CASE REPORT

'Split posterior tooth': conservative clinical re-attachment

Sathish Abraham,¹ Lisa Neelathil Chacko²

¹Department of Conservative Dentistry and Endodontics, S M B T Dental College & Hospital, Tal. Sangamner, Maharashtra, India

²Department of Periodontia, S M B T Dental College & Hospital, Tal. Sangamner, Maharashtra, India

Correspondence to
Dr Sathish Abraham,
abrahamsathish@yahoo.in

Accepted 20 July 2014

SUMMARY

Trauma is the prime causative factor for fracture of teeth/dentition. Many procedural management options are followed successfully in relation to the anterior teeth. However, most posterior cases where the tooth is fractured have only limited options to pursue to save the tooth. Fractured teeth, whether they are vital/non-vital, are predominantly managed with surgical options. This paper discusses a conservative approach to reattaching a split posterior tooth. A split tooth situation is mostly an absolute indication for extraction, but the clinician may go in for extensive surgical procedures if he/she wishes to save it. The reattachment of the tooth can be successfully done and it can be put to function. This paper discusses how a split posterior tooth can be treated successfully, although depending on multiple factors. A full crown cemented after successful reattachment and root canal therapy would provide sufficient support in order for the tooth to heal.

BACKGROUND

A split vital posterior tooth is a rare occurrence. Endodontically treated posterior teeth, if not restored with a full crown, may soon fracture because of reduced fracture resistance.¹ In such cases, the factors considered relevant are the remaining healthy tooth crown structure, restorative technique and material used for restoring the access opening.² With varying techniques such as conventional postobturation, access restoration in ideal access openings and postcore build up make a huge difference to fracture resistance of the endodontically treated teeth.³ The materials and clinical techniques used for such restorations play a pivotal role in providing long-term beneficial outcomes.⁴

However, as mentioned earlier, a split vital posterior tooth is somewhat rare. Reattachment of a posterior tooth can be successful depending on various factors presented with it.⁵ This is one such case where the procedure of clinical reattachment was done in a non-vital mandibular first molar where the tooth was already endodontically treated.

CASE PRESENTATION

A 27-year-old female patient visited us in the Department of Conservative Dentistry and Endodontics in S M B T Dental College, Maharashtra, India, with a fractured and severely painful right lower back tooth. Clinical examination revealed that the right mandibular first molar was fractured mesiodistally. History taking revealed that the patient had accidentally bitten on a piece

of bone in her meal the previous evening. The tooth was endodontically treated and the access opening had a temporary restoration. As the patient had reported early (within 12 h), an emergency treatment plan was performed. The concerned right mandibular first molar was orthodontically banded and the temporary restoration was removed. After complete debridement of the pulp chamber, the fracture line was assessed carefully. The fracture line was through to the furcation from the mesial to the distal aspect of the tooth. The fracture line was involving the root canal space. It was a typical two rooted mandibular first molar which had a standard three canal configuration.

INVESTIGATIONS

1. Clinical examination with a straight probe revealed the fracture line running mesiodistally.
2. A diagnostic intraoral periapical radiograph (IOPA) was taken but failed to reveal the fracture line. Adjacent periradicular tissues were radiographically normal.

TREATMENT

After anaesthetisation with an inferior alveolar nerve block, the two halves of the tooth were banded together as tightly as possible. Removal of the temporary restoration and debridement of the pulp chamber were performed to evaluate the fracture line. However, the tooth was root canal treated with gutta percha using AH plus, a resin based sealer. On careful probing it was confirmed to be a complete fracture which ran through from the crown to the furcation with involvement of the root canal space. The tooth was thoroughly cleansed prior to reattachment to remove the previously applied zinc oxide eugenol cement, which can hamper the properties of resin composite.

Clinical reattachment: A number 12 round bur was used with a slow speed hand piece for saucerisation of the entire intracoronary fracture line to a depth of 3 mm. On completion of saucerisation, the fracture towards the furcal area, which is on the floor of the pulp chamber, was restored with restorative glass ionomer cement after conditioning with a diluted polyacrylic acid. The fracture line towards the walls of the access preparation was etched and bonded using flowable composite resin. The tooth was temporarily restored with zinc oxide eugenol cement for an observational period of 2 weeks. The patient was advised to have a soft diet especially on the right side. The patient presented no clinical symptoms suggestive of a failure and was scheduled for completion. Access

CrossMark

To cite: Abraham S, Chacko LN. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-202695

restoration was completed with resin composite. The band was removed and the tooth was prepared for a full crown. The exposed extracoronal fracture line was restored with composite resin after saucerisation up to the gingival margins on the mesial and distal aspects. A temporary crown was cemented on for an observational period of another 2 weeks before loading the tooth with permanent porcelain fused to a metal crown.

OUTCOME AND FOLLOW-UP

The patient had an uneventful phase during the 2 weeks after successful endodontics. After the cementation of a full crown the patient did have slight discomfort which tapered gradually in 2 days, during which she was prescribed with analgesics. Clinical examination and radiological images confirmed satisfactory results even after 8 months. No gingival or periradicular changes were noticed in clinical and radiological examinations. Gingival sulcus depth around the concerned tooth appeared normal at a range of 1.5–2.5 mm throughout the procedure and follow-ups.

DISCUSSION

A vertical crown-root fracture of posterior teeth is a rather difficult scenario to treat successfully.⁶ There are several factors to consider before deciding which treatment modality could save the tooth.⁷ Currently, clinicians prefer more complicated surgical options like hemisection, bicuspidisation, root resection and reimplantation as treatment modalities to save a fractured posterior tooth.^{8–11}

A conservative clinical modality involving reattachment of fractured segments of posterior teeth is a potential methodology which could save many teeth. It reduces the requirement of complicated surgical procedures. However, this method requires professional skill and is dependent on various factors associated with a vertical crown–root fracture of posterior teeth. The significant factors which should be considered before attempting reattachment are:

1. Time elapsed.
2. Presence or absence of infection in and around associated tissues.
3. Fracture with/without loss of tooth structure.

4. Vital/non-vital tooth.

5. Fracture with/without involvement of pulp canal space (radicular).

All these factors play an important role in this treatment method and invariably decide the outcome of reattachment.

Time elapsed after the tooth fracture is the most significant factor to be taken into account.¹¹ Proper case history recording to know the details is mandatory to arrive at a definite conclusion on whether to try reattachment or not.¹² As in all trauma cases, if the patient reports early the success rate could be much higher. The more time has elapsed, the more chances of associated tissue structures getting infected, thus ultimately leading to failure through periodontal abscesses. It may be wise to get rid of the infection before trying reattachment. If there is no loss of tooth structure, it would be easy to approximate the fractured segments of the tooth before commencing reattachment¹³ through orthodontic banding to ensure tight approximation. A fracture with loss of tooth structure is more difficult to reattach and, therefore, may have a poorer prognosis. Non-vital teeth tend to fracture more often than vital ones. Numerous studies have proved that endodontically treated teeth should be strengthened with full crowns. However, studies have also reported that use of resin composite¹⁴ as the choice of material to restore access openings is beneficial since it has fracture resistance similar to that of teeth.^{15–17} Incidence of fractures in endodontically treated teeth may vary from population to population depending on diet and habits. Fractures involving the radicular pulp canal space is more difficult and complicated to treat with reattachment. Hence, all the aforementioned factors should be favourable for reattachment to achieve long-term clinical success. Fracture of posterior teeth without involvement of the radicular pulp canal space is even more favourable for reattachment through this conservative clinical reattachment procedure.

Clinical procedure

After history recording, the clinician should carry out indicated investigations to arrive at diagnosis of a split tooth. Vertical crown-root fractures that run mesiodistally (figures 1 and 2) are not evident on radiographs. Hence, methods like visual

Figure 1 Schematic representation. (A) Maxillary first molar. (B) Crown root fracture (vertical). (C) Access preparation on orthodontically banded tooth. (D) Saucerisation along the fracture line (intra and extra coronal). (E) Reattachment with glass ionomer cement and flowable resin composite after obturation. (F) Access restoration with resin composite and tooth preparation for full crown. (G) Reattachment of the extracoronal fracture line after saucerisation. (H) Full crown cemented.

SCHEMATIC REPRESENTATION

Figure 2 Clinical photographs. (A) Fractured mandibular first molar. (B) Assessment of fracture line. (C) Tooth banded orthodontically. (D) Rubber dam isolation for reattachment. (E) Removal of temporary restoration and assessment of fracture line. (F) Saucerisation of intracoronary and extracoronary fracture lines. (G) Reattachment with glass ionomer cement and flowable resin composite. (H) Access restoration with resin composite. (I) Postreattachment. (J) Tooth preparation for full crown (with saucerisation and restoration of the exposed extracoronary fracture line with resin composite). (K) Full crown cementation.

examination, careful probing, rubber wheel test,¹⁸ fibre-optic transillumination or even modern technologies like endomicroscopes and cone beam CT could be used to diagnose fractures.¹⁹

Once diagnosed, the tooth should be reinforced circumferentially through banding²⁰ (figures 1 and 2) in order to stabilise the fractured segments. This also ensures close approximation of the halves. The concerned tooth has to be anaesthetised and isolated with a rubber dam²¹ (figure 2). This clinical approach is most technique sensitive as it is dependent completely on adhesion and therefore needs absolute isolation.

In vital posteriors, the split tooth would require a root canal treatment (figure 1) and therefore a single sitting (visit) endodontic treatment should be done. In non-vital/endodontically treated teeth, the access restoration should be removed in order to

evaluate the fracture line carefully (figure 2). The tooth should be cleansed thoroughly to remove residues of the zinc oxide eugenol cement used for temporisation as it may hamper the properties of the resin composite. A number 12 (large) round bur is used at slow speed for saucerisation (figures 1 and 2) of the fracture line to a depth of at least 2–3 mm.^{22–24} Glass ionomer cement should be preferred to restore the saucerised part at the floor of the pulp chamber (figure 1). We should be concerned about good health of periradicular tissues. It helps to obtain a chemical bond between the tooth structure and the cement interface. A flowable resin composite should be used at the walls of access preparation and extracoronally to restore the saucerised fracture lines²⁵ (figure 2). A composite resin restoration should be done to restore the access preparation (figures 1 and 2).

Figure 3 Radiographic and clinical images. (A) Postreattachment. (B) 8 months follow-up. (C) 8 months follow-up with a mesial shift. (D) Clinical photograph after 8 months.

However, there are concerns about the fracture line towards the periodontal tissues remaining unattended to. This is a prime factor that could be discussed as a disadvantage with this procedure. The literature suggests that reattached fractured segments may heal in four different ways.^{26 27} Any of these may be responsible in achieving long-term clinical success in such a treatment modality. On removal of the band used for reinforcement and approximation of the fractured halves, crown/tooth preparation should be undertaken for providing a full crown^{4 12} (figures 1 and 2). Any fracture line remaining extracoronally should also be saucerised and restored with resin composite at this stage. An immediately cemented temporary full crown would ensure reinforcement until completion of the observational period (figures 1 and 2). Observational time may vary depending on the fracture type, materials used for root canal therapy and time elapsed after the incidence of fracture.^{8 10 11}

Considering all these factors, reattachment of split posterior teeth can be considered a potential option for better oral care and patient safety. Other than materials used in the present case, one can opt for more advanced materials as well as techniques (use of Biodentin in combination with hard tissue lasers) to fuse the fractured segments together. Hence, this method of reattachment of fractured posterior teeth would open up a lot of scope for further modifications and improvement both in techniques as well as material sciences.

Longer follow-up of these cases is mandatory to predict the outcome of treatment. However, this technique does provide an opportunity to treat such cases if all the factors concerned are positive and can save teeth. Every attempt, within permissible limits, should be made to save natural teeth. Glass ionomer cement (GIC) has proven itself to be an efficient chemically bonding restorative material. It also has additional advantages like anticariogenic properties. Unlike monomer components in composite resins, the molecular weight of polyacrylic acid is high, hence it does not penetrate the dentinal tubules. Mineral trioxide aggregate has a long setting time and may not be ideal for such a treatment modality. Biodentine, in combination with the use of hard tissue lasers could prove to be a suitable treatment modality for this technique. Overall, this report only suggests a novel technique to promote reattachment of vertically fractured teeth. More combinations of materials can be pursued as a research topic to identify which material combinations would work best in order to obtain better prognosis, thus serving the quest of saving natural teeth.

Reattachment of the right mandibular first molar reported here requires constant observation and care. IOPAs taken do not reflect the fracture line, as it is running mesiodistally. Follow-up radiographic examinations of up to 8 months do not indicate any periradicular changes, which suggests sound periodontal health (figure 3). Clinical examination confirmed good gingival health with the sulcus depth ranging from 1.5 to 2.5 mm (figure 3).

Learning points

- Time elapsed after fracture of the tooth is a predominant factor and would decide the outcome of this procedure.
- Approximation of fracture halves should be complete without loss of tooth structure for a better prognosis.
- Single visit endodontics should be preferred in vital cases.
- This conservative clinical approach should be preferred to more complicated surgical options currently used.

Proper oral hygiene instructions have been given to the patient, in addition to advice for periodical oral prophylaxis for good long-term care, which is vital for better prognosis.

Acknowledgements Dr Priya Yawwalikar, Dr Pratik Lahoti, Dr Neha Jaju and Dr Deepak Kakde.

Contributors SA and LNC have contributed significantly (as per your guidelines) towards this case report for publication in your esteemed journal.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Reeh ES, Messer HH, Douglas WH. Reduction in tooth stiffness as a result of endodontic and restorative procedures. *J Endod* 1989;15:512–16.
- 2 Mondelli J, Steagall L, Ishikiriama A, et al. Fracture strength of human teeth with cavity preparations. *J Prosthet Dent* 1980;43:518–21.
- 3 Steele A, Johnson BR. In vitro fracture strength of endodontically treated molars. *J Endod* 1999;25:6–8.
- 4 Goerig AC, Muenninghoff LA. Management of the endodontically treated tooth. Part II: technique. *J Prosthet Dent* 1983;49:491–7.
- 5 Pusman E, Cehreli ZC, Altay N, et al. Fracture resistance of tooth fragment reattachment: effects of different preparation techniques and adhesive materials. *Dent Traumatol* 2010;26:9–15.
- 6 Reis A, Loguercio AD, Kraul A, et al. Reattachment of fractured teeth: a review of literature regarding techniques and materials. *Oper Dent* 2004;29:226–33.
- 7 Farik B, Munksgaard EC, Andreasen JO. Impact strength of teeth restored by fragment-bonding. *Endod Dent Traumatol* 2000;16:151–3.
- 8 Andreasen JO, Andreasen FM. *Textbook and color atlas of traumatic injuries to the teeth*. Copenhagen: Munksgaard Publishers, 1993.
- 9 Loomba K, Loomba A, Bains R, et al. A proposal for classification of tooth fractures based on treatment need. *J Oral Sci* 2010;52:517–29.
- 10 Moule AJ, Kahler B. Diagnosis and management of teeth with vertical root fractures. *Aust Dent J* 1999;44:75–87.
- 11 Reis A, Loguercio AD. Tooth fragment reattachment: current treatment concepts. *Pract Period Aesthet Dent* 2004;16:739–40.
- 12 Hudis SJ, Goldstein GR. Restoration of endodontically treated teeth: a review of the literature. *J Prosthet Dent* 1986;55:33–8.
- 13 Farik B, Munksgaard EC, Andreasen JO, et al. Fractured teeth bonded with dentine adhesives with and without unfilled resin. *Dent Traumatol* 2002;18:66–9.
- 14 Reeh ES, Douglas WH, Messer HH. Stiffness of endodontically treated teeth related to restorative techniques. *J Dent Res* 1989;68:1540–4.
- 15 Van Meerbeek B, Lambrechts P, Inokoshi S, et al. Factors affecting adhesion to mineralized tissues. *Oper Dent* 1992;17(Suppl 5):111–24.
- 16 Hernandez R, Bader S, Boston D, et al. Resistance of fracture of endodontically treated premolars restored with new generation dentine bonding systems. *Int Endod J* 1994;27:281–4.
- 17 Joynt RB, Wiczowski G Jr, Klockowski R, et al. Effects of composite restorations on resistance to cuspal fracture in posterior teeth. *J Prosthet Dent* 1987;57:431–5.
- 18 Cohen S, Blanco L, Berman L. Vertical root fractures: clinical and radiographic diagnosis. *J Am Dent Assoc* 2003;134:434–41.
- 19 Kajan ZD, Taromsari M. Value of cone beam CT in detection of dental root fractures. *Dentomaxillofac Radiol* 2012;41:3–10.
- 20 Homewood CI. Cracked tooth syndrome—incidence, clinical findings and treatment. *Aust Dent J* 1998;43:217–22.
- 21 Liebenberg WH. Extending the use of rubber dam isolation: alternative procedures. Part I. *Quintessence Int* 1992;23:657–65.
- 22 Demarco FF, Fay RM, Pinzon LM, et al. Fracture resistance of re-attached coronal fragments—influence of different adhesive materials and bevel preparation. *Dent Traumatol* 2004;20:157–63.
- 23 Yoshikawa T, Burrow MF, Tagami J. The effects of bonding system and light curing method on reducing stress of different C-factor cavities. *J Adhes Dent* 2001;3:177–83.
- 24 Yoshikawa T, Sano H, Burrow MF, et al. Effects of dentin depth and cavity configuration on bond strength. *J Dent Res* 1999;78:898–905.
- 25 Uno S, Takada A, Sasaki T, et al. Inner hardness and cavity adaptation of composite resin fillings polymerized at a low power light source. *Jpn J Cons Dent* 1994;37:888–92.
- 26 Andreasen FM, Andreasen JO, Bayer T. Prognosis of root-fractured permanent incisors—prediction of healing modalities. *Endod Dent Traumatol* 1989;5:11–22.
- 27 Malhotra N, Kundabala M, Acharaya S. A review of root fractures: diagnosis, treatment and prognosis. *Dent Update* 2011;38:615–16, 619–20, and 623–4.

Copyright 2014 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow