Endodontic Challenges in the Management of Multiple Pulp Stones and Root Canal Calcification - A Case Report

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INTRODUCTION

Root canal calcification is currently a challenging and interesting case for endodontists. Removing microorganisms and their by-products from the root canal system is the goal of root canal treatment. Worse outcomes from root canal procedures can occur due to root canal calcification, as it can block access to the root canal and hinder cleaning and shaping. Iatrogenic errors may occur in the treatment of such cases which will lead to failure of endodontic treatment. This case report describes a 20-year-old woman with multiple pulp stones in the pulp chamber of the mandibular left first molar. In addition, there were also calcified root canals in the mesiolingual and mesiobuccal canals. The patient had asymptomatic irreversible pulpitis and had to undergo endodontic treatment. Several challenges were faced in this case. The initial challenge was to determine the location of the pulp stone in the pulp chamber. Radiographs taken from multiple angles, as well as a direct assessment of the cavity during access preparation, addressed this initial challenge. Retrieval of the pulp stone which in this case is the embedded type that was carried out by grinding it with the help of an ultrasonic tip. Other difficult challenges were avoiding perforation of the pulp chamber floor during treatment, especially when removing the pulp stone, and identifying the location of the orifice. With clinical knowledge, magnification aids and ultrasonic tips, successful treatment in this challenging case was achieved.

Calcific metamorphosis, sometimes known as pulp canal obliteration (PCO), is the extensive formation of tertiary dentin in the pulp chamber leading to circumferential narrowing of the pulp chamber and root canal. According to the AAE (American Academy of Endodontics), PCO is radiographic evidence of increased dentin production mainly in response to trauma. The result is a calcified canal and does not necessarily indicate pulp disease. Pulp calcification is a common occurrence. The incidence varies, but overall it can be estimated that 50 % of teeth have one or more calcifications.

There is no evidence to explain whether pulp calcification is a pathological process associated with various forms of injury or natural phenomena. In general, the pulp chamber becomes progressively smaller and often very small, a phenomenon known as calcified metamorphosis or obliteration of the pulp canal. Dentin can be accelerated by caries, trauma, abrasion, restoration, and periodontal disease and is not uniform.

Calcifications are divided into denticle (pulp stones) and diffuse (linear) calcifications. Pulp stones are divided into free, attached, and embedded types. Pulp stones tend to be found in the coronal pulp, and diffuse calcifications are found in the radicular pulp. It has been speculated that the nidi of calcification arise from degenerating nerves or blood vessels, but this has not been proven.


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Pulp stones are detected by radiographic examination by the presence of a single mass or several radiopaque masses visible within the pulp of varying size. Digital radiography taken from different angles could help the operator to determine the location of the root canal. In addition, images can also be used to see the teeth in more detail, so that diagnosis and positioning of the pulp stone can be done accurately. If the radiograph shows the presence of calcifications that can block access into the root canal, then a small file is used to fit into the narrow gap.

Root canal obliteration may be partial or almost complete (after several years) and does not indicate the need for root canal treatment unless other signs and symptoms suggest pulp necrosis.

Root canal treatment with pulp stone and canal calcification is a challenge for endodontists because there is a risk of perforation of the pulp chamber floor when removing the pulp stone, difficulty in determining the orifice that is hard to observe directly, and also difficulties in negotiation and penetration into the root canal until it reaches its working length without causing perforation.

Case Report

A female patient, 20-year-old, came to the dental conservation clinic, complaining of a cavity in the lower-left molar 7 months ago. The patient had never been to the dentist. Clinical examination revealed that tooth #36 had caries (Figure 1). The tooth gave a positive response to the electric pulp test and was not tender to percussion and palpation. The mobility test was negative.

Based on radiographic examination (Figure 2), there were two pulp stones (more radiopaque) in the pulp chamber. There was a radiolucency in the pulp chamber (Deep caries to the pulp / D6). Two mesial root canals with overlapping positions on X-rays appeared as two calcified mesial roots from the orifice, one distal root with one root canal. At the apical distal root the lamina dura was severed, and the periodontal ligament/PDL space was widened. To assist imaging, the SLOB (Same on Lingual, Opposite on Buccal) technique (Figure 3) and contrasted radiography (Figure 4) were used.

This is a pulp stone case with mesiobuccal and mesiolingual root canal calcification of tooth #36. The patient was also diagnosed with asymptomatic irreversible pulpitis.

At the first visit, informed consent was obtained and followed by local anaesthesia (2 % lidocaine with 1:100,000 epinephrine) with the infiltration technique. 4.5x magnification was used using Carl Zeiss Eyemag Pro S. Then isolated with a rubber dam, followed by removal of carious tissue, and lingual wall rewelling. Preparation of access opening was done by diamendo (endo access bur), irrigation with saline. A calcified mass was seen in the pulp chamber, then it was removed with an ultrasonic tipping instrument ETBD (Satelect P5® Piezo).

Determination of the mesiobuccal and mesiolingual root orifices was done by staining with methylene blue and using magnification. The narrow canal was obtained/obliterated, and then negotiation & penetration was performed with an endodontic ultrasonic instrument, namely the ultrasonic tip ETBD (Satelect P5® Piezo). The clinical view of access preparation can be seen in Figure 5.

Pathfinding of mesiolingual and mesiobuccal root canals with C+ #6, #8, #10 Files (Dentsply, Tulsa, OK, USA) lubricated with chelating agent RC-Prep (15% EDTA gel) and obtained IAF # 10. Any increase in working length is confirmed by radiograph, to ensure the file remains in the centre of the root canal (Figure 6). Each file change was accompanied by 5.25 % NaOCl irrigation. Use of ultrasonic tip...
New ET 18D, on the mesiolingual and mesiobuccal canals. The mesiobuccal root canal was re-explored with C+ #8, #10 files coated with RC Prep (15% EDTA gel).

After getting the working length, chemomechanical preparation was carried out using the crown-down technique: shaping with ProTaper Gold up to #F2 on the mesiobuccal, shaping with Protaper Gold up to #F1 on the mesiolingual. Cleaning with 5.25% NaOCl + sonic activation (EDDY) 20-30 seconds, saline irrigation, and irrigation with 17% EDTA for 1 minute. The master cone was fitted and the radiograph was taken (Figure 7). Dried with paper points. Mesiobuccal MAC was obtained, namely gutta-percha F2 (Dentsply) and mesiolingual, namely gutta-percha F1 (Dentsply), radiograph of root canal dressing with CaOH, covered with a temporary restoration.

On the second visit 2 weeks later, the temporary restoration was opened. CaOH medicament was removed and then dried with paper points. Obturation (figure 8) was performed with a single cone + bioceramic sealer (ceraseal), X-ray to evaluate obturation, then placed RK Flow (bulk fill) as an orifice barrier and then closed with a temporary restoration.

At the third visit, a periapical x-ray was taken for obturation control. The colour was determined, and then isolated with a rubber dam, onlay preparation was carried out, and then a double impression was made. Covered with a temporary restoration.

On the fourth visit, the temporary restoration was removed. Try in onlay e-max, checked for occlusion and margin density, inserted with resin cement (Relix X U200, 3M). Then evaluated with X-ray photos to see gaps and checked fitness.

DISCUSSION

Canal calcification is a common occurrence and is usually asymptomatic. Tertiary dentinal processes are affected by trauma, caries, and several systemic diseases. Calcifications may manifest as pulp stone (dentine) or linear (diffuse). This is a pulp stone case with mesiobuccal and mesiolingual root canal calcification of tooth 36. The patient was diagnosed with asymptomatic irreversible pulpitis which was known from the complaint of a cavity in the lower left molar. The patient was also diagnosed with apical periodontitis. From the existing studies it is said that the development of apical periodontitis after PCC is unavoidable, and endodontic treatment should be avoided unless there are signs and symptoms of infection. Several long-term studies report a 7% - 27.2% range for the development of apical periodontitis after PCC.[6]

Endodontic treatment of pulp stone and canal calcification is a challenging case for endodontists. In root canals of teeth that have calcified deposits blocking access to the canals, treatment efforts are often cautioned. Attempts to locate residual canals can remove a large amount of dentin and risk root perforation or fracture.5 Pulp stone in this case was known from a radiographic view. Based on the periapical radiograph, a pulp stone was suspected which was characterized by multiple radiopaque features in the pulp chamber. This photo was then emphasized with an inversion image of the digitally processed photo. In addition, photographs were also taken from various angles, especially to determine the location of the calcified root canal. To assist imaging, the SLOB (Same on Lingual, Opposite on Buccal) technique and contrasted radiography were used.

Pulp stone removal is also a challenge because of the risk of perforation of the pulp chamber floor. Ultrasonic tips of small and thin size are more recommended than using a bur.
to remove dentin tissue so that the risk of perforation is less.[7] This instrument has a working principle when the instrument tip vibrates at high speed to create sound waves that can break up calcifications. The location of the canal orifices can be easily identified by removing the calcified tissue at the base of the pulp chamber. In this case, an ultrasonic tip ETBD (Satelect P5®Piezo) was used. This ultrasonic uses a special diamond-coated tip, which can remove calcification, and can also provide maximum cutting efficiency and good control when used in the pulp chamber.

There are several "pathfinding" instruments that have been introduced. The DG-16 explorer is a very useful instrument in canal hole locations. Instruments with a reduced flute can also be used, such as the canal pathfinder (JS Dental, Ridgefield, Conn). Pathfinder CS (Kerr Manufacturing Co.) can also be used because it has greater shaft strength and is more likely to penetrate highly calcified canals. The C+ file (Dentsply, Tulsa, OK, USA) is an ideal instrument for early instrumentation of calcified root canals. They have cutting ends that bind to the dentin. In this case, a C+ file was used and it gave good results.[6]

It is also challenging when determining the location of the orifice. In an obliterated tooth, the root canal may be narrow, and difficult to locate or negotiate but this space can be a space with millions of microorganisms in it.[8] Krasner and Rankow have provided a guide for identifying the location of the orifices within the pulp chamber using the law of symmetry, the law of colour change and the law of orifice location. This helps in assessing the location of the orifice.[9]

The magnification technique in endodontics helps determine the location of obliterated root canals. The microscope directly with magnification can see the bottom of the pulp chamber, with high light intensity so that the pulp chamber area can be seen in detail.[10]

The method used in this case is methylene blue dye which is used to help locate the orifice under a microscope. Sodium hypochlorite can also be used to identify root canal obliteration by performing a “bubble” or “champagne” test. This event can be seen under a microscope so that the location of the orifice can be known.[10]

Negotiation of a narrow root canal in an obliterated root canal is a challenge. Small files #6, #8 and #10 are commonly used at the start of pathfinding. However, the file is rigid and often fractures when used with watch-winding vertical stresses. The solution to this is to use files #8 and #10 with light watch-winding pressure and the files should be replaced before the instrument fatigues.[11] In this case, C+ Files (Dentsply, Tulsa, OK, USA), are ideal for initial instrumentation in obliteration, as they have a cutting tip that can cut through the dentin. It should be noted when negotiating and penetrating obliterated root canals and the clinician should not rush and the instrument should be inserted passively.[8]

The chelating agents should be used when preparing root canals, especially in narrow and calcified canals. The apical dentin is often sclerotic and more mineralized.[12] Ethylenediaminetetraacetic acid (EDTA) acts on calcified tissue by replacing calcium ions in sclerotic dentin with sodium ions, making them more soluble. At normal concentrations, EDTA removes 10.6 g of calcium from 100 g of calcium.[13] EDTA results in demineralization of dentin to a depth of 20-30 % within 5 minutes. Liquid irrigation material can reduce torsional loads while paste/gel-shaped materials can increase the ability to cut tissue during instrumentation.[14] Lubrication during root canal preparation can also reduce the mechanical load on the instrument, thereby reducing the risk of instrument fracture.[15] EDTA liquid solution is placed in the pulp chamber with a pipette or cotton pellet to identify orifices in obliterated root canals.[6]

CONCLUSIONS

The case presented is one of the most challenging cases encountered by endodontists. Success is achieved with clinical knowledge, magnification aids and ultrasonic tips.

REFERENCES