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ENDODONTIC MANAGEMENT OF TAURODONTISM: A CASE SERIES

Endodontics

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ABSTRACT

Taurodontism is indeed a dental anomaly characterized by specific changes in tooth shape, particularly affecting the molars. The key features, including the failure of Hertwig's epithelial sheath diaphragm to invaginate properly, leading to an enlarged pulp chamber, apical displacement of the pulpal floor, and the absence of constriction at the cemeto-enamel junction.

The fact that taurodontism can affect both permanent and deciduous dentition, unilaterally or bilaterally, and can occur in isolation or in association with various syndromes and abnormalities adds to the complexity of its clinical presentation. This article explores these aspects in detail, shedding light on the prevalence of taurodontism in modern dentitions and emphasizing the importance of accurate diagnosis and appropriate management.

Given the clinical challenges posed by taurodontism, it's crucial for dental professionals to be aware of its features, associations, and potential treatment considerations.

KEYWORDS

Dental caries, hypertaurodontism , Mesotaurodontism, Dental Treatment, Thermoplasticized gutta-percha

INTRODUCTION:

Taurodontism is a dental anomaly and formative defects resulting from genetic disturbances during tooth morphogenesis. Understanding the genetic basis helps in recognizing the condition and considering potential associations with syndromes or other genetic factors.

Taurodontism is characterized by specific morpho-anatomical changes in tooth shape. In this anomaly, the root length are reduced in size, while the body of the tooth is enlarged. This alteration in tooth morphology can be visually distinct and is a result of developmental disturbances during tooth formation.[2]

In taurodontism, the pulp chamber is extremely large and elongated with much greater apicoocclusal 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. Also, the furcation is displaced apically, resulting in shorter roots while enlarging the body of the tooth.

These features provide a clear picture of the morphological changes associated with taurodontism.[2] Almost half of the cases show this condition bilaterally.

Gorjanovic-Kramberger was the first to describe taurodontism in 1908 reflects the initial recognition of this dental anomaly. Early observations such as these contribute significantly to the understanding of dental anomalies and their morphological variations.

Sir Arthur Keith attributed the term "taurodontism" in 1913 highlighted the importance of terminology in the field of dentistry. Sir Arthur Keith's choose the term, drawing from Greek roots meaning "bull" and "tooth," adds an interesting layer to the description, emphasizing the morphological resemblance of affected teeth to those of hoofed animals, particularly bulls.[3]

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 cemento-enamel junction (CEJ). The distance from the trifurcation or bifurcation of the root to the CEJ is greater than the occluso-cervical distance.”[4]

Causes And Etiology:

- Taurodontism is primarily attributed to the failure of Hertwig's epithelial sheath diaphragm to invaginate properly at the horizontal level during tooth development.
- Interference in epitheliomesenchymatose induction has also been proposed as a potential etiological factor.[5]

Genetic Factors:

- Some reports suggest a genetic transmission of taurodontism.
- Genetic studies have pointed towards an association with an increased number of X chromosomes.
- Autosomal transmission of the trait has been observed, suggesting a complex genetic basis.

Chromosomal Abnormalities:

- Chromosomal abnormalities, including X chromosomal aneuploidy, may be linked to more severe forms of taurodontism.
- The disruption of tooth development form may result from these chromosomal abnormalities.[6]

Polygenic System:

Blumberg et al. (1971) proposed that taurodontism operates as a polygenic system, describing it as a continuous trait without discrete modes of expression.

External Factors:

In addition to genetic factors, external factors such as infection (osteomyelitis), disrupted developmental homeostasis, high-dose chemotherapy, and a history of bone marrow transplantation can also contribute to damage in developing dental structures.

Classification

I. Shaw (1928)[7]

Shaw's classification was based on the relative displacement of the floor of the pulp chamber, and it included three subtypes:

a. Hypotaurodontism: Hypotaurodontism is the least pronounced form, in which the pulp chamber is enlarged.

b. Mesotaurodontism: Mesotaurodontism is the moderate form, in which the tooth roots are divided only at the middle third.

c. Hypertaurodontism: Hypertaurodontism is the most severe form, in which bifurcation or trifurcation occurs near the root apices.

II. Shifman and Chanannel's index(1978)[8]

Later, Shifman & Chanannel[1] quantified the degree of taurodontism based on a mathematical formula relating the anatomical landmarks as shown in the figure below. The anatomical landmark ratio is calculated as shown below:

$$Landmark\ Ratio = \frac{distance\ from\ A\ to\ B}{distance\ from\ B\ to\ C}$$

Where, A = the lowest point of the pulp chamber roof, B = the highest point of the pulp chamber floor, and C = the longest root's apex.

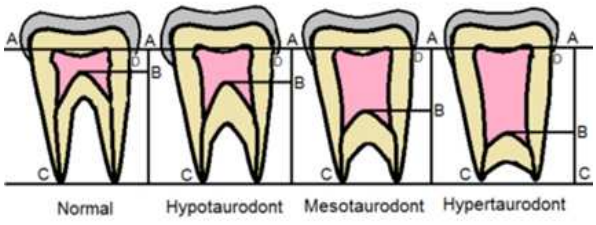

Figure 1 Shiffman and Chanannel A: Lowest point of the roof of the pulp chamber. B: Highest point of the floor of the pulp chamber. C: Root apex. D: Cementoenamel junction (CEJ)

Using this formula, a tooth is a taurodont if the landmark ratio is ≥ 0.2 and the distance from the highest point of the pulp chamber floor (B) to the cemento-enamel junction (D) is ≥ 2.5 mm. The full classification system based on this formula are displayed in the table below:

Classification	Landmark ratio
Normal	< 0.2
Hypo-taurodont	≥ 0.2 - 0.209
Meso-taurodont	≥ 0.3 - 0.399
Hyper-taurodont	≥ 0.4 - 0.75

Differential Diagnosis:

In certain metabolic conditions including pseudo-hypoparthyroidism, hypophosphatasia, and hypophosphatemic vitamin D-resistant and dependent rickets, the pulp chamber may be enlarged but the teeth are of relatively in normal form . Another differential diagnosis is in the early stages of dentinogenesis imperfecta, where the appearance may resemble the large pulp chambers found in taurodontism . Moreover, the developing molars may appear similar to taurodonts; however, an identification of wide apical foramina and incompletely formed roots helps in the differential diagnosis .[9]

Endodontic Management

A taurodont tooth shows wide variation in the size and shape of the pulp chamber, varying degrees of obliteration and canal configuration, apically positioned canal orifices, and the potential for additional root canal systems. Therefore, root canal treatment becomes a challenge .

Case Report 1:

A 15-year-old female patient reported to the Department Of Conservative Dentistry and Endodontics postgraduate clinic for treatment and advice regarding her left mandibular molar.The patient complaints of persistent pain in lower left back region of jaw since 2 months, the left mandibular molars showed signs of Dental caries and was tender on percussion at the time of intraoral examination. When the affected teeth was radiographed, it was discovered that the left mandibular first molar had an abnormally long pulp chamber without any constriction at the cemento-enamel junction, two short roots were visible at the apical third's furcation area.The radiographic evaluation of the left mandibular first molar demonstrated periapical changes together with deep occlusal caries involving pulp . The mandibular left first molar was diagnosed with hypertaurodontism with chronic periapical periodontitis based on the clinical and radiological findings. Root canal treatment was planned for left mandibular first molar.

The pulp chamber of the mandibular left first molar (36) was accessed under rubber dam isolation after the patient was anesthetized with an inferior alveolar nerve block containing 2% lignocaine and 1:100000 epinephrine. On examination, it was discovered that the pulp chamber was large and there were two divisions with broad apical foramina, one on the distal side and one on the mesial side. The apical divisions were almost near the apex. The apical divisions were cleaned and shaped separately.

The working length was measured using #10 K files in the mesial canals and #10 K files in the distal canal (Fig 1a). This was verified using radiovisiography and an electronic apex locator. The pulp chamber was biomechanically prepared by circumferentially filing all canals with ISO K files of size #25, then further shaping of the pulp chamber was done using Neoendo file size 25.6 % followed by selection of mastercone(Fig 1b). The canals were irrigated with 2.5% sodium hypochlorite, 17% EDTA aqueous solution, 2% W/V chlorhexidine gluconate, and saline as the last irrigant. The mesial and distal canals were obturated using the lateral compaction technique. Next, OBTURA 2 was used to obturate the extended pulp chamber using thermoplasticized gutta percha(Fig 1c). A well-condensed filling of the canals was confirmed by the final radiograph.

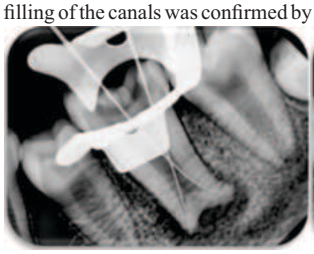

Fig 1a showing working length.

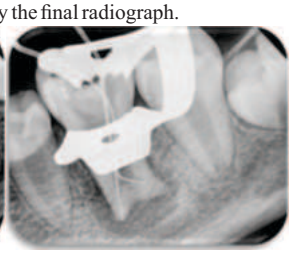

Fig 1b showing selection of mastercone

Fig 1c Showing Obturation

Case Report 2

A 32-year-old female patient reported to the Department of Conservative Dentistry and Endodontics postgraduate clinic for treatment and advice regarding her left maxillary molar. The patient complaints of persistent pain in lower left back region of jaw since3 months, the left maxillary first molar showed signs of Dental caries and

was tender on percussion at the time of intraoral examination. When the affected teeth was radiographed, it was discovered that the left maxillary first molar had an abnormally long pulp chamber with small constriction at the cemento-enamel junction, two short mesial roots were visible at the apical third's furcation area.The radiographic evaluation of the left maxillary first molar demonstrated periapical changes together with deep occlusal caries involving pulp. The maxillary left first molar was diagnosed with hypotaurodontism with chronic periapical periodontitis based on the clinical and radiological findings. Root canal treatment was planned for left maxillary first molar.

The pulp chamber of the maxillary left first molar (26) was accessed under rubber dam isolation after the patient was anesthetized with posterior superior nerve block containing 2% lignocaine and 1:100000 epinephrine. On examination, it was discovered that the pulp chamber was large and there were two divisions with broad apical foramina, one on the mesiobuccal side and oneon the distobuccal side.

The working length was measured using #10 K files in all the three canals. This was verified using radiovisiography and an electronic apex locator(Fig2a). The pulp chamber was biomechanically prepared by circumferentially filing all canals with ISO K files of size 25, then further shaping of the pulp chamber as done using Neoendo file size 25.6% followed by selection of mastercone(Fig 2b). The canals were irrigated with 2.5% sodium hypochlorite, 17% EDTA aqueous solution, 2% W/V chlorhexidine gluconate, and saline as the last irrigant. Obturation of the canals were done using GP cones and AH plus sealer with conventional lateral compaction technique(Fig 2c). A well-condensed filling of the canals was confirmed by the final radiograph.

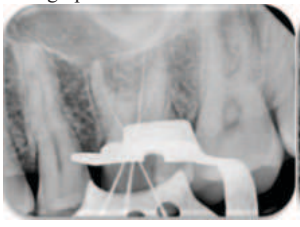

Fig 2a showing determination of working length

Fig2b Showing selection of mastercone

Fig 2c Showing Obturation

DISCUSSION:

A taurodontic tooth presents a problem for endodontic treatment because of its variable pulp chamber size and apically positioned root canal orifices with short roots. The only way to detect taurodontism is by radiographic examination because the taurodont crown exhibits normal structure, form, colour, and texture in clinical settings.[10]

Based on the relative displacement of the pulp chamber floor, Shaw (1928) defined the subtypes of this syndrome as hypotaurodontism, mesotaurodontism, and hypertaurodontism. Due to this arbitrary, subjective classification, taurodontism was mistakenly identified in cases of normal teeth. An index was proposed by Shifman and Chanannel to determine the degree of taurodontism.[11]

The pulp chamber's long, rectangular shape makes it challenging to find the canal orifices, which in turn makes canal preparation and obturation challenging. Therefore, the use of a dental microscope is critical to the outcome of endodontic therapy in teeth with taurodontia. By providing improved illumination of the cavity's depths, magnification improves the ability to see the pulpal floor and makes it easier to identify the root canal orifices. Owing to the complexity of the root canal system, ultrasonic irrigation to chemomechanical debridement are beneficial in thoroughly cleaning and disinfecting the root canal system.[12]

According to Tsesis et al., a taurodont tooth can be obturated by combining the warm vertical compaction approach with the lateral compaction technique. A three-dimensional obturation of the canals is ensured by sectional sealing of the apical region of the canal and backfill with thermoplasticized gutta-percha, which also inhibits apical extrusion of the material.[13]

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