

## Case Report

# Management of Cracked tooth syndrome: A case Report

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#### Abstract:

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Cracked tooth is a distinct type of longitudinal tooth fracture which occurs very commonly and its diagnosis can be challenging. This type of fracture tends to grow and change over time. Clinical diagnosis is difficult because the signs and symptoms are variable or nonspecific and may even resemble post-treatment disease following root canal treatment or periodontal disease. This variety and unpredictability make the cracked tooth a challenging diagnostic entity. In this paper we present a case of cracked tooth and emphasise on the timely proper diagnosis and management.

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#### Introduction:

The human dentition is subject to many and varied destructive forces which decrease the longevity of the individual tooth and dentition. Cameron coined the term cracked tooth syndrome (CTS) to define the condition as “an incomplete fracture of a vital posterior tooth that involves the dentin and occasionally extends to the pulp.”<sup>1,2</sup>

In recent times, the definition has been modified as follows: “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.”<sup>3</sup>

The incidence of cracks in teeth seems to have increased since the last three decades. This is probably because of better health care facilities, people live longer and their teeth last longer too, thus making them more susceptible to cracking from normal wear and tear. Stress and stress-related habits such as bruxism and clenching have also become more prevalent, thereby contributing to the increased incidence of cracks. Finally, because dentists are becoming increasingly aware of the existence of cracks, more cracks are being diagnosed than before.<sup>4</sup>

Other terms often used interchangeably with CTS include: “incomplete fracture of posterior teeth”<sup>5</sup> “green-stick fracture”, “split tooth syndrome.”<sup>6</sup>

The forces placed on the dentition during normal masticatory functions are small when compared with the maximal biting force. Anderson measured loads on mandibular molars using strain gauges and found that the maximum whole tooth load varied between 7.2 and 14.9 kg (70.6 and 146 N) when eating meat, biscuit or carrots.<sup>7,8</sup> Howell and Manly recorded that the maximum biting force

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on the first molar was approximately 90 kg (880 N),<sup>9</sup> and Helkimo *et al.* the maximal biting forces between natural molars ranged from 10-73 kg (98-715 N) with an average of 45.7 kg (448 N) for males and 36.4 kg (357 N) for females.<sup>10</sup> Arnold stated that the ratio of force on molars, premolars and incisors is 4:2:1, with far heavier forces on the most posterior teeth close to muscles producing this force.<sup>11</sup> An individual can generate very high occlusal forces during nocturnal bruxing which can at times be greater than those during conscious effort. This may be due to cortical inhibitors being suppressed during sleeping hours allowing greater forces to be exerted.<sup>12</sup>

**Case Report:**

A male patient aged 54 years reported with pain on lower left second premolar, that is, 35, for the past two weeks. Pain was severe, throbbing in nature, and radiating towards the temporal region and the neck. It was aggravated on taking cold and hot drinks and relieved with pain killers (NSAIDs). No caries or fracture was detected nor was restoration present Figure:-1). The tooth was tender on percussion and no mobility was detected. Thermal pulp vitality test showed normal response. Dye test with mythelene blue

Diagnosing CTS has proved to be difficult even for the most experienced dental practitioners, the reason being that associated symptoms are usually very variable and sometimes even bizarre. Successful treatment and favorable prognosis would depend on an accurate and early diagnosis.

A detailed history is imperative along with a thorough assessment of all symptoms, though these vary with the depth and orientation of the crack.

To avoid irreversible damage, it is imperative that a cracked tooth be treated as soon as possible.

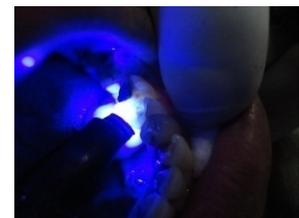
gave positive finding for cracked tooth Figure:-2).. Bite test revealed positive response on releasing of pressure. Trans illumination also speak for CTS Figure:-3). Based on the history and clinical presentation it was diagnosed as CTS without pu Figure:-4). P involvement on tooth 35. The treatment plan was to do restoration with glass ionomer cement for immediate stabilization followed by prosthetic crown placement on the tooth for permanent stabilization.



**Fig:1 Visual inspection**



**Fig:2 Dye test**



**Fig:3 Trans illumination test**

After getting consent of the patient the tooth was isolated with cotton roll and a suction device during the treatment procedure. Judicious use of diamond bur with adequate cooling arrangement crack line was removed and cavity prepared. )Figure:-4)Calcium hydroxide was given as a

lining material)Figure:-5), then glass ionomer cement was used as a permanent restoration)Figure:-6). The tooth was polished and finished using polishing bur)Figure:-7). Patient was referred to prosthodontic department for permanent stabilization by temporary crown.



Fig:4 Cavity Preparation



Fig:5 Application of calcium hydroxide



Fig:6 Glass ionomer restoration



Fig:7 After Finishing

### Discussion

The presence of a cracked tooth occurs primarily in adulthood. Contradictory data were reported regarding the correlation between a patient's age and the occurrence of CTS. The most commonly affected teeth are the mandibular molars, for example, as reported by Cameron<sup>13</sup> (67 per cent) and Hiatt<sup>14</sup> (69 per cent). Mandibular second molars were more likely to be involved than first molars. Cameron found that 'most posterior teeth that crack have been restored' and also 'there was a direct relationship between the size of the restorations and the number of teeth cracked'. She found in a series of 102 teeth that 27.5 per cent had occlusal restorations, 33.3 per cent had MO or DO restorations, 32.4 per cent had MOD restorations, and 6.8 per cent had other or no restorations.<sup>13</sup>

Fitzpatrick observed that incomplete fractures primarily occurred in people between the ages of 30-39;<sup>12</sup> these findings indicate that more and more young patients are affected by CTS.<sup>15</sup> Luebke<sup>16</sup> found mandibular molars especially the distolingual cusp to be the most susceptible to cracking. The maxillary molars and premolars

have a similar incidence of fracture, with the mandibular premolars being the least susceptible because the stresses during mastication is minimal on these teeth.<sup>17</sup> Cracks not only appear in restored teeth but also may occur in intact ones.

When discussing the symptoms of these patients, most (90 per cent) described tenderness to biting with the pain being short and sharp. Fewer (48 per cent) described a reaction to cold, sweet or hot or a combination of these, with cold being the most common, then sweet. These symptoms can be explained by the hydrodynamic theory of pain first described by Gysi,<sup>18</sup> and since substantiated experimentally by Brännström.<sup>19</sup> This theory is based on the concept that rapid movement of dentinal fluid in the dentinal tubules causes pain. This movement stimulates mechano-receptors in close proximity to the odontoblast cell body, which then activate A-delta nerve fibres (faster myelinated fibres), resulting in a short sharp pain. The pain is produced with movement of dentinal fluid when the crack is opened by pressure on the cusp, and it also explains the short sharp pain as the fluid moves back on releasing the pressure. Seventy to eighty per cent of nerve fibres entering the pulp

are non-myelinated fibres, known as C-fibres. These fibres are slow-conducting and produce a dull, poorly localized sensation and are activated by inflammation, heat and mechanical deformation. The pain is a dull, poorly localized ache which increases after a hot drink. These fibres are usually activated by stimuli which cause actual damage to the pulp.<sup>18</sup> If a tooth with CTS is exhibiting this type of pain, urgent treatment is required to tie the cusps together (for example, an orthodontic band) and a sedative dressing is required (ZOE to seal the cavity).

Diagnosing CTS has proved to be difficult even for the most experienced dental practitioners, the reason being that associated symptoms are usually very variable. A detailed history is imperative along with a thorough assessment of all symptoms, though these vary with the depth and orientation of the crack. If the crack is directly visible, diagnosis can be fairly simple.<sup>20</sup> This is possible in cases where there is exogenic staining from food or beverages. But more often than not, common mesiodistal cracks are not visible because most of these teeth present with an overlying occlusal or proximal restoration. Hence removal of these restorations may prove to be useful.<sup>21</sup> With larger restorations, cracks tend to be more superficial and thereby produce fewer symptoms, whereas with smaller restorations cracks tend to be deeper and closer to the pulp.<sup>22</sup> Initial cracks may not be visible because they are too small to be detected by the naked eyes.

Many authors have suggested the use of stains like gentian violet or methylene blue to stain the fracture line and make it visible.<sup>23</sup> But this technique still has its disadvantages-first, that staining may take many days to become effective, hence requiring an interim restoration<sup>20</sup> which may further compromise the structural integrity of the tooth. Furthermore, after the use of these dyes, placing a definitive aesthetic restoration may prove to be difficult.<sup>21</sup> Magnifying loupes and transillumination using a fiber-optic device have been considered instrumental in the diagnosis of a cracked tooth.<sup>24</sup> This "relief pain" can be replicated by bite tests.<sup>25</sup> To accurately diagnose an incomplete fracture by the use of any of the following-orange wood sticks, cotton-wool rolls,

rubber abrasive wheels such as a Burlew wheel or the head of a number 10 round bur in a handle of a cellophane tape.

In order to localize the cusp affected by CTS, a wood stick can be rested on each individual cusp of the suspected tooth and the patient asked to bite. According to Kruger, pain produced by release of pressure confirms a case of CTS.<sup>26</sup>

The use of commercially available diagnostic tools like Fractfinder (Denbur, Oak Brook, IL, USA) and Tooth Slooth II (Professional Results Inc., Laguna Niguel, California, USA) have found to be more sensitive and accurate in the identification of the affected/involved cusp when compared with the more conventional tools.<sup>27</sup>

But Cone Beam Computed Tomography (CBCT) may prove to be useful in many cases. Occlusal adjustment of affected teeth must be done immediately to reduce the stress on the tooth and prevent further damage to the tooth.

If the tooth in question presented with a preexisting restoration, it should be removed. This may cause the affected cusp to "splinter off" and the further treatment protocol can then be decided.<sup>28</sup> In case there is no splintering, immediate immobilization should be employed, using an "immediate extra-coronal circumferential splint." A copper ring or a stainless steel orthodontic band can be used for this purpose.<sup>5</sup> The use of full coverage acrylic provisional crowns has been advocated for "immediate splinting."<sup>29</sup> Another available option is the use of bonded composite resin to splint the teeth, which is known as a "direct composite splint" (DCS).<sup>30</sup>

In case of a cracked tooth, the patient should be fully informed that the prognosis is questionable at best. A number of factors would need to be considered before evaluating the prognosis of a cracked tooth.

The location and extent of the crack is probably the most important of these factors. Prognosis is considered excellent for cracks that are limited to dentine and not involving the dental pulp, or for those fractures which are limited to a single marginal ridge which do not extend more than 2-3 mm below the periodontal attachment.<sup>31</sup> The prognosis becomes poor in cases involving both marginal ridges, or reaching up to the pulp.<sup>32</sup>

Anatomy of the tooth and roots, the previous operative/ restorative history of the tooth and the functional forces acting on the tooth (during both functional and para functional activity), are other factors affecting the prognosis.<sup>25</sup> The loss of pulp vitality has also been found to have adverse effects on the prognosis of the tooth.<sup>32</sup> Finally the technique used and skill and experience of the operator can also affect the long term prognosis of such teeth.

### Conclusion

The CTS presents both a challenge and an opportunity for the dentist. The diagnosis of this condition can be difficult, but every attempt must be made to do it with expediency. Though a number of definitive restorative techniques have been described for the treatment of posterior teeth affected by CTS, there is very limited clinical evidence available in the dental literature to substantiate the use of any of them. Three principal factors determine the prognosis of a tooth affected by CTS: The extent and location of the fracture, the point in time when restorative intervention is initiated and thirdly by the type of restoration applied to splint the fracture. It is our foremost duty to provide a solution to the problem the patient comes to us with. No matter what the prognosis of the particular tooth, all available treatment options must be known to the dentist and explained well to the patient to help him decide on and initiate the proper treatment plan.

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