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Different Treatment Modalities for Pulp Stones

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Abstract

Pulpal calcifications or also called pulpal calcium degeneration are small masses of calcified tissue that obliterates part or almost all of the endodontic network, the presence of these masses can further complicate endodontic treatment and requires an adaptation of the therapeutic approach. The objective of this article is to illustrate the difficulties and the keys to success of endodontic treatment in the presence of pulpal calcifications. Three patients with three levels of difficulty; a free coronary pulp stone, an adherent coronary pulp stone and diffuse root canal calcification required well-adapted treatment in order to eradicate these calcified masses. The discovery of pulpal calcifications during daily practice is particularly frequent. These calcifications can present different clinical forms and pose problems of diagnosis and management. The indication for endodontic treatment cannot be based solely on the presence of pulp stone but on a diagnosis confirmed by a clinical and radiological examination showing the pulp status of the tooth.

Keywords: Pulp-stone • Obliteration • Dental microscope • Catheterization

Introduction

Pulpal calcifications or also called pulpal calcium degenerations are small masses of calcified tissue that obliterates part or almost all of the endodontic network [1]. The exact cause of their formation remains unknown. Therefore, it is currently unclear whether their presence reflects a pathological manifestation or a normal physiological development of the dental pulp [2]. Thus, many factors predisposing to the development of pulpal calcification have been suggested, such as aging, caries, periodontal disease and orthodontic movements. On the other hand, some studies have tried to establish a relationship with other general diseases such as cardiovascular and renal diseases [3]. These masses of calcified tissue can be found at the level of the pulp chamber and/or at the level of the root canals, but the accessibility to the canal orifices which is an essential element for the success of any endodontic treatment can become more complicated by the presence of these pulpolites [4].

Case Presentation

Clinical case N°1

A 22-year-old patient in good general condition consulted following spontaneous pain related to the first left mandibular molar. The clinical examination reveals a Sista 1.3 carious lesion. The radiological examination shows the presence of calcification which obliterates almost all of the pulp chamber with a cleavage plane (clear X-ray line) between the calcified tissue and the healthy dental tissue (Figure 1). After carious eviction and opening of the access cavity by connecting the projection of the pulp horns (Figure 2), the extent of the pulpolite is delimited by a hemorrhagic colorimetric demarcation between the dentin of the cameral walls and the calcified tissue center (Figure 3). Subsequently, this demarcation was widened using an ultrasonic diamond insert (ET18D) (Figure 4). Once released and mobilized, the calcified mass is completely removed by an endodontic excavator (Figures 5-7). After removal of the pulpstone, abundant irrigation with Naocl 5.25% was performed to better visualize the root canal entries (Figure 8) and from here endodontic treatment was continued as if of a normal tooth without particularities (Figure 9).

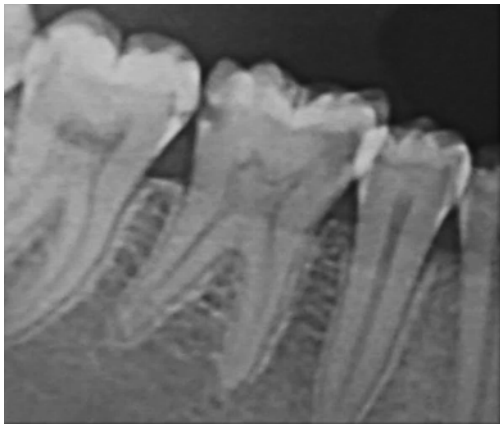

Figure 1. Retro alveolar radiograph of a calcification occupying the entire cameral pulp with a clear X-ray cleavage plane that delimits the calcified mass (yellow arrow).

Figure 2. Carious eviction and delimitation of the access cavity which connects the projections of the 4 pulpal horns.

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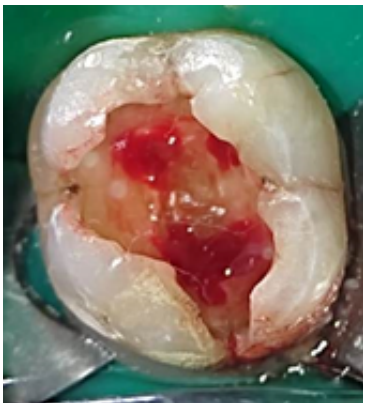

Figure 3. Hemorrhagic demarcation delimiting the extent of the pulpolite.

Figure 4. Diamond insert ET18D.

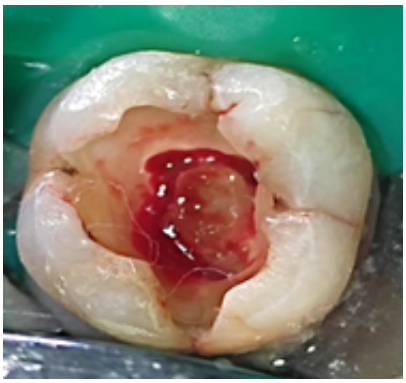

Figure 5. Release of the pulpstone and its mobilization using an endodontic excavator.

Figure 6. Clinical view of the pulpstone after its removal from the pulp chamber in one piece.

Clinical case N°2

A 66-year-old patient, hypertensive, diabetic under treatment, consulted urgently for symptomatic irreversible pulpitis related to the first maxillary right molar. The clinical examination shows a deep mesial caries reaching the inner third of the dentin, the radiological examination refines the report and the extent of the carious lesion and highlights the presence of a pulpolite which completely obliterates the cameral pulp (pulpolite adhering to the dentinal walls and to the pulpal floor) (Figure 9). The reference points cited in the first clinical case when creating the access cavity are not applicable in this case. For example, there is no longer the feeling of emptiness during pulp effraction, there is no cleavage plane and the pulpolite cannot be mobilized.

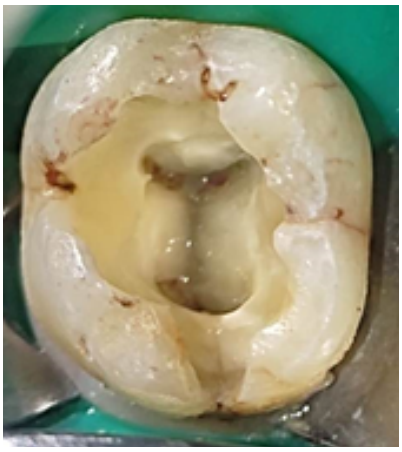

Figure 7. Clinical aspect of the access cavity after removal of the pulpstone and abundant irrigation (orifices are easily visualized).

Figure 8. Enlargement of root orifices and canal shaping.

In this case, we proceeded by deepening the perimeter of the access cavity step by step with a long-necked ball burr, then began circumferential pulpolite clearance with ultrasonic diamond inserts (ET18D/ETBD), giving priority to freeing the canal entrances (Figures 10-12).

Using the same long-necked ball bur, the calcified tissue was abraded under direct visual control, using the color difference (between cameral dentin and calcified tissue) as a milling guide. This was continued until complete removal of the pulpolite and release of the canal orifices. Once free, root canal negotiation and instrumentation were carried out step by step, with continuous renewal of the irrigation solution (Figures 13-15).

Clinical case N°3

Hypertensive 65-year-old patient referred by a colleague for non-localization of root canal orifices on 46 with radiological evidence of diffuse calcifications obliterating the entire ductal network (Figure 12).

Root canal negotiation began with pre-curved, small-diameter K files (K6/K8/K10), without immediately attempting full root canal catheterization (Figures 16 and 17). We also opted for abundant irrigation with sodium hypochlorite, which has a solvent action on the organic substances involved in pulpolite adhesion. The addition of a lubricating and chelating gel (EDTA) facilitated instrument insertion and eliminated the mineral phase of the pulpolites. Once negotiation to the working length had been achieved, advancement into the canal became easier with rotary Niti instruments always under abundant irrigation (Figures 18-22).

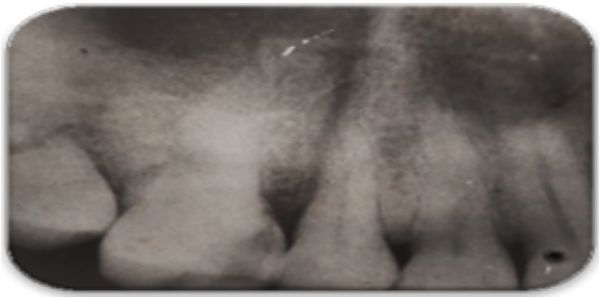

Figure 9. Preoperative x-ray.

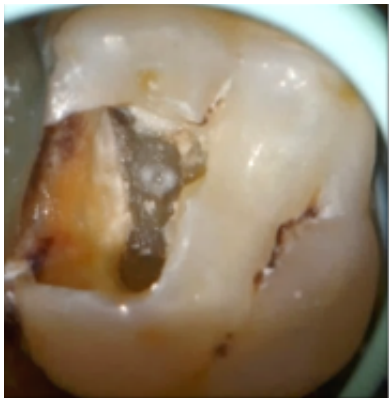

Figure 10. Color difference between calcified aggregate and dentin tissue.

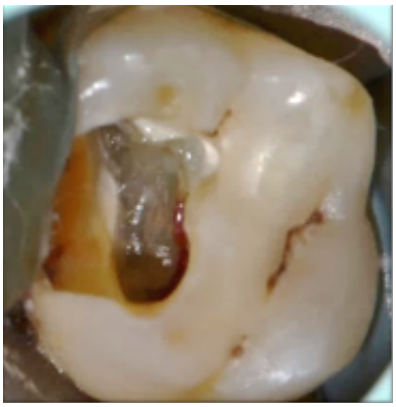

Figure 11. Clearing of orifices (ETBD), then delimitation of the pulpolite perimeter (ET18D).

Figure 12. insert (ETBD) + insert (ET18D).

Results and Discussion

A comparative study carried out in 2016 by Karimi Z, et al. attempted to investigate the prevalence of pulpal calcifications and study their impact on the quality of endodontic treatment [1]. It was shown that calcific degeneration appears to be a source of difficulty that needs to be taken into consideration to improve the quality of endodontic treatment. This can be achieved by adopting an appropriate clinical procedure for each type of calcification.

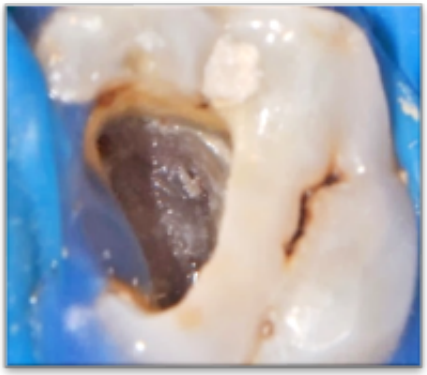

Figure 13. Clinical appearance after complete pulpolite release and abundant irrigation.

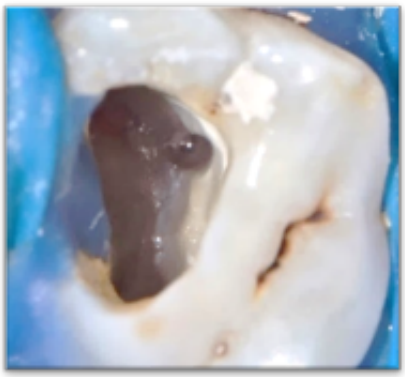

Figure 14. Enlarged canal orifices.

Figure 15. Cone fit radiograph, showing complete permeabilization of the root canal system.

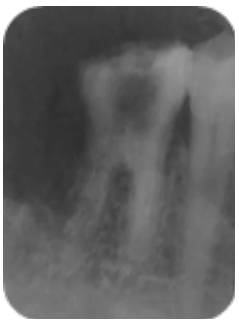

Figure 16. Preoperative X-ray showing total canal obliteration of the 46.

Preoperative X-rays can be used to determine the location of pulp calculi:

- Pulp chamber
- Root canal
- Chamber and root canal,

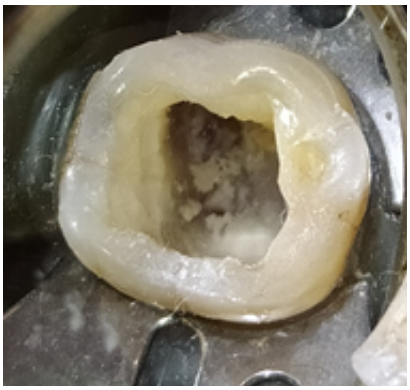

Figure 17. First root canal negotiation with pre-curved K6 / K8/K10 files.

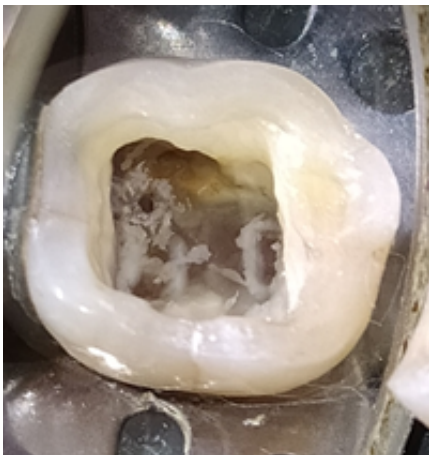

Figure 18. Glide path mechanized with 15/03 file of Plex V ORODEKA third by third without attempting to achieve complete permeabilization from the 1st pass under abundant irrigation with CLONA 5% (note the amount of debris coming out of the canal).

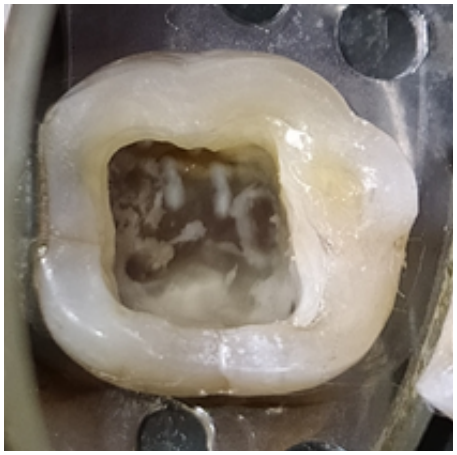

Figure 19. Shaping to an apical instrumentation of 20/04.

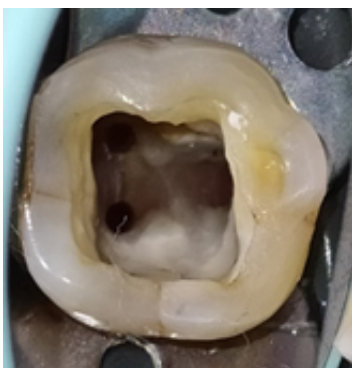

Figure 20. Clinical view after root canal enlargement and ultrasonic CLONA activation.

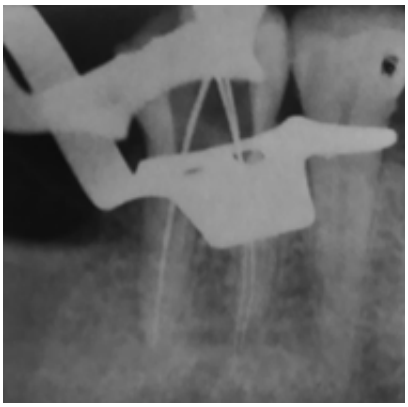

Figure 21. Radio file in place.

Figure 22. Postoperative X-ray.

And their relationship to the dentinal walls:

Free: Not attached to the dentinal walls and completely surrounded by pulp tissue. Radiographically, it appears as a radiopacity surrounded by a radiolucent halo.

Adherent: Attached to the root or cameral dentinal walls. On radiography, the radiolucent halo separating the dentinal walls from the calcified mass is absent.

Root canal obliteration: Complete disappearance of the root canal passage in a portion or all of the canal.

Depending on the radiological type of pulp calculus, we can orientate our therapeutic strategy:

- VIS-A-VIS of free coronal pulpolites (clinical case N°1); the success of endodontic treatment depends on the correct design of the access cavity. This involves establishing a contour shape linking the projections of the pulp horns at occlusal level. An ordinary cavity is then created and deepened using long-neck tungsten carbide burs. The sensation of emptiness, long associated with entering the pulp chamber, does not occur in the presence of calcified hard tissue. The extent of the pulpolite is delimited by a colorimetric demarcation between the dentin of the canal walls and the central calcified tissue. This demarcation may be manifested by a hemorrhagic line of underlying pulp tissue when the tooth in question is vital, otherwise it is manifested by a line of necrotic pulp tissue debris. This line of separation is then extended using ultrasonic diamond inserts, under direct visual control (operating microscope / dental magnifying glass) to better distinguish dentin tissue from calcified tissue. Once the calcification has been completely circumscribed, the aim is to remove it in a single block, simply mobilize it with an endodontic excavator to detach it in a single block from the access cavity. The removal of this calcified mass reveals an intact, clean pulp floor and clearly distinguished canal entrances [4,5].
- VIS-A-VIS of adherent coronal pulpolite; the problem is that this type cannot be mobilized despite circumferential clearance. So, once the access cavity has been deepened, the first step is to liberate the canal orifices. Then, slowly abrade the central calcified tissue. The challenge is to know exactly how thick the pulp-stone can be abraded without

damaging the floor. Care should be taken with a long-necked ball bur on a low-speed counter-angle or with an ultrasonic diamond insert [4].

- VIS-A-VIS root canal calcifications; the idea in this situation is not to negotiate all the way to the apical construction. This is an iatrogenic error and can lead to the formation of dentinal plugs and abutments, further complicating the management of this type of canal.

Once the root canal entrances have been located, root canal penetration can begin. It is always important to remember that instrument fractures are more difficult to treat on mineralized teeth. Full canal catheterization should not be performed from the beginning, preferring instead a crown-down approach [6]. Manual K8 or K10 files, and sometimes even K6 files, are used to progress through the canal, but these instruments are very fragile and should be replaced regularly. After initial penetration, rotary pre-enlargement instruments can be used. It is important not to forget to pre-curve manual instruments over the last few millimetres, to enable them to bypass any mineralization present in the canal [7]. Advancing into the canal can sometimes become easier as the instrument progresses, since secondary dentinogenesis is more marked coronally than apically. However, if the instrument no longer seems to be advancing correctly, you should stop and try to feel how the instrument is engaged in the canal. If there is a sensation of resistance to withdrawal, then the canal is narrowed and you can continue as normal, opening the canal progressively. If, on the other hand, the instrument appears to be free in the canal, we are faced either with total apical calcification, which is very rare, or with an abutment, in which case we need to pre-curve the instrument further to find a zone where we can obtain this sensation of resistance to withdrawal [8]. Abundant irrigation with sodium hypochlorite should always be maintained, as the solvent action of NaOCl enables digestion of the organic substances involved in pulpolite adhesion. Manual filing helps to mobilize the pulpolite in a coronal direction, by establishing low-amplitude back-and-forth movements. The use of chelating agents facilitates progression within the canal by demineralizing the canal walls and eliminating the mineral phase of calcification adhesions [9]. It should also be remembered that, in the long-term, cement deposits form at the apex, altering the position of the radiological apex in relation to the anatomical apex. Root canal preparation must therefore sometimes be carried out away from this radiological apex [4].

In the case of voluminous root canal calcification and if the clinical situation allows (visibility, accessibility) ultrasonic inserts (ET20, ETD25 Satelec®) are used to destroy this calcific obstruction, always under direct visual microscopic control [4,10].

Conclusion

Pulpal calcifications are frequently encountered in the during dental practice, and can take a variety of clinical forms, posing problems of diagnosis and management. The indication for endodontic treatment cannot be based on the presence of pulpolite alone, but rather on a diagnosis supported by a clinical and radiological examination of the pulp status of the tooth. NAOCLA thorough understanding of these particularities, the choice of appropriate therapies and the use of optical aids are the keys to successful treatment of mineralized teeth.

Acknowledgement

There are no acknowledgements.

Conflict of Interest

Any financial interest or any conflict of interest exists.

Consent

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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