



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

International Journal of Current Research
Vol. 10, Issue, 04, pp.67848-67853, April, 2018

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

CASE REPORT

ENDODONTIC MANAGEMENT OF MOLAR CUSPAL FRACTURE: CASE SERIES

***Dr. Debolina Chowdhury, Dr. Soumita Samanta, Dr. Monojit Roy, Dr. Priti Desai
and Dr. Das, U.K.**

Department of Conservative Dentistry & Endodontics, Guru Nanak Institute of Dental Sciences & Research/
The West Bengal University of Health Sciences, India

ARTICLE INFO

Article History:

Received 10th January, 2018
Received in revised form
26th February, 2018
Accepted 09th March, 2018
Published online 30th April, 2018

Key words:

Cracked tooth,
Cuspal fracture,
Orthodontic banding,
Endodontic treatment

ABSTRACT

Cracked tooth syndrome is a very common and well documented condition. Many morphologic, physical and iatrogenic factors predispose posterior teeth to an incomplete fracture. A cracked tooth is a tooth in which there exists a partial or incomplete fracture of a stress plane that commonly occurs in that tooth. A tooth stress plane results from occlusal forces that are commonly imposed on that tooth that may cause, during a masticatory cycle, an incidence of higher energy to occur within the stress plane lead to incomplete fracture. Epidemiologic data revealed that splits or complete or incomplete fractures are the third most common cause of tooth loss, indicating the high clinical significance of this syndrome. Diagnosis of such tooth is a difficult task because the patient often presents with various symptoms. These case reports describes the treatment of patients presenting with variable complaints of pain associated with biting and sensitivity of teeth. The prognosis of those teeth depends on the location and extent of the crack. Early recognition and treatment is the key for proper management of cracked tooth and preservation of tooth for function.

Copyright © 2018, *Debolina Chowdhury et al.* This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Dr. Debolina Chowdhury, Dr. Soumita Samanta, Dr. Monojit Roy, Dr. Priti Desai and Dr. Das, U.K. 2018. "Endodontic Management of Molar Cuspal Fracture: Case Series", *International Journal of Current Research*, 10, (04), 67848-67853.

INTRODUCTION

Cracks may initiate from coronal tooth structure or from within the root and affect healthy or root canal treated teeth. There are many terminologies and classifications in the literature for cracked teeth that can be as confusing as the array of clinical signs and symptoms which are associated with this condition. The term "cracked tooth syndrome" is misleading as there are a range of symptoms that do not form a distinct and reliable pattern. Symptoms will vary with teeth that have healthy pulps, for teeth with inflamed or necrotic pulps, and for teeth that have been root canal treated. The American Association of Endodontists have classified five specific variations of cracked teeth;

- Craze line,
- Fractured cusp,
- Cracked tooth,
- Split tooth, and
- Vertical root fracture.

The importance of differentiating dentin, pulpal and periodontal pain for diagnosis and treatment for these specific entities are of utmost importance.

***Corresponding author: Dr. Debolina Chowdhury,**

Department of Conservative Dentistry & Endodontics, Guru Nanak Institute of Dental Sciences & Research/ The West Bengal University of Health Sciences, India

Gibbs in 1954 first described the clinical symptoms of incomplete fracture of posterior teeth involving the cusp, naming it "cuspal fracture odontalgia". In 1957, Ritchey et al reported cases of incomplete fracture with subsequent pulpitis (Ritchey *et al.*, 1957). The term 'cracked tooth syndrome' was coined by Cameron in 1964. Cameron's cracked tooth syndrome described fractures that were not easily visible but the teeth responded painfully to cold or pressure applications and became necrotic despite an apparent healthy pulp and periodontium (Cameron, 1964). In the late 1970s, Maxwell and Braly advocated use of the term incomplete tooth fracture (Maxwell and Braly, 1977). Despite the introduction of further terms such as hairline fracture, incomplete crown-root fracture, split-root syndrome, enamel infraction, hairline tooth fracture, crown craze, craze lines and tooth structure cracks, Luebke considered fractures as either complete or incomplete (Luebke, 1984). Ellis¹⁵ defined incomplete tooth fracture as a "fracture plane of unknown depth and direction passing through tooth structure that, if not already involving, may progress to communicate with the pulp and/or periodontal ligament". Fractured cusps usually result from insufficient cusp support when the marginal ridge is weakened by an intra-coronal restoration. The crack often extends in mesio-distal and bucco-lingual directions commonly involving one or both marginal ridges as well as a buccal or lingual groove and terminates in

the cervical region either parallel to the gingival margin or slightly subgingival. The most common cause of an incomplete fracture is masticatory or accidental trauma. Unintentional biting with physiologic masticatory force on a small and very hard object may suddenly generate an excessive load that may cause the tooth to split.

Magnifying glasses, trans-illumination, staining with dyes are useful in visualizing cracks (Arens, 2003; Ellis *et al.*, 1996). Now a day's ultrasound imaging system is being used for crack detection (Culjat *et al.*, 2005). The use of radiographs to detect cracks is controversial.

Terminology and definitions for cracks/fractures in teeth:

1954	Gibbs ¹¹	Cuspal fracture odontalgia	
1954	Thoma ¹⁹	Fissured fracture	A crack in the crown of the tooth
1957	Ritchey <i>et al.</i> ²⁰	Incomplete tooth fracture	
1957	Down ²¹	Fissural fracture	Fractures involving enamel and dentin without loss of tissue
1961	Sutton ²²	Crack lines	A break in the continuity of the tooth revealed only by the presence of a visible transverse line
1962	Sutton ²³	Greenstick fractures	A fracture line forms in a part of a tooth underlying a cusp
1964	Cameron ²	Cracked tooth syndrome	
1972	Wiebusch ²⁴	Hairline fracture	
1973	Hiatt ³	Incomplete crown-root fracture	
1974	Talim & Gohi ²⁵	Incomplete coronal fracture	
1976	Silvestri ²⁶	Split-root syndrome	
1977	Maxwell & Braly ²⁷	Incomplete tooth fracture	A fracture of tooth structure which extends into dentin but in which the tooth remains grossly intact
1981	Andreasen ²⁸	Enamel infraction	An incomplete fracture (crack) of the enamel without loss of tooth substance
1981	Caufield ²⁹	Hairline tooth fracture	
1981	Johnson ³⁰	Crown craze/crack	Injury of enamel without loss of enamel
1983	Abou-Ras ³¹	Tooth structure cracks	A line that breaks or splits the continuity of tooth dentin surface but does not perceptibly separate the surface
1983	Abou-Ras ³¹	Crack/craze lines	Located in coronal enamel
1984	Luebke ³²	Incomplete tooth fracture	A demonstrable fracture but with no visible separation of the segments along the plane of fracture
1984	Kruger ³³	Cracked cusp syndrome	
1986	Brännström ¹⁸	Dentin crack syndrome	
1988	Williams ³⁴	Incomplete vertical tooth fracture	
1989	Lost <i>et al.</i> ³⁵	Tooth infraction	
1989	Schweitzer ³⁶	Odontiatrogenic tooth fracture	
1990	Ehrmann & Tyas ¹³	Cracked tooth syndrome	Incomplete fracture of a vital posterior tooth involving the dentin and possibly the dental pulp
1998	Zuckerman ¹⁷	Cracked tooth	Fractured segments are still joined to one another by a portion of that tooth through which the fracture has not yet extended
2001	Ellis ¹⁵	Incomplete tooth fracture	A fracture plane of unknown depth and direction passing through tooth structure that, if not already involving, may progress to communicate with the pulp and/or periodontal ligament

American Association of Endodontists classification of cracked teeth

Classification	Originate	Direction	Symptoms	Pulp Status	Prognosis
Craze Line	Crown	Variable	None	Vital	Excellent
Fractured cusp	Crown	M-D and/or F-L	Mild and generally, only to biting and cold	Usually vital	Good
Cracked tooth	Crown±Root	M-D often Central	Acute pain on biting Occasionally sharp pain to cold	Variable	Questionable: Dependent on depth and extent of the crack
Split tooth	Crown+Root	M-D	Marked pain on chewing	Often root filled	Poor unless crack terminates just subgingivally
Vertical root fracture	Roots	F-L	Vague pain Mimics periodontal disease	Mainly root filled	Poor: Root resection in multi-rooted teeth

A number of co-factors like extensive tooth preparation, unrestored deep carious lesions, teeth endodontic cells treated teeth, anatomical deep grooves or pronounced radicular grooves or bifurcation also make teeth susceptible to fracture. Iatrogenic factors like rotating instruments during cavity preparation, overzealous condensation of amalgam, excessive lateral condensation of Guttapercha and placement of friction lock or self-threading pins for restoration may also contribute to tooth fractures. Incomplete tooth cracks generally run in a mesiodistal direction (81.1%). Rarely horizontal, vertical or vestibular cracks are seen. These cracks are either limited to the crown or may involve the root. It is most commonly observed in teeth with no restorations (35%) and with class I restorations (39%) and with class II restorations (26%). The most prevalent age was over 40 years of age and the prevalence was similar in men (53.9%) and women (46.1%). Mandibular molars (67%) were more prone to incomplete fractures than maxillary molars (Byoung-Duck and Young-Eun Lee, 2006; Homewood Cracked tooth syndrome – Incidence, 1998). Sharp pain on relief of biting is important diagnostic evidence. It is speculated that this short and sharp pain is generated by an alternating stretching and compressing of odontoblastic processes located in the crack and also due to osmotic pressure change.

Radiographs may reveal the fracture line if it is in direct alignment with the central rays but since many fractures run mesio-distally, or in some intermediate plane, alignment is not possible then assessing the periapical and periodontal status of teeth is required (Byoung-Duck and Young-Eun Lee, 2006; Homewood Cracked tooth syndrome – Incidence, 1998; Rosen, 1992; Geurtsen, 1992). Different angulated radiographs also helps in detection of cracks. This case series represents management of fractured cusp of mandibular first molar with pulpal exposure by fracture fragment stabilization using orthodontic band followed by conventional non-surgical endodontic treatment. The primary goal is to splint and stabilize the fractured part of the tooth to prevent its further extension or complete fracture of the tooth and preservation of the tooth.

CASE REPORT I

A 18 year-old female patient reported to the Department of Conservative Dentistry and Endodontics, Guru Nanak Institute of Dental Sciences and Research with a chief complaint of fractured lower right posterior teeth after she met with a road traffic accident one week back. The extra-oral

examination revealed no significant findings. The post-traumatic neurologic and orthopedic status of the patient was non-contributory. Clinical examination revealed the presence of a mesio-lingual cusp fracture in relation to right mandibular first molar extending from the lingual groove to the mesio-proximal marginal ridge. Although the fragment was mobile, it was not displaced. The patient complained of pain during eating and sensitivity to cold foods. Medical and dental history were non-contributory. Radiological examination revealed a radiolucent line extending upto the pulp chamber. Pulpal exposure was revealed by clinical and radiographic examinations confirming the necessity of endodontic treatment in tooth 46.



Pic. 1. Preoperative picture

CASE REPORT II

A 19 year-old male patient came to the Department of Conservative Dentistry and Endodontics ,Guru Nanak Institute of Dental Sciences and research with a chief complaint of fractured lower right posterior teeth one week after he met with a road traffic accident. The extra-oral examination revealed no significant findings. The post-traumatic neurologic and orthopedic status of the patient was non-contributory. Clinical examination revealed redness associated with right mandibular first molar and the overlying area was tender to palpation. The tooth was tender to percussion. On closer inspection, a superficial crack was observed running in a mesio distal direction revealing the presence of a mesiolingual cusp fracture, extending on the lingual and mesial aspects of #46 extending from lingual groove to the mesio-proximal marginal ridge. The fracture fragment was mobile and undisplaced. The patient complained of pain during eating and sensitivity to cold foods .Medical and dental history were noncontributory. Electric pulp test and heat test with a gutta-percha stick gave a lingering response. Radiological examination revealed a radiolucent line extending upto the pulp chamber. Pulpal exposure was revealed by clinical and radiographic examinations confirming the necessity of endodontic treatment.



Pic. 2. Preoperative picture

CASE REPORT III

A 27 year-old male patient came to the Department of Conservative Dentistry and Endodontics ,Guru Nanak Institute of Dental Sciences and research with a chief complaint of fracture in lower right posterior tooth after he met with a road traffic accident one week back. Patient also complain pain during eating and sensitivity to cold foods. The medical history of the patient was noncontributory. Clinical examination revealed the presence of disto-lingual cuspal fracture in relation to right mandibular first molar which had an existing amalgam restoration. The mobile but undisplaced fracture extended from lingual groove to disto-proximal marginal ridge. Medical and dental history were non-contributory. Radiological examination revealed a radiolucent line extending upto the pulp chamber on the disto-lingual cusp. Pulpal exposure was revealed by clinical and radiographic examinations confirming the necessity of endodontic treatment in tooth 47.



Pic. 3. Preoperative picture

Treatment Procedure

For all the cases same treatment procedure was followed.

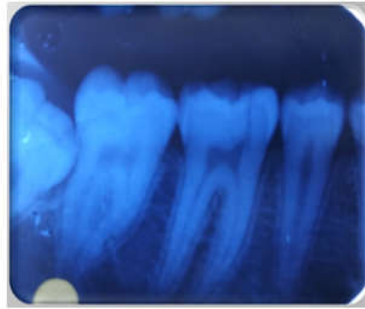
After administration of local anaesthesia Lignox 2% (Lignocaine) (Indoco Remedies Ltd), the tooth was banded with an orthodontic band .The band was luted in place with Glass Ionomer Cement. Access cavity preparation was done with no 4-round bur and endo access bur (Dentsply Endo Access Bur (Cutting Head) FG 2. Following the working length estimation with no 15 K file (Mani K-File 25mm Size 15) in #46, a thorough cleaning and shaping of the canals was performed with ProTaper Universal Files. The root canals were irrigated with 2.5% sodium hypochlorite (Hyposol, Prevent Denpro) and normal saline solution. The canals were dried with sterile paper points. At the second appointment the canals were obturated with F2 ProTaper gutta-percha cones using AH Plus sealer. The fractured fragment was sealed with flowable composite. The access cavity was restored with packable light cure composite resin. In the next appointment orthodontic band was removed and crown reduction was done followed by cementation of the PFM crown on #46. Follow up examinations was carried out after one week and three months and in all the three cases the tooth was functional and asymptomatic.

PICTURES

Case 1.



Inspection of fracture line



Preoperative radiograph



Orthodontic Banding



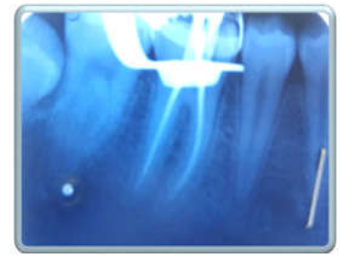
Access cavity



Working length radiographs



Master Cone radiographs



Post obturation radiograph



Tooth reduction



PFM Crown cementation and radiograph



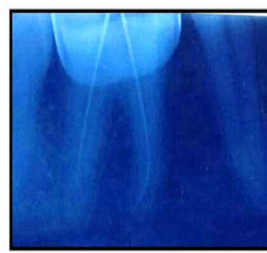
Case 2.



Preoperative radiograph



Orthodontic Banding



Working length radiograph



Master cone radiograph



Post obturation radiograph



Access cavity restoration



PFM Crown Cementation

Case 3.*Preoperative radiograph**Orthodontic banding**Canal instrumentation**Master cone fit**Post obturation radiograph**Access cavity restoration**Tooth reduction**Metal crown cementation***DISCUSSION**

Traumatic dental injury is a frequent common oral finding with its relatively high prevalence and significant impact on individuals and society. Dental fractures account for 26-76% of dental injuries in the permanent dentition. Trauma to the teeth may result either in injury to the pulp, with or without damage to the crown or root, or in displacement of the tooth from its socket. Traumatic injuries to teeth can occur at any age. A 12 year review of the literature reports that 25% of all school children experience dental trauma and 33% of adults have experienced trauma to the permanent dentition. Depending on age, the incidence is higher in boys than in girls, with male: female ratios varying from 2:1 to 3:1. Dental trauma and associated fracture of tooth often has a severe impact on the psychological wellbeing of a patient. This condition requires immediate attention/consideration for re-establishing both esthetics and function. It has been found that there is a positive emotional and social response from the patient to the preservation of natural tooth structure. A number of techniques have been developed to restore the fractured crown. Early techniques include porcelain jacket crown, orthodontic bands, pin retained restoration and composite resin. Tennery (1988) was the first to report the reattachment of a fractured fragment using acid-etch technique. Starkey and Simonsen (1979) have also reported similar cases. This technique can be used only when intact tooth fragment is available and close repositioning between fragments is possible. Reattachment of the tooth structure influences aesthetics by retaining natural translucency and surface texture. Requiring only a single, less time-consuming appointment for treatment, this procedure is relatively simple, atraumatic, inexpensive, and can be performed on anterior or posterior teeth. The remarkable advancements in adhesive systems and resin composites has made reattachment of tooth fragments a long term restorative treatment procedure offering a favorable prognosis.

In this procedure, the original tooth contours are restored, the conservative treatment allows future treatment alternatives, and a more predictable long-term appearance occurs following the placement of a minimal amount of composite at the restorative interface. Follow-up visits are critically important for all traumatic injuries. The patient should be followed for 3, 6, 12 months and yearly for 5 years. Esthetics, tooth mobility, and periodontal status should be confirmed both clinically and radio-graphically on these follow up visits. Fracture tooth reattachment allows restoration of the tooth with minimal damage to the remaining tooth structure. Various problems like differential wear of restorative material, unmatched shades and difficulty of contour and texture reproduction associated with other restorative techniques can be eliminated by the use of natural tooth structure. Reattachment of the fractured fragment was possible in these cases as the fracture fragment was intact.

Conclusion

Tooth fragment reattachment procedure offers an ultraconservative, safe, fast and esthetically pleasing result when the fractured fragment is available. Reattachment of the dental fragment as a restorative procedure has become possible with the improvement of adhesive techniques and restorative materials.

REFERENCES

- Agar JR, Weller RN. Occlusal adjustment for initial treatment and prevention of the cracked tooth syndrome. *JProsthet Dent* 1988; 60(2):145-7.
- Arens DE Introduction to magnification in endodontics. *JEsthetRestor Dent* 2003; 15(7):426-39.
- Bremer DB, Geurtsen W. Fracture resistance of human molars after adhesive restoration with ceramic inlays or composite resin fillings. *Am J Dent* 2001; 14:216-220.

- Byoung-Duck, Young-Eun Lee. Analysis of 154 cases of teeth with cracks. *Dental Traumatology* 2006; 22:118.
- C. I. Homewood. Cracked tooth syndrome – Incidence, clinical findings and treatment. *Australian Dental Journal* 1998; 43:4.
- Cameron CE. Cracked-tooth syndrome. *J Am Dent Assoc* 1964; 68:405-411.
- Casciari BJ. Altered preparation design for cracked teeth. *J Am Dent Assoc* 1999; 130(4):571-2.
- Davis R, Overton JD. Efficacy of bonded and nonbonded amalgam in the treatment of teeth with incomplete fractures. *J Am Dent Assoc*. 2000; 131(7); 848-52.
- Dewberry JA. Vertical fractures of posterior teeth. In: Weine FS (ed). *Endodontic Therapy*, ed 5. St Louis: Mosby, 1996; 71-81.
- Ehrmann EH, Tyas MT. Cracked tooth syndrome: diagnosis, treatment and correlation between symptoms and postextraction findings. *Aust Dent J* 1990; 35(2):105-12.
- Ellis S G S, McCord J F, Burke F J T. Predisposing and contributing factors for complete and incomplete tooth fractures. *Dent Update* 1999; 26: 150-158.
- Geurtsen W, Garcia-Godoy F. Bonded restorations for the prevention and treatment of the cracked-tooth syndrome. *Am J Dent* 1999; 12:266-270.
- Geurtsen W, Schwarze T, Gunay H. Diagnosis, therapy and prevention of cracked tooth syndrome. *Quintessence Int* 2003; 34(6):409-17.
- Geurtsen W. The cracked-tooth syndrome-Clinical features and case reports. *Int J Periodontics Restorative Dent* 1992; 12:395-405.
- Gibbs JW. Cuspal fracture odontalgia. *Dent Digest* 1954; 60:158-160.
- Gutmann J L, Rakusin H. Endodontic and restorative management of incompletely fractured molar teeth. *Int Endo J* 1994; 27: 343-348.
- Hiatt WH. Incomplete crown-root fracture in pulpal periodontal disease. *J Periodontol* 1973; 44:369-379.
- Ingle J I, Bakland L K. *Endodontics*. 4th edn, Philadelphia: Williams and Wilkins, 1994; 364-65, 537-38.
- Luebke R G. Vertical crown-root fractures in posterior teeth. *Dent Clin North Am* 1984; 28: 883-894.
- Maxwell E H, Braly B V. Incomplete tooth fracture: Prediction and prevention. *J Calif Dent Assoc* 1977; 5: 51-55.
- MO Culjat, RS Singh, ER Brown, RR Neurgaonkar, DC Yoon and SN White. Ultrasound crack detection in a simulated human tooth. *Dentomaxillofacial Radiology* 2005; 34:80-85.
- Ritchey B, Mendenhall R, Orban B. Pulpitis resulting from incomplete tooth fracture. *Oral Surg* 1957; 10:665-670.
- Rosen H. Cracked tooth syndrome. *J Prosthet Dent* 1982; 47:36-43.
- Trushkowsky R. Restoration of a cracked tooth with abonded amalgam. *Quintessence Int* 1991; 22(5):397-400.
