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An Ounce of Prevention is Worth a Pound of Cure: Benefit of Early Diagnosis in Crack Tooth.

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Abstract:

With an increase in the life expectancy, people are living longer and wants to retain their natural dentition, as a result for this patients are opting more of complex restorative and endodontic procedures thus leaving the teeth more susceptible to cracks. Cracked tooth syndrome is a major diagnostic challenge in clinical practice which presents with bizarre of signs and symptoms which is frustrating for both the dentist as well as the patient. Successful diagnosis lies in the awareness of its presence and appropriate diagnostic tests. Thus the diagnosis and management of cracked teeth is an integral part of dental practice today. The American Association of Endodontists have classified five specific variations of cracked teeth; craze line, fractured cusp, cracked tooth, split tooth, and vertical root fracture. This review article aims in highlighting different types of cracks and the role of CBCT in diagnosing and differentiating them.

Key-words: *Cracked tooth syndrome, CBCT, Craze line, vertical root fracture, Split tooth, Fractured cusp.*

Key Messages: *Although cracked teeth is a common problem for patients and dentists, there are evidence-based guidelines on how to prevent, diagnose, and treat cracks in teeth. The purpose of this article is to review the the different types of cracks, how to diagnose and differentiate them on CBCT and thus helping to retain the natural tooth by early diagnosis at a right stage.*

Introduction

Cracked tooth is a distinct type of longitudinal fracture which may extend through either or both the marginal ridges and through the proximal surface.**[**1**]**

Term cracked tooth syndrome coined by Cameron in 1964 is 'an incomplete fracture of a vital posterior tooth that involves the dentin and occasionally extends to the pulp' which was first described by Gibbs in 1954 and termed it as 'Cuspal fracture odontalgia'. **[**2,3**]**

A cracked tooth can act as a pathway for bacteria that may induce pulpal degeneration and/or periapical inflammation.**[**1,4**]** Therefore early diagnosis and treatment are essential for its management.**[**1**]**Assessment of the pattern or extent of fracture with the aid of advanced method like CBCT can help the endodontist in making a decision for the treatment to be preferred for better prognosis of involved tooth. **[**1,5**]** In this review, typical CBCT presentation of the diagnosis of five specific variations of crack/fractures of teeth will be discussed.

Prevalence/Incidence Rate

Most of the studies agreed that the cracked teeth were significantly associated with intracoronal restorations and were most prevalent in mandibular molars with the disto-lingual cusp, most susceptible to fracture.**[**2,6**]** The highest prevalence rates appeared in patients over 40 years old with males being more affected.**[**6**]** Arnold reported that the force ratio on molars, premolars, and incisors is 4:2:1, with far heavier forces on the most posterior teeth.**[**7**]** Himani Sharma and K Harish S Shetty reported that non-functional cusp may be more susceptible than fuctional cusp.**[**6**]** The majority (91.7%) of the cracks were located centrally on the teeth while most (61.0%) of the cracks ran in a mesiodistal direction. Nearly half of the detected cracked tooth are seen under transillumination. **[**8**]** **[**Figure 1**]**

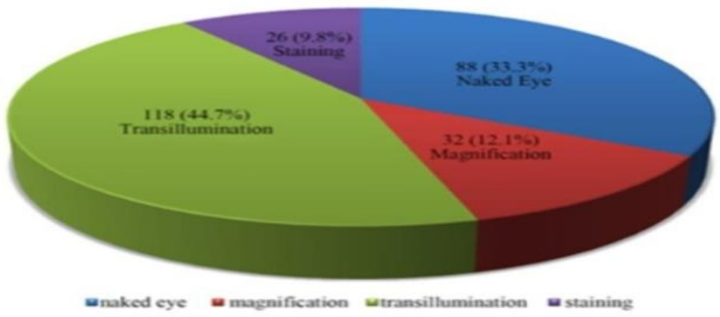

Figure 1. Different tools used in identifying cracked tooth.**[**8**]**

Classification

The American Association of Endodontists identified five types of cracked teeth in a document titled "cracking the cracked tooth code". **[**Table 1**] [**9**]**, **[**Figure 2**] [**9**]**

S. No	Classification	Originate	Direction	Symptom	Pulp status
1.	Craze line	Crown (Enamel)	Occlusal/ F-L	None	Vital
2.	Fractured cusp	Crown (Enamel extending to dentin terminate to cervical third)	M-D or F-L	Mild pain & generally to biting and cold	Usually Vital
3.	Cracked tooth	Crown + Root	M-D often central	Acute pain on biting	Variable
4.	Split tooth	Crown + Root (Incomplete crack separated into 2 fragments)	M-D	Marked pain on chewing	Often root filled so non vital
5.	Vertical root fracture	Entire root or portion of root.	F-L	Vague pain, mimics periodontal disease	Mainly root filled- non Vital

Table 1. American Assosciation of Endodontists classification of cracked tooth.**[**9**]**

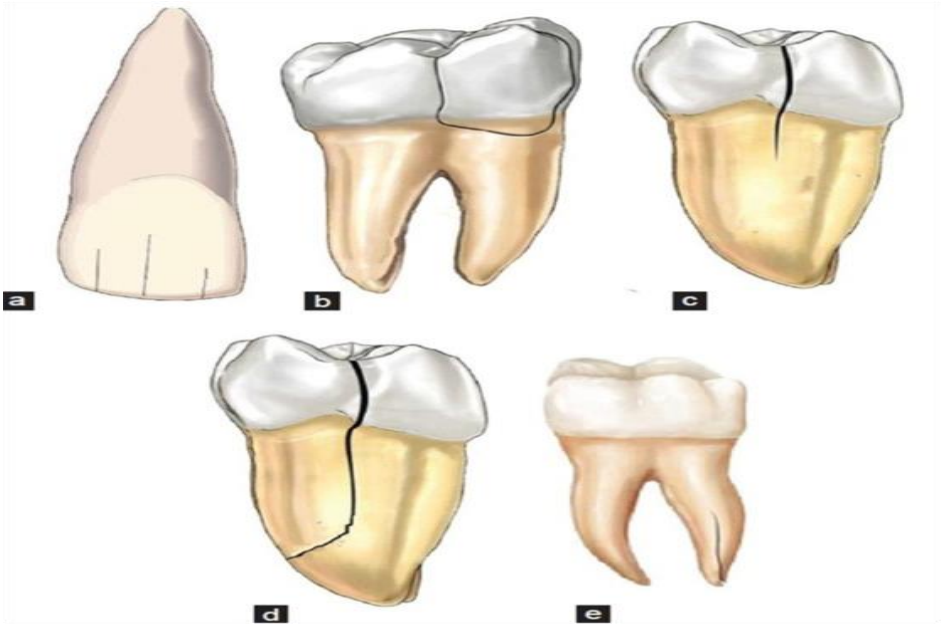

Figure 2. (a) Depicting visible fracture lines with the enamel suggestive of craze lines; (b) Fractured cusp terminating in the cervical part of tooth (c) Cracked tooth extending from the occlusal surface without the separation of tooth fragments (d) Split tooth causing separation of fragments (e) Vertical root fracture.**[**9**]**

Etiology

Etiology of crack tooth syndrome is multifactorial. Guersten et al stated that excessive force to a healthy tooth or physiologic force to a weakened tooth can cause an incomplete fracture of enamel or dentin. **[**3,12**]**

Tooth with developmental defects tends to develop cracks on normal occlusal loading or on a slight increase in biting pressure (Christopher et al 2002 and Hiatt 1973). The higher incidence of cracked tooth syndrome in mandibular second molars may be because of their proximity to the temporo-mandibular joint based on the principle of the "lever" effect. (Christopher et al 2002).The fracture of cusps whether functional or non-functional are primarily associated with large intra-coronal restorations and carious lesions. Thermal cycling, damaging horizontal forces or parafunctional habits have also been implicated in the development of crack in unrestored teeth. **[**3,4,13**]**

The most common cause for an incomplete fracture is masticatory or accidental trauma, such as biting on a hard, rigid object with unusually high force or excessive removal of tooth structure during tooth preparation. Normal occlusal contact occurring on extensive occlusal or proximo-occlusal intracoronal

restorations may subject the remaining weakened tooth structure to crack (Bales1975). Excessive condensation pressures, hygroscopic expansion of amalgam, placement of retentive pins and extensive composite restorations placed without due care for incremental technique predispose the tooth for fracture formation (Trushkowsky 1991). Over-carving of a restoration can lead to a loss of appropriate occlusal contact which can result in the extrusion of a tooth, altering the cusp fosse relationship and resulting in fracture of the non-functional cusp (Christopher et al 2002 and Bales1975).**[**3,4,12,13,14**]**

Analysis and Diagnosis of cracks by CBCT

A cracked tooth is a diagnostic problem especially in the early stage. Cracks/fractures in teeth may occur in both the horizontal and vertical directions and can involve the crown or root. Conventional peri-apical radiographs (PRs) can only provide a definite diagnosis of obviously displaced root fractures which are confounded by a number of factors including the regional anatomy, geometric distortion as well as superimposition of both the teeth and surrounding dentoalveolar structures, however these radiographs reveal only limited aspects, i.e a two-dimensional view of the true three-dimensional anatomy. The advancement of dental Imaging took great strides with the development of 3 Dimensional (3D) imaging i.e, CBCT, which stands for Cone beam computed tomography and is also known as Cone beam volumetric imaging (CBVI) or Cone beam volumetric tomography (CBVT). It is an outstanding three-dimensional (3D) dental and maxillofacial imaging modality widely used for the diagnosis of cracks which are very difficult to be identified by naked eye alone or with the help of periapical radiographs, only CBCT provides 100% visualization of cracked tooth images with high spatial resolution. **[**5,15**]**

Craze lines are diagnosed by direct visualization and transillumination and CBCT is not required.**[**16**]**

Fractured cusps are relatively easy to diagnose and are found incidentally on CBCT imaging.**[**16**]** **[**Figure 3A**]**

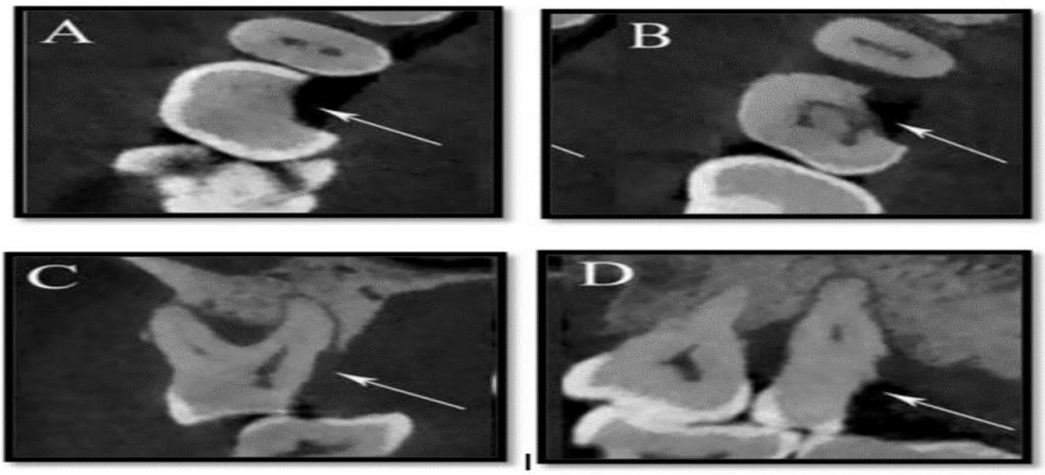

Figure 3. (A,B) Axial images in tooth 16 shows a complete fracture of the mesiopalatal cusp (arrows); (C,D) Coronal and sagittal images shows that the fracture initiates from the crown of the tooth and extends subgingivally (arrows).**[**16**]**

Cracked tooth are difficult to be seen by naked eye, only CBCT provides 100% visualization of cracked tooth images.**[**Figure 4a-c**]**

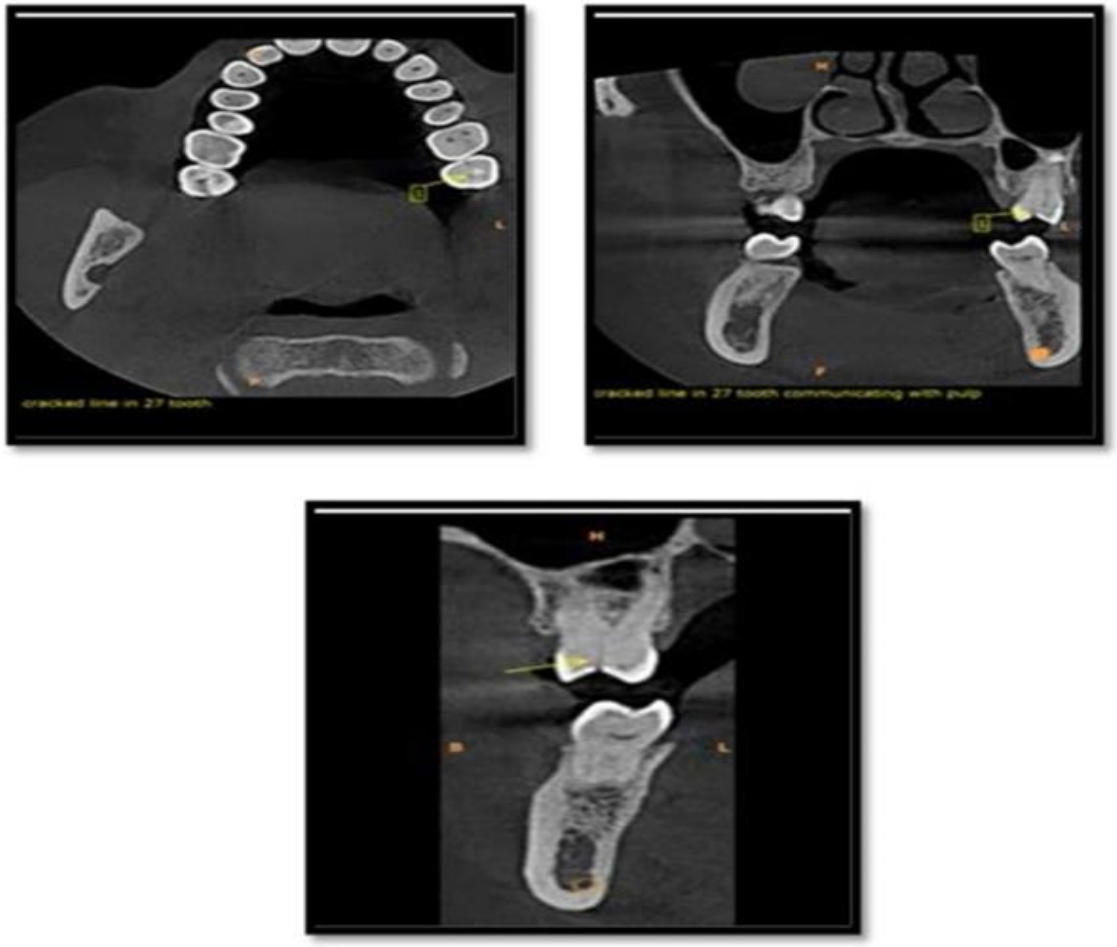

Figure 4. (a,b) CBCT evaluation revealed thin linear cracked line in coronal part of 27 tooth along the mesiodistal tooth surface which was extending to the pulp but cracked line was not extended below the CEJ of tooth. c) Cracked line favour the prognosis as it is not extended below the CEJ of tooth.**[**17**]**

Split teeth leads to obvious separation of segments and are easy to identify. CBCT is sometimes used to determine the extent of root involvement, periapical and periodontal status for incomplete split tooth.**[**16**]** **[**Figure 5**]**

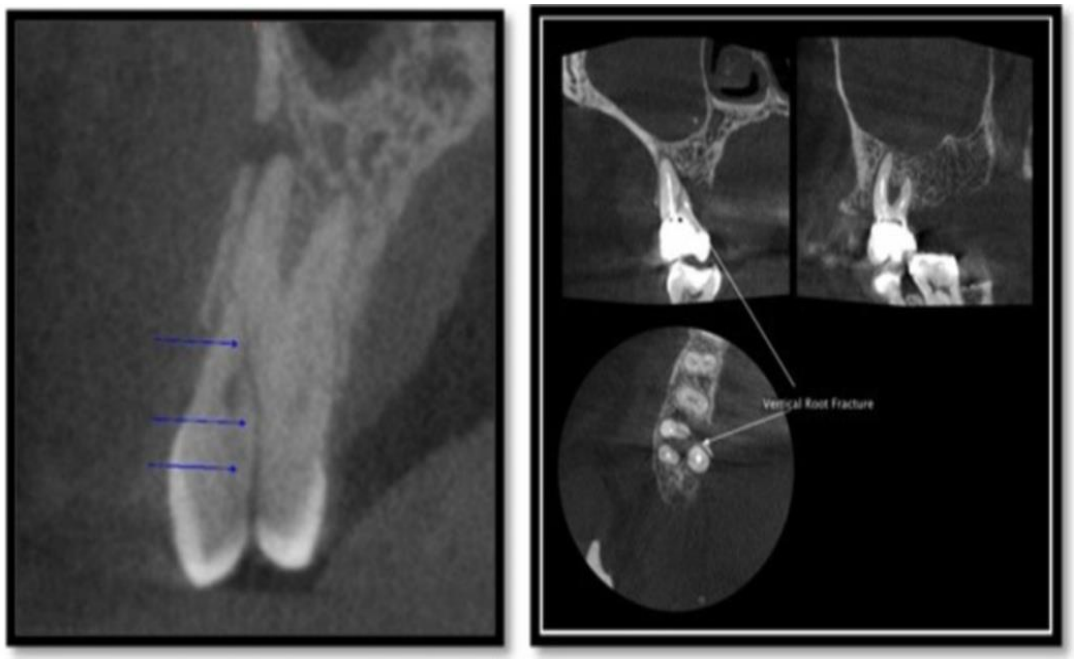

Figure 5. A split tooth 25, axial image showing a mesiodistal hair-like hypodense line (arrow) that is present on the crown but gradually disappears on the root.**[**16**]**

Vertical root fracture are complete fractures with obvious separation of the fracture fragments and are easily diagnosed on CBCT.**[**5,16**]** **[**Figure 6**]**

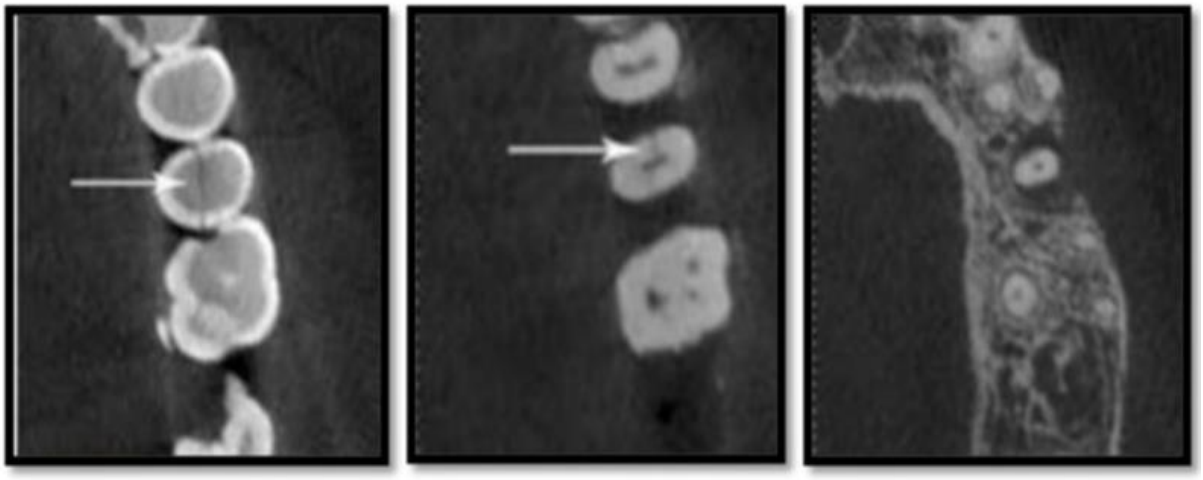

Figure 6. Vertical root fracture extending from crown to apical one third root favoring poor prognosis.**[**18**]**

Conclusion

Diagnosis is not the end but the beginning of solution. Due to changed eating habits and stresses in today's generation, cracks and fractures are very common. Epidemiological data reveals that cracks or fractures in teeth are the third most common cause of tooth loss**[**19**]**. Early diagnosis is a weapon to save the tooth from a sacrifice but main issue is the stage of diagnosis. There is limited clinical evidence available in the dental literature to substantiate the use of any definitive restorative techniques. The extent of the fracture, the time of intervention and the type of restoration are crucial parameters in determining the outcome of the treatment.**[**10**]** Management options vary according to clinical need from replacement of the fractured cusp with a simple restoration to placement of an extracoronal restoration with adequate cuspal protection.**[**4**]** Careful clinical examination and inspection, supplemented by specialized tests such as the non-axial application of pressure to cusps, will be conclusive, hence newer diagnostic aids should be used at right stage to initiate proper treatment plan.

References

1. Chakravarthy PVK, Telang LK, Nerali J, Telang A. Cracked Tooth: A report of two cases and role of cone beam computed tomography in diagnosis. Case Reports in Dentistry. 2012;15:1-6

2. Kahler W. The cracked tooth conundrum: Terminology, classification, diagnosis, and management. American Journal of dentistry. 2008;21:275-82

3. Sharma H, Shetty KHS. Crack tooth syndrome and its management. International Journal of Advanced Research. 2016;5:1161-66

4. Lynch CD, McConnell RJ. The cracked tooth syndrome. Journal of the Canadian Dental Association. 2012;68:470-75

5. Sridharan S, Gokul V, Sukumaran T, Gupta A, Ostwani EO, Alaa. Applications of CBCT in endodontics. Oral Diseases. 2020;42:1-15

6. Lubisch EB, Hilton TJ, Ferracane J. Cracked teeth: A review of the literature. Journal of Esthetic and Restorative dentistry. 2010;22:158–67

7. Shikder AHM, Quader SMA, Chowdhury SS, Begum F, Hasan MN. Management of cracked tooth syndrome: A case Report. Update dental college journal. 2014;4:53-8.

8. Ogundare TO, Ajayi DM, Idon PI, Bamise CT, Oginni AO, Esan TA. Prevalence and distribution of cracked posterior teeth among adult patients. Open Journal of Stomatology. 2020;10:74-86

9. Hasan S, Singh K, Salati N. Cracked tooth syndrome: Overview of literature. International Journal of Applied and Basic Medical Research. 2015;5:164-68.

10. Seal M, Talukdar P, Pendharkar K, Bhattacharyya A, Budhiraja H, Chakraborty M. The cracked tooth: An engima for the clinician. International Journal of Preventive & Clinical Dental Research. 2015;2:64-70

11. Bonk J. How to recognize the 5 types of tooth cracks. Spear digest-esthetic. 2019; 23:30-35

12. Saatwika L, Prakash V, Malarvizhi D, Subbiya A. A review on cracked tooth syndrome. Indian Journal of Forensic Medicine & Toxicology. 2020;14:1120-22

13. John MK, Parameshwaran M, Vidhya S, Sreeja S, Kiran, Prabhu S. Cracked tooth syndrome- A review. International Journal of Recent Advances in Multidisciplinary Research. 2015;2:294-97

14. Banerji S, Mehta SB, Millar BJ. Cracked tooth syndrome. Part 1: aetiology and diagnosis. British Dental Journal. 2010;208:459–63

15. Shivana V, Shivamurthy GB, Lokhande P, Srivastav S. CBCT in conservative dentistry and endodontics - A review. CODS Journal of Dentistry. 2013;5:52-55

16. Gao A, Cao D, Lin Z. Diagnosis of cracked teeth using cone-beam computed tomography: Literature review and clinical experience. Dentomaxillofacial radiology. 2021;50:1-34

17. Mittal L, Singla M, Kaur H, Garg A. CBCT an eagle's eye to dentist: - case report on diagnosis of crack tooth syndrome. International Journal of Dental Science and Innovative Research. 2021;4:96-101

18. Rhodes J et al. Identification, diagnosis, and management of cracked teeth. Endodontic practice. 2020;35:1-6

19. Geurtsen W, Schwarze T, Gunay H. Diagnosis, therapy, and prevention of the cracked tooth syndrome. Quintessence International Journal. 2003;34:409-17