



Taurodontism- A Dental Oddity

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Abstract

Aim and background: Aim of this case report is to illustrate endodontic management of a taurodontic tooth.

Case description: This manuscript is a case report that describes the endodontic treatment of a permanent taurodontic molar in a systemically healthy patient. A 56-year-old female patient presented with pain in the maxillary left first molar, which exhibited hypertaurodontism and had three root canals. After radiographic evaluation, a conservative access cavity preparation followed by chemo-mechanical preparation was performed. Passive ultrasonic irrigation was performed as an auxiliary protocol to finish cleaning, and a thermoplastic obturation technique was used. Endodontic treatment of a tooth with hypertaurodontism might be difficult when it has complicated internal anatomy and supplementary root canals. At the follow-up visit, the patient was asymptomatic, and radiographic evaluation showed improvement in the periodontal status. Considering the complexities of the current case, the six-month assessment revealed favorable results due to the use of magnification during endodontic procedures as well as diligent attention to tooth preparation, cleaning and shape, and obturation techniques.

Conclusion: This case report demonstrates that with careful diagnosis, meticulous treatment planning, and the use of advanced endodontic techniques, successful outcomes can be achieved in managing taurodontic teeth. This case underscores the importance of tailored endodontic approaches and the need for ongoing research and education to enhance the management of dental anomalies like taurodontism.

Keywords: Endodontic treatment, First molar, Taurodontism, Thermoplastic obturation, Radiograph.

1. Abbreviations

TI- Taurodontism Index, V1 - Variable 1, V2 - Variable 2, V3 - Variable 3

2. Introduction

Shifman and Chanannel define taurodontism as a deformation of the dental pulp chamber, resulting in an elongated pulp chamber that extends into the root area. (1) Henry Pickerill was the first to identify the prevalence of taurodontism in people in 1909. (2) The term "taurodontism" was coined by Sir Arthur Keith in 1913. It is derived from the Latin word "taurus" (bull) and the Greek word "odus" (tooth), i.e., a "bull-like tooth". (3)

Characteristic features include an enlarged pulp chamber, apically displaced pulpal floor, and cemento-enamel junction with no constriction. Permanent molar teeth are mostly affected but this can also occur in both permanent and deciduous dentitions. (4)

The prevalence of taurodontism shows a wide variation across the world with China having a prevalence of 44%, Brazil 43%, Germany 2 % and India showing 0.4%. (5) Females showed a higher prevalence of taurodontism than males and mandibular second molar is the most affected tooth. (6)

The most common etiology of taurodontism is the failure of invagination of Hertwig's epithelial sheath diaphragm at the proper horizontal level. Other factors are certain infections like osteomyelitis, disrupted developmental homeostasis, autosomal transmission of the trait, high-dose chemotherapy, and a previous history of bone marrow transplantation. (4)

Although it is most commonly seen as an independent anomaly, it has been observed in a variety of syndromes and abnormalities. Various syndromes associated are Cleft lip and palate, Down's syndrome, Ectodermal dysplasia, Klinefelter's syndrome, Tricho-dento-osseous syndrome, and Van der woude's syndrome. (7)

The main characteristic features of a taurodontic tooth are that the pulp chamber is enlarged and elongated, CEJ constriction is less marked and the furcation is displaced apically leading to shorter roots. (4)

Shifman and Chanannel introduced a novel system for the classification of taurodontism based on radiographic assessment, the Taurodontism Index (TI). TI is assessed by measuring a few variables from the radiographs. Variable 1 (V1) indicates the vertical height of the pulp chamber, Variable 2 (V2) is the distance between the lowest point of the roof of the pulp chamber to the apex of the longest root, and Variable 3 (V3) is the distance from CEJ to the floor of the pulp chamber. (Figure 1)

Based on the values of TI, the tooth was identified as Hypotaurodontism (TI 20–30), Mesotaurodontism (TI 30–40) or Hypertaurodontism (TI 40–75). So, for a tooth to be diagnosed as taurodont, the TI value should be greater than 20 and the V3 value more than 2.5mm (1)

3. Case description

A female patient, aged 53 years, was referred to the Department of Conservative Dentistry and Endodontics, Amrita School of Dentistry, Kochi, India for treatment of left maxillary first molar. The patient complained of dull and throbbing pain in the left back region of the upper jaw for two months and a recurring abscess in the buccal aspect of the same tooth. The patient was hyperlipidemic and diabetic and was under medication for the past 10 years.

3.1. Intraoral examination

On intraoral examination, the tooth had a normal crown morphology of the first molar with no signs of carious lesion. The tooth was tender on percussion and exhibited grade 3 mobility with a pocket depth of 8 mm around the tooth on assessment using a periodontal probe. (Figure 2)

On assessing the pulp vitality using cold test and electric pulp testing, the tooth was found to be non-vital.

3.2. Radiographic assessment

Intraoral periapical radiograph (IOPAR) showed periapical radiolucency involving the mesiobuccal (MB), distobuccal (DB) and palatal (P) roots. The pulp chamber was enlarged and extending beyond the cervical area, nearly reaching the furcation. In the apical portion of the furcation area, three short roots were observed. (Figure 3)

3.3. Estimation of the taurodontic index:

The values for taurodontic index were assessed using digital vernier calipers from the radiograph. The measurements were done in triplicate and the mean value was estimated.

$V1 = 6\text{mm}$, $V2 = 14\text{mm}$, $TI = V1/V2 \times 100 = 42$, $V3 = 3\text{mm}$

From these findings, the tooth was diagnosed as a hypertaurodont according to Shifman and Chanannel classification. Hypertaurodontism on the contralateral side and the lower right and left second molar was confirmed with the help of an orthopantomogram (OPG) (Figure 4)

3.4. Diagnosis and Treatment plan:

The tooth was diagnosed as an endo-perio lesion with a primary periodontal and secondary endodontic condition of a taurodontic tooth. The proposed treatment plan was oral prophylaxis, curettage, root planning, and debridement in Phase 1 followed by orthograde endodontic treatment in Phase 2. The maintenance phase involved periodic recall and assessment in Phase 3.

3.5. Treatment Methodology

The tooth was anesthetized, and under rubber dam isolation the access cavity was prepared under magnification (Labomed Prima DNT, 2.5X). At the furcation area, in the pulp chamber three canal orifices were found: mesiobuccal, distobuccal and palatal. Working length of the root canals were determined, which was confirmed by an electronic apex locator (Root ZX II, J. Morita Inc, USA).

After working length determination, canals were instrumented to 25, 0.02 taper stainless steel hand file (Mani, Japan). Rotary instrumentation to a size of 25, 0.04 taper (HyFlex CMNiTi, Coltene, Switzerland) in the mesiobuccal and distobuccal canals and 30, 0.04 taper (HyFlex CMNiTi, Coltene, Switzerland) in the palatal canal was done. Each canal was irrigated with 1ml of 2.5% sodium hypochlorite (NaOCl) (Prime Dental Pvt Ltd, Maharashtra, India) for each instrument change. A stainless-steel ISO size 25 ultrasonic endo tip was used inside the canal for 30 seconds at a power level of 3, with a piezoelectric ultrasonic unit (Woodpecker, Guilin, Guangxi, China). The NaOCl was flushed out with normal saline, followed with 17% ethylenediaminetetraacetic acid (Anabond Desmear, India) to remove the smear layer. $\text{Ca}(\text{OH})_2$ (RC Cal, Prime Dental, India) paste was placed as intracanal medicament.

During the recall visit, two weeks after the initial procedure, it was found that the tooth was completely asymptomatic during the postoperative period. The canals were irrigated using a solution of 2.5% sodium hypochlorite. Subsequently, the canals were dried using paper points (Dentsply Maillefer, Ballaigues, Switzerland) and filled with 25, 0.04 taper gutta-percha master cone (Dentsply Maillefer, Ballaigues, Switzerland) in MB and DB canals and 30, 0.04 taper gutta-percha master cone in palatal canal with a bioceramic sealer (Safe Endo, India). The remaining pulp chamber was then back filled with thermoplasticized gutta-percha (Obtura III MAX, Obtura Corporation). Lateral compaction was also used to ensure a proper root canal closure. The access cavity was sealed using light-cure composite resin (TPH Spectra ST-LV, Dentsply Sirona, USA). The post-obturation radiograph (IOPAR) confirmed a well-condensed filling consisting of three canals obturated to the predetermined length. (Figure 5)

During the sixth month follow-up, the tooth was clinically asymptomatic with a reduction in

pocket depth from 8mm to 6 mm. (Figure 6) However, grade 1 mobility was persisting, hence occlusal adjustment was done and advised review after 1 year.

4. Discussion

This case report presented the diagnosis of a taurodontic tooth radiographically and confirmed by using the taurodontism index. The endodontic management of the tooth was completed successfully with the aid of magnification, copious irrigation, a novel irrigant activation protocol and thermoplastic obturation. On the follow-up visit in the sixth month, the tooth was asymptomatic with improvement in periodontal status.

The challenges faced during the treatment were narrow canal orifices which made the orifice negotiation difficult, deeply placed canals thereby making obturation difficult and the canals were only instrumented using the apical third of the file due to their limited length.

Tsesis et al put forward a modified obturation approach, consisting of simultaneous lateral compaction in the apical area and vertical compaction of the elongated pulp chamber which ensured a complete closure of the root canal. (8) Furthermore, Wideman and Serene proposed that to eliminate as much necrotic debris as possible, the canals should be irrigated with 2.5% sodium hypochlorite. (9) Using final ultrasonic irrigation ensures that no pulp tissue remains. (3,10) Similar protocol as employed in the present case done by Zarekar et al. (11) However, long-term assessment is required to assess the prognosis of the hypertaurodontic tooth with endo-perio lesion.

5. Conclusion

Even though taurodontism is a rare occurrence, its uncommon radicular morphology requires careful consideration in planning and treatment. Careful exploration of the grooves between all the canal orifices, especially under magnification with ultrasonic irrigation and a modified obturation technique are preferred for successful endodontic management of a taurodontic tooth. A multidisciplinary approach with periodic follow-up and effective maintenance therapy is mandatory for the clinical success of an endo-perio lesion of a taurodontic tooth.

Clinical significance: This case report highlights the importance of effective management of taurodontism, a rare dental anomaly. Accurate diagnosis using advanced imaging techniques like CBCT is crucial for understanding the complex root canal anatomy. Customized treatment strategies are essential to accommodate the enlarged pulp chamber and atypical canal structures. Employing advanced endodontic techniques, such as rotary instrumentation, ultrasonic activation of irrigants, and thermoplastic obturation, significantly improves treatment outcomes. This report provides valuable insights for dental practitioners, emphasizing the need for tailored approaches and continuous learning in endodontics to enhance clinical practice and patient care

6. Conflict of interest

There is no conflict of interest.

7. Bibliography

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Figures and figure legends:

Figure 1: ‘Taurodontism index’ (TI) is the ratio of two ‘variables’: $TI = V1 / V2 \times 100$

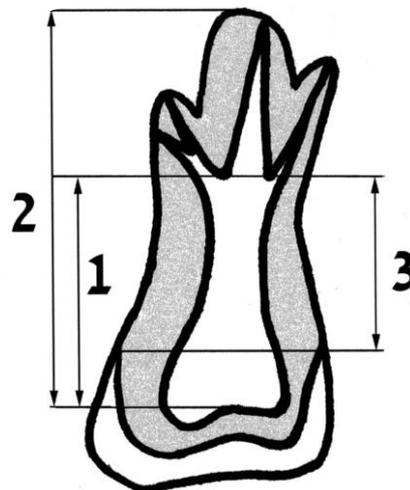


Figure 2a: Intraoral left lateral view, 2b: Intra-oral maxillary occlusal view



Figure 3: Preoperative intra-oral periapical radiograph of the affected tooth #26

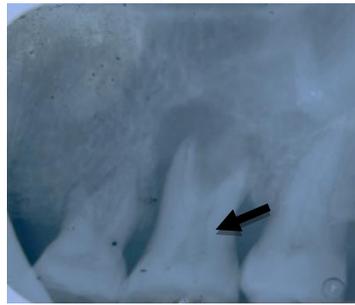


Figure 4: Orthopantomogram shows taurodontism of the maxillary first molars and mandibular second molars on both right and left sides.

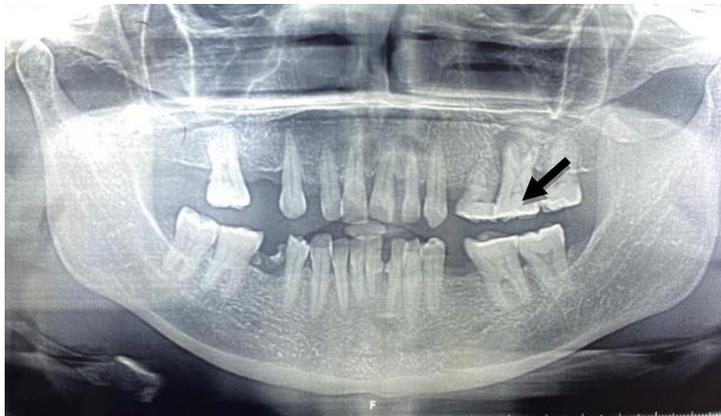


Figure- 5 - Immediate post-op IOPA



Figure 6 – Follow up after six months

