Diagnosis and Management of fractured teeth

Abstract:

Traumatic damage to the teeth and oral tissues are the most common causes of tooth fracture. Because of their location in the oral cavity, front teeth in the upper jaw are the most commonly fractured. Sports, car accidents, and physical violence are the most prevalent causes. Cracked teeth are often diagnosed by visually inspecting the tooth (preferably utilizing microscopes). The size and form of the fracture plane are not always determined by looking at the crack line. One factor that contributes to the difficulty of effectively making an endodontic diagnosis is the inability to visualize the depth of the fracture through a clinical exam alone. Transillumination, microscopes and dyes are a useful tool for finding and diagnosis of the crack, treatment of the crack depends on the type, extend of the crack as well as the condition of the patient. In this review we'll be looking at the diagnosis, etiology and management of fractured teeth

Introduction:

Traumatic damage to the teeth and oral tissues are the most common causes of tooth fracture. Sensitivity and discomfort in the shattered teeth are the most common clinical characteristics. A periapical lesion may occur in tooth fractures contacting the pulp, necessitating a radiographic evaluation. Restoration of the broken tooth or root canal therapy in fractured teeth with periapical lesions are two options for treating tooth fractures. [1]

Root fractures are defined as a fracture of the dentin, cementum, and pulp of a tooth. Root fractures can occur in any direction or orientation, and they're usually divided into two types: vertical (which frequently involves the crown) and transverse (also known as horizontal) root fractures. Although the other type of fractures is generally referred to as transverse or horizontal root fractures, it's crucial to remember that they can also occur as oblique fractures with different orientations (eg, more apical toward the palatal surface, more apical toward the labial surface, and so on). Transverse, horizontal, and oblique fractures are all referred to as root fractures in this article for the sake of simplicity. [2]

Because of their location in the oral cavity, front teeth in the upper jaw are the most commonly fractured. Sports, car accidents, and physical violence are the most prevalent causes. The tooth may be chipped, partly or totally displaced, or even knocked out of the oral cavity, depending on the severity of the occurrence. Tooth fractures require immediate treatment to restore function and appearance. [1] Root fractures are a very uncommon dental injury, with studies estimating that the proportion of root fractures among all dental injuries in the permanent dentition ranges from 1.2 percent to 7.0 percent. Some root fractures may not be detected during early trauma therapy since they can only be observed via radiographic imaging techniques, and the fracture may not be seen soon after the event if the coronal fragment has not been displaced. [2,3-8]

What elements of the tooth are intersected by the present partial fracture of the stress plane, or would be intersected if the stress plane were entirely broken, determines the biomechanical and periodontal prognoses and treatment requirements of a cracked tooth. A tooth stress plane or fracture plane may be completely supra-gingival and may or may not intersect the pulp chamber, or it may intersect the pulp chamber (potentially causing pulpal necrosis), a furcation (potentially causing tooth root disconnection), a sub-gingival aspect of the root surface (potentially causing chronic periodontal inflammation), or a tooth root surface. Depending on what structures the stress or fracture planes cross, many types of cracks–furcation fractures, cuspal fractures, root fractures, gingival interface fractures, or craze lines–may be identified. [9]

CTS diagnosis has proven difficult for dentists, and it is a cause of aggravation for both the dentist and the patient. Because the discomfort or pain might mirror those of other diseases such as sinusitis, temporomandibular joint problems, headaches, ear pain, or atypical orofacial pain, diagnosis can be challenging. As a result, diagnosis can be time consuming and clinically challenging. Early identification is critical because restorative intervention can prevent fracture propagation, following microleakage, and involvement of the pulpal or periodontal tissues, as well as catastrophic cusp failure. [10]

Etiology:

A direct or indirect collision might result in traumatic dental injury. The energy, direction, and form of the hitting item, as well as the reaction of the tissues

around the tooth, determine the severity of the injury. Sports injuries, bicycle accidents, motor vehicle accidents, and physical violence are the most prevalent causes of oral trauma, accounting for up to 65 percent of cases. [1] Root fractures occur when a horizontal, frontal collision, such as with a hard object or during a fight, causes direct stress to a tooth. Smaller, sharper objects focus the force of contact on a smaller region of the tooth, resulting in a fracture rather than tooth displacement. A root fracture is likely to develop if the root is the point of impact. When a strong yet blunt item strikes the crown of a tooth, the higher area of resistance to the force in the crown enables the impact force to be passed to the tooth root, resulting in a root fracture, which is most likely to occur in the coronal (cervical) third of the root. [2]

Classification and diagnosis:

Cracked teeth are often diagnosed by visually inspecting the tooth (preferably utilising microscopes). A crack is frequently diagnosed by a dentist viewing a crack line, which is a line segment from the perimeter of a fracture plane that is also found on a tooth surface that the dentist can see. The size and form of the fracture plane are not always determined by looking at the crack line. If a direct restoration is found with a fracture line that is continuous with the restoration margin, it may be wise to remove the restoration to see the entire length of the crack line underneath it. [9,11-13]

According to the broken tissue and pulp involvement, dental fractures are divided into the following categories: [1]

1. **Enamel infractions** are asymptomatic microcracks in the enamel that do not cause tooth structural loss. Transillumination is used to diagnose them, and they must be distinguished from thermal attack fractures. On clinical examination, such teeth have a normal response to pulp vitality tests, no tooth movement, and no periapical tissue involvement; hence, no percussion sensitivity. X-rays aren't really important.
2. **Enamel-dentin fractures** (uncomplicated crown fractures) show obvious enamel and dentin loss but do not expose the tooth pulp. A vital tooth with no sensitivity to percussion and no movement is generally discovered during a clinical examination.

3. **Enamel-dentin fractures with pulp exposure** (complicated crown fracture): A missing crown structure and pulp exposure are used to identify it. The tooth is normally sensitive to air, temperature, and pressure, but pulp testing is usually negative unless a luxation injury occurs at the same time.
4. **Crown-root fractures** may or may not affect the pulp and extend apically to the cementoenamel junction. Clinical and radiological examinations are used to make a diagnosis. Although this fracture extends below the gingival edge, its apical extension is difficult to see. The fragment is present and movable for the most part. The patient will complain of sensitivity to percussion and pressure if this is the case. According to pulp involvement, if the component is absent, the tooth might react like a crown fracture.
5. **Root Fractures**: Dentin, pulp, and cementum are all affected by root fractures, which can be horizontal, oblique, or both. Clinical signs include gingival sulcus haemorrhage, percussion pain, and a movable crown piece that may be displaced. Pulp testing may first come up negative because of a temporal or permanent neurological lesion.

One factor that contributes to the difficulty of effectively making an endodontic diagnosis is the inability to visualise the depth of the fracture through a clinical exam alone. The presence of facets on the occlusal surfaces of teeth (identifies teeth in eccentric contact and at risk from damaging lateral forces), the presence of localised periodontal defects (found where cracks extend subgingivally), or the evocation of symptoms by sweet or thermal stimuli are some of the other clues visible on examination. Once the tooth has been located, several writers recommend removing old restorations and stains to help in the sight of the fracture. [10]

the mandibular molars are the most often broken teeth, possibly because to the pointed, projecting maxillary molar palatal cusps occluding aggressively into the mandibular molar central grooves. Maxillary premolars are more prone to break than mandibular premolars, which are subjected to compression stresses due to opposing teeth occluding into the buccal cusps of the mandibular premolars. If it is the only surviving (or restored) posterior tooth in that quadrant, or if it displays evidence of occlusal trauma or an abfraction lesion, a posterior tooth with a class II restoration may be the source of pain. [9,14-17]

Certain different clues can be discovered when asking the patient's history. There may be a history of intensive dental treatment, such as recurrent occlusal adjustments or restorative replacement, that has failed to alleviate symptoms. The patient will describe how chewing on a particular tooth causes discomfort, which is more common with meals that have small, identifiable, tougher particles, such as bread with hard seeds or muesli. Aside from discomfort during biting, the patient will be sensitive to temperature fluctuations, particularly cold. Patients who have had a previous episode of CTS are often able to self-diagnose their disease. Sweets might cause sensitivity in certain people. It's also worth noting that in certain cases, the patient may be asymptomatic for an extended length of time. [10]

Methylene blue has long been utilised by endodontists to detect radicular fractures during surgery, and it is now being used to detect coronal cracks. Because of its pooling propensity and flocculent character, methyl blue can be useful in determining the extent of a fracture. Methylene blue, on the other hand, has drawbacks, including as the tendency for plaque to stain abundantly, and the dye's absorption by mildly decalcified enamel and dentin, which can mask fissures. Sodium hypochlorite can also produce substantial dye absorption by dentin after extended exposure. As a result, methylene blue should be utilised as soon as possible after entering the pulp chamber. [18]

Microscopes allow for the detection of tiny fracture lines that may have minor colour differences against a desiccated tooth surface without the need of trans-illumination or dyes. By correlating the tactile feeling of an explorer tip falling into a cleft with the minuscule location on a crack line where the tip is positioned, microscopically accurate tactile sense allows verification of a crack. Microscopes allow for the detection of minute quantities of debris in the gap, as well as microscopic changes in the relative movement directions of various tooth components shifting independently around a cleft. When a microscopically thin layer is removed from a surface with a deep craze line, the underlying tooth structure may be found to be uncracked, suggesting that the crack is superficial. [9]

Transillumination is a useful tool for finding a crack, whether it's a partial vertical root fracture (as in CTS) or a full vertical root fracture. The tooth should be

cleansed before transillumination, and the light source should be positioned directly on the tooth. Under these conditions, a break that reaches the dentin of the tooth will produce a disturbance in light transmission. For conventional crack diagnosis, transillumination is perhaps the most prevalent method. The use of transillumination without magnification has two disadvantages. Transillumination, for example, magnifies all flaws to the point that craze lines resemble structural fissures. Second, minor colour shifts are rendered undetectable. The use of magnification and transillumination with a fiber-optic light will help in the visibility of a fracture. [10]

Management:

Soft tissue injuries, such as edoema, haemorrhage, and laceration, are frequently connected with tooth fractures. Cold packs applied to the affected area might help reduce pain and swelling before beginning particular dental therapy.

Emergency Department: Provide sufficient pain treatment and tetanus immunisation, as well as thorough follow-up care, in the emergency department. [19]

Ellis I fracture: Smooth rough edges with a dental drill or an emery board. Treatment of fractures confined to the enamel alone does not need immediate attention. The tooth can be aesthetically fixed at the patient's convenience.

Ellis II fracture: Cover exposed dentin with a coating of zinc oxide or calcium hydroxide paste. For Dycal to attach, the tooth must be completely dry. A little piece of dental or aluminium foil might be used to cover the tooth. The pace at which the Dycal sets is accelerated when exposed to dampness. Coverage is especially crucial in patients under the age of 12 to avoid infection.

Ellis III fracture: Covering exposed dentin with a coating of zinc oxide or calcium hydroxide . With this sort of fracture, bleeding and moisture make it more difficult for these materials to cling to the tooth.

Because it might create inflammatory responses in the surrounding soft tissues, bone wax (Ethicon), which is a mixture of beeswax and isopropyl palmitate, is not advised for open tooth fractures.

When dealing with a difficult crown fracture, it's important to think about the best strategy to deal with the pulp exposure and restore the tooth structure. When utilising a pulp-capping substance, teeth can build a dentinal bridge following pulp exposure, hence a conservative approach is usually recommended. Is it better to have a partial pulpotomy or a pulp capping? It is determined by the length and diameter of exposure, the status of the pulp before to the injury, the age of the tooth, the stage of root development, and any concurrent luxation injuries. When the pulp has only been exposed for a short time, pulp capping is recommended because the longer the pulp has been exposed, the greater the risk of bacterial invasion and permanent inflammatory responses. Clinically, the diameter of the exposure should not exceed 1.5 mm. Healthy pulp prior to damage, immature teeth with open apices, the lack of concurrent luxation injuries, and younger teeth all improve the chance of pulp healing; hence, pulp capping may be adequate. [1,20,21]

Alternative treatment options to conventional designs and materials include minimally invasive crack preparation paired with the flexibility of composite bonded restorations. Individual occlusal or interproximal preparations are not linked in minimally invasive preparations. The option of whether to preserve a tooth with a break in the root canal chamber or to remove and replace such a tooth is a critical one for a physician. Because of the success of dental implants, treatment planning paradigms have shifted dramatically. Endodontic therapy has a success rate equivalent to single tooth implants. This does not, however, include fractured teeth. [18]

Conclusion:

Teeth cracks are common, Traumatic damage to the teeth and oral tissues are the most common causes of tooth fracture, front teeth of the upper jaw are the most exposed to it, treatment of fractured teeth depends heavily on prober diagnosis which relies mostly on the visual evaluation of the medical practitioner. However, there’s also some tools that can help the dentist such as microscope usage.

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