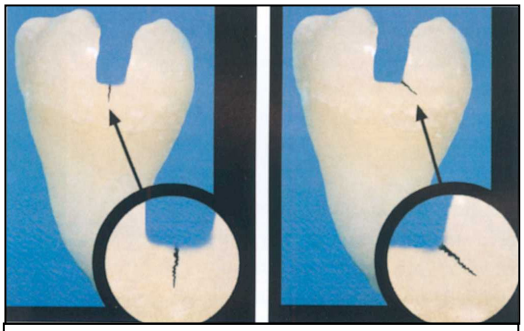
Endodontic Center
A Professional Dental Corporation

Catherine A. Hebert, D.D.S.

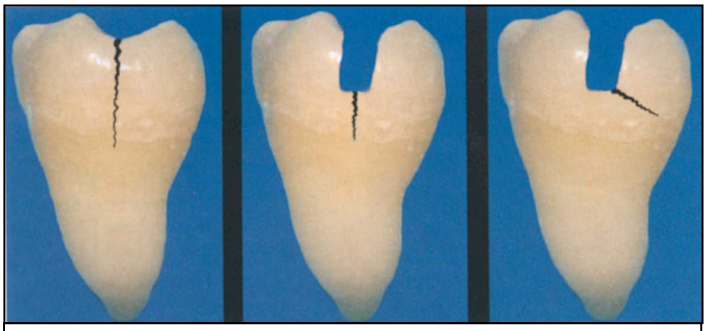
Reference Guide For Microscopic Fractures In Posterior Teeth

- **Most teeth in aging adults display enamel fractures**
- Enamel fractures, even dramatic ones, do not necessarily indicate that the tooth is fractured
- **Many enamel fractures do not penetrate significantly into dentin**
- Many enamel fractures have multiple features; many teeth have multiple fractures
- **Three types of underlying pathology** produce enamel fractures; **dentinal fractures**, **decay**, and **undermined enamel** often contributing to micro leakage around a restoration
- Dentinal fractures should be considered **structural fractures**, causing teeth to be structurally unsound
- Dentinal fractures fall generally into two types: (1) **vertical**, generally positioned in the middle of the pulpal floor – "**preradicular**," and (2) **oblique**, generally positioned at line angles of cavity preparations – "**precuspal**". Refer to photos of early dentinal fractures below
- Many teeth exhibit both types of dentinal fractures; **hybrid fractures** are also common. Rigorous classification is less important than **early recognition and treatment**.
- Microscopic **fractures in restorative materials** can also indicate a lack of coronal structural integrity
- Well-defined discoloration of a cusp or cusps can indicate a lack of structural integrity
- Unusual or unilateral **gapping between an occlusal restoration** and tooth structure can indicate a lack of structural integrity

Dentinal (Structural) Fractures



Early Stage (microscopic) coronal dentinal fracture falls into one of two categories: a vertical (pulpal floor) fracture (left) or an oblique (line angle) fracture (right)

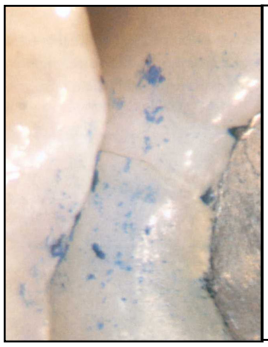


Late Stage progression of coronal fractures. Endodontic, periodontal and restorative problems are now brought into play. Regular microscopic examinations can significantly reduce the number of teeth that reach traditional symptom-driven diagnosis and treatment.

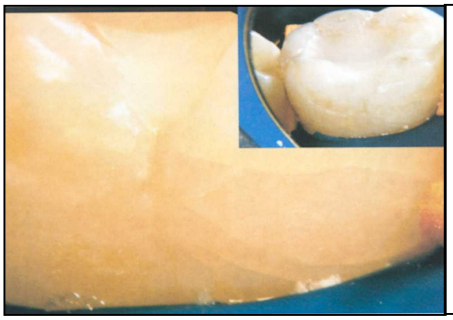
Classification System for Enamel Fractures

Type I: Little or No Risk of Underlying Pathology

● Craze lines are usually linear and vertical and do not widen or become more pronounced as they extend from gingival to occlusal ● Vertical fractures not associated with restorations and without environmental stain penetration ● Fractures that follow natural anatomic grooves ● Fractures with superficial environmental stain penetration ● Fractures that result from polymerization shrinkage of composites



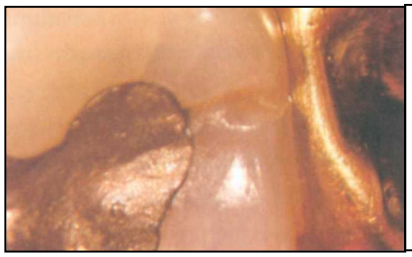
Distal marginal ridge of an upper first molar. During subsequent crown preparation, no underlying dentinal fractures were observed that corresponded with this enamel fracture.



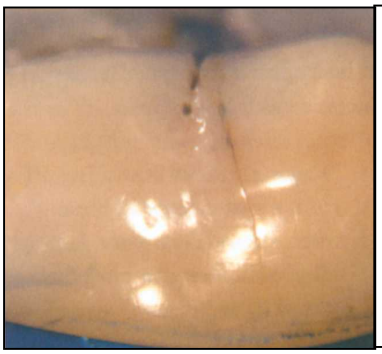
An undermined mesiolingual cusp was no match for polymerization shrinkage of a bonded composite. Several horizontal enamel fractures are present but do not extend into the dentin.

Type II: Moderate Risk of Underlying Pathology

● Wedge-shaped enamel ditching resulting from a loss of enamel tooth structure with no prior restoration, often associated with a wear facet and localized occlusal loading centered over an otherwise benign fracture ● Wedge-shaped enamel ditching resulting from a loss of enamel tooth structure with an adjoining restoration, often associated with a wear facet and localized occlusal loading centered over an otherwise benign fracture ● Fractures that detour from or do not follow anatomic grooves



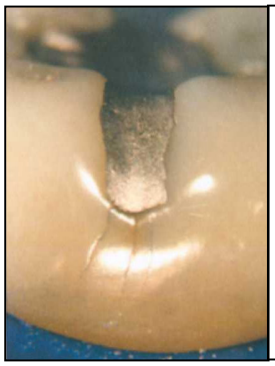
Occlusal view of a lower second bicuspid. Although dramatic, This type II fracture presents as wedge-shaped enamel ditching centered over an otherwise benign fracture.



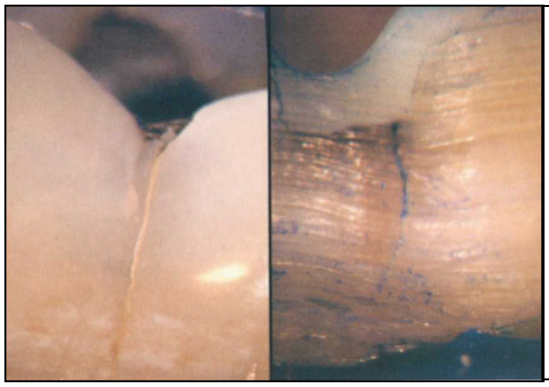
Lingual view of a lower second molar. Note the lingual groove to the left and fracture to the right. The fracture is nonlinear, nonvertical, and widens as it extends occlusally. Significant vertical and oblique dentinal fractures were viewed after amalgam removal.

Type III: High Risk of Underlying Pathology

● Diagonal fractures branching off from vertical fractures; these often are indicative of a late-stage oblique incomplete fracture ● Horizontal or diagonal fractures that normally emanate from the corner of a restoration; they narrow as they extend gingivally and are typically nonlinear ● Fractures that house debris, with or without previous restorations (indicative of a fracture size approximately 200 um or greater) ● Pairs of fractures that outline an area (cusp[s] or marginal ridge) of discolored enamel; these show a high potential for an underlying dentinal fracture and future complete fracture ● Fractures with a corresponding “halo” of brown, gray, or white centered on fracture



Three fractures are present on a facial view of the lower right first molar. After the amalgam is removed, we observe that a diagonal fracture on the left has severely undermined the distobuccal cusp. A vertical fracture was insignificant. The tooth was symptomatic.



Lingual view of the lower left first molar. A subtle darkening or halo is centered on a fracture that does not follow the anatomic groove and houses very fine debris. The prepared tooth shows a dentinal fracture.

Reference: David J. Clark DDS, Cherilyn G. Sheets DDS, Jacinthe M. Paquette DDS, Definitive Diagnosis of Early Enamel and Dentin Cracks Based on Microscopic Evaluation Journal of Esthetic and Restorative Dentistry 2003.vol 15, Number 7 391-401