

Endodontic Diagnosis/Pulp Tests and Etiology of Pulp Inflammation

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Before pulp vitality tests are conducted, dentists should examine periapical radiographs of each tooth in the symptomatic area. Radiographs of suspect teeth from multiple angles are helpful. Bitewing radiographs may also be useful in determining proximity of restorations or caries to the pulp space. The review of the radiographs should consider condition of pulp chamber (calcifications), proximity of restorations and/or caries to the pulp space, periapical and periodontal status, and uniformity of the periodontal ligament around the entire root(s). Keep in mind that symptomatic teeth may have an entirely normal radiographic appearance. This is especially true in cases of irreversible pulpitis (IRR) where periapical changes are not discernable. Therefore, clinical examination of each tooth is essential. It is important to consider the presence of cracks and craze lines as well as the more obvious restorative condition (defective restorations, caries, external or internal resorption). Transillumination can be very helpful in identifying cracks. Invariably cracks are not apparent in radiographs and can be hidden from clinical view beneath a restoration.

Pulp test responses are taken in context relative to radiographic and clinical observations. When conducting pulp vitality tests, the most useful clinical response is one that duplicates the patient's chief complaint. For example, if a patient complains of prolonged dental pain after a hot beverage, heat tests that duplicate that response are most conclusive. Likewise for cold tests when cold is the chief complaint, and bite-stick analysis when bite pressure/lancing pain has been noted when chewing.

Cold testing is a simple way to establish relative pulp response levels. This test can be done using spray refrigerant (Endo Ice) on a cotton pellet applied to the facial cervical areas of the teeth to be tested. Alternatively, some clinicians prefer using an ice pencil. Response to cold should be relatively consistent among normal teeth in a given area. Typically a normal response would be immediate, possibly sharp and intense, but brief in duration (under 10 seconds). Teeth with highly calcified pulp chambers may react in a delayed manner. Duration and relative intensity of response are key in making a diagnosis. An abnormal response would include one that is severe relative to surrounding teeth, or one that lingers beyond ten seconds. Pulsing or throbbing after the initial response subsides would also be considered abnormal; a sign of irreversible pulp damage.

When the chief complaint is sensitivity with heat (partially necrotic pulp) , the offending tooth (pulp) *might* have an altered cold response, but not always. The cold response in such a case may be absent, diminished, normal, or even heightened. Sometimes only heat tests can pinpoint the partially necrotic pulp. Heat applied to a partially necrotic tooth creates thermal expansion of the degenerative pulp and may duplicate the patients chief pain response. The most efficacious heat test is done by individually isolating each tooth with a rubber dam, and then bathing the tooth with hot water applied from a syringe with a blunt irrigating needle (water can be heated in a microwave safe vessel then drawn into a 50 cc syringe). Alternatively heat can be applied to a tooth by running a polishing point (brownie) against the facial cervical aspect of each tooth until frictional heat generates a response. The latter technique is a bit more tedious and it can be less effective in reproducing heat response than hot water immersion. Normal pulp response to heat is typically subdued. A degenerative pulp will often stand out with an intense response to heat.

Electric pulp tests (EPT) are less helpful than thermal pulp vitality tests. EPT does not dependably differentiate a tooth with partial vitality. Vital (normal) responses might be elicited with EPT even when the pulp tissue is in a degenerative phase.

It is important that patients be asked if they have taken any pain medications within 12 hours of the diagnostic appointment. Even low doses of anti-inflammatory medications can lessen the pulp response and make it difficult to reproduce the patient's symptoms during vitality tests.

Pathways of Inflammation in the Pulp

Almost any insult to the tooth depending on duration and severity can set the inflammatory process in motion. Three pathways to the pulp are usually described:

Direct extension via dentinal tubules as in caries or chemicals placed on the dentin.

Extension by the process of anachoresis, the passage of bloodborne bacteria to the pulp. Studies have shown that bacteria will migrate toward areas that are already injured or inflamed. This may explain why some pulps are necrotic when there is no other apparent etiologic factor than trauma.

Extension of periodontal disease into the pulp system via lateral root canal passages or apical foramina.

Seltzer has summed up the entire spectrum of pulpal histopathology by the following classifications:

Atrophic calcification Transitional stage Acute partial pulpitis Chronic partial pulpitis with liquefaction necrosis Chronic total pulpitis Total pulpal necrosis

For clinical purposes the diagnostic categories for endodontic involvement can be segregated as follows:

Reversible pulpitis: transient hypersensitivity in teeth, i.e. following recent dental restoration. No endodontic treatment needed.

Irreversible pulpitis (IRR): prolonged sensitivity following thermal tests revealing irreparable damage to the pulp. This condition often shows no radiographic manifestations as the damage is confined to the pulpal tissues within the tooth at this stage. Endodontic treatment, or tooth extraction is needed. If not treated this condition progresses to one of the following two disease states:

Acute apical periodontitis (APP): partially or totally necrotic pulp which may show either total absence of reaction with thermal tests or possibly severe prolonged thermal response, but always accompanied by spread of bacteria from the dental pulp into the attachment apparatus with subsequent tactile tenderness, i.e. percussion sensitivity. Not always discernable radiographically, but may show onset of PDL thickening. The patient with this diagnosis is by definition symptomatic and requires endodontic treatment or extraction of the tooth.

Chronic periapical periodontitis CPP: totally absent thermal response following total pulp necrosis, with chronic infiltration of bacteria from the dental pulp into dental attachment apparatus. This is usually demonstrable radiographically by the presence of thickened apical or lateral periodontal ligaments. Patient is by definition asymptomatic (chronic rather than acute) and the involved tooth requires either endodontic treatment or extraction.

Seltzer believes that the most definitive factor in irreversible pulpitis is the presence of an intrapulpal abscess. The diagnosis is based on a history of previous moderate to severe pain, no response to pulp tests, or pulp test responses differing markedly from those on control teeth. In addition, the presence of spontaneous severe pain, or a prolonged response after thermal testing usually indicates irreversible pulpitis. In the presence of two or more findings, the diagnosis of irreversible pulpitis is fairly easy to make.