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Hypercementosis: A Challenge for Endodontic Therapy

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Abstract

The abnormal buildup of cementum increases as patients age. Genetic factors appear to play a role in hypercementosis among younger patients. Literature reveals a lack of studies guiding endodontists on treating teeth with hypercementosis, as excess cementum lengthens the canal and increases the distance from the cemento-dentinal junction (CDC) to the root apex. Therefore, it's crucial to correlate the tooth morphology in hypercementosis with specific aspects of endodontic therapy to define treatment boundaries. The cause of hypercementosis remains unclear. Endodontists may encounter challenges in shaping and sealing root canals due to the impermeable nature of this cementum.

Keywords: *Hypercementosis, 1st Molar, cementum-dentin-canal (CDC) junction*

1. Introduction

Cementum is a mineralized connective tissue that forms part of the periodontium, anchoring firmly to the root dentin. It serves as the interface between the dentin and the periodontal ligament. Cementum appears as a thin, yellowish layer with a hardness level lower than that of dentin. Its primary role is to protect the root surface and establish a connection to the bone via collagen fibers [23]. Chemically, cementum is constituted by approximately 50% of inorganic substances and 50% of water and organic material [30]. Similarly to bone tissue, its organic matrix is composed of mainly type 1 collagen and may undergo resorption and neoformation under pressure [29]. Clinically, hypercementosis may directly influence on root canal treatment, since the professional needs to know the most important anatomical references, during endodontic treatments, for determining endodontic treatment success: the cementum-dentin-canal (CDC) junction.

Hypercementosis, so-called cementum hyperplasia, constitutes the excessive formation of this tissue and comprises either a limited point or the entire root surface [14]. Pinheiro et al. [32] emphasizes that to be characterized as hypercementosis, the cementum formation should be beyond the limit necessary to perform its normal functions, which results in both the abnormal thickening and root's macroscopic shape alterations. Concerning to its etiopathogeny, in 1931, Gardner and Gardnes [17] discussed the hypothesis linking infection to the etiology of hypercementosis by analyzing teeth affected by this condition. Authors observed that hypercementosis occurs 4.2 times more frequently in teeth with necrotic pulp compared to those with vital pulp. However, establishing a causal relationship is challenging, as it's unclear whether the deposition of cementum precedes or follows pulp necrosis. According to Shafer et al, cementum deposition may be due to a low-intensity inflammation, similarly to that occurring both in apical pericementitis and in pulp's chronic

inflammatory process; or it can be stimulated by the chronic inflammation of the periapex. Prabhakar et al. [33] reported a clinical case in which the repetitive formation of dental abscesses would be responsible for the hypercementosis formation.

2. Case Report

A 21-year-old male patient was referred to the Department of Conservative Dentistry and Endodontics, Aurangabad, Maharashtra with a chief complaint of pain in the right lower back region of jaw for 2 months. Clinically deep dentinal caries was noted along with 46, tooth was tender on percussion. Radiographic examination revealed deep dentinal caries involving pulp space with 46, both mesial and distal roots had hypercementosis with calcified apical root canal system. It was diagnosed that 46 had Symptomatic apical periodontitis with periapical rarefaction so root canal treatment was planned.

Pre-operative radiograph 46

The tooth was isolated using rubber dam. Endodontic access was gained with an endo access bur using high speed air-rotor handpiece. Dental caries was removed followed by a pre-endodontic buildup. Radiographic examination showed calcification at apical third of the root canal system. #10 k file was inserted in canal slowly and carefully, the apical root canal system was negotiated using a #10 D-finder. A small in and out movement along with copious irrigation of the root canal was done [1]. Patency of the canal was obtained with # 10k D- finder file. 17% EDTA gel and liquid was used as a lubricating agent. In between instrumentation, copious irrigation with 5.25% sodium hypochlorite solution and saline was done. Working length was determined using apex locator and further confirmed using radiograph [1].

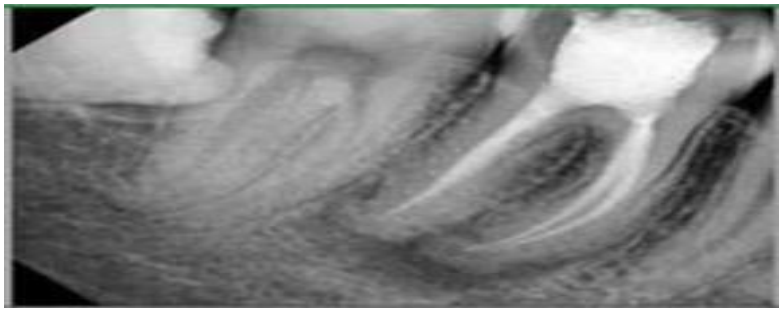
Working length determination

Cleaning and shaping of 2 mesial canals and 2 distal canals were done with no. 25/4% NiTi files. Thorough irrigation was done in between with 5.25% sodium hypochlorite to remove debris and smear layer followed by saline. The canals were dried with paper points and intra canal dressing of calcium hydroxide was given for 7 days and the temporary cement was placed with respect to 46. After seven days, access cavity was re- entered and the canals were irrigated thoroughly with 5.2% sodium hypochlorite followed by normal saline. Final wash was done by using 2% chlorhexidine for its sustainable effect. Master cone selection 25/4% for both distal and mesial canals was done [1].

Master cone selection

Root canals were obturated using cold, lateral compaction of gutta percha cones with epoxy resin sealer. A post obturation radiograph was taken.

Obturation with respect to 46



Obturation and post-obturation restoration with respect to 46

3. DISCUSSION

Pinheiro et al. [32] reported that the dentinal canal is located more than 1 mm away from the radiographic apex. Also, the authors highlighted that the endodontist may experience difficulty, in these cases, for reaching the adequate shaping and filling limit because this cementum may be not permeable to endodontic instruments. It is important highlighting that

root canal shaping and filling below the adequate limit will cause the retention of either a contaminated area or inflamed tissue within root canal, without repair conditions, leading to endodontic treatment failure. Coolidge [13] was perhaps the first author to draw attention for the role of pathological cementum deposition in Endodontics. He reports that cementum deposition would be related to root fracture occurrences, with cementum deposition because of either aggression to periodontium or functional trauma, and which would interfere in pulp removal and periapical inflammation treatment.

Barros [7] reported the hypercementosis relationship with the occurrence of a greater number of secondary canals, accessory canals, and apical deltas, as well as apical third constriction associated to change in the original path of the main canal. The author emphasized that these modifications in the internal morphology of the apical third of teeth presenting hypercementosis may not be seen radiographically, which may complicate endodontic treatment.

Apical root anatomy comprises three different anatomical and histological limits: the apical constriction, CDC junction, and apical foramen. According to Kuttler [24], the apical constriction is generally localized at 0.5 to 1.5 mm short of the apical foramen. This area is still the most frequent landmark used by the dentist as the apical limit for performing root canal cleaning, shaping, and filling. CDC junction location, however, is very variable. In most times, root canal is not apically opened in a single apical foramen, but in secondary and accessory canals, constituting the so-called apical delta; they are opened in small foramens, namely foramina, presenting diameters between 60 and 80 µm [19].

In teeth without hypercementosis, starting from the apical constriction, root canal becomes wider as it is close to the apical foramen [44]. The shape of the space between the apical constriction and foramen, however, can be defined as conical or tapered, with the smallest diameter faced to the apical constriction. Due to the continuous deposition of cementum at the apical area, the mean distance between these two points increases, as the patient gets older [46].

Generally, teeth presenting root canals with pulp necrosis have some degree of apical inflammatory resorption of either the cementum or dentin [4, 18], which alters the normal apical anatomy, favouring bacterial colonization. Bacteria are located in apical ramifications, deltas or foramina, and accessory/ secondary canals. Moreover, these resorption areas are very irregular and retentive, favouring bacterial biofilm formation, which is a medium for facilitating bacterial survival. In teeth with pulp necrosis, therefore, root canal cleaning is imperative, in its entire length, to maximize the removal of the infectious and necrotic content of root canal system.

According to Leonardo [25], root canal instrumentation of teeth presenting pulp vitality should be limited to dentinal canal, radiographically placed approximately 1 to 2 mm below root apex, aiming not to traumatize the pulp stump, which would be essential for tissue repair in these cases. In necropulpectomy cases without periapical lesion, the author recommended that the working length be placed between 1 to 2 mm below the radiographic apex, since the cementum canal is still intact. In necropulpectomy cases with chronic periapical lesion, because the cementum canal was resorbed and dentin is not covered, working length should be closer to the apical portion, 1 mm below the radiographic apex.

The changes induced by hypercementosis necessitate adjustments in the apical limit of root canal fillings to prevent voids due to insufficient material at the root canal's apex. Odontometry facilitates the determination of the tooth's working length, minimizing the risk of chemical and mechanical trauma and thereby enhancing the likelihood of successful repair. In cases of hypercementosis, it is important to shift focus from the cemento-dentinal junction (CDC) to biological principles. The elongated cementum canal may harbor microorganisms capable of sustaining chronic inflammation. Complete removal of necrotic tissue supports the healing of periodontal ligament cells, promoting recovery and resolution in these cases.

Rosa-Neto's findings suggest that the optimal apical limit for root canal filling should be 1 mm short of the radiographic apex. This approach enhances the effectiveness of dentinal canal filling in teeth affected by pulp necrosis and chronic periapical lesions. Even in cases of vital pulp, this limit appears to be beneficial as it reduces the likelihood of retaining inflamed tissue within the root canal, which could potentially lead to necrosis and subsequent contamination.

Therefore, regardless of the pulp condition (vital or necrotic) and the presence of contamination, Rosa-Neto recommends that root canal cleaning, shaping, and filling should be carried out throughout the entire length up to the apical foramen. This comprehensive treatment approach aims to ensure thorough management of the root canal system, promoting successful outcomes in both therapeutic and preventive aspects of endodontic care.

Pinheiro et al. [32] stated that most of root apexes of teeth presenting mild and diffuse hypercementosis did not show irregularities and resorption, but they had a greater number of foramina. Moderate hypercementosis cases presented more irregular areas and also foramina presence. In severe hypercementosis, the authors found a decrease, and in sometimes, obliteration of root apex. Therefore, it is possible to indicate a conventional endodontic treatment in cases of mild and diffuse hypercementosis because the working length will not show many differences compared with normal teeth. However, to assure a correct root canal cleaning in cases of moderate and severe hypercementosis, the instrumentation should reach the apical foramen in cases presenting necrotic tissue at the apical portion.

In hypercementosis cases, it is believed that whenever possible the cases presenting pulp necrosis must have the entire root canal length cleaned.

The choice of filling technique by gutta-percha thermoplastification may provide a better filling of secondary/accessory canals and apical deltas [32], which is an interesting alternative also in cases of hypercementosis. Both the presence of a greater number of foramina and apical foramen obliteration in hypercementosis cases warn for the need of further studies on the development of techniques, medicaments and products to allow the adequate root canal shaping and filling, aiming to a better repair and, if possible, to the biological sealing of root canal systems to assure a favourable prognosis of these cases.

4. CONCLUSION

In cases of hypercementosis, the apical foramen can be laterally displaced. When the cemental canal is calcified and associated with apical periodontitis, thorough cleaning during shaping is crucial, encompassing both the dentin and cementum canals. To prevent mechanical and biological complications, it's essential to clean the entire length of the root canal system, removing dentin uniformly from all canal walls in three dimensions, while respecting the natural anatomical course of the canal. Additionally, ensuring patency of the foramen throughout all stages of root canal preparation is imperative for achieving successful treatment outcomes. This comprehensive approach aims to effectively manage the complexities posed by hypercementosis, promoting optimal cleaning and shaping of the root canal for subsequent obturation and healing.

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