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# A Review on Cracked Tooth Syndrome

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## Abstract

Cracked tooth syndrome(CTS) remains a big challenge to dentist because of its variable, bizarre clinical presentation, unpredictable symptoms and diagnostic dilemma. Based on the severity of the symptoms and depth of tooth structure involved, the treatment planning and management of CTS varies from one case to another or from one tooth to another in the same individual. The prognosis of such tooth continues to be questionable and needs continuous analysis. This article aims to resolve some of the confusion surrrounding tooth cracks diagnosis and different treatment options.

***Key words:*** *craze, incomplete fracture, cracked tooth*

## Introduction

Fractures are one of the major conditions in human teeth that cause pain. However when a tooth fracture is incomplete the presentation is more subtle and frequently remains undiagnosed[1]. Among longitudinal tooth fractures only craze lines and cracked tooth are referred as incomplete breaks[2]. Cameron in 1964 defined craked tooth as an incomplete fracture of a vital posterior tooth that involves the dentin and occasionally pulp[3].This definition is modified by Ellis SG 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[4].Cracks in teeth manifest as "cracked tooth syndrome." This syndrome is characterized by acute pain on mastication (pressure or release) of grainy, tough foods and sharp, brief pain with cold[2].Patients aged between 30 and 50 years of both sexes are commonly affected[5].Mandibular molars followed by maxillary premolars and maxillary molars are mostly affected[6]. It originates in the crown and extends subgingivally and directed mesiodistally. The fracture may extend through either or both of the marginal ridges and through the proximal surfaces.Cracks in the teeth favours bacteria ingression.There are two classic patterns of crack formation: In the first pattern, the crack is centrally located, following which the dentinal tubules may extend to the pulp; in the second the crack is more peripherally directed which may result in cuspal fracture[7].Cracks most likely cause pulpal and periapical pathosis as it more centered and apical than a fractured cusp .When pressure is applied to the crown of a cracked tooth there is a separation of the tooth components along the line of the crack. Saliva penetration along the crack line may further increase the sensitivity of dentine[8].This review highlights the importance of diagnosis of cracked tooth and its management.

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## Etiology

The best way to manage tooth fractures is to understand the factors causing it.Incomplete fractures of posterior teeth is multi-factorial. Guersten et al., stated that 'excessive forces applied to a healthy tooth or physiologic forces applied to a weakened tooth can cause an incomplete fracture of enamel or dentin[9]. Lynch et al., classified the causes of cracks into four major categories: Restorative procedures, Occlusal

factors, Developmental conditions and Miscellaneous factors[10].

**Restorative procedures**

Cracks are caused due to stressess on the residual tooth structure by the placement of friction lock or self threading dentin pins. When restorations are tightfitting, luting inlays, onlays, crowns or bridges produce excessive hydraulic pressure leading to tooth fracture[11]. Similarly, extreme condensation pressure during amalgam restoration may also induce fractures[12]. Unrestricted removal of tooth during cavity preparation has also been shown lower tooth rigidity. Over-contouring of restorations results in a deep cusp-fossa relationship which contribute to the fracture of the nonfunctional cusp.MOD amalgam restorations on vital tooth has been shown to reduce relative cuspal rigidity significantly[13]. A prepared cavity is said to be in a increased risk of fracture if the width of a cavity is in excess of one quarter of the intercuspal distance[14]. Intra-coronal restoration can increase the risk of fracture 29 fold times than that of a healthy, un-restored tooth[15].

**Occlusal factors**

The most common cause of crack is due to excess force on biting suddenly on a hard object such as bone. Other attributing factors include betel nut chewing, inadvertent biting of lead shot, cherry stones and 'granary' bread[16]. Trauma from the occlusion also leads to fracture[17].The maximum biting force for molars ranges from 10 to 73 kg with an average of 45.7 kg for males and 36.4 kg for females. There is a generation of harmful eccentric forces when there is a loss of anterior guidance. The habit of nocturnal bruxismgenerates considerable occlusal forces causing fracture[18].

**Developmental factors**

Natural predisposing factors such as deep occlusal grooves, pronounced vertical radicular grooves or bifurcations, extensive pulp spaces, steep cusp angles, prominent mesio-palatal cusps of upper maxillary first molars as well as the presence of lingually inclined mandibular molar suffer from complete loss by fracture of both lingual cusps[19].

**Miscellaneous factors**

The use of high speed rotary instruments; erosive tooth wear and the factor of thermal cycling induce enamel cracks. An ageing dentition predispose to cracking as dental hard tissues become more brittle and less elastic with age[20].

**Diagnosis**

If you do not look for cracks and fractures in teeth, you will likely not find them. Since the endodontically treated tooth has no remainig vital tissue, symptoms are restricted to those caused by the affected periodontium. For the tooth that has a vital pulp, the subsequent steps can ensure the presence or absence of a crack. Historyof repeated occlusal adjustments by several practitioners without a conclusive diagnosis. Enlarged jaw muscles indicate a habit of overstressing the teeth during mastication[2]. Attrition gives a history of clenching, bruxism, or biting and chewing with excessive forces. Craze lines or darker cracks are seen in a dry field. Check for evidence of an underlying dehiscence or fenestration. The use of angular percussioncause separation of the crack line and stimulation of periodontal ligament fibers or fluid movement in the dentinal tubules[7]. Peform Bite Tests using tooth slooth, rubber wheel, wood stick or other instrument to focus biting pressures on specific cusps and ask the patient bite down with moderate pressure and release[21]. Pain during biting or chewing is considered a classic symptom in the early indentification[10]. A narrow, isolated periodontal probing is characteristic of a crack. J-shaped or U-shaped radiolucency may indicate a crack. Buccolingual cracks will only appear if there is actual separation of the segments whereas mesiodistal cracks can never be seen. The other possible diagnoses can be ruled out using radiographs. Methylene blue dye can be applied to the external tooth surface in the cavity after restoration removal to check for cracks[22]. When a fiberoptic transilluminator is applied directly to the tooth surface, a crack will block the light. Sound teeth, including those with craze lines, will transmit light. Wedging test can be done to check for movement of the segments which helps in differentiating a cracked tooth from a fractured cusp or split tooth. No movement with wedging forces implies a cracked tooth[2].

**Treatment**

Location and extent of the crack determines the treatment of cracked tooth. Performing root canal treatment must be dependent on the determination of pulpal and periapical diagnosis. Removal of the fracture line in the area of the cavity floor that would initiate an ideal endodontic access opening which will be helpful in determining the apical extent of the crack. Removal of the fracture line on the proximal surface of the tooth below the cemento - enamel junction is not usually indicated[2]. Removal of the proximal marginal ridge takes away sound tooth structure, thereby decreasing tooth strength and resistance to fracture. To avoid irreversible damage, it is important that a cracked tooth be treated as soon as possible.To reduce the stress on the tooth and to prevent further damage to the tooth occlusal adjustment of affected teeth must be done immediately[23]. A copper ring, stainless steel orthodontic band, or the use of full coverage acrylic provisional crowns can be used for immediate immobilization. Bonded composite resin can also be used for splinting. Intra coronal restorations, without cuspal coverage can be used for non splintering teeth. Composite resin and glass-ionomer cements are most commonly used materials for restoring cracked teeth[24]. Amalgam overlays have fracture resistance equivalent to that of intact teeth. Cast metal inlays with cusp coverage or partial crowns with circumferential external splinting are applied where esthetics is not of great concern[25]. When the crack extends from the occlusal incline to the cervical third of the clinical crown, full coverage crowns are the most appropriate form of treatment. Loss of pulpal vitality is a major disadvantage following the preparation of teeth to receive a full coverage crown. Treatment of crack which extends deeply in the furcation remains difficult. Full crown or onlay to bind the cracked segments is indicated unless the tooth is to be extracted[26].

**Prognosis**

Periodontal probing, radiographic examination, need for banding to evaluate reduction of symptoms etccan affect prognosis, and each of these must be carefully considered before proceeding with treatment. The location and extent of the crack is most important factors in determining the prognosis. Prognosis is considered excellent for cracks that does not involve the dental pulp and for those fractures which does not extend more than 2-3 mm below the periodontal attachment limitIng to a single marginal ridge[27]. The prognosis becomes poor if both the marginal ridges are involved , or if the crack reaches up to the pulp[28].Prognosis is hopeless in cases with complete mesio-distal fractures[29].

## Conclusion

The cracked tooth syndrome remains challengingto the dentist in diagnosis and management. Every attempt must be made for early diagnosis of CTS with expediency. There is very limited clinical evidence available in the dental literature to substantiate the use of any definitive restorative techniques . Hence treatment of CTS will depend on the position and extent of the crack. Management options vary according to clinical need from replacement of the fractured cusp with a simple restoration to placement of an extracoronal restoration with adequate cuspal protection.

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