No.	Percent	No.	Percent		No.	Percent
First Molar	12	14.63	18	21.95	0.74	30	36.59
Second molar	16	19.51	25	30.49		41	50
Third molar	3	3.66	8	9.76		11	13.41
Total	31	37.80	51	62.20		82	100

*Chi-square test.

prevalence was 22.9%. In this study, the prevalence in Urmia (20.3%), Sari (32.4%), Qazvin (27%), Karaj (31.1%), Isfahan (26.5%), Zahedan (17.3%), and Yazd (23.1%) was more than the one in the present study.[18]

However, studies show a wide range of the prevalence of taurodontism from 1% to 60% in different communities.[21] The prevalence of taurodontism in deciduous teeth in Japan was 0.45%,[22] among 150 patients aged 15-19 years in Senegal was 48%,[23] in Jordan was 8%,[17] and in two different studies in India was 0.4% and 4.79%, respectively.[24,25] This rate was reported to be 11.3% in Saudi Arabia,[15] 5.6% in Israel,[26] 3.9% in Korea,[27] and 12% in Pakistan.[28]

These variations in prevalence between different populations can be related to racial differences. Besides, other factors such as the specific teeth examined, research method, sample size, different samples (images or teeth), type of teeth (molar, premolar, or both), and variable definitions of taurodontism may have led to these differences.

In the present study, the most common type of taurodontism was hypotaurodontism. The prevalence of mesotaurodont and hypertaurodont teeth was 6.1% and 1.22%, respectively. Jamshidi et al, also showed that the prevalence of hypertaurodont and mesotaurodont teeth was 4.8% and 11.07%, respectively. Moreover, two other studies by Bronoosh et al,[14] and Bürklein et al,[29] in line with the findings of the present study, showed that the prevalence rates of mesotaurodont and hypertaurodont teeth were lower than hypotaurodontism. Nevertheless, Munir et al[28] showed higher prevalence of mesotaurodont teeth. Although the detection of the two more severe types is simple, identification of hypotaurodont teeth requires accurate measurements. In this study, the criteria proposed by Seow and Lai for classification of taurodont teeth were utilized.[12] Therefore, similar to the study by Jamshidi et al, in the present study, dental parameters and performed measurements were both taken into account while many studies use only one method.[30-32] However, different criteria used for assessment of severity of taurodontism or racial differences might have led to different results in different studies.

As mentioned earlier, differences in the definition of taurodontism can also be one of the causes of variations in prevalence of taurodontism. In previous studies, teeth with more apical furcation area and larger pulp chambers have been considered as taurodont.[33,34] In another study, when the distance between the furcation and CEJ was larger than the occlusocervical height, the tooth was defined as taurodont.[35] In a study by Keene,[36] taurodont teeth was defined based on the approximate severity of this feature and the enlargement of the pulp chamber. Some studies also considered the ratio of total length of tooth to total length of crown.[8,37]

Since this trait is probably dependent on the X chromosome, it is more common in women. However, there is debate about the role of gender in the occurrence of this anomaly.[8,37] In the present study, the prevalence of taurodontism was higher in women than men but this

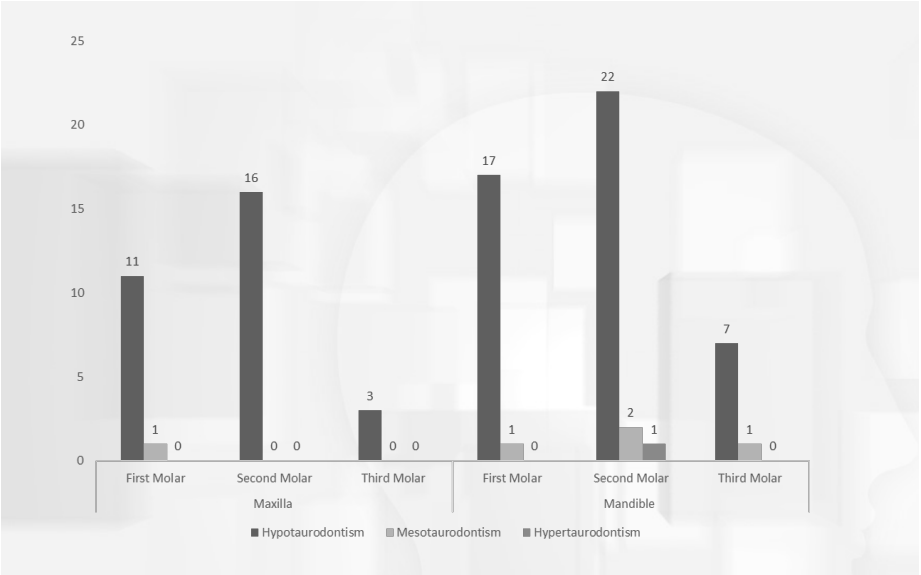

Figure 4. Frequency of taurodont types in maxillary and mandibular molars.

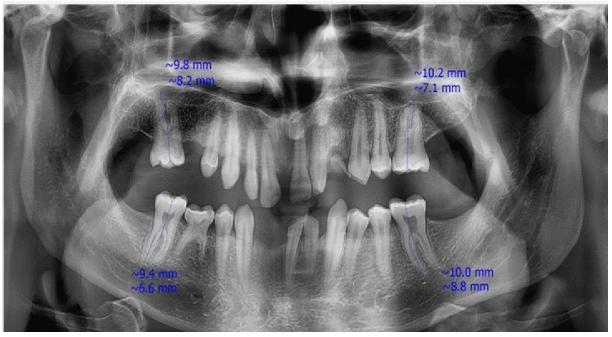

Figure 5. Panoramic image of hypodontia with hypertaurodontism and mesotaurodontism in a male participant.

difference, similar to the results of the study by Jamshidi et al in eight cities in Iran,[18] and other studies,[15,38] was not significant. Nonetheless, in the study by Bronoosh et al[14] in south of Iran, the prevalence of taurodontism (in molars and premolars) was significantly higher in females than males. Moreover, Munir et al[28] showed higher prevalence of taurodont teeth in Pakistani females than males which was similar to the results of the present study. Therefore, it seems that in addition to genetics, some other factors such as low prevalence of this anomaly and limited sample size may have resulted in insignificant differences in the prevalence of taurodontism between the two genders.

The teeth most involved in taurodontism in the present study were the mandibular second molars. This is similar to the results of the studies by Park et al,[27] Shifman and Chanannel,[26] and Keene,[36] which indicated a higher prevalence of this anomaly in the mandible. However, some other studies reported that the prevalence of taurodontism was higher in the maxilla.[18,39] Jamshidi et al, in contrast with the findings of the present study, showed significantly higher frequency of taurodontism in the maxillary second molars.[18] However, these differences may be due to racial differences and the sample size.

In the present study, only one man had taurodontism with hypodontia. Therefore, no association was found between taurodontism and hypodontia. In contrast with this finding, in a study conducted on Indians, Puttalingaiah et al found that out of 946 panoramic images, 164 had taurodontism, 148 had hypodontia, and 62 had hypodontia with taurodontism.[7] Furthermore, in another study in Brazil, Gomes et al examined seventeen families with non-syndromic hypodontia to find out the prevalence of taurodontism and its association with hypodontia. The prevalence of taurodontism in patients with hypodontia was 29%. In their study, the prevalence of taurodontism was higher in patients with hypodontia.[8] The reason for this difference in results could be due to the limited sample size.

The present study had some limitations. First, the panoramic radiographs of patients who visited the centers for dental treatment were assessed. This might influence the generalizability of the results to the communities that were not investigated. However, it is important to note that radiography of healthy individuals without any therapeutic causes is not in line with the ethical principles. Second, due to the relatively small sample size of this study, inevitably because of the low prevalence of taurodontism, made some comparisons impossible. Third, it was not possible to examine premolars due to the overlap of these teeth in panoramic images. Future studies are recommended to have a larger sample size.

Conclusion

The prevalence of taurodont molars was 7.78% in this study and it was more common in the mandibular second molars. Hypotaurodontism was the most common type of taurodontism. The prevalence of anomalies associated with taurodontism was 3%. It is recommended that further studies be conducted in the future with a larger sample size considering both molars and premolars.

Acknowledgements

This study was supported by Oral and Dental Diseases Research Center, Kerman University of Medical Sciences, Kerman, Iran.

Authors' contribution

Conceptualization: JH, MD and HE. Methodology, Validation and Formal analysis: MS, MJ and JH. Investigation, Resources and Data curation: JH, MD and MJ. Writing, Preparation, Review Editing and Visualization: JH, HE and MS

Conflict of interests

None.

References

1. Dineshshankar J, Sivakumar M, Balasubramanium AM, Kesavan G, Karthikeyan M, Prasad VS. Taurodontism. J Pharm Bioallied Sci. 2014;6(Suppl 1):S13-5. doi: 10.4103/0975-7406.137252.
2. Pillai KG, Scipio JE, Nayar K, Louis N. Prevalence of taurodontism in premolars among patients at a tertiary care institution in Trinidad. West Indian Med J. 2007;56(4):368-71.
3. Manjunatha BS, Kovvuru SK. Taurodontism: a review on its etiology, prevalence and clinical considerations. J Clin Exp Dent. 2010;2(4):187-90.
4. Hasan M. Taurodontism part 1: history, aetiology and molecular signalling, epidemiology and classification. Dent Update. 2019;46(2):158-65. doi: 10.12968/denu.2019.46.2.158.
5. Bhat SS, Sargod S, Mohammed SV. Taurodontism in deciduous molars-a case report. J Indian Soc Pedod Prev Dent. 2004;22(4):193-6.
6. Nieminen P, Morgan NV, Fenwick AL, Parmanen S, Veistinen L, Mikkola ML, et al. Inactivation of IL11 signaling causes craniosynostosis, delayed tooth eruption, and supernumerary teeth. Am J Hum Genet. 2011;89(1):67-81. doi: 10.1016/j.ajhg.2011.05.024.
7. Puttalingaiah VD, Agarwal P, Miglani R, Gupta P, Sankaran A, Dube G. Assessing the association of taurodontism with numeric dentition anomalies in an adult central Indian population. J Nat Sci Biol Med. 2014;5(2):429-33. doi:

10.4103/0976-9668.136222.
8. Gomes RR, Habckost CD, Junqueira LG, Leite AF, Figueiredo PT, Paula LM, et al. Taurodontism in Brazilian patients with tooth agenesis and first and second-degree relatives: a case-control study. Arch Oral Biol. 2012;57(8):1062-9. doi: 10.1016/j.archoralbio.2012.04.006.
9. Jafarzadeh H, Azarpazhooh A, Mayhall JT. Taurodontism: a review of the condition and endodontic treatment challenges. Int Endod J. 2008;41(5):375-88. doi: 10.1111/j.1365-2591.2008.01388.x.
10. Giambersio E, Barile V, Giambersio AM. Klinefelter's syndrome and taurodontism. Arch Ital Urol Androl. 2019;91(2). doi: 10.4081/aiua.2019.2.130.
11. Shaw JC. Taurodont teeth in South African races. J Anat. 1928;62(Pt 4):476-98.1.
12. Seow WK, Lai PY. Association of taurodontism with hypodontia: a controlled study. Pediatr Dent. 1989;11(3):214-9.
13. Rajendran R, Sivapathasundharam B. Shafer's Textbook of Oral Pathology. 6th ed. India: Elsevier; 2009. p. 43.
14. Bronoosh P, Haghnegahdar A, Dehbozorgi M. Prevalence of taurodontism in premolars and molars in the South of iran. J Dent Res Dent Clin Dent Prospects. 2012;6(1):21-4. doi: 10.5681/joddd.2012.005.
15. Ruprecht A, Batniji S, el-Neweihi E. The incidence of taurodontism in dental patients. Oral Surg Oral Med Oral Pathol. 1987;63(6):743-7. doi: 10.1016/0030-4220(87)90380-x.
16. MacDonald-Jankowski DS, Li TT. Taurodontism in a young adult Chinese population. Dentomaxillofac Radiol. 1993;22(3):140-4. doi: 10.1259/dmfr.22.3.8299833.
17. Darwazeh AM, Hamasha AA, Pillai K. Prevalence of taurodontism in Jordanian dental patients. Dentomaxillofac Radiol. 1998;27(3):163-5. doi: 10.1038/sj/dmfr/4600342.
18. Jamshidi D, Tofangchiha M, Jafari Pozve N, Mohammadpour M, Nouri B, Hosseinzadeh K. Prevalence of taurodont molars in a selected Iranian adult population. Iran Endod J. 2017;12(3):282-7. doi: 10.22037/iej.v12i3.13905.
19. Ezoddini Ardakani F, Sheikhha MH, Ahmadi H. Prevalence of dental developmental anomalies: a radiographic study. Community Dent Health. 2007;24(3):140-4.
20. Moshfeghi M, Mirzaeipour A, Kheirkhahi M. Prevalence of taurodontism of permanent molars in dental school of Shahid Beheshti university from 2000 to 2006. J Dent Sch. 2015; 33(3): 205-9. (Persian).
21. Rakhshan V, Kaviani R, Mackinejad SA. Prevalence of taurodontism in dental patients referred to two radiology centers in Tehran, Iran during 2009-2011. J Isfahan Dent Sch. 2013;9(3):259-65. (Persian).
22. Daito M, Hieda T. Taurodont teeth in primary dentition. Jpn J Pedodont. 1971;9:94-106.
23. Toure B, Kane AW, Sarr M, Wone MM, Fall F. (Prevalence of taurodontism at the level of the molar in the black Senegalese population 15 to 19 years of age). Odontostomatol Trop. 2000;23(89):36-9.
24. Shah D, Garcha V, Garde J, Ekhande D. Prevalence of taurodontism among the patients visiting a dental teaching hospital in Pune, India: a retrospective orthopantomogram study. J Indian Assoc Public Health Dent. 2015;13(1):83-6. doi: 10.4103/2319-5932.153601.
25. Patil S, Doni B, Kaswan S, Rahman F. Prevalence of taurodontism in the North Indian population. J Clin Exp Dent. 2013;5(4):e179-82. doi: 10.4317/jced.51118.
26. Shifman A, Chanannel I. Prevalence of taurodontism found in radiographic dental examination of 1,200 young adult Israeli patients. Community Dent Oral Epidemiol. 1978;6(4):200-3. doi: 10.1111/j.1600-0528.1978.tb01150.x.
27. Park GJ, Kim SK, Kim S, Lee CH. Prevalence and pattern of dental developmental anomalies in Korean children. J Oral Pathol Med. 2006;35(7):453.
28. Munir MB, Sajjad I, Sajid M. Prevalence of taurodontism in mandibular second molars. Pak Oral Dent J. 2013;33(3):528-30.
29. Bürklein S, Breuer D, Schäfer E. Prevalence of taurodont and pyramidal molars in a German population. J Endod. 2011;37(2):158-62. doi: 10.1016/j.joen.2010.10.010.
30. Prakash R, Vishnu C, Suma B, Velmurugan N, Kandaswamy D. Endodontic management of taurodontic teeth. Indian J Dent Res. 2005;16(4):177-81. doi: 10.4103/0970-9290.29900.
31. Gupta SK, Saxena P. Prevalence of taurodontism and its association with various oral conditions in an Indian population. Oral Health Prev Dent. 2013;11(2):155-60. doi: 10.3290/j.ohpd.a29363.
32. Kan WY, Seow WK, Holcombe T. Taurodontism in children with hypodontia and supernumerary teeth: a case control study. Pediatr Dent. 2010;32(2):134-40.
33. Calvano Küchler E, De Andrade Risso P, De Castro Costa M, Modesto A, Vieira AR. Assessing the proposed association between tooth agenesis and taurodontism in 975 paediatric subjects. Int J Paediatr Dent. 2008;18(3):231-4. doi: 10.1111/j.1365-263X.2007.00876.x.
34. Ghabanchi J, Haghnegahdar AA, Khodadazadeh S, Haghnegahdar S. A radiographic and clinical survey of dental anomalies in patients referring to Shiraz dental school. J Dent. 2009;10 Suppl:26-31. doi: 10.30476/dentjods.2019.43602.
35. Feichtinger C, Rossiwall B. Taurodontism in human sex chromosome aneuploidy. Arch Oral Biol. 1977;22(5):327-9. doi: 10.1016/0003-9969(77)90031-0.
36. Keene H. A morphologic and biometric study of taurodontism in a contemporary population. Am J Phys Anthropol. 1966;25:208-9.
37. Azzaldeen A, Mai A, Nezar W, Muhamad AH. Taurodontism; clinical considerations. IOSR J Dent Med Sci. 2017;15(12):61-7. doi: 10.9790/0853-1512086167.
38. Sert S, Bayrl G. Taurodontism in six molars: a case report. J Endod. 2004;30(8):601-2. doi: 10.1097/01.don.0000121609.74336.24.
39. Çelikoglu M, Miloglu Ö, Öztek Ö, Kamak H, Kazanci F, Oktay H. The frequency of taurodontism in an East Anatolian orthodontic patient population. Turkiye Klinikleri J Dent Sci. 2010;16(3):214-7.