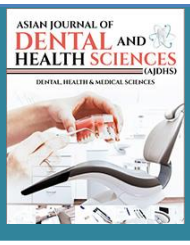

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Rehabilitation of a Cracked Tooth: A Case Report

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Abstract

A cracked tooth is a tooth in which there exists a partial or complete fracture of a stress plane. The prevalence of cracked teeth is relatively more in patients over 40 years of age. The incidence of cracks or incomplete tooth fracture with vital pulps is 9.7%. The average biting loads in humans range from 45.7kg/mm^2 (males) to 36.4kg/mm^2 (females) and the force ratio between molars, premolars, and incisors is 4:2:1 respectively.

A tooth stress plane results from occlusal forces that are commonly imposed on that tooth. This may cause an instance of higher energy to occur within the stress plane during masticatory cycle. The functional prognosis and periodontal treatment requirements of a cracked or incompletely fractured tooth depend on the location and amount of tooth structure intersected along with involvement in the stress plane.

This case report highlights the diagnosis and management of a cracked maxillary first molar and identifies the prognostic indicators, which are largely dependent on the extent of the fracture within the tooth structure.

Keywords: Crack tooth; Orthodontic banding; Ribbond; Bite test; Transillumination

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INTRODUCTION

Cracked Tooth Syndrome is a clinical diagnostic dilemma that typically manifests as phantom pain. However, the phrase cracked tooth syndrome is frequently deceptive because cracked teeth exhibit a variety of symptoms, and its unpredictability makes it a difficult diagnostic and therapeutic entity.

A cracked tooth is a tooth in which there exists a partial or complete fracture of a stress plane that commonly occurs in that tooth. Cracked tooth syndrome may be defined as a fracture plane of unknown depth, which originates from the crown, passes through the tooth structure and may extend subgingivally and progress to connect with the pulp space and/or periodontal ligament. The fracture may extend through either or both of the marginal ridges and the proximal surfaces. It may be located in the crown portion of the tooth only or extend from the crown to the proximal root surface. The location, direction, and extent of a crack have a profound effect on the choice of treatment.[1] As an occlusal crack is more centered and apical than a fractured cusp, it is more likely to cause pulpal and periapical pathosis.[2]

The occurrence of CTS is unknown, but an incidence from 34–74% has been documented.[3] In 2006, Roh and Lee reported that cracks were found more frequently in maxillary molars (57.2%) than in mandibular molars (36.3%).[4]Several authors have proposed classifications which are generally based on either the type or location of the crack, the direction and extent of the crack, and / or the risk of symptoms and /or pathological processes. The American Association of Endodontists[1] in a document titled “Cracking the Cracked Tooth Code” identified five types of cracks in teeth which are described in **Table 1.**

Table 1: 5 types of crack in a tooth according to AAE

CLASSIFIACTION	ORIGIN	SYMPTOMS	PULP STATUS	PROGNOSIS
 **Craze lines**	Crown	None	Vital	Excellent
 **Fractured cusp**	Crown	Mild pain on biting or cold	Usually vital	Good
 **Cracked Tooth**	Crown and root	Acute pain on biting or cold	Variable	Questionable
 **Split tooth**	Crown and root	Marked pain on biting or cold	Often root filled	Poor
 **Vertical root fracture**	Root	Often shows no symptom	Mainly root filled	Poor

Signs and Symptoms

The signs and symptoms associated with CTS are:

1. Acute pain on mastication (pressure or release) of grainy, tough foods and sharp, brief pain with cold.

2. Vary according to position and extend of incomplete fracture.

3. Pain associated with release of pressure called rebound pain is a consistent finding.

4. Sensitivity to sweets is seen occasionally.

5. Pulpal and periodontal symptoms occur when fracture extends to involve pulp.

6. May not be tender to percussion.

7. Radiographs may be inconclusive.

8. History of pain which may be difficult to co-relate.

9. History of treatments which may be failed to relieve the symptoms.

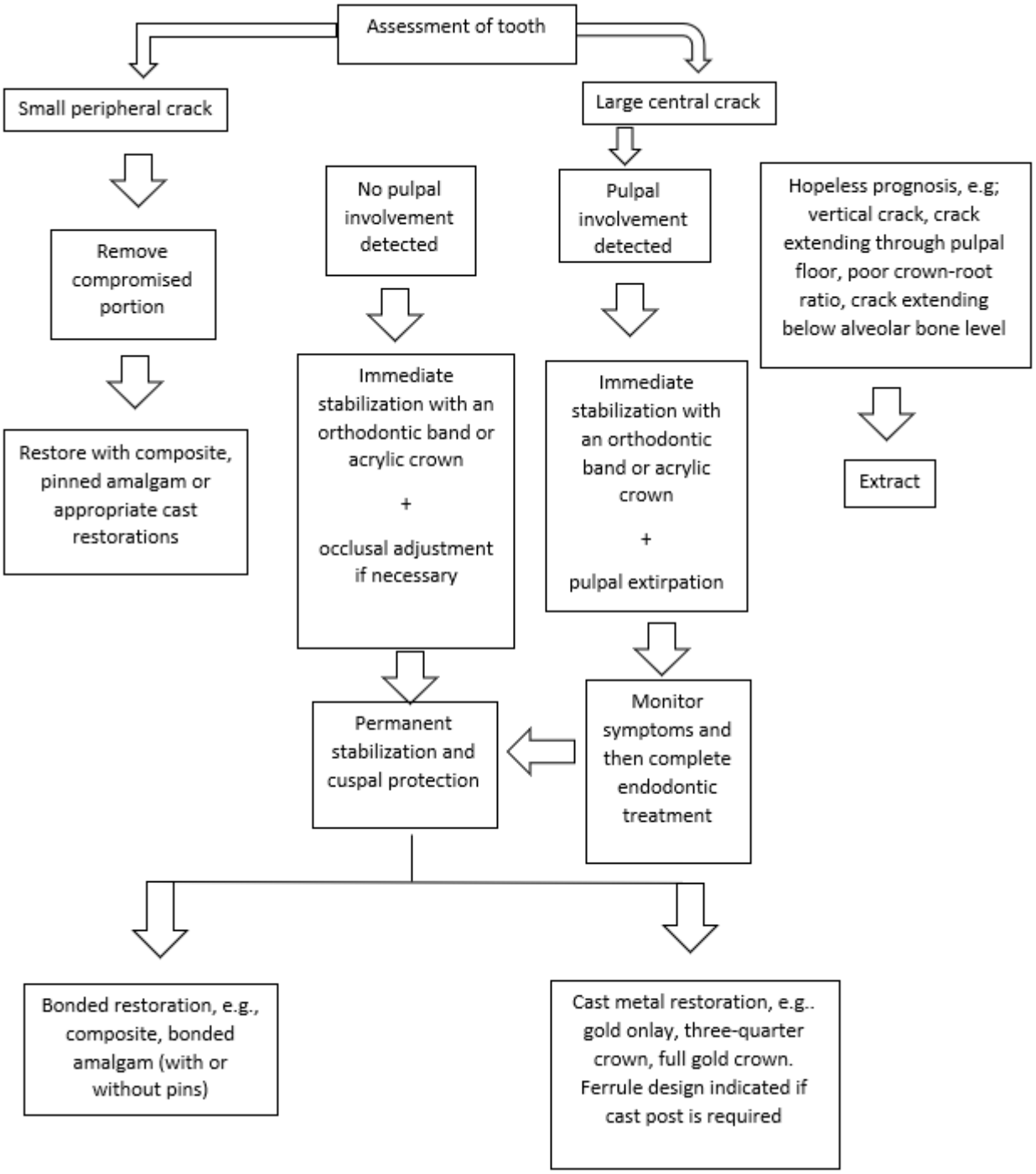
10. Difficult to identify the affected tooth.

Diagnosis

Successful diagnosis of CTS requires awareness of its existence and appropriate diagnostic tests. Pain on biting that ceases after the pressure has been withdrawn is a classical sign. Significantly, symptoms can be elicited when pressure is applied to an individual cusp[5]. Bite tests can be performed using various aids such as a toothpick, cotton roll, burlew wheel, wooden stick or the commercially available Tooth Slooth. Early diagnosis and intervention are important to limit the propagation of the crack, subsequent microleakage and involvement of pulpal and periodontal tissues.

Treatment Plan

The treatment requirement of a cracked tooth is dependent on the position and extent of the fracture. An assessment of the stimuli, character and duration of the pain are influential guide for treatment. A decision flow chart indicating the treatment options available has been presented:



CASE REPORT

A 54-year-old male patient came to the Department of Conservative Dentistry & Endodontics with the chief complaint of pain in the left upper back tooth region since 1 month. Pain was sharp and intermittent in nature and increased on mastication. Clinical examination revealed:

- Presence of a crack on the buccal surface of 26**(Fig 1)**
- Presence of sinus tract opening on the buccal mucosa
- No mobility
- Periodontal probing depth of 3-4mm

On radiographic examination **(Fig 2)**, it was noted that the crack was extending into the pulp along with periapical radiolucency. To further confirm the pathology a sinus tracing **(Fig 3)** was done.

Fig 1: Pre-operative picture: Buccal aspect of 26

Fig 2: Pre-operative radiograph

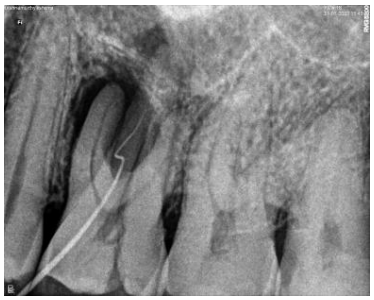


Fig 3: Radiograph showing Sinus tracing

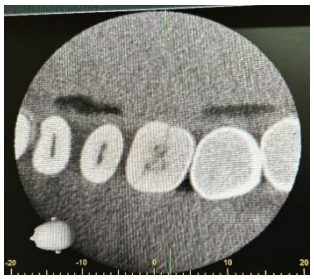
And the crack was further confirmed by bite test. Pain on biting that ceases after the pressure has been withdrawn - classical sign. Symptoms elicited when pressure was applied to the mesio-buccal cusp.

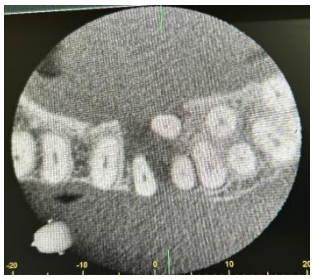
CBCT was taken to know the extent of the crack and thereby the prognosis of the tooth. On CBCT it was revealed that:

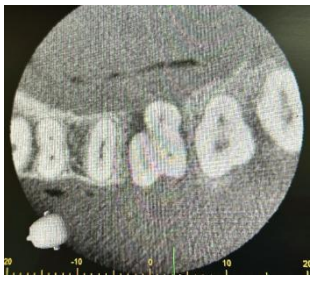
- the crack was extending buccolingually from the mesio-buccal cusp.
- from occluso-apically it is extending upto the pulpal floor.
- periapical radiolucency was also noted indicating a periapical lesion

a) 

d) 

b) 

f) 

c) 

g) 

Fig 4(a-g): CBCT images of the AXIAL SECTIONS showing the extent of the crack and the periapical lesion surrounding the tooth

Fig 5: CBCT images of the SAGITTAL SECTIONS depicting the same

The treatment plan was to perform orthograde endodontic treatment followed by reinforcing the crack using flowable composite and ribbond fibers and post endodontic restoration.

In the first appointment, occlusal height reduction was done to relieve the tooth followed by banding of the tooth**(Fig 6)** in order to stabilize the crack. Then access opening was done under rubber dam isolation. Working length was determined**(Fig 7)**. Cleaning and shaping were done with Heroshaper hand files upto 25 4% in relation to mesiobuccal and mesiolingual canals and 30 6% in relation to palatal canal. $Ca(OH)_2$ intracanal medicament was placed for 1 week and the access cavity sealed using Cavit.

Fig 6: Occlusal reduction and Banding of the tooth

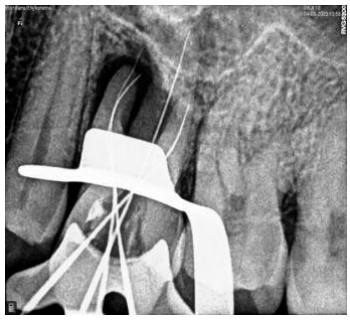


Fig 7: Working length determination

In the second recall visit after a week, healing of the sinus tract opening was noted. Under rubber dam isolation $Ca(OH)_2$ dressing was removed.Then the canals were dried using sterile paper points. Obturation was done using gutta-percha and $Ca(OH)_2$ based sealer (Ivoclar Vivadent Apexit Plus) **(Fig 8 and 9)**.

Fig 8: Post obturation radiograph

Fig 9: Picture taken post obturation and debanding showing the extent of crack

Crack was then sealed and reinforced with flowable composite and ribbond fibers**(Fig 10)**. Access restoration was done with bulk fill composite**(Fig 11)**. Follow up was done in the 1st, 3rd, and 6th month after the endodontic treatment. At the 6th month follow up, the tooth was prepared for PFM crown and crown was placed**(Fig 12 and 13)**.

Fig 10: Sealing of crack using flowable composite and ribbond fiber

Fig 11: 3 month follow up

Fig 12: Postoperative picture

Fig 13: 6 month follow up

DISCUSSION

Early detection of a cracked tooth is crucial for effective treatment. Early diagnosis can be challenging due to the complicated etiology. Proper dental history and visual examination plays a crucial role in the diagnosis. Other diagnostic methods for crack teeth include periodontal probing, radiographic examination, transillumination test, biting test,

restorative removal, tactile examination, dyes, periapical tests, and vitality testing.

A dental operating microscope (DOM) and loupes can help with visual assessment. A dental operating microscope can provide various magnification levels. Swept-source optical coherence tomography (SSOCT) is a promising method for detecting and analyzing enamel caries and early CTS.[6] Ultrasonic systems, infrared thermography, and near-infrared 810 nm diode laser are some of the other diagnostic aids in the detection of cracks.

The treatment plan and success rate of cracked teeth depends on the extent and location of the cracks and also upon the severity of the symptoms. If the size of the involved portion of the tooth is relatively small and the crack does not involve the pulp, the tooth could be restored conventionally using resins, inlays, or crowns with periodic follow-ups.[7] If the crack is extensive with prolonged symptoms, thermal hypersensitivity, and pulpal and periapical pathology, root canal treatment is the treatment of choice followed by crown placement and continuous follow-up.[8] There are some cases in which the crack crosses the pulpal floor, extends deep into the bone, or symptoms persist even after root canal treatment; in such situations, extraction is usually the only viable option.[9-10]

In this case, there was sharp and intermittent pain, which increased on mastication, and the crack was also extensive, which could be observed on the pulpal floor in the prepared access cavity. Also, the crack line was evident in the radiograph. The primary objective of the treatment plan was to stop the further propagation of the crack.[11] This was achieved by reducing the occlusal height of the tooth and banding of the tooth using stainless steel band. Root canal therapy was performed and the crack was sealed using flowable composite. The tooth was further reinforced by placing ribbond fibers along with composite as access restoration.[12-13] Finally, it was restored with a full coverage crown.

Root canal treatment is a viable nonsurgical treatment option for salvaging cracked teeth. Though information regarding survival rates of root-filled cracked teeth and prognosis assessment are scarce[14], this case has shown stabilization of the crack, healing of the periapical lesion and the patient is asymptomatic. Thus, root canal treatment followed by crown serves as a viable treatment option for cracked tooth depending upon the extent of the crack with good success rates.

CONCLUSION

Cracked tooth syndrome has a wide variety of signs and symptoms, thus making the diagnosis difficult and complicated. Various techniques have been put forth in the management of cracked teeth to preserve, stabilize, and protect the affected tooth. In this case report, combined use of restoratives, banding of the tooth followed by endodontic and prosthodontic intervention have resulted in a favorable outcome.

Consent

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

Ethical Approval

As per international standard or university standards written ethical approval has been collected and preserved by the author(s).

Authors' contributions

This work was carried out in collaboration among all authors. Author KM had done the case. Authors BSKP and HMR had extended guidance throughout the case and helped in writing the paper. All authors read and approved the final manuscript.

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Competing Interests

Authors have declared that no competing interests exist.

REFERENCES

1. Rivera EM, Walton RE. Cracking the cracked tooth code: detection and treatment of various longitudinal tooth fractures. Am Assoc Endodontists Colleagues for Excellence News Lett.2008;2:1-9.

2. Yang S-E, Jo A-R, Lee H-J, et al. Analysis of the characteristics of cracked teeth and evaluation of pulp status according to periodontal probing depth. BMC Oral Health 2017;17(1):135. https://doi.org/10.1186/s12903-017-0434-x PMCid:PMC5704503

3. Hasan S, Singh K, Salati N. Cracked tooth syndrome: overview of literature. Int J Appl Basic Med Res 2015;5(3):164-168. https://doi.org/10.4103/2229-516X.165376 PMCid:PMC4606573

4. Roh BD, Lee YE. Analysis of 154 cases of teeth with cracks. Dent Traumatol 2006;22(3):118-123. https://doi.org/10.1111/j.1600-9657.2006.00347.x

5. Geurtsen, W. (1992). The cracked-tooth syndrome: clinical features and case reports. International Journal of Periodontics & Restorative Dentistry, 12(5).

6. Shimada Y, Sadr A, Sumi Y, et al. Application of optical coherence tomography (OCT) for diagnosis of caries, cracks, and defects of restorations. Curr Oral Health Rep 2015;2(2):73-80. https://doi.org/10.1007/s40496-015-0045-z PMCid:PMC4544493

7. Bales, D.J.(1975). Pain and the cracked tooth. J Indian Dent Assoc, 54(5):15-8.

8. Ehrmann, E. H., & Tyas, M. J. (1990). Cracked tooth syndrome: diagnosis, treatment and correlation between symptoms and post-extraction findings. Australian dental journal, 35(2), 105-112. https://doi.org/10.1111/j.1834-7819.1990.tb05872.x

9. Kahler, W. (2008). The cracked tooth conundrum: terminology, classification, diagnosis, and management. American journal of dentistry, 21(5), 275.

10. CASCIARI, B. J. (1999). Altered preparation design for cracked teeth. The Journal of the American Dental Association, 130(4), 571-572. https://doi.org/10.14219/jada.archive.1999.0254

11. Xu H, Zheng Q, Shao Y, et al. The effects of ageing on the biomechanical properties of root dentine and fracture. J Dent 2014;42:305-311. https://doi.org/10.1016/j.jdent.2013.11.025

12. Lynch, C. D., & McConnell, R. J. (2002). The cracked tooth syndrome. Journal-Canadian Dental Association, 68(8), 470-475.

13. Milot P, Stein RS. Root fracture in endodontically treated teeth related to post selection and crown design. J Prosthet Dent. 1992;68:428-35. https://doi.org/10.1016/0022-3913(92)90405-Y

14. Davis MC, Shariff SS. Success and survival of endodontically treated cracked teeth with radicular extensions: a 2-to 4-year prospective cohort. J Endod 2019;45(7):848-855. https://doi.org/10.1016/j.joen.2019.03.015