**Preparation and Invasive Inflammatorical Management of a First Upper Molar with Invasive Cervical Resorption Pulpitis**

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External cervical tooth resorption is characterized by an irreversible loss of dentin tissue due to the action of odontoclasts (Patel et al 2007). It may also be called invasive cervical resorption (ICR). It is an inflammation of the tissues supporting the tooth. Initially, there is no pulp involvement (Mavridou AM, Pyka G, Kerckhofs G, et al 2016). Generally, this type of resorption begins immediately below the union epithelium in the cervical region of the tooth. While there is no bacterial invasion in the pulp cavity, the pulp’s vitality is maintained. Thus, the pre-dentin layer will be present. The ICR does not progress into the pulp cavity possibly due to the presence of inhibitory factors in this pre-dentin layer (Wedenberg 1987, Mavridou et al. 2016, Mavridou AM, Pyka G, Kerckhofs G, et al 2016). Its diagnosis and treatment are not always easy and the prognosis depends on the location and degree of severity of the lesion when diagnosed. Several etiological factors may be involved in ICR. These include the following:

- Physical: dental trauma, surgical procedures, orthodontic movements, periodontal scaling and bruxism (Heithersay 1999).
- Chemical: internal bleaching agents, especially in cases of heat and high concentrations of hydrogen peroxide (Harrison & Natkin 1979, Cvek & Lindvall 1985).

The diagnosis of ICR can be performed by clinical examination when it is in a more advanced stage allowing its direct visualization. Clinically, at the beginning of the process, the tooth condition is asymptomatic since no pulp pathophysiological changes are involved. In these cases, diagnosis by image is the most effective method. For this reason, direct visual clinical diagnosis is not possible in the early stages. Imaging examinations such as periapical radiographs and/or CT scans are efficient methods of diagnosis. Among these, the conical beam tomography is more accurate than the periapical radiography (Patel et al. 2016, Vaz de Souza D et al 2017).

The treatment of ICR aims to protect the affected dentin from exposure to the patient’s immune system. For this, cleaning the affected area and restoring the cavity with biocompatible materials is the indicated treatment. As these areas are in direct contact with tissue and saliva fluids, they are wet and irregular due to the destructive aspect of the resorption process. Therefore, the material of choice for the closure of this cavity, besides being biocompatible, must be able to fill irregular cavities and have good physical and chemical behavior in a wet environment.

Throughout the history of dentistry, several materials such as resins, amalgam, resin-modified glass ionomer, hydroxyapatite, and endodontic sealers were used for this purpose. However, none of these presented desirable characteristics and results. Only bioerodent materials have the desirable characteristics for this purpose. Among bioerodent materials, MTA is the most used material and has the highest scientific evidence of its results (Pitt Ford et al 1996, Torabinejad & Parti rokh M 2010).

**Clinical Case**

A 52-year-old female patient, ASA I, came to the clinic with complaints of spontaneous pain exacerbated by hot and cold foods in the right maxilla. On clinical examination, tooth 16 responded to thermal tests, with high intensity, pulkaking pain and taking long to cease. She did not present positive responses to lateral and vertical percussion tests, nor to apical palpation. The clinical diagnosis was symptomatic irreversible pulpal resorption with periapical cyst. In addition, a radiolucent image was visualized on the radiographic examination involving the cervical and coronal region of tooth 16, leading to the suspicion of a Cervical Invasive Resorption (Fig 1-3). In order to have a confirmation of the diagnosis and assess the extent of the lesion, a concomitant computed tomography scan was performed.

In the tomography, we could observe the three-dimensional extension of the ICR around the pulp cavity. As previously described, the ICR does not invade the pulp cavity when the pulp is alive due to the presence of the pre-dentin layer. This imaging characteristic is present in cases of external dental resorption where the pulp is still alive with consequent preservation of the pre-dentin non-mineralized layer (Fig 4-7).

The endodontic treatment was performed according to the pulpal diagnosis. However, a complementary approach was required in the resorption area (Fig 8). The marked curvature of the mesial root led to the selection of a reciprocating nickel-titanium instrument with shape memory control (Reciproc Blue – VDW) for mechanical preparation.

After accessing the pulpal chamber, 5 ml of sodium hypochlorite were used for initial irrigation (FIGURE 9). Afterwards, a Reciproc Blue 25 instrument was progressively introduced into each of the canals, in cycles of 3 slight incoming and outgoing movements in the canals followed by irrigation of 1 ml Hypochlorite between each cycle, until they reached 1/3 of the radiographic length of the tooth. At this time, the actual working length was established using an electronic file ramaluli. Subsequently, the Reciproc Blue 25 instrument was taken to the working length. With a Reciproc Blue 40 instrument, the diameter of the apical preparations was increased (FIGURE 10, FIG-
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URE 10. Due to the shape memory control of the Reciproc Blue files, it was possible to perform the apical preparation of the mesiobuccal root with marked curvature, even with an instrument of 0.46 apical di-ameter and 5% taper.

The irrigation protocol of 3 ml of solution per canals at every 30 min- ute and outgoing movements of the reciprocating instrument was maintained until the end of the preparation. After finishing the chemical/mechanical preparation of the canals, the irrigation was per-formed with 27% EDTA associated to pass the ultrasonic irrigation in 3 cycles of 20 seconds per cycle in each canals. The canals were then re-irrigated with 2.5% Sodium Hy- pochlorite.

For endodontic filling by the cold vertical compaction technique, MTA Fillapex (Angelus - Londrina, Brazil) and pre-calibrated gutta- percha cones were selected.

In the resorption region, an intra- coronary (non-surgical) sealing ap- proach was chosen. This choice was made due to the small extent of the area of communication between the resorption and the external dental surface (FIGURE 19). For seal- ing the resorption area including the communication between the external/internal surface, the ma- terial of choice was MTA-HP and not the conventional MTA. As the conventional MTA contains Bismuth Oxide as radiopacifier, it may lead to a darkening of the tooth crown if used near the cervi- cal region or in the dental crown. Bismuth Oxide may react with the dentin collagen, causing a graying of the dental structure (Marciano MA et al 2014). This color alteration may also occur due to the interac- tion between Bismuth Oxide and Sodium Hypochlorite (Camilleri et al 2014, Marciano MA et al 2015). Thus, using bioceramic materials containing Bismuth Oxide as a ra- diopaque should be avoided.

With the concern for preserving the aesthetics of the clinical cases treated with bioceramic materials, new formulations of these mate- rials have been proposed by the industry. As an example, MTA HP Angelus has Calcium Tungstate as radiopacifier. This new formulation does not lead to chromatic changes in dental structure (Marciano MA et al 2014). Thus, HP MTA can be used in areas close to the tooth crown without the chromatic impairment of the treated tooth. Furthermore, the addition of an organic plasticizer to the liquid component of this new material significantly im- proved its clinical management. As this clinical case involves the place- ment of bioceramic material near the cervical area of tooth crown 16, we chose MTA HP to preserve the original color of the tooth crown (FIG. 12). In the 8 month clinical control it was possible to observe the mainten- ance of the color of the original color of the tooth 16 (FIG. 15) as well as the normality of the peripapillary tissues (FIG. 14-15).

Conclusion

Invasive cervical resorptions are pa- thologies of immunological charac- ter. When early diagnosed, where the extent of tooth destruction is still small and easily accessible, the prognosis is favorable. Bioceramic repair materials are indicated to seal the communication between the endodontium and the exter- nal surface of the root. As invasive cervical resorptions involve an- aethetic areas, bioceramic materials containing Bismuth Oxide should be avoided because they cause chromatic changes in the crown of the impaired tooth. Therefore, traditional MTAs are not indicated in these cases. However, new for- mulations of MTA such as MTA HP do not contain Bismuth Oxide. This characteristic does not lead to changes in tooth color. Hence, this is the most suitable material for sealing these areas of resorption.

References