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Dariela Isabel Gonzalez-Guajardo
Master in Sciences Student,
Universidad Autonoma de Nuevo
Leon, Facultad de Odontologia,
Monterrey, Nuevo Leon, CP 64460,
Mexico

**Guadalupe Magdalena Ramirez-
Herrera**
Professor, Universidad Autonoma de
Nuevo Leon, Facultad de
Odontologia, Monterrey, Nuevo Leon,
CP 64460, Mexico

Alejandro Mas-Enriquez
Associate Professor, Universidad
Autonoma de Nuevo Leon, Facultad
de Odontologia, Monterrey, Nuevo
Leon, CP 64460, Mexico

**Guadalupe Rosalia Capetillo-
Hernandez**
Professor, Universidad Veracruzana,
Facultad de Odontología, Veracruz,
Mexico

Leticia Tiburcio-Morteo
Professor, Universidad Veracruzana,
Facultad de Odontología, Veracruz,
Puebla, Mexico

Claudio Cabral-Romero
Professor, Universidad Autonoma de
Nuevo Leon, Facultad de
Odontologia, Monterrey, Nuevo Leon,
CP 64460, Mexico

Rene Hernandez-Delgadillo
Professor, Universidad Autonoma de
Nuevo Leon, Facultad de
Odontologia, Monterrey, Nuevo Leon,
CP 64460, Mexico

Juan Manuel Solis-Soto
Professor, Universidad Autonoma de
Nuevo Leon, Facultad de
Odontologia, Monterrey, Nuevo Leon,
CP 64460, Mexico

Corresponding Author:
Dariela Isabel Gonzalez-Guajardo
Master in Sciences Student,
Universidad Autonoma de Nuevo
Leon, Facultad de Odontologia,
Monterrey, Nuevo Leon, CP 64460,
Mexico

Cracked tooth syndrome, an update

Dariela Isabel Gonzalez-Guajardo, Guadalupe Magdalena Ramirez-Herrera, Alejandro Mas-Enriquez, Guadalupe Rosalia Capetillo-Hernandez, Leticia Tiburcio-Morteo, Claudio Cabral-Romero, Rene Hernandez-Delgadillo and Juan Manuel Solis-Soto

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Abstract

Introduction: Cracked tooth syndrome is defined as an incomplete fracture initiated from the crown and extending cervically, and sometimes gingivally, and is usually directed mesiodistally. **Objective:** To analyze the literature about cracked tooth syndrome, its etiology, prevalence, pulp involvement and treatment.

Methodology: Using the keywords “cracked tooth syndrome”, “etiology”, “prevalence”, “pulp involvement” and “treatment”, the MEDLINE/PubMed and ScienceDirect databases were searched, with emphasis on the last 5 years. It was evaluated with the PRISMA and AMSTAR-2 guidelines.

Results: There are many causes for cracks, the main one being malocclusion. Another is due to restorations, pieces to which amalgam was placed due to the extension of the cavity for the retentions. The second lower molar presents more frequently fissures due to premature contact. Cracked teeth are a challenge for the dentist in the diagnosis since the discomfort is presented with different stimuli. Depending on the extent of the fissure, the treatment is decided, always keeping in mind that the prognosis is reserved.

Conclusions: Cracked tooth syndrome will always be a challenge for the dentist at the time of diagnosis and treatment. There is no specific treatment, depending on the extent of the fissure is to decide the treatment to be performed.

Keywords: cracked tooth syndrome, etiology, prevalence, treatment

1. Introduction

The pulp of a cracked tooth can become inflamed due to microfiltration. The spread of cracks can cause irreversible pulpitis. Once the crack has spread and exposed the pulp, it is likely to necrose and produce a periapical lesion ^[1]. The frequency, according to reports of fissures in natural teeth are 4% to 5% in every 100 adults, molars constitute more than 75% of cases and premolars constitute the rest. Most studies have found that fissures occur primarily in teeth with unrestored root canal therapy, constituting 35% ^[2]. A cracked tooth is defined as an incomplete fracture initiated from the crown and extending cervical and sometimes gingival and usually directed mesiodistally ^[3]. The term "cracked tooth syndrome" was described by Cameron and referred to teeth with unexplained bite sensitivity and thermal sensitivity ^[4]. The causative factors of a dental fissure vary. Chewing function is the most common factor. Diagnosing a fissure is complicated, and it can also be arduous to determine the appropriate treatment due to the difficulty of visualizing such cracks and the variable symptoms ^[2], even if the fissure is identified, it is difficult to estimate the prognosis because there is no precise way of knowing how advanced the fissure is ^[5]. The main problem of a cracked tooth is the possibility of bacteria penetrating the pulp, which can cause pulpitis and, ultimately, apical periodontitis. The critical problems involved in saving teeth with fissures are: proper confirmation of the cracks; improvement of the symptoms and signs; and proper choice of final restorations ^[6]. In addition, the extension of the fissure can cause a bone dehiscence with a narrow and deep periodontal pocket resulting from extensive periapical bone resorption. The treatment options are composite resin, indirect resin or ceramic inlay, total crown and root canal treatment ^[1].

Cracked tooth syndrome is a condition that is frequently observed during the consultation, it continues to be a challenge for the dentist during the diagnosis, since the symptomatology is usually occasional and resembles that of irreversible pulpitis. Additionally, it can be difficult for patients to identify which is the piece that is causing them discomfort; furthermore, the parameters on which they should be based in order to carry out the appropriate treatment are not well established. As far as is known, there is no article that discusses the etiology, prevalence, pulp involvement and appropriate treatment for these teeth, since it is believed that with early diagnosis, most cracked teeth can be maintained longer. The aim of the study is to analyze the literature on the syndrome of cracked teeth, its etiology, prevalence, pulp involvement and treatment for these pieces, so that dentists know the symptoms in order to detect early cracked teeth and perform restorative treatment without having to reach the endodontic treatment.

2. Materials and Methods

Articles on the subject published through the PubMed, SCOPUS and Google Scholar databases were analyzed, with emphasis on the last 5 years. The quality of the articles was evaluated using PRISMA guidelines, i.e., identification, review, choice and inclusion. The quality of the reviews was assessed using the measurement tool for evaluating systematic reviews (AMSTAR-2) [17].

The search was performed using Boolean logical operators AND, OR and NOT.

It was constructed with the words “cracked tooth syndrome”, “etiology”, “prevalence”, “pulp involvement” and “treatment”. The keywords were used individually, as well as each of them related to each other. Initially, the titles of all the articles were selected, the abstract of each one was evaluated, and the articles were chosen for a complete reading review.

3. Results & Discussion (Times New Roman, 12, Bold)

3.1 Etiology of Cracked Tooth Syndrome

Many reports on the etiology of cracked teeth have indicated that it is multifactorial. There are 2 main factors that induce fissures in teeth: natural characteristics (dental and occlusion anatomy) [8] such as cusp inclination [9] and by iatrogenies (cavity preparation and restorations) [8] the use of restorative materials such as non-adherent inlays like gold or amalgam increases the occurrence of longitudinal dental fractures [5,10]. Another factor has to do with eating habits, eating hard foods, chewing hard objects and bruxism [8]. It has also been observed in patients who have received radiation crack lines from the enamel, indicating a weakened enamel structure [11].

3.1.1 Instrumentation

It has also been associated with the different torques used during instrumentation with rotary system [12]. The flexibility of nickel-titanium due to the heat treatment seems to have a significant influence on the formation of fissures [13], it has been observed that ProTaper Universal causes the formation of fissures in the root canal dentin with a high torque [11], however with ProTaper manual no dental microfissures were formed *in vivo* [14].

3.1.2 Access cavity

Traditional access does not increase the resistance to fracture of teeth with endodontics compared to conservative and traditional access. In addition, the loss of the mesial and distal ridges reduces the fracture resistance of the teeth significantly

[15].

3.1.3 Irrigants

It has been investigated if the irrigants favor the formation of fissures, the NaOCl caused more defects compared to the saline solution [16].

There are many reasons why fissures are produced in teeth, the main one is due to malocclusion producing small fissures when chewing something hard that produce the fracture of the dental piece. Another cause is the restorations, mainly pieces to which an amalgam was placed due to the extensive cavity that has to be made to create the retention, makes the dental pieces more likely to have fissures in the long term.

3.2 Prevalence

The fissures generally go from mesial to distal, and the second lower molars have the highest incidence of fissures [4]. Prevalence studies have reported that the lower molars are the most likely to present a fracture [17,6,13], the second lower molars (25.3%) are the teeth most involved [1,18] the first upper molar (28.0%) [5] and finally the first lower molar (27.8%) were the teeth that most frequently presented a fissure [19]. The second lower molar is the dental organ that presents fissures with the highest prevalence due to premature contact since it is the first molar to contact at the time of occlusion, likewise the malocclusion is a causal factor of this condition. It is important to know the symptoms and clinical signs in order to detect them and to know the adequate treatment that should be given to these pieces.

3.3 Pulp affection

Cracked tooth syndrome is defined as an incomplete fracture of the tooth structure that can progress to affect the pulp and periodontal ligament. Cracked tooth syndrome has always been a nightmare for the patient because of its unpredictable symptoms and a diagnostic dilemma for the dentist because of its variable and strange clinical presentation [20,21], it is important to rule out a trigeminal autonomic cephalgia [22]. The prognosis can be unpredictable, and this should be understood by patients before definitive treatment is performed [23]. Patients report discomfort for several months and severe pain when biting into or consuming cold foods or drinks. The pain can be caused by the consumption of substances containing sugar and also by the act of grinding teeth or during jaw movements while hiking [24,25,26]. When the fracture line extends into the pulp chamber, symptoms of irreversible pulpitis or apical periodontitis may appear, while fractures that progress further towards the root may be associated with localized periodontal fracture areas [27]. Epidemiological data reveal that fissures are the third most common cause of tooth loss, affecting mainly upper molars and premolars and lower molars [28]. In a histobacteriological and histopathological study, it was found that the dentin tubules were invaded by bacteria, especially when the fissure extended perpendicularly towards the dentin. When the fissure extended into the pulp, it caused reactions with intensities ranging from acute inflammation to pulp necrosis. The response of the pulp tissue varies according to the location, direction and extent of the fissure [29]. Teeth with fissures with periodontal pockets larger than 4 mm are more likely to have a necrotic pulp [1,30]. A diagnostic method for cracked teeth is by means of the Scanning Source OCT (SS-OCT) [31] as well as the x64 endoscopy is a more precise visual aid [32]. Cracked teeth will always be a challenge for the dentist at the time of diagnosis because the symptoms are

presented with different stimuli and are difficult to reproduce. The symptomatology is going to present itself depending on the extension of the fissure, when arriving at the pulp chamber there will be bacteria filtration and an inflammatory process of the pulp begins giving signs and clinical symptoms of an irreversible pulpitis.

3.4 Treatment of cracked teeth

The dentist must evaluate if the fracture plane seems to extend at a fast enough speed to justify the placement of a crown^[33], coronal fissures can be treated predictably, while root fissures increase the chances of tooth being extracted^[34]. Restorations should be placed after the symptoms have been managed. A conservative preparation will help to keep the tooth in the mouth longer and to prevent irreversible damage of the pulp^[25,35], as for example, a direct resin onlay restoration can have considerable advantages^[36], the resin restoration reduces significantly the occlusal stress on the underlying dentin of the preparation^[37]. A survey of endodontists regarding the treatment they would perform on a cracked tooth, 92.65% would perform endodontic treatment when the crack extends through the marginal ridge without a probing depth, 80% preferred extraction if the crack extends through the distal marginal ridge and is associated with a probing depth. When the fissure involves mesial and distal marginal ridges and extended through the pulp chamber, 79.74% preferred extraction. Most endodontists consider the presence of a 6 mm periodontal pocket as an important factor when deciding whether to preserve the tooth or extract it^[38,39]. The presence of a periodontal pocket associated with a fissure results in an increased risk of losing the tooth^[40,18]. In addition to endodontic treatment, barriers have been suggested to prevent leakage, placed apically to the extent of the fissure, complete occlusal reduction, post-operative instructions and rapid placement of a full-coverage restoration^[41]. In actuality, there is still no specific treatment for cracked teeth. When the fissure is detected in time without spreading to the pulp chamber, the placement of the crown will help to keep the piece "splinted" and this may help to stop the fissure from advancing. However, if it enters the pulp chamber, it will be decided to perform the endodontic treatment and later the placement of a crown.

4. Conclusions

The second lower molar is the most frequently fissured tooth. There are many reasons why fissures are produced, the main one is due to malocclusion producing small fissures that advance as mastication takes place. These pieces will always be a challenge for the dentist at the time of diagnosis since patients do not know how to identify which is the piece that bothers them and the symptomatology is similar to that of an irreversible pulpitis, however, the symptomatology is not specific. Currently, there is no defined treatment, so depending on the extension of the fissure, different treatments are chosen, always bearing in mind that the prognosis is reserved.

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