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EFFECTIVE DEBRIDEMENT AND SUBSEQUENT OBTURATION OF TOOTH WITH MORPHOANATOMIC VARIATIONS IN NON SYNDROMIC PATIENTS– A SERIES OF 3 CASE REPORTS

Dental Science

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ABSTRACT

Taurodontism is a morphoanatomical anomaly of teeth characterised by enlarged pulp chamber with apically displaced pulp chamber floor and furcation.Endodontic treatment of a taurodont is challenging and requires special handling because of proximity and apical displacement of roots. In performing root canal treatment on such teeth, one should appreciate the complexity of the root canal system, canal obliteration and configuration, and the potential for additional root canal systems. Careful exploration of the grooves between all orifices particularly with magnification, use of ultrasonic irrigation; and a modified filling technique are of particular use. This paper presents three case reports on diagnosis and successful endodontic management of hypertaurodontic teeth, in non-syndromic patients.

KEYWORDS

Taurodontism; Gutta-Percha (GP); Cone Beam Computed Tomography (CBCT); Mineral Trioxide Aggregate (MTA).

INTRODUCTION:-

Taurodontism a morphoanatomic variant, lacks constriction at the level of the cementoenamel junction (CEJ), depicts vertically elongated pulp chambers and apical displacement of the pulpal floor.[1] The term Taurodontism was introduced by Sir Arthur Keith in 1913 meaning 'bull tooth'.[2] Clinically the tooth appear normal in the oral cavity. However, radiographically the distance from the bifurcation or trifurcation of the roots to the cementoenamel junction is greater than the occlusalcervical distance, thus imparting it a rectangular shape.[3]

The etiology of taurodontism is still not clear. The proposed mechanism for its occurrence could be because of failure of Hertwig's epithelium sheath diaphragm to invaginate at the proper horizontal level, changes in the mitotic activity of cells of the developing teeth that can affect root formation, influence from external factors on the development of the teeth[4,5,6]

Its prevalence is reported to range from 2.5% to 11.3% of the population.[7,8] The phenomenon of Taurodontism may be unilateral or bilateral with no sex predilection and affects permanent teeth more frequently than primary teeth. Mandibular molars are found to be more affected than maxillary molars and also of which mandibular second molar is the most frequently involved. It is commonly observed among the Eskimos, Australia aborigines and the natives of Central America.[9,10]

This trait can occur either as an isolated, singular trait or in association with syndromes and anomalies, including Amelogenesis Imperfecta, trichoonychodental syndrome Down's syndrome, Klinefelter's syndrome, Oral-facial-digital syndrome II, osteoporosis and Ectodermal disturbance[11,12,13,14]

In the oral cavity, a taurodontic tooth appears as like a normal tooth. The diagnosis of taurodontism is usually made from diagnostic radiographs. The severity of taurodontism is classified according to degree of apical displacement of the pulpal floor, as mild, moderate and severe (hypo-, meso and hypertaurodontism respectively).[15] Shifman and Chananel proposed an index to calculate the degree of taurodontism as shown radiographically.[16] According to this index, taurodontism is present if the distance from the lowest point at the roof of pulp chamber to the highest point at the apical end of the chamber i.e the vertical height of pulp chamber (AB or V1), divided by the distance from lowest point of pulp chamber roof to the longest root apex (V2 or AC) and multiplied by 100 is 20 or above (hypotaurodontism TI 20–30, mesotaurodontism TI 30–40 and hypertaurodontism TI 40–75) and also if the distance between the baseline connecting two CEJ and the highest point of pulp chamber floor (V3 or BD) is greater than or equal to 2.5 mm. Taurodontism can also be determined if the distance from the highest point of the pulp chamber floor to the cementoenamel junction is more than 2.5 mm. Taurodontism, although an uncommon anomaly may influence endodontic management of the tooth.[16] The purpose of this article is to present a series of 3 case reports of effective debridement of voluminous pulp cavity and its subsequent obturation in non-syndromic patients with hypertaurodontic tooth using novel irrigating device and obturating system.

CASE REPORT 1

A 18 year-old male patient reported to the department of conservative dentistry and endodontics at Pacific dental college & hospital, Udaipur with a chief complaint of pain in the upper right back tooth region. On clinical examination there was a frank cavity covered with food debris in relation to maxillary right first molar (#16) (figure 1 A). The patient gave history of attempted root canal at private clinic 2 months back. The tooth #16 was tender on percussion. An intraoral periapical radiograph was suggestive deep dental caries involving pulp and oversized elongated pulp chamber with short roots (figure 1 C). Based on clinical and radiographical findings a diagnosis of taurodontic tooth with Previously initiated therapy, symptomtic apical periodontitis was made for #16.

With the consent of patient and relying on availability of resources, a Cone Beam Computed Tomography (CBCT) scanning was done using The 3D Accuitomo CBCT machine [MCT-1(EX-2F); J. Morita Manufacturing Corp., Kyoto, Japan] was used which provided a gray-scale image of 14 bits and had a voxel size of 0.125 mm. The machine operated at 80 kV and 5.0 mA, with a 17-second exposure time. All images used a 1-mm slice thickness. The metric analysis was carried out using shifman and channanel Taurodontic index (Table 1). The axial CBCT images demonstrated wide pulp cavity at coronal and middle third of root while three canal orifices, resorptive defects in bone and root apices at apical third of all roots. Also the sagittal section, coronal section and 3-D reconstruction image was suggestive of taurodontic tooth with resorption of all roots apices and bone (Figure 1 F – 1 L).

Table – 1 showing the degree of taurodontism of teeth in the same patient.

TOOTH NUMBER	AB (V1) (cm)	AC (V2) (cm)	B-CEJ (V3) (cm)	(AB/AC)×100	INFERENCE
16	0.53	1.28	0.35	41.4	HYPERTAURODONTISM

Lidocaine 2% with epinephrine 1:100,000 was administered. The endodontic access cavity was modified in #16 with safety tip carbide bur (SS White Burs, Inc Lakewood, NJ USA) and Endo-Z bur (Dentsply Maillefer, Ballaigues, Switzerland) was used to remove any overhanging dentin. The entire endodontic management was done using rubber dam (Hygenic, Coltene Whaledent Inc., USA) isolation (Figure 1 B)

Upon endodontic exploration both teeth were found to have large pulp chamber with deeply located pulp chamber floor. The access cavity exploration revealed three deeply seated canal orifices which were negotiated with size10 K file (Dentsply Maillefer, Ballaigues, Switzerland). The working lengths were determined using E-PEX Pro apex locator (Changzhou Eighteeth Medical Technology Co. Ltd, Jiangsu Province, China) and was confirmed radiographically (Figure 1 D). There were three canals – mesiobuccal (MB), distobuccal (DB) and palatal (P) with the working lengths of 18,18 and 19 mm respectively.

The shaping and cleaning of root canals were done by crown down technique with Neoniti (Neolix, Châtres-la-Forêt, France) using C1 (25/0.12) for coronal flaring and the size A1 (size 20, 0.06 taper) for MB and DB canals, while Palatal was prepared till 25,6% Neoniti (Neolix, Châtres-la-Forêt, France) was used till working length. The root canal was irrigated with warm 3% sodium hypochlorite (Novo Dental Product Pvt Ltd, Mumbai, India) using EndoIrrigatorPlus (Innovations Endo, Nasik, India) and saline and 17% EDTA. The canals were dried with paper points (Kerr Corp., Romulus, MI) and Calcium hydroxide paste (Kalsin, Aktu, Turkey) was placed as an intracanal medicament (ICM). The tooth was temporized using Cavit G (3M, ESPE, Germany) and the patient was recalled after a period of 1 week

In the recall appointment, the patient was asymptomatic. The cavit was removed and calcium hydroxide was flushed out of the pulp cavity through irrigation using irrigants and Endoirrigator plus followed by drying of canals with paper points (Kerr Corp., Romulus, MI).

The pulp cavity was obturated using apical plug of NeoMTA Plus till the level of pulp chamber floor, moist cotton pellet was placed over it and was temporized and recalled next day. In recall visit temporary material and cotton pellet was removed and over the set MTA mass backfilling was done using Gutta-flow sealer and Obtura II system.

The tooth was later restored with posterior composite P-60 (3M, ESPE). The post-obturation radiograph confirmed well obturated root canals (Figure 1 E). A 1 year follow-up radiograph showed good periapical healing.

CASE REPORT 2 –

A 28 year-old male patient reported to the department of conservative dentistry and endodontics, P.M.N.M dental college and hospital with a chief complaint of pain in the left side of lower jaw. There was a history of initiation of endodontic treatment 4 months back, following which upon pain relief patient did not turned back for the completion of treatment. Patient gave history of intermittent pus discharge through gingiva around the same tooth.

On clinical examination there was caries with food accumulation over prepared access cavity, with respect to left mandibular second premolar (#35). An intraoral periapical radiograph of #35(Fig. 2 A) was suggestive of prepared access cavity and large periapical radiolucency and oversized pulp chamber with short roots. Based on clinical and radiographical findings a diagnosis of taurodontic tooth with previously initiated therapy; acute apical abscess was made in relation to #35.

Spiral Computed Tomography (SCT) scan for better understanding of complicated root morphology of taurodontic teeth was planned. With the consent of patient and relying on the availability of resources, a spiral computed tomography (SCT) (GE Healthcare, USA) Scan with a constant thickness of 0.65 mm per slice and a constant spiral or a table speed of 0.75 and with exposure parameters of 84 kV, 6.0 Ma, and 12 seconds was taken of the area of interest. For confirmation and categorization, metric analysis was carried out according to Shifman and Chananel onto the involved teeth (Table 2).

The axial SCT scan (GE Healthcare, USA) images demonstrated wide pulp chamber cavity with 2 canal orifices located more apically and a large periapical lesion, while the sagittal view confirmed the elongated pulp chamber, apically displaced pulp chamber and bifurcation or trifurcation more towards the root apex (Figure 2 E – 2 H).

With local anaesthesia the endodontic management was initiated under rubber dam isolation and access was modified using safety tip carbide bur (SS White Burs, Inc Lakewood, NJ USA) and Endo-Z bur (Dentsply Maillefer, Ballaigues, Switzerland). The two canals buccal (B) and lingual (L) were negotiated using size 15 k file. The working lengths were determined using E-PEX Pro apex locator (Changzhou Eighteeth Medical Technology Co. Ltd, Jiangsu Province, China) and was confirmed radiographically (Figure 2 B). Shaping and cleaning was done through crown down technique with Neoniti (Neolix, Châtres-la-Forêt, France) till the size A1 (size 20, 0.06 taper) for B and L canal. The same irrigating protocol was employed as discussed in previous case.

The master cone fit was checked and confirmed radiographically (Figure 2 C). The apical 1 mm of GP were severed using Bard Parker blade No. 12. The root canals were coated with GuttaFlow root canal sealer (Coltene/Whaledent, Langenau, Germany) using paper points and selected GP points coated with sealer were placed into the canals and using Touch n heat endodontic heat source (EIE / Analytic, Redmond, WA, USA) the GP was thermoplasticized and compacted till the level of pulp chamber floor. This was followed by backfilling of voluminous pulp chamber with OBTURA II SYSTEM (Spartan, Earth city, MO) and Gutta-Flow sealer.

Buchanan Hand Plugger Size #2, #3 (Sybron Endo, Orange, CA) was used for the compaction of warm GP. The tooth was later restored with posterior composite P-60 (3M, ESPE). The post-obturation radiograph confirmed well obturated root canals. A follow-up evaluation revealed absence of any signs and symptoms in same teeth (Figure 2 D).

Table 2 Metric analysis (based on Schifman and Chananel) from SCT Scan

TOOTH NUMBER	AB (V1) (cm)	AC (V2) (cm)	B-CEJ (V3) (cm)	(AB/AC) ×100	INFERENCE
34	0.61	1.37	0.48	44.52	HYPERTAURODONTISM
35	1.02	1.78	0.88	57.3	HYPERTAURODONTISM
44	0.92	1.66	0.78	55.42	HYPERTAURODONTISM
45	0.73	1.62	0.533	45.06	HYPERTAURODONTISM

CASE REPORT 3-

A 35 year-old male patient reported to the department of conservative dentistry and endodontics at P.M.N.M.dental college & hospital, Bagalkot with a chief complaint of pain in the left side of lower jaw. On clinical examination there was a deep dental caries with respect to left mandibular second and third molar (#37, #38). The teeth did not respond to electric pulp vitality test using an Analytic Pulp Tester (Analytic Technology Corp., Richmond, VA, USA.) and thermal test using Pulper (GC Corporation, Tokyo, Japan). The teeth #37 and #38 were tender on percussion. An intraoral periapical radiograph of #37 and #38 was suggestive deep dental caries involving pulp and oversized elongated pulp chamber with short roots (Figure 2 I). Based on clinical and radiographical findings a diagnosis of taurodontic tooth with pulp necrosis, symptomtic apical periodontitis was made for #37 and #38.

Spiral Computed Tomography (SCT) scan for better understanding of complicated root morphology of taurodontic teeth was planned. With the consent of patient and relying on the availability of resources, a spiral computed tomography (SCT) (GE Healthcare, USA) Scan using parameters discussed previously. Canals were located at about 15 mm from occlusal reference surface chosen for estimating working length. The SCT scan was taken to understand the tooth anatomy. The axial SCT scan (GE Healthcare, USA) images demonstrated that there was a periapical lesion and wide pulp chamber with 3 canal orifices located more apically, while the sagittal view confirmed the elongated pulp chamber, apically displaced pulp chamber and bifurcation or trifurcation more towards the root apex (Figure 2 K – 2 L). The degree of taurodontism was estimated using shifmann index on to the SCT images (Table 3).

Table 3 - showing the degree of Taurodontism of teeth in the same patient.

TOOTH NUMBER	AB (V1) (cm)	AC (V2) (cm)	B-CEJ (V3) (cm)	(AB/AC) ×100	INFERENCE
38	0.59	1.02	0.63	57.84	HYPERTAURODONTISM

Lidocaine 2% with epinephrine 1:100,000 was administered. The endodontic access cavity was made in #37 and #38 teeth with safety tip carbide bur (SS White Burs, Inc Lakewood, NJ USA) and Endo-Z bur (Dentsply Maillefer, Ballaigues, Switzerland).

The access cavity exploration revealed three deeply seated canal orifices which were negotiated with size10 K file (Dentsply Maillefer, Ballaigues, Switzerland). The working lengths were determined using E-PEX Pro apex locator (Changzhou Eighteeth Medical Technology Co. Ltd, Jiangsu Province, China); mesiobuccal (MB), mesiolingual (ML) and distal (D) with the working lengths of 20,19 and 19 mm respectively. The canals were located at about 15 mm from occlusal reference level.

The shaping and cleaning of root canals were done by crown down technique with Neoniti (Neolix, Châtres-la-Forêt, France) TILL size A1 (size 20, 0.06 taper) for MB and ML canals, while distal was prepared till 25,6% Neoniti (Neolix, Châtres-la-Forêt, France). The same irrigating protocol and obturation technique were employed as discussed in previous case

The tooth was later restored with posterior composite P-60 (3M, ESPE). The post-obturation radiograph confirmed well obturated root canals (Figure 2 J). A follow-up evaluation revealed absence of any signs and symptoms in same teeth.

DISCUSSION:-

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.[1,10] Moreover, pre-treatment radiographs produce little information about the root canal system.[12]

According to Durr the morphology of taurodont could hamper the location of canal orifices, thus creating difficulty in instrumentation and obturation.[14] Therefore, careful exploration of the grooves between all orifices, especially with magnification has been recommended to reveal additional orifices and canals.[4,12]

Three percent sodium hypochlorite coupled with EndoIrrigatorPlus (Innovations Endo, Nasik, India) could be an effective means to achieve complete elimination of pulpal tissue from the voluminous pulp cavity. This device is based on the principle of active negative pressure and operates on the concept of continuous warm activated irrigation and evacuation system (CWAIS).

The 3 % sodium hypochlorite can be delivered into the canal system at a temperature of about 50° C using single-use Neoendo 30-G (Orikam healthcare Pvt Ltd., Gurgaon, India) side-vented needles. This irrigating device provides warm irrigant, more volume and its continuous replishment thus contributing to effective debridement of voluminous pulp chamber.[17]

Moreover, as adequate instrumentation of the irregular root canal system cannot be anticipated, Widerman & Serene (1971) suggested that additional efforts should be made by irrigating the canals with 2.5% sodium hypochlorite in order to dissolve as much necrotic material as possible.[18]

The canal portion was obturated with standardised Gutta percha cones and root canal sealer and were severed at the level of pulp chamber floor. Warm vertical compaction technique requires more time and precision and is superior over cold lateral compaction as the latter offers voids, poor adaptation and incomplete fusion of GP cones.[19]

In the present case reports the backfilling of pulp chamber cavity was done using Obtura II system (Obtura Spartan, Fenton, MO). A rubber stopper was attached on 23 G needle to the level of pulp chamber floor. A little GP was expressed out in order to preheat the needle, followed by the placement of needle into pulp chamber and expressing plasticised GP in an increment of 3 to 4 mm and were compacted gently with a #11 endodontic plugger (Caulk/Dentsply, Tulsa, OK). In order to avoid adherence of molten GP, the plugger was dipped in alcohol.[20]

CONCLUSION:-

This case report highlights the importance of having a thorough knowledge of all possible root canal irregularities. Taurodont teeth show a wide variations in the size and shape of pulp chambers, varying degree of obliteration and canal complexity, low canal orifices, and the potential for additional root canal systems. In performing root canal treatment on these teeth, one should appreciate the complexity of the root canal system. Careful exploration of the grooves between all orifices, particularly with magnification, ultrasonic irrigation and a modified filling technique are recommended. Use of Computed Tomography (CT) imaging in endodontically challenging cases can facilitate a better understanding of the complex root canal anatomy. With advances in modern endodontic techniques, most teeth with complex root canal anatomies can be successfully treated without surgical intervention.

LEGENDS

FIGURE 1. Photomicrograph showing preoperative clinical view of tooth 16 (1 A); clinical view of prepared access cavity under rubber dam isolation (1 B); preoperative radiograph (1 C); working length radiograph (1 D); post-endodontic radiograph (1 E); 3D reconstructed CBCT image of hypertaurodontic 16 (1 F); axial view of CBCT scan showing periapical lesion (1 G, 1 H); sagittal view (1 I); schifmann index on CBCT images (1 J, 1 K, 1 L).

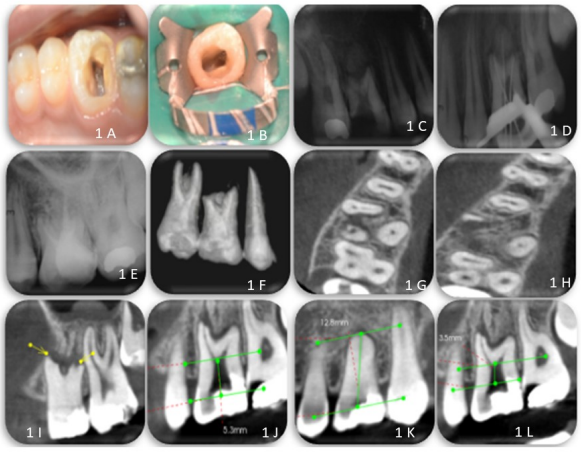
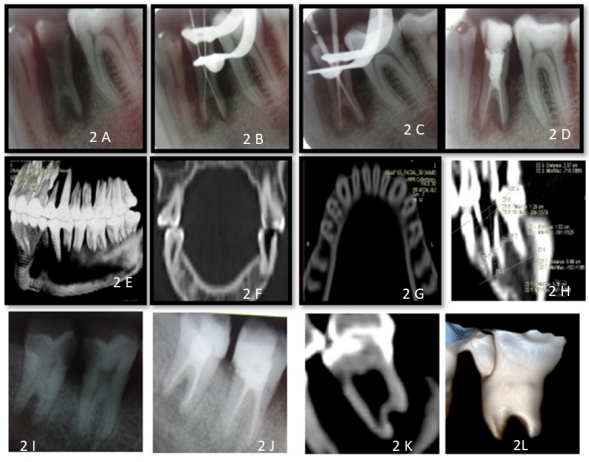


FIGURE 2. Photomicrograph showing preoperative radiograph (2 A); working length radiograph (2 B); mastercone radiograph (2 C); post-endodontic radiograph (2 D); 3D reconstructed CBCT image of hypertaurodontic 35 (2 E); coronal view of 35 tooth (2 F); axial view of 35 tooth (2 G); sagittal view with schifmann index (2 H);preoperative radiograph (2 I); post-endodontic radiograph (2 J); sagittal view (2 K); 3D reconstructed CBCT image of hypertaurodontic 35 (2L).



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