

Decision Analysis on the Management of Cracked Tooth

Kavalipurapu Venkata Teja and Sindhu Ramesh*

Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India

Corresponding author: Sindhu Ramesh, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India, E-mail: sindhuramesh@saveetha.com

Abstract

Background: Tooth fractures are commonly encountered in day to day dental practice. The consequences of these fractures can range from a minor to severe from a stage where no treatment is needed to a stage leading to root canal therapy or even tooth loss. One form of these fractures include cracked tooth syndrome. It often presents a difficulty in diagnosis to the dentist and many times it's a painful and a frustrating event to the patient. Cracked tooth syndrome is a term applied to a presumptive diagnosis of an incomplete tooth fracture which typically presents with the symptoms of pain on biting and responds to temperatures especially to cold stimuli. Routine clinical examinations in patients with asymptomatic teeth, often uncover these fracture lines. Unfortunately, by the time these incomplete tooth fractures become symptomatic, tooth may already be destined to root canal therapy or extraction. Hence appropriate knowledge is needed for dentists in the prevention, diagnosis and treatment of the cracked teeth. **Aim:** To provide decision analysis tree for the management of cracked tooth. **Methodology & Results:** Literature search was carried out on cracked teeth and a decision tree analysis was framed for the management of cracked teeth.

Keywords: Cracked teeth; Root canal therapy; Extraction; Pulpitis; Trans-illumination

Introduction

A cracked tooth is a condition that occurs in a tooth where there exists a partial or a complete fracture along the stress plane that commonly occurs in that tooth. ^[1]

A tooth stress plane is resulted from the occlusal force that is commonly imposed on a tooth during mastication. So that, any instance of higher energy is always concentrated along these stress planes.

These higher energies result in the disruption of some chemical bonds within the natural tooth while travelling along the stress planes.

A clinically significant fracture, may develop on long run of several masticatory loads along these stress planes. ^[2] As the fracture proportionately expands, due to proportionate stress being put on the remaining un-fractured area of the stress plane, the rate of fracture theoretically accelerates.

Occlusal forces now become capable of causing tooth to flex. If these stress planes are in continuous with the periodontal ligament or pulp chamber they lead to the fluid movement within the odontogenic process, leading to sensitivity. ^[3] Eventually these

stress planes causes the complete fracture of the teeth resulting in the separation of the tooth piece along the stress plane. Sometimes a single sudden traumatic hit results a complete fracture along these stress planes. ^[4]

The endodontic and periodontal prognosis of the fractured teeth depend on what aspects of the tooth are intersected by the existing fracture or would be intersected if the stress plane is fractured completely. A tooth fracture plane or a stress plane, may be completely supra or sub-gingival and may or may not intersect with the pulp chamber, a furcation or a sub-gingival aspect of the root surface or a tooth root, making the prognosis poor. ^[5]

Types of Furcation Fractures

Various types of furcation fractures, cuspal fractures, root fractures, craze lines, gingival interface fractures may be defined on what structures the fracture planes intersect. A partial fracture is considered as catastrophic, if the complete fracture of these stress planes would result to non-restorability

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of tooth with a crown or an endodontic procedure or a post endodontic restoration. A partial fracture is considered as non-catastrophic, when this complete fracture of the stress plane is still restorable with a crown or post endodontic restoration. Various terminologies have been proposed to describe these cracked tooth, but there is no clear cut universal agreement among the dentists concerning the exact correct descriptive systems.^[6] The major reason for this being the inconsistency in symptoms and the random shapes of these fracture lines that appear clinically. Cameron claimed the phenomena of these cracked tooth be defined as a cracked tooth syndrome.^[7,8] Cracked tooth is not a disease. But instead it's a factor that can facilitate the biomechanical, pulpal and periodontal problems.^[9] The symptoms of these cracked teeth are inconsistent.^[10-14] These two realities contradict the scientific rationale for cracked teeth as a syndrome. Some authors define cracked tooth syndrome as an incomplete fracture involving the dentin and occasionally extends into the pulp but this definition excludes the complete fractures of the teeth and also the fractures of the non-vital teeth and doesn't specify the symptoms of a cracked teeth making the term syndrome irrelevant. Some authors claim these fractures as horizontal, oblique or vertical.^[15,16] However, it is very unambiguous to differentiate between different crack types, based on the directions of these fracture planes because these fracture planes are mostly irregular. Some authors claim that fracture that involves only the enamel is called as a non-structural craze, which doesn't require any treatment.^[17,18] If the structural crack in the dentin, become a complete would result in a chunk of the tooth structure fracturing off the tooth. Since outcomes for the teeth with incomplete fractures can be so consequential results a significant problem to both dentists and patients. The stress planes resulting in the incomplete or complete cracked tooth are mainly the furcation stress planes, cuspal stress planes, gingival interface stress planes and root fractures. Furcation stress planes are such that when a complete fracture of the stress planes occurs, results in a separation or disconnection of one root from another. Complete disconnection of a root occurs when these stress planes fracture the tooth structure inferior to the pulp chamber floor, which helps to connect the two roots. Observation of a furcation fracture in an asymptomatic tooth is possibly an indication that tooth is necrotic. Cuspal stress planes occur approximately apical to one cusp or apical to two or more connected cusps. These stress planes may intersect with the pulp chamber wall or roof but not the floor. The lateral aspect of these stress planes may intersect with the external buccal or lingual tooth surface and possibly a root that is located subgingivally. Gingival interface stress plane occurs along the cross section of the tooth structure that is located approximately at the interface between the supra and subgingival tooth structure. Root fracture is a fracture of stress plane, contained within a single root, such that complete fracture of the stress plane results in the disconnection of one root from the other. Previously our team has a rich experience in working on various research projects across multiple disciplines.

Classification of Tooth Fractures by Talim and Gohil

Class I. Fracture involving enamel

- Horizontal or oblique
- Vertical
 - Complete
 - Incomplete

Class II. Fracture involving enamel and dentin without involving pulp

- Horizontal or oblique
- Vertical
 - Complete
 - Incomplete

Class III. Fracture of enamel and dentin involving the pulp

- Horizontal
- Vertical
 - Complete
 - Incomplete

Class IV. Fracture of the roots

- Vertical or oblique
 - Involving the pulp
 - Not involving the pulp
- Horizontal
 - Cervical third
 - Middle third
 - Apical third

These cracked tooth are mostly associated with the intracoronal restorations and most prevalent in mandibular molars.^[19,20] The highest prevalence rates are seen in patients over 40 years of age.^[21] Some studies state women are being more affected than men, but some others say almost equal in distribution.^[21] The best way to prevent these cracks is to understand the factors that predispose a tooth to crack. The main predisposing factors for the cracks are natural and iatrogenic causes. Natural include lingual inclination of the lingual cusps of the mandibular molars, steep fossa or cusp of maxillary premolars, bruxism, clenching, extensive attrition and abrasion. The iatrogenic causes include the usage of rotary instruments, cavity preparation, and width and depth of the cavity.^[22] Age is also a contributing factor. It has been shown that as the age of the tooth increases, fatigue resistance of a human dentin decreases as a consequence of dehydration.^[23]

Diagnosis Observations

Cracked tooth syndrome is described in literature as a difficult diagnostic and treatment problem. The diagnosis is purely symptomatic with localised pain on chewing or biting with unexplained sensitivity to cold and pain during release of pressure.^[24] Several other tests are also performed by a

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