Case summary

Root canal treatment of tooth 46

Composite core placement

Definitive restoration with a porcelain-bonded crown

Patient details

Sex:

Age:

Occupation:

Referral details

The patient had been referred to the Endodontic New Patient clinic by her general dental practitioner for root canal treatment of tooth 46.

Presenting complaint

The patient had presented with the complaint of dull aching pain from the lower right region.

History of presenting complaint

The patient had been experiencing pain for approximately 6 months. The pain had not improved since the patient's dental practitioner had attempted root canal treatment two months previously.

Relevant medical history

Unremarkable

Dental history

The patient had been a regular attendee at her general dental practitioner for approximately 5 years.

Social history

The patient was a non-smoker and only drank alcohol occasionally.

Examination

Extra oral -

No abnormalities of facial symmetry or temporomandibular articulation.

No extra oral swelling or sinus tracts evident. Tooth 46 was not in the patient's smile line.

Intra oral -

Soft tissues: No abnormalities were detected.

Periodontal condition: The patient's oral hygiene was fair with some supragingival calculus on the lingual aspects of the lower incisor teeth.

BPE score

0	0	1
0	2	0

Occlusion

The patient had a class III incisal relationship with an anterior open bite. The molar relationship was class III on a class II skeletal base. The guidance in lateral excursions was group function on both sides.

Teeth present

	O											O	
7	6	5	4	3	2	1	1	2	3	4	5	6	7
7	**6**	5	4	3	2	1	1	2	3	4	5	6	7
	OB											O	

Tooth 46

The tooth was restored with an extensive occluso-buccal temporary restoration, which had worn down (**Figure 1**). The remaining buccal wall was thin and some marginal caries were evident around the temporary restoration (**Figure 2**).

Tooth 46 was tender to axial percussion but there was no tenderness to palpation in the buccal sulcus adjacent to the tooth.

Special tests

Sensitivity testing

Tooth 46 failed to respond to thermal and electrical sensitivity testing. Teeth 36, 37, 45 and 47 all responded to both thermal and electrical testing.

Pre-operative radiograph

A paralleled periapical radiograph of the lower right molar region; significant findings - a furcal radiolucency associated with tooth 46 (**Figure 3**). A fractured endodontic instrument in the coronal third of the mesial root.

Diagnosis Tooth 46:

A pulpless, previously accessed tooth with a fractured file fragment in the mesial root and chronic apical suppurative periodontitis. A cracked or split tooth could not initially be excluded

Treatment options

1. Root canal treatment of tooth 46 followed by definitive restoration with a cast cuspal coverage restoration
2. Extraction then leave the gap or consider a denture, bridge or implant-retained crown
3. Simply monitor the disease (‘do nothing’) was discussed for completeness but not recommended given the presence of disease which would not resolve spontaneously and in the future may affect future treatment options

Treatment plan

1. Root canal treatment tooth 46
2. Composite core placement
3. Definitive restoration with a porcelain-bonded crown
4. Follow-up
5. Hygiene appointments were recommended for scaling and dental health education
6. Routine, whole-mouth care was to be gained by the patient's general dental practitioner (GDP)

Treatment

Rubber dam placement:

Rubber dam was secured over tooth 46 with a Hygenic 12A rubber dam clamp (Hygenic Fiesta, Coltène/Whaledent, Cuyahoga Falls, OH, USA - **Figure 4**).

Access:

The entire temporary restoration was removed using a cross-cut carbide bur (SybronEndo Corporation, Orange, CA, USA). The pulp chamber was fully accessed and refined using a zirconium-nitride-coated ultrasonic tip (ENDO tip 2, ProUltra, Dentsply Maillefer, Ballaigues, Switzerland) under copious water spray. Two mesial and two distal canals were located, and straight line access was obtained with the use of Gates Glidden burs. The separated instrument could be visualised in the mesiobuccal canal following coronal flaring with Gates Glidden burs (**Figure 5**). Straight-line access to the instrument was further improved by careful use of a size 15 energised ultrasonic file (Obtura Spartan, Earth City, Missouri, USA - **Figure 6**).

Following troughing around the coronal part of the instrument, the instrument was loosened and removed (**Figures 6 and 7**).

The removed instrument was confirmed to be a Gates Glidden bur (**Figure 8**).

Copious irrigation with 1% sodium hypochlorite solution was utilised throughout the preparation of the root canals.

Preparation:

Following removal of the instrument from the mesiobuccal canal, the working lengths of all four canals were determined using an apex locator (Raypex 5, VDW, Munich, Germany):

Canal	Reference point	Length
Mesiobuccal	Mesiobuccal cusp tip	21.0 mm
Mesiolingual	Mesiolingual cusp tip	22.0 mm
Distobuccal	Distobuccal cusp tip	20.0 mm
Distolingual	Distobuccal cusp tip	21.0 mm

Figure 9: Apex locator working lengths

A working length radiograph was taken to verify the apex locator readings (**Figure 9**) which confirmed consistent and satisfactory length. Each canal was then prepared with a size 20 K-Flexofile to full working length, using the balanced-force technique.

The canals were instrumented with a size S2 ProTaper (Dentsply Maillefer, Ballaigues, Switzerland) rotary instrument to full working length, andthen with a size F3 ProTaper 1-mm short of full working length. Apical gauging of the four canals was then carried out using nickel titanium hand files. The mesial canals were both gauged to ISO size 35, whilst the distal canals were both gauged to ISO size 40. F3 ProTaper gutta percha points were customised to the aforementioned apical sizes with a sterile scalpel and were tried in the corresponding canals (**Figure 10**).

The root canals were rinsed with 17% EDTA solution (Pulpdent, Watertown, MA, USA), followed by a final flush with 1% sodium hypochlorite. The sodium hypochlorite solution which was activated using a size 15 ultrasonically activated file (Obtura Spartan, Earth City, Missouri, USA).

Paper points were used to dry the canals.

Obturation:

The canals were obturated with gutta percha and Kerr Pulp Canal Sealer EWT® (KerrHawe, Bioggio, Switzerland) using warm vertical condensation with System B (SybronEndo Corporation, Orange, CA, USA) and Obtura® (SybronEndo Corporation, Orange, CA, USA). A composite (Herculite, Kerr Corporation, Orange, CA, USA) restoration was then placed, ensuring that the composite sealed the canal orifices (**Figures 11 and 12**).

A post-operative radiograph of the completed root canal treatment was taken (**Figure 13**).

Restoration:

Following core placement, tooth 46 was definitively restored with a porcelain-bonded crown (**Figure 14 – 18**). Following the use of astringent (Racestyptine®, Septodont, Maidstone, Kent, UK) impregnated retraction cord (**Figure 14**), an impression was made (**Figure 15**) using an addition-cured silicone wash material (Aquasil, Dentsply Maillefer, Ballaigues, Switzerland). After checking for fit, occlusion and aesthetics the crown was cemented using AquaCem® (Dentsply Maillefer, Ballaigues, Switzerland).

Follow-up

In accordance with ESE guidelines, the patient was reviewed at one year, at which time the patient reported no problems. A follow-up radiograph of the tooth 46 was taken and there marked evidence of healing of the furcal radiolucency (**Figure 19**).

The tooth was again reviewed at 2 years. At this appointment, the patient did not report any symptoms and there were no clinical signs of persistent or recurrent disease. The GDP was advised to carry out further annual follow-up for 4-years or resolution of the apical radiolucency

Discussion

This case demonstrates the management of a non-vital lower first molar complicated by a separated instrumented in the mesiobuccal canal.

Clinical studies have shown that the prevalence of instrument fracture during endodontic treatment ranges from 1% to 6% (Crump & Natkin 1970, Spili *et al.* 2005, Iqbal *et al.* 2006). Although the reported incidence is low, retained fractured instruments may prevent adequate cleaning and shaping of the root canal system. As bacteria are the essential cause of apical periodontitis (Kakehashi *et al.* 1965, Sundqvist 1976), the inability to disinfect the entire root canal system may reduce the prognosis of treatment.

A number of factors have been demonstrated to influence the probability of instrument removal (Hülsmann & Schinkel 1999, Suter *et al.* 2005). The location of the instrument in relation to the curvature of the root canal appears to be critical (Hülsmann & Schinkel 1999); with instruments coronal to the curvature having the best prognosis for removal. The use of a surgical operating microscope appears to be of great benefit in the successful removal of fractured instruments (Suter *et al.* 2005). Specific to the instrument itself, the shape of the root canal, the length of the fractured file and the type of file appear to be important considerations (Shen *et al.* 2004).

The use of ultrasonic instruments allows the conservative removal of dentine to facilitate instrument removal (Ruddle 1997). In relation to this case, minimal dentine removal was necessary as the instrument was coronal to the curvature in the root canal. In addition, as there was no perforation of the root, the endodontic prognosis of the tooth is good.

References

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