Non-surgical treatment of pulp canal obliteration using contemporary endodontic techniques: Case series

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ABSTRACT

Pulp canal obliteration (PCO) is defined as a deposition of hard tissue within the root canal space. These tissues can eventually produce the radiographic appearance of a root canal space that has become partial or completely calcified. Success in root canal treatment is based on proper debridement, disinfection and obturation of the root canal system. However, this procedure may be difficult or even impossible to achieve if the pulpal space is calcified. The endodontic treatment performed under these circumstances pose the risk of root perforating, a complication that seriously affects the long-term prognosis of tooth. The present article discusses a series of cases of endodontic treatment in teeth with partially or completely PCO and methods for the clinical management of these cases using contemporary endodontic techniques.

Keywords: Dental pulp calcification. Endodontics. Radiographic image interpretation. Computer-assisted.

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Introduction

Pulp canal obliteration (PCO), also called calcific metamorphosis (CM) is defined as a deposition of hard tissue within the root canal space. This may occur idiopathically or following direct pulp capping or trauma.[1,2] The exact mechanism of PCO is unknown but is believed to be related to damage to the neurovascular supply of the pulp at the time of injury.[3,4] An osteoid tissue is produced by the odontoblasts, which results in a simultaneous deposition of a dentin-like tissue along the periphery root canal walls and within the pulp space proper. These tissues can eventually fuse with one another, producing the radiographic appearance of a root canal space that has become partial or completely calcified.[5]

The calcification of the pulp chamber results in a darker hue, the loss of translucency and the yellowish appearance of the crown of the tooth.[6] The affected teeth do not always react to sensibility tests for some time, and generally there is no sensitivity to percussion.[7] Pulp necrosis has also been reported as a complication,[5,8] with ranges varying from 1% to 16%. Periapical lesion develops in a range of 7.3% to 24% in these cases up to 4 years after initial traumatic injury, especially in completely calcified teeth.[5,9]

Success in root canal treatment is based on proper debridement, disinfection and obturation of the root canal system. However, this procedure may be difficult or even impossible to achieve if the pulpal space is partially or completely calcified. The endodontic treatment performed under these circumstances pose the risk of perforating the root, a complication that seriously affects the long-term prognosis of the tooth. If calcified root canal treatment fails, the endodontic surgical intervention may be the only possible alternative other than extraction of the tooth. Although its importance could not be underestimated, there is a lack in the literature regarding the optimum treatment of teeth showing signs of PCO. We herein report clinical options and a series of cases of endodontic treatment in teeth with partially or completely PCO.

Case reports

Case 1

A 30-year-old male patient was referred to a private dental office for an evaluation of pain and discomfort associated with the second right maxillary premolar. PCO could be observed in computed tomography (CT), which also revealed the presence of patent canal apically (Fig 1). However, a previous endodontic treatment was performed unsuccessfully. Clinically, the mobility and probing depth of the tooth were within normal limits. Tenderness to percussion was associated with the tooth, however occlusal disharmony was not detected. After tooth isolation, the access cavity was deepened with an ultrasonic tip under the use of the operating microscope. To gain access through the calcified dentin, a #15 K-file was modified as follows. The final 2 mm of the file was removed using a sterile pair of surgical scissors and the tip was edged with a diamond disk. This modification allowed an improvement in cutting efficiency of the file and its insertion into the calcified tissue with more resistance to deformation and fracture.

To ensure the insertion of the file in the correct position, centered and angulated periapical radiographs were taken as the file advanced 1-2 mm apically. In centered radiographs, the mesiodistal position of the file could be viewed, while angulated radiographs demonstrated its buccal-palatal position. If in disto-angulated radiograph the file was distally positioned in relation to root canal, it was palatally dislocated. On the other hand, if in disto-angulated radiograph the file was mesially positioned in relation to root canal, it was buccally dislocated. In these cases a correction in the file position was performed. If both centered and angulated radiographs images showed the position of the file coinciding with that of the root canal space, an apical 1-2mm movement could be performed with safe. With this approach, the limitations of the two-dimensional radiographic view could be overcome.

After each apical movement, the tip of the file was edged again in order to keep its cutting efficiency. Irrigation was performed copiously with 5% sodium hypochlorite. Once in contact with organic tissue, the “bubbles” formation could be observed under the operating microscope, demonstrating that root canal space was reached. Root canal treatment was properly finished and in the post-operative appointment review 30 days after the patient was completely asymptomatic.

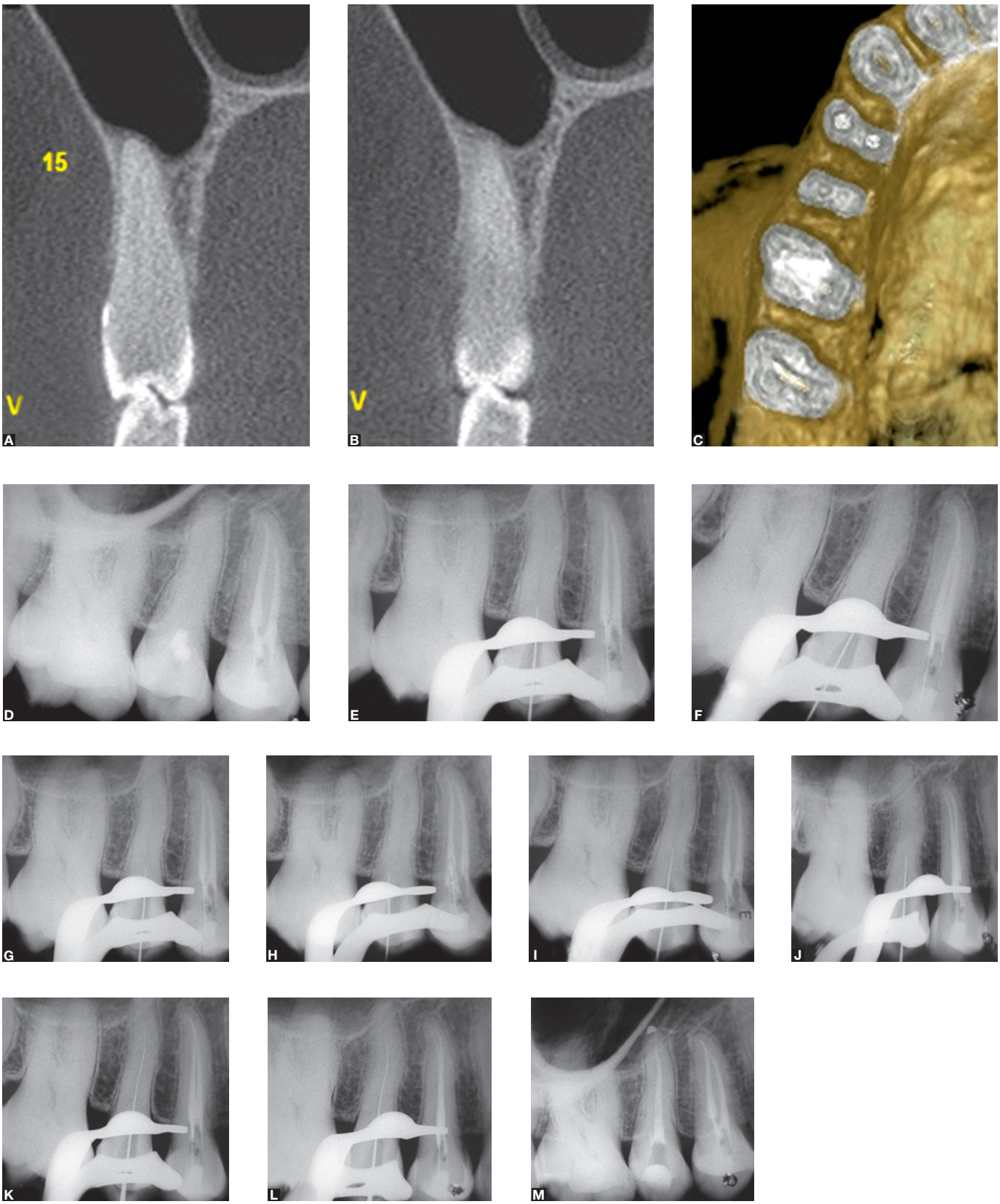

Figure 1. (**A-C**) Preoperative CT and radiograph. (**D**) Centered radiograph. (**E**) In the angulated radiograph, the file seems to be mesially dislocated. (**F**) After correction in the position of the file, it was inserted 1-2 mm apically. In the centered radiograph the file seems to be in the correct position. (**G**) However, the angulated radiograph shows that the file is palatally dislocated. (**H**) After new correction, the file was inserted 1-2 mm apically. (**I**) The angulated radiograph shows the file in the correct position. (**J,K**) The file reached the root canal space. (**I**) Obturation done.

Case 2

A 45-year-old male patient was referred to a private dental office by another endodontist that had not been well succeed in the endodontic treatment of the left central mandibular incisor with PCO. The tooth presented a yellow crown and slight periapical radiolucency. The preoperative radiograph shows the mesially deviated path followed by the bur (Fig 2). The tooth was isolated with rubber dam and floss. The clamp was not placed initially to avoid radiographic difficulties. Under the analysis with the operating microscope, the access cavity was deepened with a #2 long shank steel round bur on a slow speed handpiece and ultrasonic tips.

Important to notice is that the root of the mandibular incisor is often labially inclined, so if the instrument insertion follows the inclination of the crown, perforation of the root surface somewhere below the gingival attachment may occur. In this way, the instrument insertion must be done in the center of the tooth parallel to root long axis. The modified #15 K file was inserted as previously described. The radiograph shows a mesial deviation of the file (Fig 2B). After correction in the file position, it was inserted again. The radiograph shows that the deviation persisted (Fig 2C). The file was then moved 1-2 mm apically. Centered radiograph shows it in a supposed correct position (Fig 2D), however in distally angulated radiograph a deviation could be noticed (Fig 2E). The file was lingually positioned and patent canal could be found under the operating microscope (Fig 2F). The clinical view shows the file distally to the initial access cavity (Fig 3G).

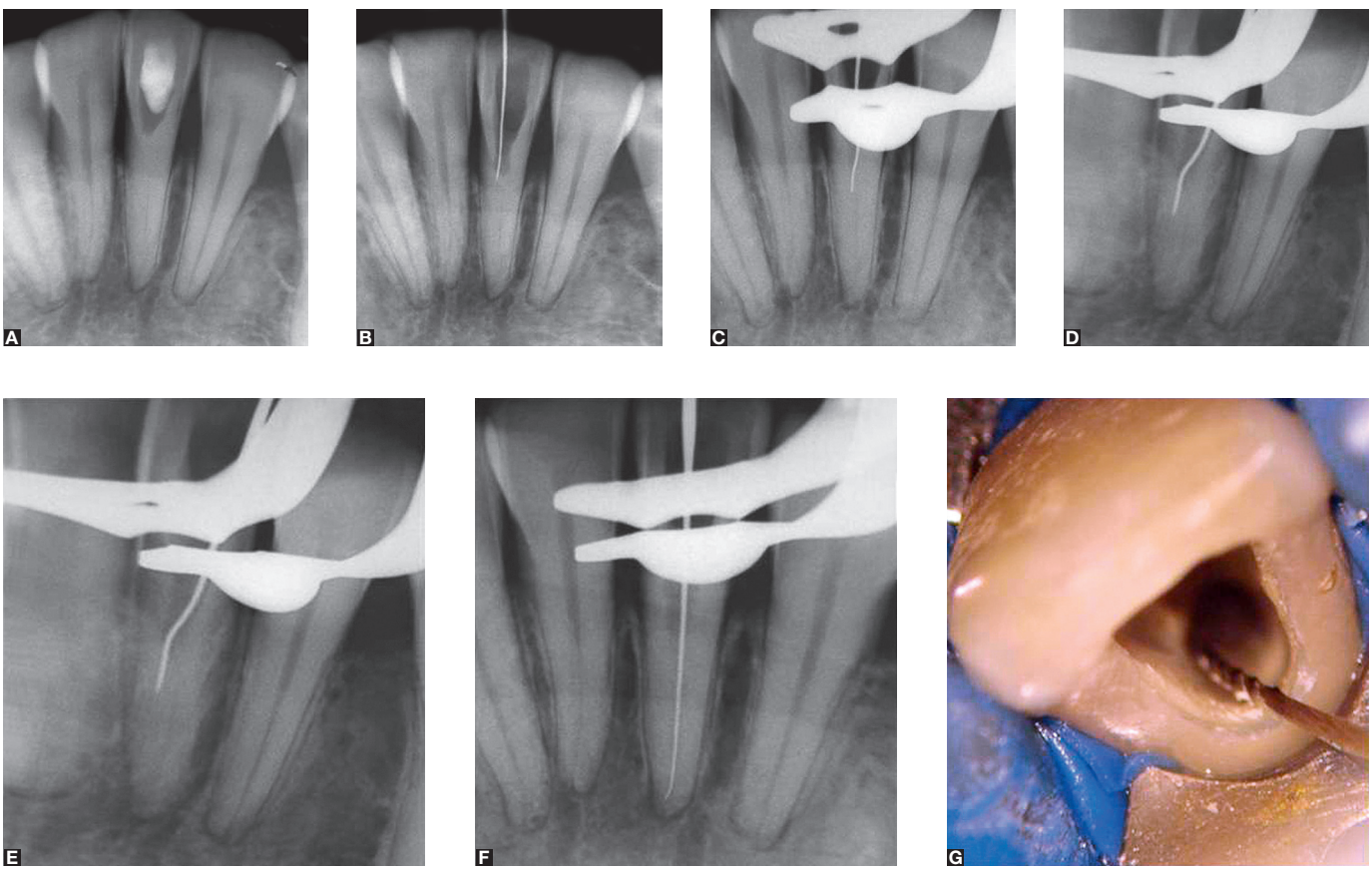

Figure 2. (**A**) Preoperative radiograph. (**B**) A mesial deviation can be observed. (**C**) The file was inserted 1-2 mm apically. The mesial deviation persisted. (**D**) After correction in the file position, it was inserted 1-2 mm apically. Centered radiograph shows the file in the correct mesio-distal position. (**E**) However the distally angulated radiograph shows that the file is labially dislocated. (**F**) After correction in the file position, the root canal space was reached. (**G**) File placed in the canal.

Case 3

A 40-year-old female patient was referred to endodontic treatment of the mandibular left second premolar. The crown had fractured and a dentinal post could be noticed. Its presence was justified due to an impossibility to retain an intracanal post, since the root canal was completely obstructed. The only chance to restore the tooth was "creating" a new canal space, so an intracanal post could be placed. The treatment was performed following the protocols described in cases 1 and 2 (Fig 3A-H).

Discussion

Complete or partial radiographic obliteration does not necessarily mean the absence of the pulp canal space.[10] This study confirmed the previous findings

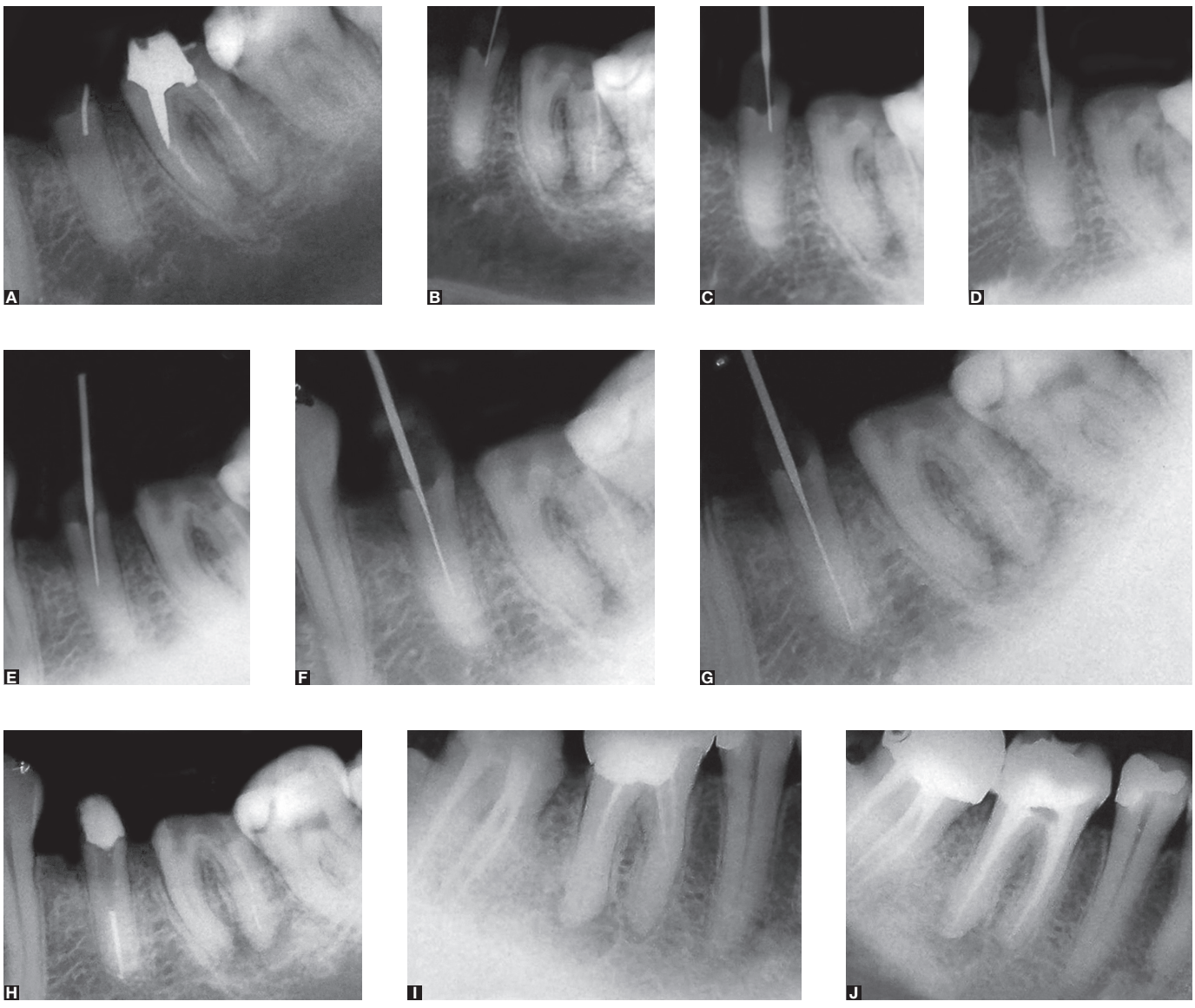

Figure 3. (**A**) Preoperative radiograph. A dentin post can be noticed. Initial access. (**B**) The tooth was isolated without clamp. (**C**) Angulated radiograph demonstrating buccal deviation. 1-2mm apical insertion. (**D**) The deviation persisted. (**E**) After correction in the file position, it was inserted1-2mm apically. (**F**) It seems to be mesially dislocated. (**G**) Deviation correction. (**H**) Patency reached. Final radiograph. Preoperative radiograph. (**I**) The mesial root canals are completely obliterated. (**J**) Final radiograph demonstrating success in root canal re-treatment.

that some form of patent canal usually persists in these cases.[6,11] However, the localization and access of calcified root canals are a challenge in endodontic practice[12] which may cause serious problems such as severe loss of dentine and perforation.[13]

The knowledge of root canal anatomy is paramount for the clinical success. It has been established that if the access preparation remains well-centered and aligned to the long axis of the tooth at the level of the cementum-enamel junction (CEJ), the root canal is normally easy to locate.[5,14] However, as shown in case 3, the absence of the crown associated with the obliterated root canal makes it difficult to identify exactly the long axis of tooth. The use of centered radiograph alone in these cases is not always helpful since it is seen in only two dimensions, compared with the three-dimensional structure of the tooth.[15,16] To overcome this limitation, centered and angulated radiographs were used in association to give us the third dimension of the roots. This clinical approach was previously demonstrated in the treatment of obliterated canals[17,18] and allowed us to control and adjust the course of the instruments during the access procedure and avoid gross cutting of dentin.

The modified instrument used in this study demonstrated to be efficient for initial pathfinding, since it has the rigidity required to transverse restricted spaces and can be used with vertical watch-winding forces with low incidence of buckle or fracture. A variety of 'pathfinding' instruments with different designs are available. The most common has a quadrangular cross-section that enhances rigidity;[19] however, the value of these instruments remains to be demonstrated.[19] Various burs and ultrasonic tips have been designed to locate and to enter calcified pulp chambers and canals. In the cases herein described, low speed burs associated with ultrasonic tips were used to selectively remove the calcified dentin under the operating microscope.

A better appreciation of the differences between the dentine deposited in the pulp chamber and that of the 'normal' surrounding dentine of the crown could be enhanced with the use of the operating microscope, which improved the outcome in the treatment of calcified canals, as previously described by others.[20,21,22] A 5% sodium hypochlorite solution was also important in the identification of obliterated canals. Its contact with the remnants of the pulp tissue resulted in a stream of bubbles which could be easily identified with the use of the operating microscope.

Conclusion

We attribute the success observed in these cases to the localization of patent canals and their complete debridement and sealing in full extension. The protocols herein described permitted the avoidance of unnecessary cutting of dentin and perforation of the teeth .The results reinforce the importance of centered and angulated radiographs to evaluate the depth reached by the modified instrument, slow speed burs and ultrasonic tips. Additionally the use of operating microscope and teeth morphology knowledge are also important components of endodontic treatment of obliterated canals.

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