

# The Cracked Tooth Dilemma



*Endodontics  
& Malden*

## THE CRACKED TOOTH DILEMMA

With today's advances in dentistry, the older we get – the longer we are keeping our teeth! But, no matter how healthy you keep your teeth or how many times a day you floss and brush, teeth are subjected to many occlusal forces and may weaken with age and use. The result of these forces often results in cracks and fractures that are not always visible. Often times, the only indicator of a cracked tooth is pain. Crack lines are the precursors of root fractures (1) and if left untreated, this may progress to a Longitudinal Root Fracture which results in imminent extraction.

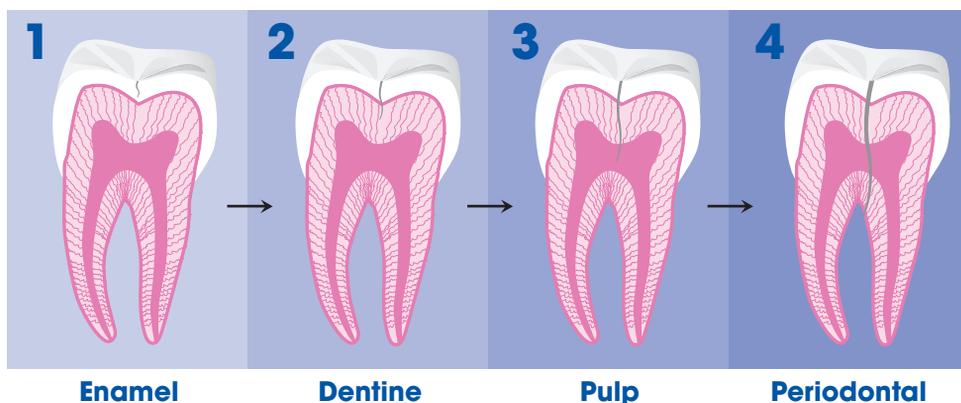


## What causes a tooth to crack or fracture?

- Blunt Trauma.
- Bruxism/Clenching/Grinding.
- Stress on a particular tooth/Occlusal pre-maturities
- Chewing on hard objects, uneven chewing pressure or repetitive heavy chewing.
- Large existing restorations that tend to act as a wedge to transfer lateral forces against the tooth surfaces supporting that restoration.
- Non-Restored endodontically treated teeth.

## How does an innocuous-looking craze line progress to a longitudinal root fracture?

- 1 A craze line in enamel is the first sign that a tooth is in danger of becoming a victim of occlusal forces.
- 2 If left unattended, it will progress to a crack line that starts in enamel and then propagates to involve the dentine as well. This is when patients start to experience symptoms.
- 3 The next stage would be pulpal involvement, either by direct extension of the fracture line or indirectly by pulpal degeneration.
- 4 Then periodontal involvement as the fracture line extends into the root. When the fracture line actually creates a break in the continuity of the tooth structure, it is only a matter of time before certain signs manifest to indicate that the time has come for the tooth to be extracted.



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Throughout this booklet we will be addressing the 4 progressive stages that move a craze line to a longitudinal root fracture. There are 3 main questions to address:

- A) Why do these teeth hurt?
- B) And how can we diagnose which stage the crack/fracture is at?
- C) What can we do about it?

### 1

- A) A craze line in enamel is usually the first sign of occlusal trauma.
- B) When noticed during an exam, look for other signs of bruxism such as occlusal attrition, cervical abfraction lesions and generalized sensitivity of several teeth in a quadrant.
- C) Timely intervention will save the tooth from future problems. This can be done by:
  - a) Addressing with the patient possible causes of para-functional activity—Stress and Fatigue are commonly cited. Create awareness that these actions are detrimental to the health of the tooth.
  - b) Occlusal equilibration, if necessary.
  - c) A night guard.



### 2

- A) In the initial stages, the crack is limited to the clinical crown (the periodontal ligament is not affected). Pain is felt on release of the clenching pressure. This is because the fluid movement in the dentinal tubules at the crack line stimulates mechanoreceptors near the odontoblast cell body resulting in the activation of A-delta fibers in the pulp which produce the sharp, moderate pain that lasts for just a few seconds (2,3).
- B) Diagnosis:
  - i) On examination—The crack may be clearly visible. Look for those breaks in the continuity of enamel at the mesial and distal marginal ridges on the occlusal surface. Also look for craze lines on the buccal enamel of teeth, as these are often times good indicators of Bruxism.

- ii) The Bite test—The tooth slooth is a very useful sleuth in the diagnosis of the cracked tooth. Pain on release of biting pressure as the tooth slooth is placed on one or more cusp tips is a classic sign of a cracked tooth.
- iii) Pulp tests—The electric pulp tests may be normal or give an early reading and the cold test elicits a sharp response that goes away on removal of the cold.

**C) Clinical Diagnosis at this stage could be**

- i) Hypersensitive Dentine or
- ii) Hyperemic pulp—Early stage.

Both these conditions are reversible if the cause of the occlusal trauma is removed, by occlusal equilibration (if occlusal prematurities exist) or using a night guard, if Bruxism is suspected.

Additional treatment required: Full crown coverage will prevent further propagation of the crack line.

**3a**

**A)** As the crack line encroaches the pulp space, degenerative changes start to take place in the pulp and these changes could be either calcific in nature (manifested by the development of pulp stones in the chamber) or they could be necrotic in nature. At this stage, the pain felt is not the sharp pulpal (A-delta fiber) pain, but a more dull pain that lasts for a longer duration. This is the result of pulpal C-fibers being stimulated in response to the chronic pulpal inflammation and the necrotic changes that ensue.

**C)** Treatment necessary: Endodontic treatment followed by prompt full crown coverage.



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### 3b

- A) If the cracked tooth is left untreated, the crack line could progress horizontally across the pulp chamber. If left to run its course, one fine day the patient will present to the office with a tooth fracture that split the tooth in half. The chief complaint of pain on biting down is mainly caused by the fractured segments being wedged apart and putting pressure on the periodontal ligament.
- B) These are easy to diagnose as the fracture line is clearly visible (with magnification) and one can see the fragments move when pried apart with the tine of the explorer.
- C) Treatment: One and only one recourse - **EXTRACTION!!**

### 4

- A) The crack line may continue to progress vertically along the length of the **root**. This infamous situation is commonly referred to as a “Longitudinal/Vertical Root Fracture” (LRF/VRF).

In it's early stages, commonly referred to as an infraction, the vertical root fracture does not cause any noticeable change in the Periodontal ligament (PDL) alongside the fracture line – neither on the radiograph nor on probing the gingival sulcus. The surest way to diagnose this type of root fracture is to actually see it under the Surgical Operating Microscope (SOM) while performing the root canal treatment.



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**B)** When the fracture line is seen extending vertically into the clinical root, it behooves the dentist to stop in his tracks, take the rubber dam off and sit the patient up and TALK! Inform and educate the patient about the presence of the VRF and its implications; that it affects the prognosis of the root canal procedure because the integrity of the tooth and therefore its longevity is compromised. Explain to the patient that the tooth will likely be lost in 2-4 years (i.e. when periodontal complications arise) at which point, extraction and an implant/bridge will be imminent. Most patients are not mentally or financially prepared to go in for an implant immediately and will agree to the other option that you present to them—to continue the root canal procedure and then get a crown on the tooth.

**C)** This is an important part of **informed consent** before one can proceed with the root canal treatment. In our office, the patients initial against small paragraph on the chart that reads,

\_\_\_\_\_  
Patient's  
Initials

'I have been informed of the root fracture and that the prognosis for this tooth is guarded. The tooth may be lost in a few years. I have been advised to explore alternative treatment procedures such as a bridge or an implant, for when the time comes for the tooth to be extracted.'

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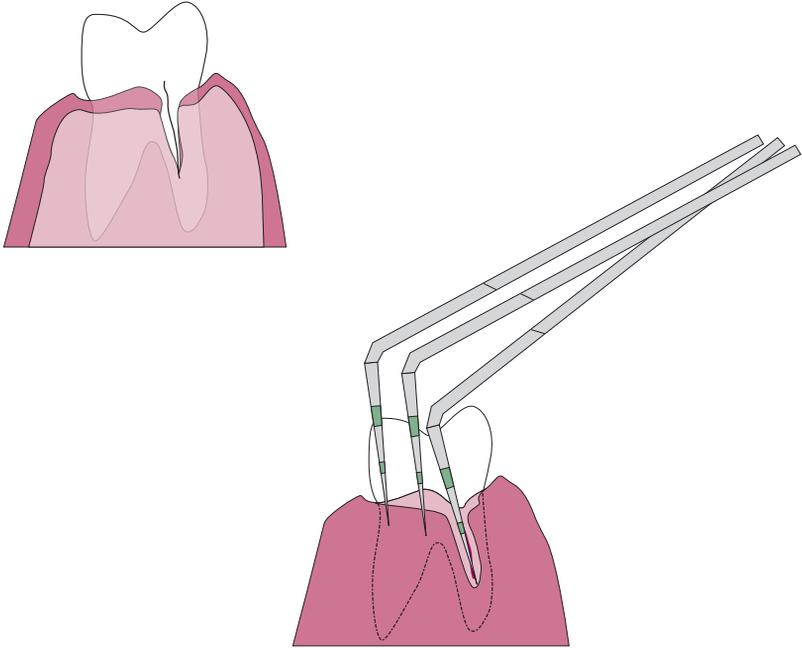
### How do we know when the time has come for the tooth with a vertical root fracture to be extracted?

As the fracture line becomes established for a longer period of time, bacteria harbor in this fracture line and cause the alveolar bone proper alongside it to be resorbed.

This is manifested in several ways:

- i) Radiographically, by a widening of the PDL starting from the crest of the alveolar bone and running towards the apex of the tooth. This broad band of radiolucency that runs alongside and parallel to the root surface is pathognomic for diagnosing root fractures.

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- ii) Probing the gingival sulcus will yield probing depths that correspond to the widened PDL along the fracture line. The nature of the probing pattern in fractured teeth is slit-like and exists only alongside the fracture of the root (5). This bone loss differs from that of periodontal disease in which the alveolar crestal bone loss extends over a wider area.
- iii) In well-established root fractures, there could be a periodontal abscess or fistula that originates at the fracture site.
- iv) Often times, the inflamed gingival tissue may be pushed back with hemodent and the sub-gingival tooth structure at the cervical 1/3 examined under the microscope to confirm the presence of a root fracture.

If a tooth presents with any one of the above signs, **extraction** is the only treatment option.

## Do all vertical root fractures commence at the occlusal surface?

Unfortunately not! There is also a type of root fracture that originates at the apex of the tooth and extends coronally. These, too, in its later stages cause the above mentioned changes in the periodontal ligament. But in the early stages, when the changes in the PDL are not detectable radiographically or on probing, it certainly poses a diagnostic dilemma!!



## What is new on the horizon for us to more accurately detect the root fracture site?

Cone Beam Computer Technology (CBCT) is the new wave of diagnostic radiology that allows us to view a three dimensional object as a three dimensional image. Remember that **Radiology Quiz** question about the drawback of conventional dental radiology giving us a “two dimensional image of a three dimensional object?!”

Cone Beam radiology will help us solve the diagnostic dilemma that besieges fractured teeth. To be more specific, CBCT will detect any slit-like bone loss cause by the fracture line, thus inferring that this is the fracture site. However CBCT can not help us permanently retain that tooth. At this time, **preventing a fracture of the tooth is still its best cure!**

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### What can I do to educate my patients about preventing cracked tooth syndrome/VRF?

- Identify craze lines or heavily restored teeth that may be subject to cracks or fractures.
- Large restorations (that tend to promote a wedging effect) should be modified to incorporate the cusp tips, similar to an onlay type of restoration.
- Recommend night guards for patients that present with significant occlusal wear, generalized abfraction lesions, heavily restored teeth, or TMJ damage.
- Prompt restoration of endodontically treated teeth. Inform patients and reinforce to them that all endodontically treated teeth should be protected with full crown coverage within 7-10 days after the root canal procedure.

At Endodontics of Malden, we take pride in the success rate of our endodontic procedures. That success relies on the patient restoring the endodontically treated tooth in a timely manner. We encourage our referring dentists to inform the patient that he/she must return to your office after the root canal procedure to restore the tooth.

The current recommendation for restoration of the endodontically treated tooth is using a fiber post (if a post is necessary) (4), core build-up and full-crown. We suggest that this appointment be scheduled before the patient leaves your office. Allow 7-10 days for the patient to get the Endodontic treatment done and to allow time for post-operative healing.

***Together, let us strive to stay one step ahead of the Cracked Tooth Dilemma!***

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Dr. Fernandes' career in Dentistry began when she was 17 years old at the Goa Dental College in Goa, India. She was awarded the B.D.S degree in 1986 from Government Dental College and Hospital in Bombay. She participated in the "All India Entrance Exams" in 1988, placing 22nd and received the M.D.S. degree in 'Operative Dentistry and Endodontics' at Nair Hospital Dental College in Bombay, India in 1991. She joined her family in the US, where she continued her education and attained the D.D.S. degree from New York University College of Dentistry in 1994. Upon completion, she attended The University of Medicine and Dentistry at the New Jersey Dental School and completed the Postgraduate program in Endodontics in 1996.

Dr. Fernandes opened 'Endodontics of Malden' in January 2005 after acquiring an existing location from the highly regarded Endodontics, Inc. Thus, accomplishing one of her professional dreams – maintaining a successful state of the art endodontic practice where her patients would receive the utmost care and respect.

Dr. Fernandes continues her education and shares her knowledge on a regular basis with her colleagues. She is a member of the American Association of Endodontists, the American Dental Association, The Massachusetts Dental Association and the East Middlesex District Dental Society. Dr. Fernandes served as the secretary of the East Middlesex District for 6 years.

When not indulged in Dentistry, Dr. Fernandes devotes her time to her family, her husband Vinny and children – Aparna, Vikram and 11 year old Analiese. A luxury for the busy doctor these days is curling up 'uninterrupted' with a good book, gardening and travelling AKA 'just getting away'!



Dr. Christine Marie Melito graduated magna cum laude from Northeastern University with a B.S. in Cardiopulmonary Science in 1997. After she practiced as a respiratory therapist for three years, she began her dental training. She received her DMD degree in 2004 from Tufts University School of Dental Medicine, where she graduated summa cum laude. Dr. Melito was elected into the Alumni membership in the XI-XI Chapter of Omicron Kappa Upsilon, a National Dental Honor Society.

She then received her Masters of Science degree in Dentistry and a Certificate of Advanced Graduate Study in Endodontics from Boston University Goldman School of Dental Medicine in 2007. She has been in private practice in endodontics since that time. Dr. Melito is a member of the American Association of Endodontists, the American Dental Association, and the Massachusetts Dental Society. She presented the results of her thesis research at the 2006 AAE Annual Session in Honolulu.

Dr. Melito is a Massachusetts native and lives with her husband Mark and son Dominic in Saugus. In her spare time, she enjoys running, cooking and traveling.



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