Non-surgical retreatment and perforation repair in a maxillary first molar

John Rhodes describes the non-surgical retreatment of a maxillary first molar and the management of a pulp floor perforation

CPD Aims and objectives

This clinical article aims to present a case of a patient undertaking non-surgical retreatment for a failed root filling and chronic periapical (periradicula) abscess.

Expected outcomes

Correctly answering the questions on page 29, worth one hour of verifiable CPD, will demonstrate that the reader understands the diagnosis and management of non-surgical retreatment.

A 52-year-old man was referred to an endodontic specialist following an attempt to retreat UL6. Unfortunately, a Gates Glidden bur had broken while attempting to remove gutta percha from the root canals and could not be retrieved. A comprehensive medical history was uncomplicated.

Clinical examination

Intraoral examination revealed that UL6 was slightly tender to palpation. The tooth was restorable and had a temporary (MO) compomer filling sealing the access. There was no abnormal mobility, no significant or increased periodontal pocketing nor bleeding on probing. Soft tissue examination revealed that there was a buccal sinus tract through which pus could be expressed.

Sensitivity testing with Endo-ice (Coltene) showed that the adjacent teeth were vital. A paralleling periapical radiograph of the UL6 was exposed using a Rinn Holder (Rinn, Dentsply). The radiograph showed good marginal bone levels. The UL5 and UL7 were minimally restored with no evidence of periapical pathology and the root canals appeared sclerosed. An unerupted UL8 was present. The UL6 had been root-filled with gutta percha but the canals were under-prepared and under-filled. The second mesiobuccal canal (MBII) had been located.

A fractured Gates Glidden bur was lodged in the distobuccal canal. The inferior border of the maxillary antrum was visible and reached its lowest point between the first and second molars. There was potential radiolucency in the trifurcation and periapically around the mesiobuccal root, however, this was masked by the proximity of the antrum.

Diagnosis

The diagnosis was a failed root filling and chronic periapical (periradicular) abscess. The root canal filling had most probably failed as a result of persistent bacterial infection in the root canal. The treatment options were as follows:

1. Root canal retreatment and restoration with a cusp coverage onlay or crown
2. Extraction and nothing
3. Extraction and replacement with an implant.

The prognosis for root canal retreatment should be good and the patient could expect the tooth to remain functional for many years. Replacement with an implant may be feasible but generally well root filled and restored teeth appear to function comparably to single tooth implants (Hannahan and Eleazer 2008; Torebinejad and Parirokh, 2007). Restored natural teeth also tend to be less costly to repair if and when they fail, as reported by Pennington and colleagues (2009). After discussing all the treatment options the patient elected to have the UL6 retreated non-surgically.

Treatment

A two-visit strategy was adopted in this case to ensure adequate disinfection of the root canals, allow optimal management of a pulp floor perforation and confirm healing of the sinus tract before obturation.

Profound anaesthesia was provided by buccal and palatal infiltration of 4% Articaine 1:100,000 Adrenaline (Septodont). Single tooth isolation with latex rubber dam and a number 14 clamp provided a controlled operating field. Using an operating microscope the existing compomer filling was removed with a long-tapered diamond bur, and the margins of the cavity refined.

A cotton wool pellet was removed from the access cavity and after rinsing with 3% sodium hypochlorite a preliminary survey of the pulp floor could be carried out under low magnification with the operating microscope. This showed the fractured Gates Glidden bur seated in the distobuccal canal and a moderately large perforation adjacent to the mesiobuccal canal, extending into the furcation. Granulation tissue was visible through the perforation.

Gates Glidden burs provide a very efficient means of removing gutta percha and have a fail-safe stress-point at the end of the shaft, so that if they break, retrieval is easier. If they fracture when embedded in gutta percha, this cools and hardens around the bullet-shaped tip making them more difficult to remove. A simple technique to overcome this involves vibrating the fractured piece with a dry ultrasonic tip; the energy is dissipated as heat, re-plasticising the gutta percha and allowing removal with Stieglitz forceps.

In this case the fragment of Gates Glidden bur was vibrated with a Start-X tip number three (Dentsply). The remaining bulk of gutta percha in all canals was rapidly removed with a Gates Glidden size two and Hedstroem file size 30 (Dentsply). Straight-line access to all canals was then refined. Working length estimations were made with an apex locator (Endo Analyzer, Sybron) and size 10 Flexofile (Dentsply Maillefer). A steady zero reading was achieved in all canals despite the perforation.

Patency was confirmed and glide paths created in the primary

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Figure 1: The UL6 and buccal sinus tract

Figure 2: A paralleling radiograph showing a technically poor and failing root filling UL6

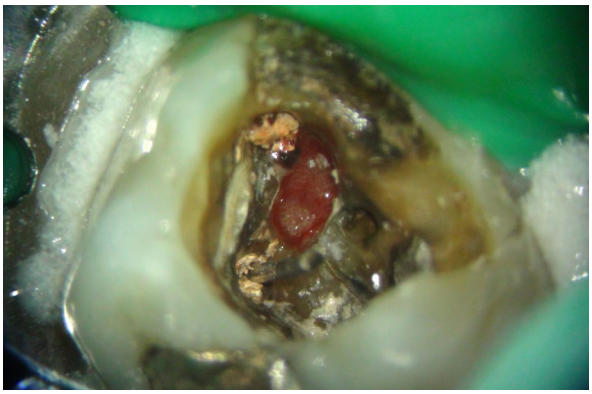

Figure 3: The pulp chamber floor showing a perforation; there is gutta percha in the MBI and a fractured Gates Glidden bur in the distobuccal canal

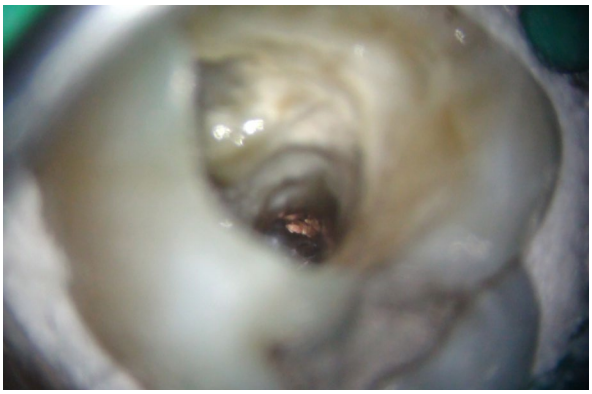

Figure 4: Gutta percha tags on the wall of the palatal canal were removed with micro-openers and chloroform solvent

root canals with a Proglider rotary instrument (Dentsply Maillefer), these were then rapidly tapered using reciprocating Waveone primary and large instruments (Dentsply Maillefer). The canals were kept flooded with sodium hypochlorite and patency recapitulated throughout preparation.

The root canals were inspected under high magnification and any tags of gutta percha on the canal walls removed with an endo-explorer (Dentsply Maillefer). A small amount of Choroform, which was wicked with sterile paper points, was used as a solvent to dissolve any gutta percha lodged in lateral anatomy.

The root canal system was disinfected with a solution of heated 3% sodium hypochlorite (Teepol) irrigant, delivered using a safe-ended needle (Henry Schein). The needle was pre-bent and kept moving in the root canal to prevent extrusion of irrigant.

Disinfection was carried out over approximately 30 minutes. The sodium hypochlorite was agitated with a size 20 Irrisafe ultrasonic tip (Satelec) and an Endoactivator (Dentsply) with a red tip. The solution was replenished every two minutes. A final sequence of 40% citric acid (Cerkamed) and 3% sodium hypochlorite completed irrigation. Sodium hypochlorite solution was able to penetrate the perforation site, but was not injected into it. The canals were dried with sterile paper points (Dentsply) and non-setting calcium hydroxide placed (Calasept). Collagen matrix (Hemocollagene Septodont) was packed through the perforation site to form a matrix onto which Biodentine (Septodont) was compacted. Once set, the access was sealed with Cavit (ESPE) and Fuji IX (GC).

One week later the sinus had healed, the tooth was symptom free, the canals dry, the integrity of the Biodentine confirmed and the tooth ready for obturation. Calcium hydroxide inter-appointment medicament was removed with alternate citric acid and sodium hypochlorite irrigation. The canals were then dried and obturated with vertically compacted thermoplasticised gutta percha and Ahplus sealer (Dentsply).

Biodentine was packed into the coronal 3-4mm of the MBI and MBII canals to ensure that the perforation site was well sealed. (Should the MB root ever need to be resected this material would provide a good seal.)

Once the Biodentine had set, Fuji IX was used to seal the pulp floor. A Paldodent Plus sectional matrix (Dentsply) was placed and the cavity thoroughly washed. The cavity was selectively etched with 30% phosphoric acid and Scotchbond (3M Espe) dual cure bonding agent applied. A composite core was constructed with flowable bulk-fill composite (Smart Dentine replacement [SDR] Dentsply) and Ceram-X mono.

A final paralleling radiograph was exposed using a Rinn Holder. This showed a well oburated root canal system and homogenous coronal seal with no voids. A cusp coverage restoration was to be provided by the referring dentist to help prevent fracture.

Reviews will be carried out at one year and subsequently at two and four years if required in line with the guidelines set out in the consensus report by the European Society of Endodontology (2006).

Discussion

Iatrogenic pulp floor perforation can occur if the operator becomes disorientated when trying to locate canal orifices. The importance of using illumination and magnification during endodontic procedures cannot be overemphasised (Buhrley et al, 2002; Schwarze et al, 2002).

Perforation repair can be technically challenging and offering referral if treatment is beyond the expertise of the operator is good practice (General Dental Council, 2013). Management of

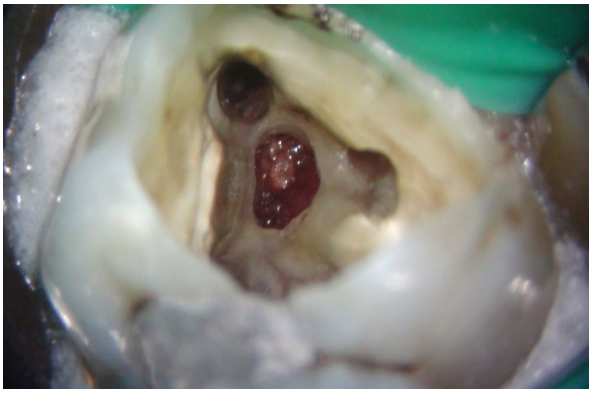

Figure 5: The pulp floor just prior to perforation repair and placement of calcium hydroxide medicament

Figure 6: The canals irrigated and dried ready for obturation

Figure 7: Biodentine was packed into the coronal part of the MBI and MBII and across the pulp floor between them

Figure 8: The completed composite core

iatrogenic perforation is dependent on several factors, as shown by Fuss and Trope (1996).

Level

There is a high risk of microleakage when perforation occurs at crestal bone level. Obtaining adequate coronal seal can be difficult and direct communication with the oral cavity via the periodontal tissues means the prognosis may be guarded. If bone is present on the external aspect of the perforation, repair is normally feasible.

Location

Perforations that have damaged the root canal orifice can be more difficult to seal. In this case there was dentine around the periphery of the mesiobuccal canal and the perforation was positioned away from any isthmus between the MBI and MBII.

Size

The larger the perforation, the greater the surface area that will need to be sealed.

Time

It is preferable to seal a perforation as soon as possible to prevent microleakage and bacterial contamination.

During retreatment the existing material, any obstructions and missed canals should be prepared and disinfected as efficiently as possible and at the first visit (Van Nieuwenhuysen, 1994).

When retreating teeth that have been obturated with gutta percha most of the filling material can be removed mechanically. Gates Glidden burs are extremely efficient and once a glide path has been established tapering the canal with nickel-titanium instruments will remove most of the remainder. Material lodged in fins and isthmuses will need to be removed using a solvent (Ferreira, Rhodes and Pitt Ford, 2001). Mechanical preparation will reduce the bacterial load in an infected root canal (Byström and Sundqvist, 1981) but sodium hypochlorite in a concentration of at least 1% is required to kill the majority of bacteria in a contaminated canal system, as shown by Byström and Sundqvist (1983). Bacteria aggregate as biofilms on the root canal wall. These bacteria are surrounded by matrix and can be difficult to remove.

Irrigants used during endodontic treatment therefore have to be agitated to disrupt biofilm (Ahmad, Pitt Ford and Crum, 1987). Ultrasonic activation removes more debris form the root canal than syringe irrigation alone (Burleson et al, 2007). A solution of 17% EDTA or citric acid as a final rinse (Byström and Sundqvist, 1985) is used to remove smear and has a positive benefit on outcome in retreatment cases (Ng, Mann and Gulabivala, 2011).

The concept of a two-visit strategy using a chemomechanical approach has been adopted since the 1980s. Dressing the canals (after preparation and disinfection) with calcium hydroxide for seven days was shown to be effective at producing bacteria free canals (Byström, Claesson and Sundqvist 1985; Sjögren et al, 1991). Universal use of a two-visit approach has been questioned as calcium hydroxide and sterile saline slurry limits but does not completely prevent regrowth of endodontic bacteria (Peters, 2002). A systematic review of the literature reported that multiple visits with calcium hydroxide treatment did not improve clinical outcome, and there was a minimal level of evidence for considering one versus two appointments in non-surgical endodontics (Hargreaves, 2006).

Many endodontists have therefore adopted a single visit approach for many cases with no significant postoperative

difficulties nor reduced prognosis, such as Ng, Mann and Gulavbivala (2011). Contrary to this, a two-visit strategy was adopted in this case to allow setting of the perforation repair material and confirm healing of the sinus tract before obturation.

Calcium silicate cements such as Biodentine and MTA have excellent sealing abilities and have many reported uses in endodontics (Parirokh and Torabinejad, 2010). The excellent performance of MTA in surgical endodontics is well published (Chong, Pitt Ford and Hudson, 2003). Long-term follow-up case studies have demonstrated that MTA can be predictably used as a repair material for furcal perforation, such as from Pace, Giuliani and Pagavino (2008).

Biodentine contains tricalcium silicate with additives as powder and a liquid containing calcium chloride to speed up setting. Calcium silicate materials have excellent biocompatibility and are able to induce calcium-phosphate precipitation at the periodontal ligament interface allowing bony healing Tay and colleagues (2007) and Torabinejad and Parirokh (2010). With a reduced setting time compared to MTA, Biodentine is perhaps more user-friendly for perforation repair (Wongkornchaowalit and Lertchirakarn, 2011).

Definitive restoration of root filled molar teeth with loss of marginal ridges should encompass cusp coverage to reduce the risk of tooth fracture under masticatory forces (Whitworth, Walls and Wassell, 2002; Sorensen and Martinoff, 1984). In this case the final restoration was to be completed by the referring dentist.

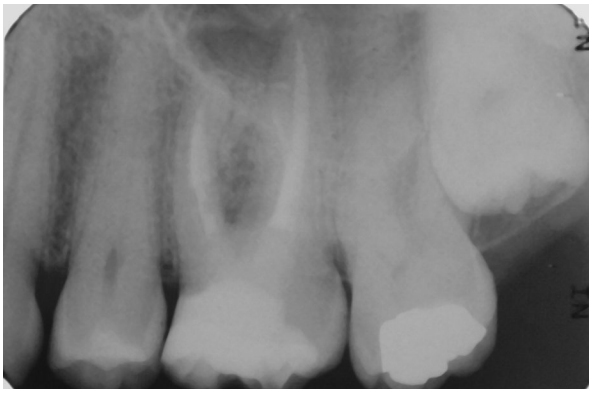

Figure 9: A final radiograph shows well obturated canals and homogenous coronal seal with core material

Conclusion

This article highlights the diagnosis and management of non-surgical retreatment, instrument removal and perforation repair with microendodontic techniques and Biodentine. ■

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