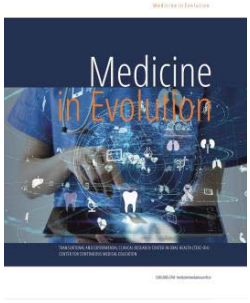
Continued root-growth and apexification procedure of immature permanent incisors using calcium hydroxide



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Abstract

Teeth with incomplete apical development or with a wide apex (unformed apex) have the etiology of complicated dental caries or a trauma with pulp exposure and periapex damage, before the root is fully matured. Two male patients aged 9 and 7 years old with history of carious pathology and dental trauma were selected for the apexification procedure. Apexification produced consistent results in the treatment of immature teeth with pulp necrosis and apical periodontitis.

Keywords: open apex, endodontic treatment, central incisor

INTRODUCTION

Teeth with incomplete apical development or with a wide apex (unformed apex) have the etiology of complicated dental caries or a trauma with pulp exposure and periapex damage, before the root is fully matured. In such situations it can be encountered a wider apex with thin root canal walls than near the cervical area with extensive periapical lesions [1].

The treatment of this type of lesion, followed by the correct obturation of the canal, is very difficult to achieve under normal endodontic therapy conditions, requiring the intervention of some surgical methods [2]. Considering, however, the fact that such cases are mainly encountered in very young patients (children) with difficult cooperation, a method that allows the complete development of the apex is required as a therapeutic solution, the method called apexification [3].

Maxillary central and lateral incisors are often considered the easiest teeth to treat due to the uncomplicated anatomy of the root canal. The canal is usually straight with a cross-sectional shape approximating the shape of the crown and root [4]. Frequent complications include the presence of the oral dentine shoulder in the cervical area that often prevents direct access to the root canal system and directs the bur and files to the vestibule. This fact can result in a vestibular perforation. When the curvature is completely removed, good visibility is obtained directly towards the channel. Because these teeth are subject to greater trauma than the rest of the mouth, calcified pulp chambers are often encountered, which frequently lead to complications in treatment [5].

Pulpal and periapical disease associated with a divergent canal towards the apex, with a radiological image of radiolucency institutes great difficulties in terms of the therapeutic method. First of all, a larger apical and smaller coronal canal diameter makes it difficult to carry out mechanical treatment in terms of complete debridement; the lack of an apical stop makes the root obturation technique difficult and the thin walls of the root canal are prone to fractures [6].

Apexification has as its main objective an apical repair of the tooth in question by forming a tissue barrier at this level, thus making it possible to carry out a root obturation through condensation techniques, without the danger of pushing the obturation material beyond the apex [7].

Successful endodontics aims at effective debridement of the root canal system and complete obturation of the root space. The anatomy of the root canal system sets the parameters within which root canal therapy will be performed and can directly affect the likelihood of success [2,4].

Aim and objectives

The present study aims to demonstrate the effects of calcium hydroxide on the apex of endodontically immature teeth that have undergone complicated carious processes with irreversible pulp damage complicated with periapical lesions. Closing the apex represents the final goal of these techniques to keep the teeth on the arch for a long time.

MATERIAL AND METHODS

Two male patients: M.T., 9 years old and G.R. 7 years old presented with the chief complaint of colour modification and fetid breath. The presented radiological investigations demonstrated the presence of affected immature central incisors with radiolucency revealed at the periapical level.

Patient M.T. presented with affected tooth no. 2.1. (Fig.1) with a history of high caries risk with multiple carious lesions both in temporary and permanent teeth.

Figure 1. Immature left upper incisor, no. 2.1.

Patient G.R. presented with the history of dental trauma in the frontal region, 6 months before being treated, with necrotic tooth no. 2.1. (Fig.2).

Figure 2. Immature left upper incisor, no. 2.1.

Mechanical canal preparation. Reaming up to the apical formation is not mandatory, allowing the expansion to penetrate the atraumatic, apical delta and the periapex; mechanical cleaning only of the accessible part (provisional space - maximum 3/4 of the root canal) drastic antiseptics (coagulants and toxic) are not used. If necessary, sodium hypochlorite can be used. After using sodium hypochlorite, wash with water and do not air dry. We have to take into account that by blowing air into the canal we create an air bubble, which forms an obstacle to expansion, by creating insulating barriers between the calcium oxide and the endodontic water.

Paste preparation. It is done simply by mixing the powder with liquid as desired to change the consistency of the paste.

The consistency of the paste is left to the discretion of the professional and depends on the extent of the main canal and the secondary ones, as well as the existence of a periapical granulomatous reaction.

Inserting the paste into the channel. A Lentulo file with a smaller diameter than the canal or the provisional space is used, in order not to introduce air into the canal, between the paste and the endodontic space. In all cases, we avoid inserting the apical periodontium puncture to avoid unnecessary trauma.

It must not be forgotten, to cover the paste with a preferably non-hydrophilic inert material, to avoid contact between the paste and the temporary obturation material, between the paste and the walls of the coronary cavity.

Temporary filling of the cavity. It can be performed with any type of temporary obturation cement that does not contain eugenol.

RESULTS

The evaluation of the apexification process is done three months after the treatment through a radiographic examination to highlight the closure of the apex. The quality of the formed tissue is done by testing with a file needle no. 35 which must not penetrate this portion at the time of its introduction to this level. If such results were not obtained, a new application of calcium hydroxide-based paste is recommended, and the evaluation of the results is done every 3 months until adequate scarring is obtained in the sense of apical closure that allows root obturation by endodontic techniques.

In both treated cases, the apex of the two upper central incisors was closed at 9 months, requiring two reapplications of calcium hydroxide, followed by the endodontic obturation with gutta-percha (Fig. 3, 4).

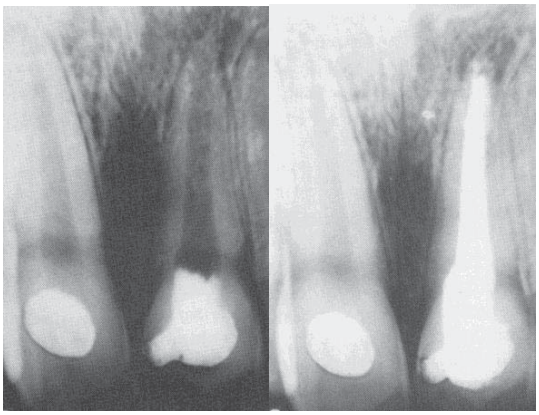

Figure 3. Radiological image of tooth no. 2.1. with a matured apex and the final endodontic obturation

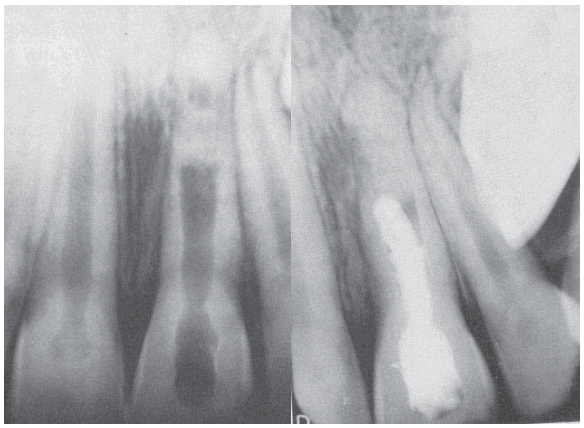

Figure 4. Radiological image of tooth no. 2.1. with a matured apex and the final endodontic obturation

DISCUSSIONS

At the origin of the inflammation that causes periapical lesions are bacterial toxins, enzymes and degradation products of pulp tissue proteins. The logical treatment of periapical lesions is therefore the suppression of inflammation [2,3,6].

In the case of a necrotic or even infected pulp, the choice of endodontic medicine depends on the relationship between the bactericidal effect and the good biocompatibility of the medicine used [7,8].

Ocalexic therapy is a treatment that can be defined from "A" to "Z" as physiological and biological. Ocalexic therapy provides the endodontist with four certainties:

• pulpal catabolism and microbial proliferation are stopped, the environment becomes alkaline from acid;

• enzymatic activity is canceled; when the pH goes from 8.5 it becomes impossible;

• leukocytosis increases and the defense capacity is maximum;

• bone restoration is enhanced by removing the obstacles that oppose the activity of alkaline phosphatase [5, 9].

Ocalexic expansion spontaneously penetrates and occludes any endodontic space inaccessible to conventional instruments and antiseptics [10].

Calcium hydroxide is able to lyse and make dead organic matter disappear completely and at the same time respect the living organic matter even stimulating its metabolism and favoring bone, cementum and dentine distribution [11].

Studies have shown that healing is faster if the periapex is respected. Current techniques therefore use less irritating methods. Endodontic healing associated with the use of biological endodontic techniques induces spontaneous scarring of the periapex. This implies rigorous criteria for canal preparation and obturation [2, 12].

The preparation of the canals aims at suppressing the pulp tissue and pathogenic agents represented by microorganisms and organic debris, through mechanical and physico-chemical action [13].

The purpose of the obturation is to put the canal system out of the circuit, by achieving a precise, hermetic and durable filling of the apical orifice.

Teeth bearing periapical lesions require more special attention regarding:

- establishing the apical limit of the preparation;
- establishment of a biological environment favorable to scarring;
- the problem of the number of interim meetings;
- choice of obturation technique [14].

In contact with living tissues producing carbon dioxide, calcium hydroxide turns into calcium carbonate, which has no caustic action on tissues. The anti-alkaline effect of tissue carbon dioxide is the result of the inactivation of hydroxide in the vital environment, as long as this environment has preserved its basal metabolic activity, which is exacerbated precisely by the deficit obtained in carbon dioxide [15]. But the action of calcium hydroxide in the living environment is not only passive and negative, by neutralizing its chemical action, but also active, with its own metabolic wave. In living tissues, there is a constant ratio between carbon dioxide and carbon. An acceleration of the basal metabolism is thus produced by increasing cellular activity [16].

CONCLUSIONS

Apexification produced consistent results in the treatment of immature teeth with pulp necrosis and apical periodontitis. The choice of treatment should be chosen after a thorough analysis of prognostic variables.

Despite the high success rate of apical barrier development using calcium hydroxide, these teeth nevertheless require long-term monitoring. There could be issues including cervical root fracture, infection recurrence, and failure to control infection. The latter occurs more frequently in luxated teeth that are still developing their roots.

The therapeutic decision is influenced by the clinical situation, the desired treatment outcomes, and the dentist's performance and dexterity.

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