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Endodontic Management of a Mesotaurodontic Mandibular Molar with Distobuccal Cusp Fracture: A Case Report

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1. INTRODUCTION

Taurodontism is a developmental anomaly of multirooted teeth characterized by an apical displacement of the pulp chamber floor, elongated pulp chamber, and shortened roots, often with lack of constriction at the cemento-enamel junction (CEJ) [1]. This morphological variation poses particular challenges to endodontic therapy because of altered internal anatomy, unpredictable canal configurations, and difficulty in achieving effective debridement and obturation [2].

The etiology of taurodontism is not fully established. One commonly accepted hypothesis is a late or incomplete invagination of Hertwig's epithelial root sheath diaphragm during root development, which leads to apical shift of the root furcation and an enlarged pulp chamber [3]. Genetic factors have also been implicated; taurodontism has been associated with chromosomal anomalies (e.g. extra X chromosomes) and several syndromes such as Klinefelter's, Tricho-dento-osseous, and Mohr syndrome [4,5].

The classification of taurodontism is typically based on the relative displacement of the pulp chamber floor. Shaw originally categorized teeth into hypo-, meso-, and hypertaurodont depending on vertical position [2], while Shifman & Chanannel later proposed a metric index for quantification [3] . Prevalence varies from 0.5–10% across populations, reflecting diagnostic and genetic differences [5,6].

From a clinical standpoint, taurodont teeth often appear normal externally, making radiographic evaluation essential. Radiographically, they exhibit rectangular pulp chambers, apically displaced chamber floors, and short roots [7]. These features complicate access design, canal location, working length determination, disinfection, and obturation, requiring modifications in endodontic technique [4,8].

Although most publications are case reports, literature emphasizes that favorable outcomes can be achieved with careful planning, magnification, CBCT imaging, and modified obturation methods [9,10] . In this context, our report of a mesotaurodontic mandibular second molar with symptomatic pulp involvement and cusp fracture contributes to the growing body of evidence, highlighting diagnostic considerations, clinical modifications, and treatment success.

Clinical history (Figure 1):

A 57-year-old Indian male was referred to the Department of Endodontics, Saveetha Dental College and Hospitals, Chennai with a chief complaint of pain in the lower left back tooth region for the past one month. The pain was continuous in onset, dull aching in nature and aggravated over last week at night. His medical history was noncontributory, with no known systemic conditions, recent hospitalizations, or long-term medication use. Patient did not have any relevant dental history in the region. On intraoral examination, tooth #37 exhibited attrition with a distobuccal cusp fracture and occlusal pit and fissure caries. There was no mobility or swelling. The tooth showed mild gingival recession and delayed response to electric pulp testing (Gentle-pulse, Parkell, USA).

Radiographic examination (Figure 1G):

Intraoral periapical radiograph revealed an elongated pulp chamber extending deep into the root structure with short, thinned-out roots—features consistent with possible taurodontism. Coronal radiolucency involving enamel, dentin and extending to the distal pulp horn was noted. A mild widening of the periodontal ligament space was also observed, but no significant periapical radiolucency was detected

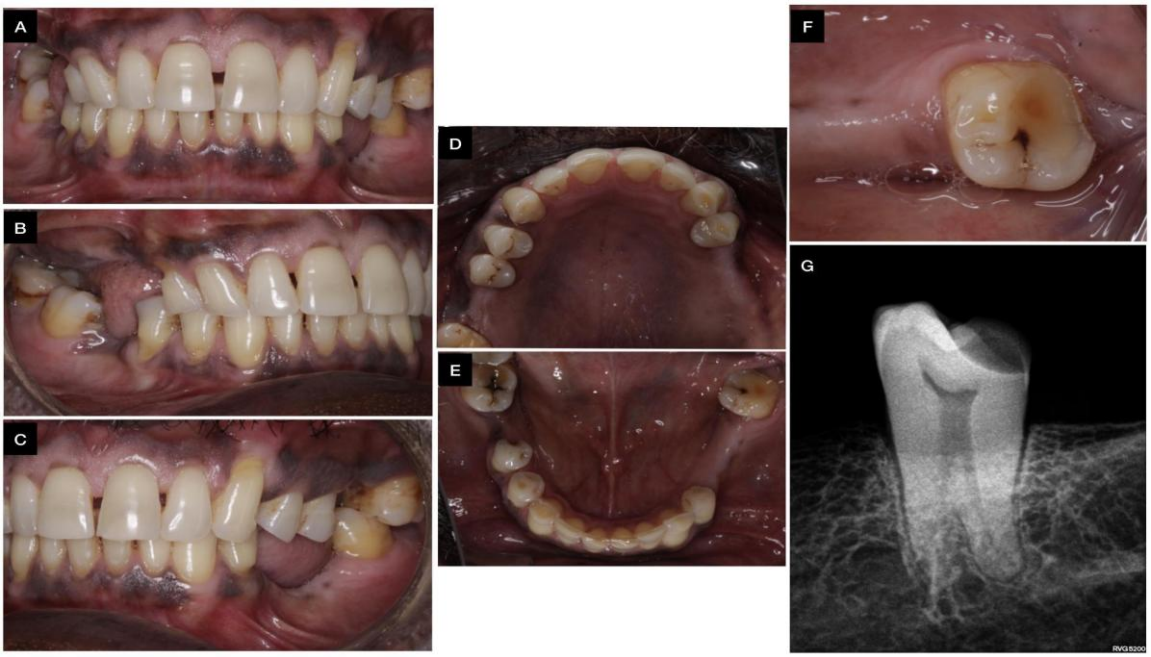

Figure 1: A) Preoperative intraoral centric photograph; B) Preoperative intraoral lateral right photograph; C) Preoperative intraoral lateral left photograph; D) Preoperative upper arch occulsal photograph; E) Preoperative lower arch occulsal photograph; F) Preoperative clinical photograph (37); G) Preoperative

2. DIAGNOSIS:

Based on the clinical and radiographic findings, a diagnosis of mesotaurodontism with symptomatic irreversible pulpitis was established for tooth #37. Radiographic findings confirmed the presence and severity of taurodontism. The assessment was based on the Keene index, modified by Shifman and Chanannel (as shown in Figure 2A and 2B) (where V1 = 5.4 mm, V2 = 14.2mm and V3 = 5.2 mm based on digital analysis). Thus, the taurodontism index was calculated to be in the range of mesotaurodontism. Internal morphology was considered over external landmarks (as opposed to the Shaw Index).

3. TREATMENT PLAN:

Root canal therapy was advised for the tooth based on the diagnosis. Special considerations for taurodontic morphology were discussed, including altered access cavity preparation and obturation techniques. Informed written consent was taken from the patient after explaining the treatment procedure for clinical documentation and the procedure.

Endodontic Challenges: Atypical root morphology requiring careful access cavity design. Short roots and apically positioned canal orifices necessitate precise working length determination to prevent over-instrumentation. Adequate obturation to ensure complete sealing of the elongated pulp chamber.

4. TREATMENT PROTOCOL:

Local anesthesia administered with inferior alveolar block using 2% lignocaine with epinephrine 1:80000 (Xicaine, ICPA) and conservative access cavity preparation was done with high-speed diamond round bur No. 2 bur (Mani, Japan) under rubber dam isolation to minimise structural loss and prevent chances of perforation (Figure 3A). The procedure was carried under magnification with the aid of a dental operating microscope (Carl Zeiss, Germany). Working length were determined with #10 K files (Mani, Japan) in mesial and distal canals by ingles method and confirmed with electronic apex locator (Root ZX mini, J Morita) and radiovisiography (Figure 3D) Biomechanical preparation of pulp chamber was achieved by circumferential filing with ISO K files of size #15 (Mani, Japan) and glide path was prepared in in all canals with hand files (Mani, japan) followed by further shaping with rotary instruments (Epident V+ Gold Files, Figure 2C). Canals were irrigated with 2.5% sodium hypochlorite, 17% aqueous solution of EDTA and saline as the final irrigant using 27 gauge needles under sonic irrigation. After thorough drying of canals with paper points, combined obturation technique was done in a single visit.

Canals were filled with single cone down packing technique using bioceamic sealer (BioActive RCS, SafeEndo) after master cone fit confirmation with radiography (Figure 3E) followed by backfilling with thermoplasticised gutta percha (Fast Fill, Eighteeth) for the remaining elongated pulp chamber. A permanent coronal restoration was recommended to prevent reinfection and manage the fractured cusp and was done in subsequent visit with light cure composite (Figure 3B and 3C). Radiographic assessment confirmed complete obturation of the elongated pulp chamber and the coronal seal in both mesial and distal angulations (Figure 3F). Due to missing adjacent teeth, patient was referred to the department of prosthodontics for further fixed dental prosthesis for optimal occlusal function and longevity of the treated tooth. Patient is kept under follow-up to monitor healing and assess the periapical status in long-term.

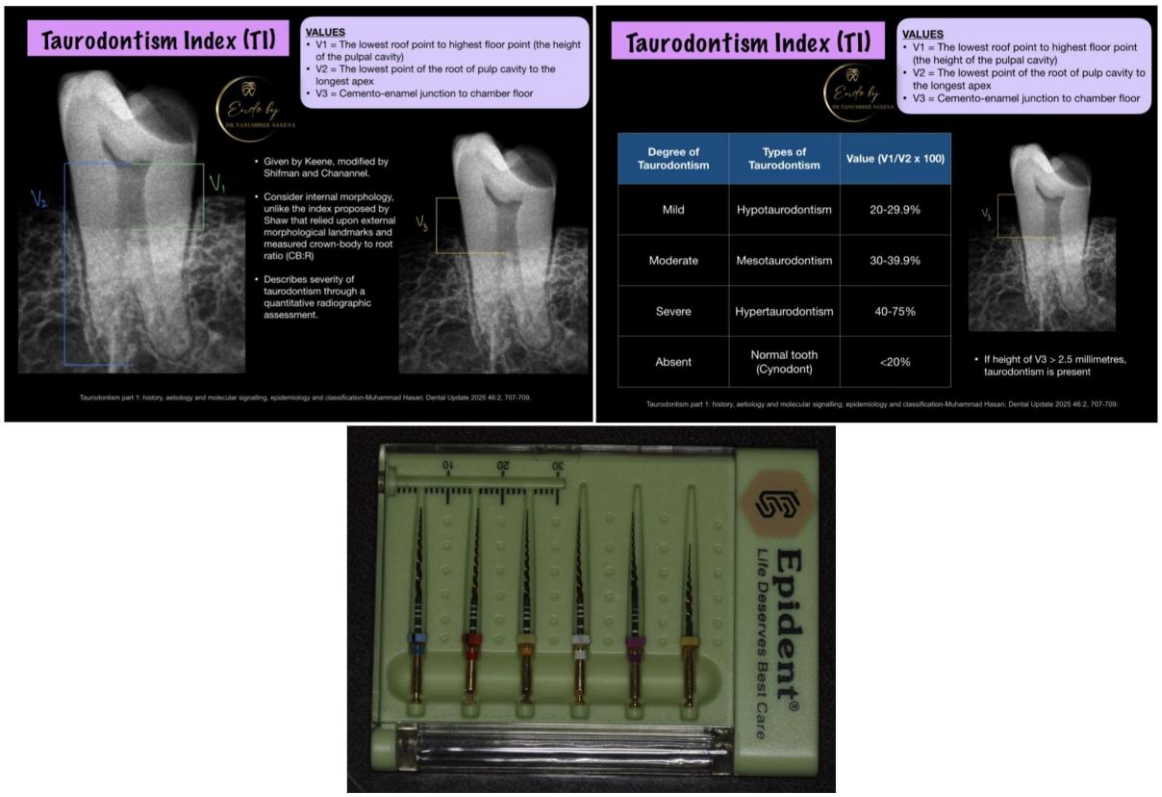

Figure 3: A) and B) Taurodontism index; C) Epident V+ Gold Files

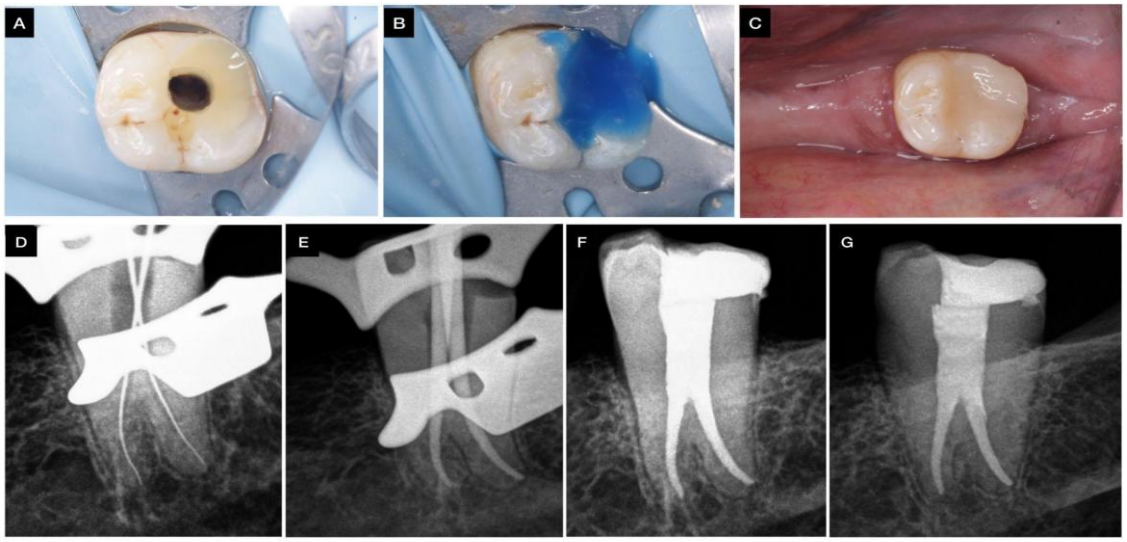

Figure 3: A) Conservative access cavity preparation; B) Etching with 37% orthophosphoric acid gel; C) Postoperative clinical photograph of composite restoration; D) Working length radiograph; E) Master cone radiograph; F) Postoperative radiograph (Mesial angulation); G) Postoperative radiograph (Distal angulation)

5. DISCUSSION

In this case, a mandibular molar with mesotaurodontism was successfully managed by tailoring conventional endodontic techniques to accommodate its altered morphology. Our findings align with earlier literature that taurodont teeth can be predictably treated if anatomic challenges are respected [4,5,11].

Diagnosis and morphology

Taurodontism is most reliably detected radiographically, since external morphology is normal [1,2]. In our case, periapical imaging revealed an elongated pulp chamber and apically displaced floor. This approach mirrors Shifman & Chanannel's index for classification [3] and recommendations by recent studies for early recognition of taurodont cases [5,6]. Aydın et al. [8] showed that meso- and hypertaurodonts display more complex canal systems, justifying the use of magnification and CBCT for canal identification. Similarly, Davaji et al. [7] reported taurodont molars with coexisting C-shaped canals, emphasizing the diagnostic value of CBCT.

Access and canal negotiation

Access preparation in taurodont teeth requires preserving coronal dentin while allowing adequate visualization. Orifices are displaced apically and may be hard to locate; magnification, ultrasonics, and microexplorers are recommended [8.9]. Our use of a dental operating microscope facilitated orifice identification, consistent with prior reports [6,7]. Negotiation with small hand files followed by cautious rotary use helped prevent procedural errors, as also suggested by Bharti et al. [8].

Cleaning, shaping, and irrigation

The enlarged pulp chamber increases the risk of incomplete disinfection. Enhanced irrigation with NaOCl and EDTA, combined with sonic or ultrasonic activation, has been advocated [5,9]. In our case, active irrigation allowed penetration into recesses. Similar strategies were highlighted in the case series by Agrawal et al.[12]. Shaping protocols must preserve thin root dentin; hence, circumferential filing and conservative taper NiTi systems are recommended [8,9].

Obturation

Obturation remains the greatest challenge in taurodont teeth due to the elongated pulp chamber. Conventional single-cone techniques often fail to achieve a homogenous three-dimensional fill [5,8]. Hybrid techniques combining apical single-cone placement with thermoplasticized backfilling have been shown to provide superior results [4,9,12]. Our obturation strategy mirrored these recommendations, producing a complete seal and radiographically satisfactory result.

Prognosis and significance

Published reports suggest that taurodont teeth, despite their complexity, respond well to tailored endodontic approaches [4,9,12]. However, their short roots and thin dentin increase susceptibility to fracture, making careful restoration essential. Adhesive core build-up is preferable over post placement in such cases[4]. Our case outcome supports these principles, though long-term follow-up is necessary to confirm prognosis.

6. CONCLUSION

This case highlights the challenges in endodontic management of a mesotaurodontic tooth, where root canal treatment was successfully performed with modified access preparation and obturation techniques. Careful radiographic assessment of severity of taurodontism and customized treatment strategies ensured a positive clinical outcome

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