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Abstract

Taurodontism is a developmental tooth disorder characterized by lack of constriction in the cementoenamel junction and consequent vertical stretch of the pulp chamber, accompanied by apical displacement of the pulpal floor. The endodontic treatment of teeth with this type of morpho-anatomical anomaly is challenging. The purpose of this article is to report the successful endodontic treatment of a hypertaurodontic mandibular molar using a reciprocating single-file system.

Key words: Endodontics — Root canal — Biomechanical preparation — Taurodontism — Reciprocating motion

Introduction

Taurodontism occurs due to the failure of Hertwig’s epithelial root sheath to invaginate at the appropriate horizontal level⁹,¹⁰,¹⁴. It may also be associated with several genetic disorders, including Klinefelter or Down’s syndrome, and development disorders, such as ectodermal dysplasia¹⁹. An elongated pulp chamber and the absence of cervical constriction at the cementoenamel junction are the most prominent features of a taurodontic tooth⁵. Such teeth can be classified as hypo-, meso-, or hypertaurodontic depending on the distance from the highest point of the pulp chamber roof to the lowest point of the floor (Fig. 1)²⁰. The anomaly is almost exclusively found in the premolars or
molars, with a significantly higher prevalence in the maxillary second permanent molar, and may involve one or more teeth, with unilateral or bilateral distribution\textsuperscript{19}.

From the endodontic point of view, coronal access, initial exploration, preparation, and root canal filling are all challenging with taurodontic teeth\textsuperscript{7,15}. Moreover, the volume of the pulp chamber is greater in such cases. This means that clinical procedures such as coronal opening can be hindered due to an unusually large volume of blood flow, which may be mistaken for perforation\textsuperscript{7,15}. Meanwhile, the short roots and apical displacement of the pulpal floor can indeed lead to perforation during coronal access\textsuperscript{3}.

The introduction of new instruments and techniques over recent years has changed the approach to endodontic therapy\textsuperscript{5}. One of the latest innovations is reciprocating motion, which allows an instrument to periodically rotate around its axis, alternating between movement 170° counter-clockwise and 50° clockwise\textsuperscript{5,13}. Reciprocating instruments are made of a special Ni-Ti alloy called M-Wire. Once formed, the instrument is subjected to a thermal process which significantly improves its flexibility and mechanical strength in comparison with instruments made of conventional Ni-Ti\textsuperscript{5,13}. In addition, in terms of kinematics, the working time with reciprocating systems is 4 times shorter than that with traditional rotary systems, as only one instrument is needed for preparation of the root canal\textsuperscript{5,13}. The purpose of this report is to describe the successful endodontic treatment of a hypertaurodontic mandibular molar using a reciprocating single-file system.

**Case Report**

A 17-year-old girl was referred to the Clinic of Endodontics at the Superior School of Health Sciences, State University of Amazonas, complaining of spontaneous pain in the mandibular left second molar. Her medical and family history revealed no significant findings, and an extraoral examination no signs of any pathology. Intraoral examination revealed an extensive carious lesion in the buccal-occlusal surface of the mandibular left second molar (tooth #37), with a positive response to the cold sensitivity test (Endo-Ice, Coltene/Whaledent Inc., Cuyahoga Falls, OH, USA). The tooth was not sensitive to the vertical percussion test. Radiographic examination was performed to determine the depth of the carious lesion. The results also revealed features consistent with a diagnosis of hypertaurodontism: the dimensions of the
pulp chamber were significantly larger than normal (TI 40–75); root shortening; and apical displacement of the pulp chamber floor (Fig. 2). A panoramic radiograph was also requested as multiple taurodontic teeth were suspected. The results confirmed bilateral hypertaurodontism in teeth #17, 27, and 47 (Fig. 3). Based on these findings, irreversible acute pulpitis associated with hypertaurodontism was diagnosed in tooth #37. There were no signs or symptoms indicating the need for endodontic treatment in the remaining taurodontic teeth.

Written informed consent was obtained from the patient before commencing treatment. First, tooth #37 was anesthetized with 2% Xylestesin (Cristália Produtos Químicos Farmacêuticos Ltda., Itapira, SP, Brazil) and the operative field isolated with a rubber dam. The subsequent procedures were performed with the aid of an operative optical microscope (DF Vasconcelos, Valencia, RJ, Brazil). The carious lesion was removed with a spherical diamond bur (No.1013, KG Sorensen, São Paulo, SP, Brazil) coupled to a high-speed device (Extra Torque 605C, Kavo, Joinville, SC, Brazil). The pulp chamber was accessed using a tapered flame-shaped bur (No.2200, KG Sorensen), at which time blood flow was observed to be strong. The pulp tissue was removed with sharp curettes, followed by copious irrigation of the pulp chamber and root canals with 2.5% NaOCl solution (Biodinâmica, Ibiporã, PR, Brazil). A glide path was then created for both root canals (mesial and distal) with sizes 10, 15, and 20 K-type files (Dentsply/Maillefer, Ballaigues, Switzerland). The remaining radicular pulp was removed during this procedure.

The working length was determined as 19.5 mm in both root canals by using an electronic apex locator (Joypex 5, Denjoy, Hunan, China) and confirmed radiographically (Fig. 4).
Root canal preparation was performed with the R50 (Reciproc system, VDW GmbH, Munich, Germany) coupled to a 6:1 contra-angle handpiece (VDW Silver Reciproc, Sirona Dental Systems GmbH, Bensheim, Germany) powered by an electric motor (X-Smart Plus, Dentsply/Maillefer) in the “RECIPROC ALL” mode in accordance with the manufacturer’s recommendations. The Reciproc R50 instrument was used due to the large amplitude of the root canals. The instrument was inserted 3 times in a slow in-and-out pecking motion. A Glyde File Prep (Dentsply/Maillefer) was used to lubricate both root canals during preparation. Each instrument was used to prepare only one root canal. After each insertion, the instrument was removed for cleaning with sterile gauze and the root canal irrigated again with 2 ml of 2.5% NaOCl solution (Biodinâmica). At the end of preparation, 1 ml of 17% EDTA (Biodinâmica) was applied for 3 min to remove the smear layer, followed by final irrigation with 2 ml of 2.5% NaOCl.

The root canals were dried using sterile paper points (VDW GmbH). Root canal filling was performed with Sealapex sealer (SybronEndo, Collins West Orange, CA, USA) and a size R50 gutta-percha master cone (VDW GmbH) (Fig. 5) using thermomechanical technique and a size 80 McSpadden (Fig. 6). After filling, the pulp chamber was cleaned to remove excess gutta-percha and sealer. Glass-ionomer cement (Vidrion R, SS White, Rio de Janeiro, RJ, Brazil) was then used to perform a temporary restoration of the coronal cavity. After 7 days, the temporary restoration was removed, and a final restoration with composite resin (Z250, 3M ESPE, St. Paul, MN, USA) was performed in accordance with the manufacturer’s instructions (Fig. 7).

The patient returned to the clinic 12 months later for follow-up clinical and radiographic examinations, which revealed no painful symptomatology or periapical changes, despite over-filling at the apical portion of the distal
root canal. Hermetic sealing of the pulp chamber and root canals, including the apical foramen, was adequate, and there was no sign of the filling having failed (Fig. 8).

Discussion

The present article describes the successful endodontic treatment of a hypertaurodontic mandibular molar using a reciprocating single-file system. Here, it should be noted that the typical signs of taurodontism can not be observed clinically, as the external morphology of such a tooth will be similar to that of a normal tooth. Although frequently associated with other anomalies and syndromes, taurodontism can also occur as an isolated feature, as in the present patient, in whom no other associated factors were observed. The endodontic treatment of such teeth has been described as complex due to the high degree of variability seen in their morphology, which is likely to make location, negotiation, and instrumentation of the root canal particularly difficult.

Several studies have reported the effectiveness of reciprocating systems in the cleaning and shaping of root canals. The efficacy of such systems in relation to teeth with significant internal morphological anomalies such as taurodontism, however, remains to be determined.

In addition, some authors maintain that the use of reciprocating systems must be preceded by glide path creation with manual files, while others report that this procedure is not necessary, especially when large taper instruments are used.

In the present patient, a glide path was created by using a manual file prior to root canal preparation with a reciprocating instrument. Initial negotiation of the root canal is one of the most critical steps in the endodontic treatment of a taurodontic tooth. Therefore, we decided to create a glide path, even though the amplitude of both root canals (mesial and distal) was large, as this reduces friction between the instrument and the root canal wall, thus preserving the original trajectory during instrumentation.

Moreover, by using the Reciproc system here, we were able to reduce the time required to enlarge both canals, even though the morphological anomalies were severe, something that was confirmed radiographically. Earlier studies have also noted that use of a reciprocating system allows the time taken for root canal preparation to be reduced to 62% of that which would be required with a conventional rotary system.

In addition, in the present patient, a thermoplastic technique was used for root canal filling as it was believed that this would promote adequate three-dimensional filling of the tooth while minimizing the risk of creating voids within the unusually large pulp chamber. This approach provides a better flow of gutta-percha and sealer than the conventional one, which in turn allows the filling material to adapt better to the pulp chamber and root canal walls, promoting more accurate filling of the anatomical details of the taurodontic tooth.

It should be emphasized, however, that radiography here revealed surplus filling material extruding beyond the root canal limits at the apical portion of the distal root
canal after filling\textsuperscript{10,15}. Root canal filling of taurodontic teeth is a challenging procedure due to the large diameter of the apical foramen\textsuperscript{10}. The presence of surplus material after completion of filling, however, does not necessarily mean that endodontic treatment has failed. Indeed, it could be asserted that such surplus rather indicates that treatment has been successful, as the entire root canal system, including the apical foramen, has been hermetically sealed\textsuperscript{13,15}. Also, as can be seen from the results of the follow-up examination in the present case, from the endodontic point of view, calcium hydroxide-based sealers such as Sealapex have proven biological compatibility, and therefore do not compromise the prognosis\textsuperscript{10,13,15}.

Despite its low incidence, an adequate diagnosis of taurodontism is crucial in implementing an appropriate treatment plan. The present report provides further evidence that reciprocating single-file systems such as Reciproc are effective and safe in treating complex clinical cases.

References

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