MetLife
Quality Resource Guide

MetLife designates this activity for 1.5 continuing education credit
for the review of this Quality Resource Guide and successful completion of the post test.

Diagnosing and Managing the Cracked Tooth Part 1: Crown-Originating Fractures

Educational Objectives

Following this unit of instruction, the practitioner should be able to:

1. Describe the three categories of dental fractures.
2. Recognize the usual symptoms of crown-originating fractures.
3. Recognize the role of radiography in diagnosis of crown-originating fractures.
4. Describe the clinical tests used for identifying teeth with crown-originating fractures.
5. Describe treatment options for crown-originating fractures.
6. Develop a prognosis for a crown-originating fracture.

Introduction

The term 'cracked tooth' has been used to describe many types of fractures and cracks in teeth. Other terms have also been used (Table 1) for this dental problem, indicating that dentistry has not previously been able to develop a generally accepted categorization scheme. Efforts have been made over the years.[1] Recently a proposal to use the term 'Dental Fractures' as the umbrella term for all fractures of teeth was published.[2] Under this term dental fractures are categorized into:

(1) crown-originating fractures (COF);
(2) vertical root fractures (VRF), and;
(3) trauma-related fractures (Table 2).

The latter fracture category is distinctly related to acute dental trauma and frequently includes horizontal fractures. This Quality Resource Guide (QRG) will focus on the first type of fracture, the COF. A follow-up QRG will discuss VRFs.

Table 1

Terms Used For Dental Fractures
Cracked tooth
Cracked tooth syndrome
Green stick fracture
Cuspal fracture odontalgia
Vertical root fractures
Tooth infractions
Craze lines
Split tooth
Fractured cusp
Hair-line fractures
Incomplete tooth fractures
Crown-root fractures
Longitudinal tooth fractures

Crown-Originating Fractures (COF)

DESCRIPTION

COFs typically originate in the tooth crown and are not related to previous root canal treatment. The fractures usually progress from a coronal origin toward the root, and may continue down the root apically or toward the root surface, resulting in cuspal fractures (Fig.1). The end result, if no treatment is rendered, will either be a split tooth or a cuspal fracture. In the latter situation, the pulp may or may not be directly exposed. If a cuspal fracture does not create a periodontal problem, the crown may usually be restored satisfactorily.

Teeth most commonly affected with a COF are maxillary premolars and molars.[3] Teeth with COFs typically have vital pulps.[4] That is a reason for the often unusual pain patterns associated with a COF. COFs most often occur in a mesio-distal direction (Fig.2), though they can

FIRST EDITION

Author Acknowledgements

Leif K. Bakland, DDS
Emeritus Professor

Tory Silvestrin, DDS
Assistant Professor

Loma Linda University, School of Dentistry
Loma Linda, California

Drs. Bakland and Silvestrin have no relevant relationships to disclose.

Originally published January 2017. Expiration date: January 2020. The content of this Guide is subject to change as new scientific information becomes available.

ADA C·E·R·P® Continuing Education Recognition Program
MetLife is an ADA CERP Recognized Provider.

ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.

Concerns or complaints about a CE provider may be directed to the provider or to ADA CERP at www.ada.org/goto/cerp.

Accepted Program Provider FAGD/MAGD Credit 11/01/16 - 12/31/20.

Address comments to:
dentalquality@MetLife.com
MetLife Dental
Quality Initiatives Program
501 US Highway 22
Bridgewater, NJ 08807

occur in a facial-lingual direction (Fig.3), and, in some cases, in a combination of both directions. Presence or absence of coronal restorations does not seem to be a determinant factor; COF are observed in teeth with carious, restored or intact crowns. One might intuitively expect teeth with restorations to be more prone to a COF than those without. The available evidence, however, is not conclusive, though many individuals feel that teeth with restorations are more likely to develop COFs.[5]

The origin of COFs is usually in one (Fig.4), or both, of the marginal ridges (Fig.5) if the fracture is in a mesio-distal direction. The origin of a COF is typically between the cusps if it is in a facial-lingual direction (Fig.3). COFs progression is from enamel into dentin; from there the fractures may enter the pulp (Fig.6), or may skirt the pulp, avoiding direct pulpal contact.[5]

A minor type of COF is an enamel craze line (Fig.7). These are limited to enamel and rarely extend into dentin. Treatment is usually not needed except for esthetic reasons when discoloration of the craze line becomes noticeable.[1]

SYMPTOMS

Pain on chewing is the most common finding in symptomatic COFs.[1,4-6] The range of discomfort varies from almost none to the most severe of orofacial pains, including pain similar to that described by patients with trigeminal neuralgia (*tic douloureux*). The diversity of symptoms contributes to the difficult task of making a diagnosis.

Figure 1

Crown-originating fracture (COF) - Fracture originates in the crown and progresses toward the apex.

Table 2

Dental Fractures

Categories	Characteristics
Crown-originating fracture (COF)	Spontaneous fracture originating in the crown and progressing into the root in an apical direction.
Vertical root fracture (VRF)	A root-originating fracture that may begin anywhere in the root; it occurs primarily in endodontically treated teeth.
Trauma-related fracture	Tooth fracture of acute nature that may involve the crown or the root or both and are often horizontal fractures.

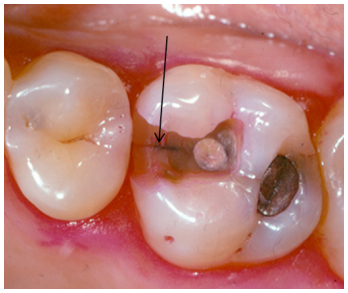
Figure 2

COF running in a mesio-distal direction.

Figure 3

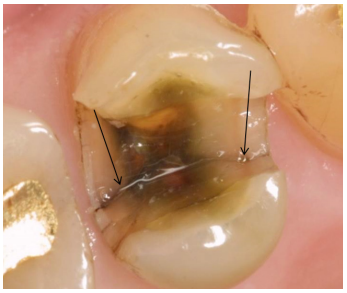
COF running in a facial-lingual direction between cusps.

Figure 4



COFs can begin in one of the marginal ridges; in this case, the mesio-marginal ridge - the fracture is highlighted using a red dye.

Figure 5

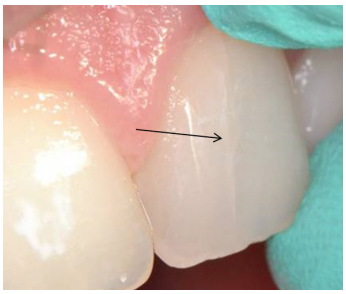


Mesial and distal marginal ridges are involved in this COF.

Figure 6

This cuspal fracture barely bypasses the pulp - in some cases the COF directly enters the pulp and in other instances fractures are located some distance from the pulp.

Figure 7



Arrow points to a typical example of an enamel craze line - such fractures are confined to enamel and seldom present any problems other than possible discoloration.

Examples of symptoms may include: a description that a tooth "feels weak"; sharp pain when chewing certain foods; or sudden electric shock-like stabbing pains. Symptoms may also resemble those experienced by patients with an earache, TMJ dysfunction, sinusitis, or various neurological problems. It is now recognized that COFs may be associated with chronic orofacial pain,[4] emphasizing the need to include a COF as an option when searching for the etiology of unusual dental pains. Teeth with a COF can also create non-localized vague pains or pain referred to other oral regions. The longer the symptoms are present and the more diffuse they become, the more difficult diagnosis becomes.[4] Even lack of symptoms can be frustrating since bacteria in such cases may infect pulps, leading to pulp necrosis.[7]

It would be reasonable to expect that teeth with a COF, and being painful on mastication, would also be hypersensitive to percussion. However, this does not always appear to be the case.[8] It has been suggested that sensitivity to percussion occurs when the pulp becomes involved, and the pulp may not initially be involved in all COFs.[9] There may not be a painful response to percussion with COFs in which the pulp is not directly involved. Until a COF has progressed all the way from the pulp to the PDL, localization by percussion of the tooth is difficult.[10]

Pain response to sweets in teeth with COFs has been reported.[11] This is probably related the presence of microorganisms located in the tooth fracture (Fig.8) causing pulpal inflammation.[12] Pain can also be felt in the PDL as parts of a fractured tooth move, regardless of pulpal involvement.[11]

Figure 8

Fracture line runs from the crown periphery (left side) to the pulp (right) and is filled with bacteria - *histologic section courtesy Dr. Henry Trowbridge.*

Since pain responses in teeth with COF can mimic many other conditions, such as teeth with caries, it is prudent to maintain a high degree of suspicion when a general dental examination yields symptoms and examination findings that are contradictory.

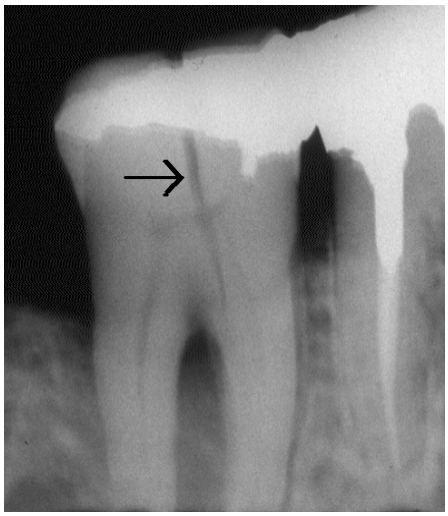
DIAGNOSIS

A tentative diagnosis of a COF can sometimes be made based on symptoms. Absent caries, a tooth that is painful to chewing (particularly fibrous food) may be considered to possibly have a COF. But since symptoms can be very diverse and clinical findings difficult to obtain, the clinician must systematically collect available information before finalizing a diagnosis.

Radiographic information is of relatively minor value in identifying a COF. Since the vast majority of fractures run in a mesial-distal direction, a typical radiographic image will not show a break in hard tissue continuity. However, in a small number of facial-lingual positioned fractures, the radiographic image will frequently show the fracture since the x-ray beam runs parallel to the fracture (Fig.9).

Cone beam computed tomography (CBCT) has made radiographic examination of dental conditions more easily visualized than ever before. Teeth with vertical root fractures (VRF) are often easily recognized on CBCT images.[13] This technology is less applicable for the diagnosis of a tooth with a COF. However, if a fracture is strongly suspected, but the clinical examination lacks enough information for diagnosis, CBCT may be indicated. The clinician should select a 0.2 voxel CBCT system because of the small diameter of the fractures.[13] The use of CBCT for COF diagnosis should be very selective; CBCT should not be used if other less complex and costly avenues of assessment are available.

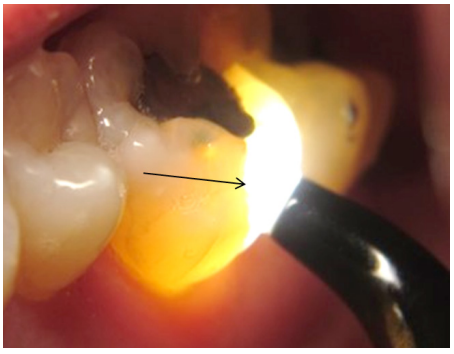
Figure 9



Facial-lingual COF (arrow) is visible radiographically because the x-ray beams run parallel to the fracture line.

Clinical Findings can provide many clues. Direct observation of an intact tooth with no restorations may allow identification of fracture lines. If a possible fracture is noted on one or both of the marginal ridges, confirmation of a COF can be obtained by transillumination.[14] Transillumination requires that the part of the tooth being examined not be restored to allow the light to pass through the tooth. When a light beam encounters a fracture line in the dentin, it will bend and the tooth structure opposite the fracture line will be dark (Fig.10).[14] An enamel craze line may be highlighted with transillumination, but it will not prevent the light from continuing through the crown (Fig.7). Fracture lines may also be highlighted with the use of red dye (Fig.4) or methylene blue. If restorations are present, they may need to be removed for direct observation of potential COFs. Since localization of the affected tooth can be difficult, it may sometimes be necessary to remove restorations from several teeth before identifying the correct one. Brynjulfsen et al.[4] recommended methodically removing restorations, one tooth at a time, to locate teeth with COFs in patients with long standing, undiagnosed orofacial pain.

Figure 10



Transillumination highlights a fracture (arrow) that involves the enamel and dentin.

An important step in the clinical examinations is conducting a biting test.[15] Various techniques have been recommended, such as biting on burlew wheels, rubber wheels, cotton tip applicators, moist cotton rolls, and commercial biting applicators. Ailor[14] suggested using a biting applicator, positioned so that pressure is placed first on the filling and then the tooth cusps to differentiate between biting pain from restorations and microleakage/pain from COF. A significant pain response to biting, experienced on release of biting pressure, is referred to as either "rebound pain" or "relief pain".[15] Kahler et al.[11] explained that the pain associated with release of pressure results from fluid movement as the crack rapidly closes. This can be used diagnostically, as suggested by Ailor,[14] by having the patient bite on a moist cotton roll. If "rebound" pain occurs on release, there is a higher likelihood that one of the two opposing teeth has a COF (Fig.11).

Cold Stimulus Application and ***Electric Pulp Testing*** (EPT) provide information about the status of the pulp. There is evidence that teeth with COFs respond at lower threshold levels to cold and EPT stimulation compared to non-fractured teeth.[6] Since any tooth with pulpal inflammation is likely to have a lowered pain threshold, it is not a particularly discriminative tool. However, it can add to the total information about the tooth.[16]

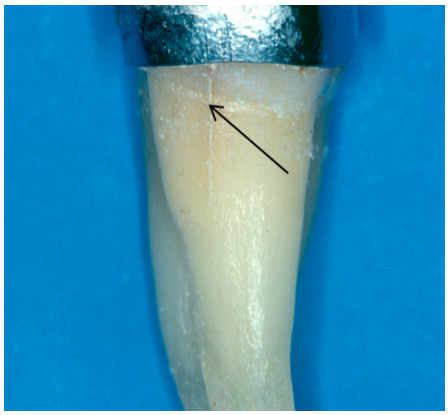
An Explorer (thin and sharp) was used by Cameron[17] to probe around the cervical circumference of teeth suspected of having fractures, particularly in interproximal areas not readily visible if the tooth crown has a large or full coverage restoration. Both the "click" of the explorer tip encountering the fracture, and perhaps the patient's response, as in touching a sensitive spot on the root surface, can provide a diagnostic clue (Fig.12). Another clue can be found by using a sharp explorer at margins of large restorations. A sharp pain may be elicited if a crack is present.[6]

Percussion eliciting sensitivity in teeth with COF is not as common as biting sensitivity.[8] An explanation for this may be that the fractures in teeth with COF typically originate internally and propagate peripherally,[11] so a tooth with a fracture is not likely to be identified by percussion until the fracture extends to involve the periodontal ligament (PDL).[10]

Figure 11

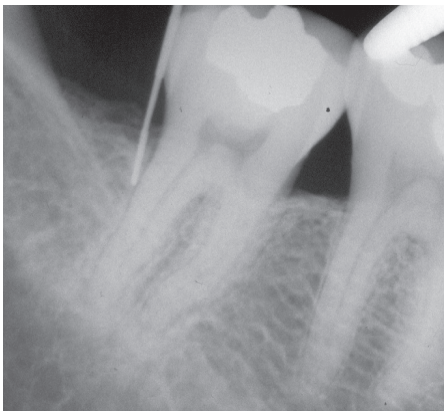
Clinical test for COF using a moist cotton roll placed between a maxillary and mandibular tooth - a "positive" test is "rebound" pain coming from one of the teeth.

Figure 12



COF (arrow) has progressed down the root below a crown margin - using a sharp explorer to trace the cervical area can generate a 'click' that would help to locate the fracture.

Figure 13



Use of a periodontal probe to explore the apical extent of a COF.

Periodontal Probing is recognized as an indispensable part of dental examinations in general. It is also useful for examining teeth with potential fractures.[14] Hiatt[18] described periodontal probing to reveal narrow pockets adjacent to fracture lines, and Ailor[14] has suggested that probing extending below the alveolar crest indicates the tooth is not suitable for restoration (Fig.13). Since the pockets adjacent to COFs are extremely narrow, in contrast to those adjacent to a VRF in an endodontically treated tooth, it is usually necessary to anesthetize the tissues surrounding the tooth prior to probing.

TREATMENT OPTIONS

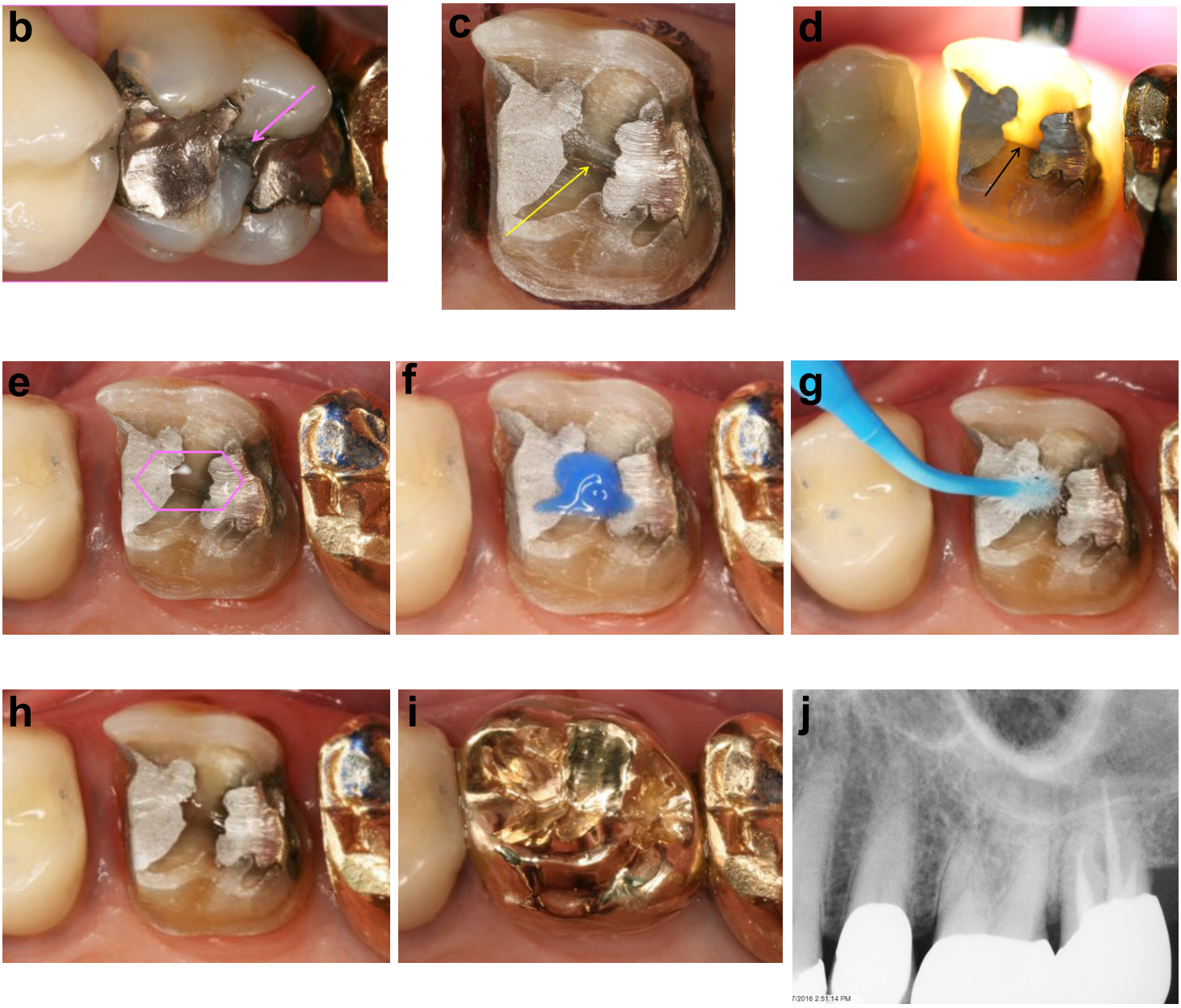
Clinicians treating teeth with COFs must understand that dentin, and probably also enamel, cannot be permanently re-bonded once a fracture line develops. Treatment efforts therefore are attempts to delay the continuing separation of the tooth segments, and perhaps to keep bacteria from colonizing the fracture spaces. Both efforts may be impossible over a long period of time (Fig.14).[12] The goal of this treatment approach is to bind a fractured tooth together, however one has to expect that in time the discontinuity in the integrity of the tooth structure will progress toward separation (split teeth or cuspal fractures). Root canal therapy, while reducing or eliminating symptoms, will not change the fact that a tooth with a fracture is weakened and likely will not last as long as a non-fractured tooth.[19]

Figure 14a (14b-j continued next page)

A patient (male, age 76, good health) reported that the tooth felt "weak" when chewing, experienced no pain to chewing and had no complaints of temperature sensitivity.

(a) the initial radiograph shows tooth #14 to have MO and DO metal restorations, and no evidence of apical lesions .

Figures 14 b-j (continued)



Figures14 b-j:

A patient (male, age 76, good health) reported that the tooth felt "weak" when chewing, experienced no pain to chewing and had no complaints of temperature sensitivity. **(a)** the initial radiograph shows tooth #14 to have MO and DO metal restorations, and no evidence of apical lesions – **(b)** clinical assessment finds an area of possible decay and a COF (arrow) – **(c)** fracture (arrow) becomes more evident after crown preparation – **(d)** fracture is further highlighted by transillumination – **(e)** area of the fracture (within the box) was soaked with chlorhexidine, anticipating that some of the solution would penetrate the fracture and kill bacteria - **(f)** area was etched in preparation for application of **(g)** dentin bonding agent and **(h)** polymerizing – provisional crown was placed and **(i)** subsequently the new crown was cemented – **(j)** tooth has remained asymptomatic and 2-year post-op film shows no indication of endodontic involvement.

Case courtesy of Dr. Charles Goodacre, Loma Linda University School of Dentistry.

The need for evidence-based treatment guidelines for COF has been identified.[5] While these are not yet available, there is some agreement that many teeth with COF may be treated,[19,20] but it is not clear if they all require root canal therapy. The lack of clear understanding is probably related to the difficulty in determining if a COF communicates directly with the pulp, in which case endodontic treatment would be a part of treatment, or the fracture is cuspal and may not communicate with the pulp.

Using the commonly accepted criteria for pulpal diagnosis, Krell and Rivera21 reported the outcomes of symptomatic, fractured teeth that were initially diagnosed with reversible pulpitis and treated with full coverage restorations. The outcomes in their case series suggest that, if a COF is identified early and the tooth is diagnosed with reversible pulpitis and a crown is placed, root canal treatment will be necessary only about 20% of the time.

An approach that can help the clinician to decide if endodontic therapy for a tooth with COF is necessary is to use the following protocol:[4,14] 1) If a tentative diagnosis of reversible pulpitis has been determined (based on no lingering pain to cold and no spontaneous, severe pain), the tooth is stabilized with an orthodontic band for about two weeks; 2) If symptoms subside within that period, the patient may be offered the option of only placing a restoration that binds the tooth together, such as a full crown*, with the awareness that the tooth may later need root canal therapy.[21] The reason for waiting after placement of the orthodontic band is because it takes some time before cold sensitivity subsides. Davis and Overton[22] found that it took two weeks for cold sensitivity to subside after restoring teeth with bonded amalgam restorations.

* Treatments described to bind fractured teeth together include the use of adhesives,[23] amalgam restorations with retention on both sides of the fracture,[22] full coverage crowns[4,14, ,18,23] and bonded composite overlays.[24]

When a fractured tooth has *irreversible* pulpitis or pulp necrosis, the need for endodontic therapy is necessary if the tooth is to be retained. Endodontic therapy will eliminate pulpal pain and sensitivity to temperature changes and sweets, but the clinician should not expect a tooth with a COF to be free of chewing pain. Pain to mastication is associated with inflammation in the PDL. Such inflammation is generated by bacteria in a COF.[11,12] The problem (not being able to predict if pain on chewing will cease after completion of the root canal treatment and restoration) can be addressed by initially placing an orthodontic band as discussed above, followed by endodontic therapy if chewing pain subsides. If the patient is not comfortable with the tooth following application of the band, extraction becomes the alternative treatment option.

PROGNOSIS

The outcome of treatment for teeth with COF has not been extensively reported. Cameron[17] reported a 75% success after ten years following placement of crowns. Brynjulfsen et al.[6] achieved pain relief in 90% of their patients after protective restorations were placed on teeth with fractures (endodontic therapy was included when indicated), and Tan et al.[25] had an 85% survival rate two years after protective crowns were placed. More recently, Sim et al.[19] reported the 5-year survival of teeth with COFs that were restored with full coverage crowns and had root canal treatment when indicated. They found that teeth with fractures confined to the crowns survived at a rate of 99%, while those with fracture extensions to the pulpal floor had an 88% survival rate.

The available data is insufficient to use as a basis for giving individual patients odds on a specific tooth survival. Patients must be fully informed of the uncertainty based on lack of data. One must recognize that in certain situations the prognosis is poor: teeth in a terminal position within the dentition; teeth with periodontal involvement related to the fracture, and; teeth with multiple fractures.[25] It is recommended that the clinician search the current literature regarding the type of clinical situation that exists, include his/her own experience and seek the patient's preferences when creating treatment recommendations and obtaining informed consent.

PATIENT INFORMATION

Teeth with COFs often present both patients and dentists with a number of challenges. Patients may have difficulty in describing symptoms and pointing out the location of the problem tooth. Dentists may be able to collect only limited clinical and radiographic data to establish a definitive diagnosis. Such a combination can result in frustration for everyone involved. Involving the patient in the problem-solving process may be helpful. Gathering all the pertinent information (history, symptom descriptions-regardless of how unusual they may be and past similar dental experiences) can provide a framework for suspicion of a COF. This gives the clinician an opportunity to share the complexity of establishing a definitive diagnosis with the patient. Such teamwork – patient and their dentist working together to solve the problem – may reduce the possibility of later conflicts.

Educating patients about a COF begins with an explanation about the factors that create symptoms. Early stages of the development may involve the pulp only (explaining both the often unusual symptoms and the inability to localize the tooth); such teeth may respond to biting tests but not percussion tests. Only when the fracture line has progressed to involve the root can localization be expected because of periodontal ligament involvement. Additional patient education can occur during discussion about treatment options and prognosis. The ideal outcome of such discussions is that the patient clearly comprehends the situation prior to making treatment choices. A patient will generally rely on his/her dentist's recommendations, but the better informed the patient, the better he/she will grasp the possible treatment consequences. Teeth with COF must be considered to have limited survival expectancy since these fractures cannot be eliminated and may continue progressing in the root. Lack of available data on survival of teeth with a COF makes it important to prepare a patient for the likelihood of eventual tooth loss.

The fact that prognosis for teeth with a COF is fair at best, does not mean that immediate replacement with a dental implant is the best treatment choice. Long-term prognosis for dental implants is reasonably good, but data from the past ten years point to increasing numbers of problems, such a peri-implantitis.[26] A reasonable approach to providing clinical guidance to a patient with a COF may be to recommend retaining such teeth for as long as practical.

References

1. American Association of Endodontists. Cracking the cracked tooth code: Detection and treatment of various longitudinal tooth fractures. Colleagues for Excellence. Chicago. 2008.
2. Bakland LK. Tooth infractions. In: Ingle's endodontics. Ingle JI, Bakland LK, Baumgartner J, editors.6th ed. Hamilton: BC Decker Inc.; 2008. p. 660-75.
3. Cameron CE. Cracked-tooth syndrome. JADA 1964; 68:405-11.
4. Brynjulfsen A, Fristad I, Grevstad T, Hals-Kvinsland I. Incompletely fractured teeth associated with diffuse longstanding orofacial pain: diagnosis and treatment outcome. Int Endod J 2002; 35:461-6.
5. Lubisich EB, Hilton TJ, Ferracane J. Cracked teeth: A review of the literature. J Esthet Restor Dent 2010; 22: 158-67.
6. Banerji S, Mehta SB, Millar BJ. Cracked tooth syndrome. Part 1: aetiology and diagnosis. Br Dent J 2010; 208:459-63.
7. Berman LH, Kuttler S. Fracture necrosis: Diagnosis, prognosis assessment, and treatment recommendations. J Endod 2010; 36:442-6.
8. Roh BD, Lee YE. Analysis of 154 cases of teeth with cracks. Dent Traumatol 2006; 22:118-23.
9. Swepston JH, Miller AW. The incompletely fractured tooth. J Prosthet Dent 1986; 55:413-6.
10. Rosen H. Cracked tooth syndrome. J Prosthet Dent. 1982; 47:36-43.
11. Kahler B, Moule A, Stenzel D. Bacterial contamination of cracks in symptomatic vital teeth. Austr Endod J 2000; 26:115-8.
12. Ricucci D, Siqueira JF, Logbin S, Berman LH. The cracked tooth: Histopathologic and histobacteriologic aspects. J Endod 2015; 41:343-52.
13. da Silveira PF, Vizzotto MB, Liedke GS, da Silveira HLD, Montagner F, da Silveira HED. Detection of vertical root fractures by conventional radiographic examination and cone beam computed tomography – an in vitro analysis. Dent Traumatol 2013; 29:41-46.
14. Ailor JE. Managing incomplete tooth fractures. JADA 2000; 131:1168-74.
15. Bakland LK. Tooth infractions. In: Ingle's endodontics. Ingle JI, Bakland LK, Baumgartner J, editors.6th ed. Hamilton: BC Decker Inc.; 2008. p. 660-75.
16. Wahab MHA, Kennedy JG. Response of cracked teeth to cold and electrical stimulation. Br Dent J 1985; 158:250-60.
17. Cameron CE. The cracked tooth syndrome: Additional findings. JADA 1976; 93:971-975.
18. Hiatt WH. Incomplete crown-root fracture. J Periodontol 1973; 44:369-79.
19. Sim IGB, Lim T-S, Krishnaswamy G, Chen N-N. Decision making for retention of endodontically treated posterior cracked teeth: A 5-year follow-up study. J Endod 2016; 42:225-9.
20. Maxwell EH, Braly BV, Eakle WS. Incompletely fractured teeth – A survey of endodontists. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1986; 61:113-7.
21. Krell KV, Rivera EM. A six year evaluation of cracked teeth diagnosed with reversible pulpitis: Treatment and prognosis. J Endod 2007; 33: 1405-7.
22. Davis R, Overton JD. Efficacy of bonded and nonbonded amalgam in the treatment of teeth with incomplete fractures. JADA 2000; 131:469-78.
23. Gutmann JL, Rakusin H. Endodontic and restorative management of incompletely fractured molar teeth. Int Endod J 1994; 27:343-8.
24. Opdam NJM, Roeters JJM, Loomans BAC, Bronkhorst EM. Seven-year clinical evaluation of painful cracked teeth restored with a direct composite restoration. J Endod 2008; 34: 808-11.
25. Tan L, Chen NN, Poon CY, Wong HB. Survival of root filled cracked teeth in a tertiary Kahler et al, institution. Int Endod J 2006; 39:886-9.
26. Holm-Pedersen P, Lang NP, Müller F. What are the longevities of teeth and oral implants? Clin Oral Impl Res 2007; 18:15-9.

POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the "Online Exam." We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.5 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **Crown-originating fractures occur primarily in which direction?**
   a. Facial-lingual
   b. Mesio-distal
   c. Multidirectional
   d. Horizontal

2. **The origin of crown-originating fractures is usually from the:**
   a. enamel toward the pulp.
   b. pulp toward the enamel.
   c. apex of the root.
   d. cervical area.

3. **Which of the following symptoms of crown-originating fractures is most common?**
   a. Pain similar to trigeminal neuralgia
   b. Ear-ache type pain
   c. Pain to chewing
   d. Continuous ache

4. **Which of the following diagnostic procedures has only a minor role in identifying teeth with crown-originating fractures?**
   a. Cone-beam computed tomography
   b. Percussion
   c. Biting test
   d. Transillumination

5. **Periodontal pockets associated with crown-originating fractures differ from those associated with vertical root fractures in that they:**
   a. typically extend to the tooth apex.
   b. can be painlessly explored.
   c. are very narrow.
   d. readily visible on radiographs.

6. **The pain experienced upon opening the mouth after a biting test, is called:**
   a. "relief pain"
   b. "chronic pain"
   c. "acute pain"
   d. "neurological pain"

7. **The treatment of a crown-originating fracture should include root canal therapy in which of the following situations?**
   a.. When the pulpal diagnosis is irreversible pulpitis
   b. Routinely when treating crown-originating fractures
   c. Only in cases of pulp necrosis
   d. Only in cases of cold sensitivity

8. **Determining the prognosis for a tooth with crown-originating fracture can be aided by:**
   a. adjusting occlusal contact.
   b. prescribing antibiotics.
   c. stabilizing the crown with a stainless steel band.
   d. recommending a soft diet.

9. **In which of the following situations can the survival rate following treatment of a crown-originating fracture be expected to be fairly good?**
   a. Fracture extending only part way into the root
   b. Fracture confined to the crown
   c. Fracture confined to the floor of the pulp chamber
   d. Fracture running in facial-lingual directions

10. **The available data on crown-originating fractures indicates:**
    a. dental implants provide the best treatment option.
    b. tooth survival after treatment is unpredictable.
    c. delaying treatment is not detrimental to the outcome.
    d. fractures can be prevented from progressing.

REGISTRATION/CERTIFICATION INFORMATION (Necessary for proper certification)

Name (Last, First, Middle Initial): _____

PLEASE PRINT CLEARLY

Street Address: _____ Suite/Apt. Number _____

City: _____ State: _____ Zip: _____

Telephone: _____ Fax: _____

Date of Birth: _____ Email: _____

State(s) of Licensure: _____ License Number(s): _____

Preferred Dentist Program ID Number: _____ ☐ Check Box If Not A PDP Member

AGD Mastership: ☐ Yes ☐ No

AGD Fellowship: ☐ Yes ☐ No Date: _____

Please Check One: ☐ General Practitioner ☐ Specialist ☐ Dental Hygienist ☐ Other

FOR OFFICE USE ONLY

Quality Resource Guide - Diagnosing and Managing the Cracked Tooth - Part 1

Providing dentists with the opportunity for continuing dental education is an essential part of MetLife's commitment to helping dentists improve the oral health of their patients through education. You can help in this effort by providing feedback regarding the continuing education offering you have just completed.

Please respond to the statements below by checking the appropriate box, using the scale on the right.

	1 = POOR				5 = Excellent	
	1	2	3	4	5	
1. How well did this course meet its stated educational objectives?	☐	☐	☐	☐	☐	
2. How would you rate the quality of the content?	☐	☐	☐	☐	☐	
3. Please rate the effectiveness of the author.	☐	☐	☐	☐	☐	
4. Please rate the written materials and visual aids used.	☐	☐	☐	☐	☐	
5. The use of evidence-based dentistry on the topic when applicable.	☐	☐	☐	☐	☐	☐ N/A
6. How relevant was the course material to your practice?	☐	☐	☐	☐	☐	
7. The extent to which the course enhanced your current knowledge or skill?	☐	☐	☐	☐	☐	
8. The level to which your personal objectives were satisfied.	☐	☐	☐	☐	☐	
9. Please rate the administrative arrangements for this course.	☐	☐	☐	☐	☐	

10. How likely are you to recommend MetLife's CE program to a friend or colleague? *(please circle one number below:)*

10 9 8 7 6 5 4 3 2 1 0

extremely likely neutral not likely at all

What is the primary reason for your 0-10 recommendation rating above?

_____

11. Please identify future topics that you would like to see:

_____

Thank you for your time and feedback.

To Complete Program Traditionally, Please Mail Your Post Test and Evaluation Forms To:

MetLife Dental Quality Initiatives Program
501 US Highway 22
Bridgewater, NJ 08807