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Review Article

Taurodontism: A Rare Dental Anomaly - A Brief Review

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Abstract

Human dentition is affected by a wide variety of abnormalities, which include variation in the number, morphology, and eruption sequences. The absence of tooth development manifests as anodontia, hypodontia, and oligodontia. Taurodontism is a developmental anomaly affecting the teeth leading to minimal or no constriction at the cementoenamel junction level manifesting as an enlarged pulpal chamber and also the trunk of the roots is displaced toward the apex giving a rectangular shape to the involved tooth. Due to the prevalence of taurodontism in modern dentitions and the critical need for its true diagnosis and management, this review article addresses the etiology, clinical and radiographic features, its association with variation syndromes and anomalies as well as clinical implications of dental treatments of such teeth.

Key words: Anomaly, Cementoenamel junction, Taurodont

INTRODUCTION

Dental morphological traits are of particular importance in the study of phylogenetic relationships and population affinities.[1] In this, dental anomalies are formative defects caused by genetic disturbances during tooth morphogenesis.[2] One such anomaly is taurodontism. Taurodontism is a developmental anomaly that has altered intrinsic pulp chamber morphology which results in the extension of the pulp chamber apically towards the root area in a multirooted tooth. It is characterized that lacks of constriction at the level of the cementoenamel junction (CEJ) and is characterized by a vertically elongated pulp chambers, apical displacement of the pulpal floor, and bifurcation or trifurcation of the roots. Witkop defined taurodontism as "teeth with large pulp chambers in which the bifurcation or trifurcation is displaced apically and hence that the chamber has greater apico occlusal height than in normal teeth and lacks the constriction at the level of CEJ." Taurodontism is currently defined as the tooth morphological alterations with the absence of the usual constriction at the CEJ, apical shift of the pulp chamber floor and furcation area at the expense of the roots and the root canal length.[1-4]

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HISTORY

In 1903, De Terra described taurodontism as unusually shaped teeth having a cylindrical or prismatic form in remnants of prehistoric hominids. In 1907, taurodontism was first described by Gorjanovic- Kramberger. The first report of taurodontism in modern man's dentition was published in 1909 by Pickerill, who used the term "radicular dentinoma" to describe the dentition. He described the maxillary first molars exhibiting an overall cuboidal or bale shape with normal crowns and one central quadrilateral shaped pulp cavity instead of individual root canals.[5] The term taurodontism was first stated by Sir Arthur Keith in 1913. In 1939, Senyurek noted taurodontism in ancient Egyptians, ancient Icelanders, and early American Indians. In 1954, the recent literature contains reports of taurodontism as an isolated oddity, a familial trait, a trait with high frequency in Eskimos and other associated with several types of other systemic disturbances. The origin of the name taurodontism is a combination of the two words "tauros" meaning bull in Latin and "odus" which is of Greek origin meaning "tooth" and the initial use of

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the term taurodontism was to describe the molar teeth resembling those of ungulates particularly bulls.[1-3,5-7]

ETIOLOGY

Theories concerning the etiology of taurodontism have been diverse and are commonly attributed to the failure of invagination of epithelial root sheath sufficient early to form the cynodont. This alteration in the Hertwig's epithelial root sheath involves failure of the epithelial diaphragm to form a bridge prior to dentin deposition resulting in a large pulp chamber.[5-8] This anomaly represents a primitive pattern, a mutation, a specialized or retrograde character, an atavistic feature, an X-linked trait, familial or an autosomal dominant trait. Taurodontism appears most frequently as an isolated anomaly, but it also has been associated with several developmental syndromes and anomalies including Amelogenesis Imperfecta, Down Syndrome, Ectodermal Dysplasia, Klinefelter Syndrome, Trichodento Osseous Syndrome, Mohr Syndrome, Wolf Hirschorn Syndrome, and Lowe Syndrome. Taurodontism has been present with other rare syndromes such as Smith-Magnesis Syndrome, William Syndrome, Mucune Albrright Syndrome, and Van de Wonde Syndrome.[9]

According to some authors, interferences in the epithelio-mesenchymatose induction have been proposed as a possible etiology. Some reports suggest that taurodontism may be genetically transmitted and could be associated with an increased number of X-chromosomes. However other researchers have found no simple genetic association but have noticed a trend for X-chromosomal aneuploidy amongst patients with more severe forms of the trait.[9,10]

But the etiology of taurodontism is still unclear. The possible causes of taurodontism have been enumerated by Mangion as follows, (a) A specialized or retrograde character, (b) A primitive pattern, (c) A Mendelian recessive trait, (d) An atavistic feature, (e) A mutation resulting from odontoblastic deficiency during dentinogenesis of the roots. Today it is considered as an anatomic variant that could occur in a normal population. The prevalence of taurodontism is reported to be in range from 2.5% to 11.3% of the human population. Females have been reported to be affected more by tooth agenesis in comparision with males.[1,5]

Theories concerning the pathogenesis of taurodontic root formation are also varied: An unusual developmental pattern, a delay in the calcification of pulpal chamber, an odontoblastic deficiency, an alteration in Hertwig's epithelial root sheath. According to some authors, taurodontism is most likely the result of disrupted developmental homeostasis.[1,11]

DIAGNOSIS

The external features have been primarily used for the diagnosis of taurodontism. It should be noted that gross external characteristics are not sufficient to generate diagnosis. Clinically taurodont appears as a normal tooth. In fact, because the body and roots of a taurodont tooth lie below the alveolar margin, its distinguishing features cannot be recognized clinically Identification of taurodontism can only be done by radiographic examination as the external teeth morphology within normal configurations. Therefore the diagnosis of taurodontism is usually a subjective determination made from diagnostic radiographs. The radiographic configuration is the best way to visualize the pulp chamber in a rectangular configuration. Diagnosis of taurodontism has been mainly based on subjective radiographic assessment. Radiographically, in taurodont tooth the pulp chamber is extremely large and elongated with much greater apico-occlusal height than normal and thus extends apically below the CEJ. The CEJ constriction is less marked than that of the normal tooth, giving the taurodont a rectangular shape. Furthermore, the furcation is displaced apically resulting in shorter roots whilst enlarging the body of a tooth. The radiographic characteristics of taurodont teeth are extension of the rectangular pulp chamber into the elongated body of the tooth, shortened roots and root canal, location of furcation size despite a normal crown size.[11]

CLASSIFICATION

Differences of opinion exist as to how much displacement and morphologic change constitutes taurodontism. In classifying tauroodont teeth, it is necessary to consider not only the size of the alveolar margin. Different classifications have been proposed in the literature.

In 1928, Shaw classified this condition based on the relative displacement of the floor of the pulp chamber as hypotaurodontism, mesotaurodontism, and hypertaurodontism. In 1966, Keene classified taurodontism based on the relation of the height of the pulp chamber to the length of the longest root. Keene proposed a taurodont index, cynodont index value of 0–24.9%, hypo-T: index value of 25–49%, meso-T: index value of 50–74.9%, hyper-T: index value of 75–100%.

In 1971 Blumberg, proposed a classification based on the mesiodistal diameter of the tooth, variable 1: Mesiodistal diameter taken at contact points, variable 2: Mesiodistal diameter taken at the level of the CEJ. Variable 3: Perpendicular distance from baseline to highest point on the pulpal chamber floor. Variable 4: Perpendicular distance

from baseline to the apex of the longest root. Variable 5: Perpendicular distance from baseline to lowest point on pulp chamber roof.

In 1977, Feichfnger and Rossiwall proposed a classification based on the distance from the bifurcation or trifurcation of the root to the CEJ should be greater than the occluso-cervical distance. In 1978, Shifman and Chanamel based on the distance between the occlusal third of the pulp chamber to the apex of the root, hypodont- T: 20–20.9%, Mesodont-T: 30–39.9%, Hyperdont-T: 40–75%.[1,11,12]

EPIDEMIOLOGY AND PREVALENCE

Taurodontism was at first thought to be a primitive tooth form. On the other hand, it is found in such diverse groups as Inuit, Aleuts, Mongolians, Europians. Except for a higher prevalence of taurodontism amongst females in a Chinese sample, no study has found a gender difference for this abnormality. Although permanent mandibular molars are most commonly affected. The degree of taurodontism increases from the first to the third molar. Furthermore, taurodontism is occasionally observed in mandibular premolars and even in maxillary premolars, mandibular canines, and incisors.

Taurodontism appears most frequently as an isolated anomaly. However reported as a feature of multiple systems malformation syndromes such as ectodermal dysplasia, down syndrome, Klinefelter syndrome, tricho-dento-osseous syndrome, and X-linked hypophosphatemic rickets. It has been found in association with various anomalies including amelogenesis imperfecta and hypodontia.[11,13]

CLINICAL CONSIDERATIONS

The clinical implication of taurodontism has a potentially increased risk of pulp exposure because of dental caries and dental procedures. Endodontic considerations include wide variation in the size and shape of the pulp chamber, varying degrees of obliteration, canal configuration, apically positioned canal orifices ant potential for additional root canal system. Endodontic therapy of choice in these clinical situations will be conservative. For its successful endodontic management, clinician should be aware of the complex canal system.[14,15] Surgical considerations include extraction of a taurodont tooth is usually complicated because of shift in the furcation to apical third. It has also been hypothesized that the large body with limited surface area of a taurodont teeth is embedded in the alveolus. Extraction of such teeth may not be problem unless the roots are not widely divergent. Pedodontic considerations include, pulp therapy for taurodonts is a challenging treatment, with increased incidence of hemorrhage during access opening which may be mistaken for perforation. Since the roots are short and pulpal floor is placed apically, care should be taken to prevent perforation. Taurodontism may complicate prosthodontic and orthodontic treatment planning. For the prosthetic treatment of a taurodont tooth, it has been recommended that post-placement be avoided for tooth reconstruction. Because less surface area of the tooth is embedded in the alveolus, a taurodont tooth may not have as much stability as a cynodont when used as an abutment for either prosthodontic or orthodontic purposes. From a periodontal view, taurodont teeth may in specific cases offer favorable prognosis. Where periodontal pocketing or gingival recession occurs, the chances of furcation involvement are considerably less than those in normal teeth because taurodont teeth have to demonstrate significant periodontal destruction before furcation involvement occurs. Taurodontism, although not very common has to be emphasized due to its influence on various dental treatments.

It is very important for a clinician to be familiar with taurodontism not only with regards to clinical complications but also its management. Taurodontism also provides a valuable clue in detecting its association with many syndromes and other systemic conditions. It can be seen that taurodontism has until now received insufficient attention from clinicians.[11,12]

CONCLUSION

Taurodontism is one of the rare dental anomalies in modern man which needs special attention while performing any treatment. This review attempts to provide knowledge regarding its etiology, related syndromes, classification, radiographic features, and clinical considerations in the treatment of such taurodont teeth. It can be seen that taurodontism has until now received insufficient attention from clinicians. No long term follow-up studies have been published regarding treatment of taurodont tooth.

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