

An Endodontic Challenge :“Taurodontism”- Case Report & Its Comprehensive Review

Abstract

Taurodontism can be defined as a change in tooth shape caused by the failure of Hertwig's epithelial sheath diaphragm to invaginate at the proper horizontal level. An enlarged pulp chamber, apical displacement of the pulpal floor, and no constriction at the level of the cemento-enamel junction are the characteristic features. This change is seen in both the permanent and deciduous dentition, unilaterally or bilaterally but most commonly it occurs in permanent molars. Endodontic treatment of a taurodont tooth is challenging and requires special handling because of the proximity and apical displacement of the roots. In this article a case report of taurodontism is presented along with its comprehensive review.

Introduction

Taurodontism is a morpho-anatomical change in the shape of the tooth in which the body of the tooth is enlarged and the roots are reduced in size. This abnormality is a developmental disturbance of a tooth that lacks constriction at the level of the cemento-enamel junction (CEJ) and is characterized by vertically elongated pulp chambers, apical displacement of the pulpal floor, and bifurcation or trifurcation of the roots^{1,4}. The term “taurodontism” (‘bull tooth’) was coined from the Latin term “tauros”, which means ‘bull’ and the Greek term “odus”, which means ‘tooth’^{5,6}. The term taurodontism was first introduced by Sir Arthur Keith⁵ and Shaw (1928) further classified taurodont teeth according to their severity into hypo-, meso- and hypertaurodont forms, hypotaurodontism being the least pronounced form, mesotaurodontism the moderate form and hypertaurodontism being the most severe form in which the bifurcation or trifurcation occurs near the root apices.⁷

The present article describes the review of condition and case reports on taurodontism by endodontic treatment

Review of literature:-

1. Keith A (1913) :- First used the term Taurodontism
2. Shaw JC (1928):- Named three subclasses : Hypo, Mesio, Hypertaurodontism
3. Kallay J (1963):- Described a single root, wedge shaped molar that occurred in association with taurodont teeth.
4. Witkop et al (1969), Crawford JI (1970), Parker JL et al (1975), Gage JP (1978), Congleton et al (1979): Taurodontism has been found to occur either as an isolated, single trait or in association with syndromes and anomalies including amelogenesis imperfecta
5. Jasper MT (1981):- Taurodontism was found to be present in Down's syndrome
6. Levin LS et al (1975), Stenvik et al (1972), Jasper MT & Witkop CJ (1980):- Taurodontism in ectodermal disturbances
7. Yeh and Hsu (1998), Keeler C (1973):- Taurodontism associated with Klinefelter's syndrome
8. Mednick GA (1973), Stewart RE (1974):- Taurodontism associated with Mohr syndrome
9. Fuks AB et al (1982):- Taurodontism

associated with Osteoporosis

10. Jorgenson RJ and Warson RW (1973), Lichtenstein J et al (1972), Gulmans et al (1976) :- Taurodontism associated with Tricho-dento-osseous syndrome
11. Meena (1971), Barker (1976):- Genetic study of Taurodontism
12. Keene (1966):- Taurodont index (it is related to the height of pulp chamber to the length of longest root)
13. Tulensalo et al (1989):- Had given simple method of assessing Taurodontism using orthopantomograms
14. Blumberg et al (1971):- Biometric method to diagnose taurodontism

Classifications of Taurodontism:-

Shaw 1928 based on External morphological criteria (on the relative amount of apical displacement of the pulp chamber floor) (fig 1)

- a) Cynodont :- Normal tooth & pulp chamber
- b) Hypotaurodont:- moderate enlargement of the pulp chamber at the expense of the roots
- c) Mesotaurodont:- pulp is quite large and the roots short but still separate
- d) Hypertaurodont:- prismatic or cylindrical forms where the pulp chamber nearly reaches the apex and then breaks up into 2 or 4 channels

Single or pyramidal root (cuneiform): usually in the lower second molar where the pulp extends throughout the root without cervical constriction and exits via a single wide apical foramen

1. Blumberg et al. 1971 just gave variables (fig2):

- a. Variable 1: mesiodistal diameter taken at contact points
- b. Variable 2: mesiodistal diameter taken at the level of the cemento-enamel junction
- c. Variable 3: perpendicular distance from baseline to highest point on pulp chamber floor
- d. Variable 4: perpendicular distance from baseline to apex of longest root
- f. Variable 5: perpendicular distance from baseline to lowest point on pulp chamber roof

Shifman & Channel (1978) suggested a most widely accepted and used criteria distance from the lowest point of the roof of the pulp chamber (a) to the highest point of

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pulp floor (b), when divided by the distance from (a) to root apex (c) should be equal to or greater than 0.2 mm and/or distance from (b) to cemento-enamel junction (d) should be greater than 2.5 mm into categories (fig3):

Etiology & Pathogenesis

There are many theories regarding the etiology of taurodontism. The suggestive etiology of taurodontism listed by Mangion⁸ is as follows:

- 1) A specialized or retrograde character
- 2) A primitive pattern
- 3) A Mendelian recessive trait
- 4) An atavistic feature
- 5) A mutation resulting from odontoblastic deficiency during dentinogenesis of the roots.

Various theories regarding pathogenesis has been put forwarded such as, according to Hamner et al., taurodontism is caused by the failure of Hertwig's epithelial sheath diaphragm to invaginate at the proper horizontal level⁹. Interference in the epitheliomesenchymatose induction has also been proposed as a possible aetiology¹⁰. Some reports suggests that it may be genetically transmitted¹¹⁻¹³, and could be associated with an increased number of X chromosomes.¹⁴

Clinical features

It may affect deciduous or permanent molars, unilateral or bilateral, or may exhibit quadrant involvement. Involved teeth tend to be rectangular rather than tapering towards root and lacks constriction at cemento-enamel junction. Clinically taurodont tooth appears similar to the normal tooth as part of crown furcation & roots are in the socket which cannot be seen.

The prevalence of taurodontism is found to be in a range from 2.5% to 11.3% of the human population. This range is accounted for by variations in race and differences in diagnostic criteria.¹⁵

Syndromes Associated with Taurodontism

Taurodontism usually appears as a single entity but it is also found to be associated with various syndromes such as amelogenesis imperfecta, Down's syndrome, ectodermal dysplasia, Klinefelter syndrome, trichodento-osseous syndrome, Mohr syndrome, Wolf-Hirschhorn syndrome and Lowe syndrome.¹⁵ Taurodontism has also been reported to present with other rare syndromes such as Smith-Magenis syndrome¹⁶, Williams syndrome¹⁷, McCune-Albright syndrome¹⁸ and Van der Woude syndrome.¹⁹

Diagnosis

Diagnosis of taurodontism can be done by routine radiographic examination as clinically taurodont appears as normal tooth but



radiographically it shows the extension of the rectangular pulp chamber into the elongated body of the tooth, shortened roots and root canals, location of furcation (near the root apices), despite a normal crown size.^{6, 20} The use of high-end diagnostic imaging modalities such as spiral computerized tomography has also been used in making a confirmatory diagnosis of the multiple morphologic abnormalities such as taurodontism, dens invaginatus, pyramidal cusps of the premolars, dens evaginatus.²¹

Differential diagnosis

Certain conditions such as pseudo-hypoparathyroidism, hypophosphatasia, and hypophosphatemic vitamin D-resistant and dependent rickets, tooth may have a large pulp chamber but the teeth are of relatively of normal structure^{6,22,23}, early stages of dentinogenesis imperfect² and developing molar as it has got wide apical foramina ; incomplete root & dental papilla.²⁴

Endodontic considerations

Endodontic treatment in taurodontism has been described as a complex and difficult procedure as 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 systems²⁵. During endodontic treatment increased incidence of haemorrhage 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. Radiographs gives very less information about the root canal system before treatment. Proper instrumentation and obturation in taurodontic tooth may be extremely difficult due to complexity of root canal system.^{25,26}

Case Report

A 18 year old female patient had come to the Dept of Conservative dentistry & Endodontics India for the treatment of mandibular left molar, with the chief complaint of pain in lower left posterior region since 10 days. Pain was sharp, intermittent in nature aggravating on mastication. Intraoral examination revealed a normal shaped crown with a temporary restoration suggestive of an attempt of root canal treatment made by general dentist in private practise. The tooth was symptomatic with the pain on percussion, The patient's medical history was noncontributory. Tooth was anaesthetize and temporary restoration was removed and proper access opening was done (fig.4) to relieve the pain. Radiograph

revealed the moderately large pulp chamber & roots were close proximity with each other & furcation was present below the cervical area of tooth. Thus it was diagnosed of mesiotauodont.

Endodontic Management of the Mandibular Right First Molar

The tooth was anaesthetized, the access was opened under rubber dam isolation and the access cavity was modified. The remaining pulp tissue was extirpated. The pulp was voluminous and to ensure complete removal, 2.5% sodium hypochlorite was initially used as an irrigant to soften the pulp. Once the pulp was extirpated, further irrigation was done with normal saline. The pulp chamber was huge and the floor of the chamber was quite deep & difficult to visualize. three canal orifices were found: distal, mesiobuccal and mesiolingual. A working length radiograph was taken with a #15 file in the canal and it was confirmed by an electronic apex locator (Root ZX; Morita, Japan).²⁷ After working length determination, orifice enlargement & preflaring of canals was done by GG drills upto no.3 & cleaning & shaping was completed using protaper system by protaper technique up to F1. It was found that both the mesial canals were joining with distal canal in apical third to become as one (fig.5). After drying the canals, AH plus (Dentsply International) sealer was applied onto the root canal walls with a lentulospiral (Dentsply /maillifer; Tulsa, USA). The premeasured master F1 cone was coated with sealer and slowly moved to full working length and the canals were obturated with lateral condensation. (Fig. 6).

Discussion

In taurodontism, 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 thus the complications in endodontic treatment.^{4,28}

Taurodontism is a dental anomaly characterized by large pulp chambers and short roots which often bifurcate or trifurcate at a lower level. They are thought to result from failure of the Hertwig's epithelial root sheath to invaginate at the proper time²⁹. The most frequently affected teeth are the molars and the distance between the baseline connecting the two CEJ and the highest point in the floor of the pulp chamber are used in determining taurodont teeth.³⁰ Taurodontism is diagnosed in molars when this distance exceeds 2.5 mm³⁰. Taurodontism is associated with several developmental syndromes and anomalies including

amelogenesis imperfecta, Down's syndrome, ectodermal disturbance, Klinefelter syndrome, tricho-dento-osseous syndrome, Mohr syndrome, Wolf Hirschhorn syndrome and Lowe syndrome.¹⁵

From an endodontist view, treatment in taurodont teeth has been described as a complex and difficult procedure. Pulp therapy for taurodonts is a challenging treatment, with increased incidence of haemorrhage during access opening which may be mistaken for perforation. In these case reports the mesial canal orifices were very close to each other & placed apically. So endodontic treatment in these was quite difficult. Here obturation was done using lateral condensation technique where as in a case report a modified filling technique, which consists of combined lateral compaction in the apical region with vertical compaction of the elongated pulp chamber, has been proposed²⁸. Recently, a case report highlights the use of high-end diagnostic imaging modalities such as spiral computerized tomography in making a confirmatory diagnosis of the multiple morphologic abnormalities such as taurodontism, dens invaginatus, pyramidal cusps of the premolars, dens evaginatus²¹

Another endodontic challenge in taurodontism is intentional replantation. The extraction of a taurodont tooth is usually complicated because of the dilation of the roots in the apical third³¹. In contrast, it has also been hypothesized that the large body with little surface area of a taurodont tooth is embedded in the alveolus. This feature would make extraction less difficult as long as the roots are not widely divergent.²⁵

Thus, it is very important for endodontist to be familiar with taurodontism not only with regards to clinical complications but also its management. It may also provide valuable clues in detecting its association with many syndromes and other systemic conditions.

References

References are available on request at editor@healtalkht.com

Legends

Fig1: Representation of normal (cynodontic) tooth and three sub-types of taurodontic teeth as proposed by Shaw (1928)

Fig2: Variables given by Blumberg 1971

Fig3: Showing measurements for Taurodontic teeth

Fig4: Access opening done

Fig5: Mastercone selection

Fig6: Obturation Canals joining as one

