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An Overview Of The Etiology, Clinical Features, Diagnosis And Management Of Cracked And Split Tooth.

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Abstract: The American Association of Endodontists have classified longitudinal tooth fractures into five types; craze line, fractured cusp, cracked tooth, split tooth and vertical root fracture. The purpose of this review is to provide an overview of the etiology, clinical features, diagnosis, and management of cracked and split teeth. Cracked and split teeth are often undiagnosed or misdiagnosed due to their wide variety of clinical presentations. Recognition of the predisposing factors, signs, symptoms, accurate diagnosis and providing the appropriate restoration that protects the tooth from fracture are all important aspects of crack tooth management.

Keywords: Cracked teeth, Split teeth, Etiology, Signs and symptoms, Diagnosis, Management.

INTRODUCTION

The American Association of Endodontists, defined cracked tooth as an incomplete fracture initiated from the crown and extending subgingivally, usually directed mesiodistally¹. Gibbs in 1954, was the first to describe the clinical symptoms of fractured cusp of posterior teeth and named it as "cuspal fracture odontalgia"². In 1957 Ritchey et al reported cases of fracture with subsequent pulpitis³. The term "cracked tooth syndrome" was coined by Cameron in the year 1964⁴. Maxwell and Braly (1977) described incomplete tooth fracture as a fracture of the tooth structure that extends into the dentin, but in which the tooth remains grossly intact⁵. Crack may involve one or both marginal ridges and proximal surfaces. The crack may be limited to the crown of the tooth or may continue from the crown to the proximal root. Cracked tooth are described as incomplete (greenstick) fractures. If the crack is centered and apical to a fractured cusp, it more likely to cause pulpitis and apical periodontitis as it extends apically^{1,4}. If the crack continues to spread, the tooth will split into two fragments, resulting in a split tooth^{1,6}.

ETIOLOGY

The etiological factors for cracked tooth include the following:

- Masticatory forces^{1,4,6}.
- Dietary habits such as chewing on hard foods^{7,8}.
- Bruxism^{9,10}.
- Occlusal prematurity's and trauma from occlusion^{9,10}.
- Masticatory forces on untreated occult carious lesions¹¹.
- Differences in thermal expansion and contraction of tooth vs the restoration^{10,12}.
- Extensive intracoronal restorations and the use of pin retained amalgam restorations^{12,13}.
- Endodontically treated teeth extensive forces exerted in condensation of gutta percha during root canal obturation^{6,14}.
- Improper design/ fitting / seating and cementation of cast post and core and attempts to remove the existing post for replacement¹⁵.
- Excessive torque on the abutment teeth in long span fixed partial dentures¹⁵.

CLINICAL MANIFESTATIONS

In cases of cracked tooth, the patient history may be similar to the fractured cusp. The teeth will manifest the symptoms of the so called the cracked tooth syndrome. This syndrome is characterized by acute pain on biting of grainy, tough foods and sharp, brief pain with cold^{16,17,18}. Pain associated with the release of pressure or 'rebound pain' is also a common finding^{16,18}. Long-standing split in a vital tooth can involve the pulp, resulting in pulpitis and pulpal necrosis^{19,20}. Pulp involvement occurs most often in centrally located cracks. The centrally located cracks follow the lines of the dentinal tubules leading to the pulpal exposure²¹. The more peripheral cracks seem to lead to cuspal fracture, with or without pulpal exposure, depending on the amount of secondary dentin. Pulp vitality may be lost due to bacterial penetration through the crack. The pulp first becomes reversible/irreversibly inflamed, later necrotic and affected^{20,22}. Symptoms range from slight to very severe spontaneous pain consistent with irreversible pulpitis, pulp necrosis, or apical periodontitis. An acute apical abscess, with or without swelling or a draining sinus tract, may be present if there is periodontal involvement of the necrotic pulp. Split tooth has the same variety of signs and symptoms of the cracked tooth. Split teeth are easier to identify. There is often visual separation of segments. The fractures usually include the pulp. There is also significant damage to the periodontium and can be detected by both patient and dentist^{6,19,22}.

RADIOGRAPHIC FINDINGS

A) Cracked Tooth

Usually there are no radiographic findings unless the fracture is severe and oriented in the buccolingual direction. Mesiodistally oriented fractures are not visible radiographically^{1,16,23}. Radiographs are useful in ruling out caries, broken restoration, root perforations and internal/ external resorptions as the possible cause of the pain source. It also helps to determine the pulp and periapical status. The rate of inter-proximal bone loss (vertical, horizontal, or furcal) can be detected which is directly proportional to the severity of the crack^{9,23}. Currently cone beam computed tomography (CBCT) is useful to identify longitudinal fractures in a nondestructive fashion. However, it has been shown to have limited use in identifying incomplete tooth fractures^{23,24}.

B) Split Tooth

Mesiodistal fracture lines are usually not visible. Often there is marked horizontal loss of interproximal or interradicular bone; this resembles a “u-shaped” furcation lesion²³.

DIAGNOSIS

Early diagnosis of a cracked tooth is critical to alleviate the patient’s symptoms while also improving the prognosis.

The following aid in the diagnosis of cracked and split teeth –

- Selective biting on objects such as cotton roll, tooth Slooth or Fracfinder is helpful, particularly when pain is reported on mastication^{18,25}.
- Transillumination assist in revealing the crack line^{19,26}.
- Staining with Methylene blue, iodine, or caries detector dye scan reveal cracks although not always predictable^{27,28}.
- The use of magnifying loupes or a surgical microscope can help to better visualize the presence and extent of the crack²⁸.
- Periodontal probing may disclose the approximate depth and severity of the fracture²⁸.
- Wedge test is done to determine if the tooth fragments are separable. If no movements are detected it is a cracked tooth. If the segments separate, it is a split tooth²⁸.

DIFFERENTIAL DIAGNOSIS–

Craze lines are differentiated from cracked tooth by transillumination. With craze lines, the transilluminated light is not blocked or reflected as in fractured cusp, cracked or split teeth, but the entire tooth is illuminated. To differentiate a cracked tooth from a fractured cusp or a split tooth a wedge test is done. An explorer is wedged into the fracture line. No movement on wedging indicates a cracked tooth. A fractured cusp may break off under light pressure with no further mobility. A split tooth will show mobility on wedging as the mobile fragment extends well below the cemento-enamel junction^{1,8,29}. Symptoms of cracked tooth can resemble trigeminal neuralgia. Trigeminal neuralgia is characterized by intense, sharp shooting pain that is usually unilateral. Light touch can elicit sharp shooting pain. Once triggered the pain subsides within few minutes until triggered again. In comparison, odontogenic pain can come and go but it does not do so in a predictable or repeatable manner. Odontogenic pain occurs in an area that has no sensory abnormalities (e.g., dyesthesia or paresthesia)^{19,30}.

PROGNOSIS

A) Cracked Tooth –

The prognosis of a cracked tooth is reduced and sometimes questionable. The location and extent of the crack determines the prognosis. The patient should be informed about the possible outcomes and the unpredictability of duration of treatment. If left untreated the crack may grow to become a split tooth, requiring tooth extraction or additional treatments^{21,31,32}.

B) Split Tooth –

Prognosis is variable. There is a greater chance of successful treatment and restoration when the fracture extends within the middle third of the root. The prognosis is poor if the fracture extends into the apical third^{21,31,32}.

MANAGEMENT -

A) Cracked Tooth –

The main goal of crack tooth management is to prevent crack from developing further and to improve chewing comfort^{21,31,33}. Immediate treatment includes placing an orthodontic band around the tooth³³ or placing a provisional crown^{19,31,33}. Final management of a cracked tooth is dependent on the location and extent of crack. Root canal therapy is indicated for cracks that enter the pulp space³⁴. On removal of the intracoronal restoration and access cavity preparation, the floor as well as the distal and mesial walls should be thoroughly examined for the presence of any cracks. If a crack runs from the mesial wall through the pulp chamber and into the distal wall, the teeth’s prognosis is poor, and extraction should be considered. If the crack does not reach the pulp space or is limited to the coronal portions of the mesial and distal walls, the tooth may be saved by pacing a crown over it. The tooth is restored to bind the fractured fragments and also to protect the tooth from further splitting forces. Full crowns are preferred but onlay with bevels may suffice. Root canal treatment followed by a permanent crown provides the advantage of removing long term painful symptoms as well as providing protection against occlusal stresses that can cause a crack tooth to develop into split tooth^{21,31,32,35}.

B) Split Tooth

When the tooth is split throughout its whole length or diagonally, extraction is the only option. However, if the fracture line is such that the split occurs in large and small portions, and if removing the small portion retains the complete restorable tooth structure, then the tooth may be kept and restored^{2,6,35}.

CONCLUSION

This article reviewed the etiology, clinical features, diagnosis, and management of cracked and split teeth. Early diagnosis is critical in the management of incomplete fractures to limit the spread of crack, subsequent microleakage and the involvement of pulpal and periodontal tissues.

CONFLICT OF INTEREST

Conflict of interest declared none.

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