



Pulpal and periradicular diagnosis

Captain Scott B. McClanahan, DC, USN, Captain Gary G. Goodell, DC, USN,
and Commander Patricia A. Tordik, DC, USN

Purpose

In the fall of 2003, a new Glossary of Endodontic Terms (1) was published by the American Association of Endodontists. The purpose of this Clinical Update is to inform clinicians of the revised terminology for endodontic diagnoses.

The significant changes are primarily in the classification of abscesses. Notably, the diagnosis Phoenix Abscess has been eliminated and the term is now considered historical.

It is critically important to have standard diagnostic terminology because of the wide variety of training backgrounds of military dental officers and contract dentists. Standardization of terms will improve communication between all clinicians.

Diagnostic procedures

Diagnosis is defined as “the art of distinguishing one disease from another” (2). In endodontics, diagnostic procedures should follow a consistent and logical order and include review of medical and dental histories, radiographic examination and clinical examination. The clinical examination consists of extraoral and intraoral evaluations and diagnostic tests (3-8). During examination procedures, assessment and reproduction of the patient’s chief complaint are imperative. The results of the examination and diagnostic tests should culminate in a two-part endodontic diagnosis, that includes both a **pulpal** and a **periradicular** diagnosis.

Pulpal diagnoses

Normal Pulp. A normal pulp is symptom free and will be normally responsive to the electric pulp tester (EPT). When evaluated by thermal testing, the normal pulp produces a positive response that is mild and subsides immediately when the stimulus is removed. Percussion and palpation testing produce non-sensitive responses.

Reversible Pulpitis. Caries, cracks, restorative procedures or trauma may cause a pulp to become inflamed. The patient’s chief complaint is usually of an exaggerated response to thermal stimulus but once the stimulus is removed, the discomfort does not linger. EPT results are responsive. Percussion and palpation testing produce non-sensitive responses.

Irreversible Pulpitis. If the inflammatory process progresses, irreversible pulpitis can develop. Patients may have a history of spontaneous pain and complain of an exaggerated response to hot or cold that lingers after the stimulus is removed. EPT results are responsive. The involved tooth will usually present with a history of an extensive restoration and/or caries. Percussion and palpation testing may or may not produce sensitive results.

In certain cases of irreversible pulpitis, the patient may arrive at the dental clinic sipping a glass of ice water or applying ice to the affected area. In these cases, cold actually alleviates the patient’s pain as the dental pulp has developed allodynia and is hyperalgesic. Normal body temperature is now causing the nociceptors in the pulp to discharge (9). Removal of the cold causes return of symptoms and can be used as a diagnostic test.

Irreversible pulpitis can also present as an asymptomatic condition. Internal resorption and hyperplastic pulpitis (pulp polyp) are examples of asymptomatic irreversible pulpitis.

Pulpal Necrosis. Necrosis is a histologic term that denotes death of the pulp. Teeth with total pulpal necrosis are usually asymptomatic unless inflammation has progressed to the periradicular tissues. The pulp will not respond to the EPT and if using a digital EPT, this result should be reported as no response (NR) over 80. The pulp will not respond to thermal tests. The dental record entry for this pulpal diagnosis should be necrotic pulp.

Pulpless Tooth. A tooth from which the pulp has been removed. For example, a tooth with previous pulpotomy/pulpectomy/root canal debridement or previous root canal therapy should be recorded in the dental record as a pulpless tooth for the pulpal diagnosis.

Periradicular diagnoses

Normal Periradicular Tissues. Normal periradicular tissues will be non-sensitive to percussion and palpation testing. Radiographically, periradicular tissues are normal meaning that the lamina dura is intact and the periodontal ligament (PDL) space is uniform.

Acute Periradicular Periodontitis. Acute periradicular periodontitis occurs when pulpal disease extends into the surrounding periradicular tissues and causes inflammation. However, acute periradicular periodontitis may also occur as the result of occlusal traumatism. The patient will generally complain of discomfort to biting or chewing. Sensitivity to percussion testing is a hallmark diagnostic test result of acute periradicular periodontitis. Palpation testing may or may not produce a sensitive response. The PDL space may or may not be widened on the radiograph.

Acute Periradicular Abscess. In this situation, bacteria have progressed into the periradicular tissues and the patient’s immune response cannot defend against the invasion. It is characterized by rapid onset, spontaneous pain, pus formation, and eventual swelling of the associated tissues. Depending upon the location of the apices of the tooth and muscle attachments, a swelling will develop in the buccal vestibule, on the lingual/palatal, or as a fascial space infection. Percussion testing produces a response that is

usually exquisitely sensitive. This exaggerated response can help differentiate between acute periradicular periodontitis and the early stages of acute periradicular abscess. Palpation testing produces a sensitive response. Radiographically, the PDL space may be normal, slightly widened, or demonstrate a distinct radiolucency. This periradicular pathosis can occur with a necrotic pulp or a pulpless tooth as a result of bacterial contamination from coronal microleakage.

Chronic Periradicular Periodontitis. When bacteria or bacterial products from a necrotic pulp or pulpless tooth slowly ingress into the periradicular tissues, the patient's immune system may become involved in a chronic conflict. The resultant inflammatory process causes periradicular bone resorption that manifests as a periradicular radiolucency on the radiograph. Clinically, the patient is asymptomatic. Percussion and palpation testing produce non-sensitive responses.

Chronic Periradicular Periodontitis With Symptoms. The patient will present with mild to moderate symptoms that may include spontaneous pain or discomfort on biting or chewing. The pulpal diagnosis will be necrotic or pulpless. Percussion testing produces a sensitive response and palpation testing may or may not be sensitive. Radiographically, the tooth will present with a periradicular radiolucency. These patients must receive endodontic treatment in a timely manner because the condition can quickly progress into an acute periradicular abscess.

Chronic Periradicular Abscess (Suppurative Periradicular Periodontitis). An inflammatory reaction to pulpal infection and necrosis characterized by gradual onset, little or no discomfort and intermittent discharge of pus through an associated sinus tract. Clinically, the patient is usually asymptomatic because the sinus tract allows drainage of any exudate from the periradicular tissues. EPT and thermal testing are non-responsive. Percussion and palpation testing usually produce non-sensitive responses. Radiographically, a periradicular lesion is associated with the involved tooth. This entity can also occur with a pulpless tooth as a result of bacterial contamination from coronal microleakage.

Focal Sclerosing Osteomyelitis (Condensing Osteitis). This entity may be considered a true lesion of endodontic origin (LEO). The involved tooth will have an etiologic factor for low-grade, chronic inflammation such as a necrotic pulp, extensive restorative history or a crack. The patient may be asymptomatic or demonstrate a wide range of pulpal symptoms. EPT and thermal tests may or may not be responsive. Percussion and palpation testing may or may not be sensitive. Radiographically, the involved tooth will present with increased radiodensity and opacity around one or more of the roots. Evidence supporting consideration as a LEO is that 85% of these periradicular radiodensities resolve after endodontic therapy (10).

Focal Osteopetrosis (Periapical Osteosclerosis). This entity is not a LEO. The patient will be asymptomatic. EPT and thermal testing are responsive and normal. Percussion and palpation testing will be non-sensitive. The involved tooth is usually a virgin tooth or has a normal pulp. Radiographically, the tooth will present with increased radiodensity and opacity around one or more of the roots. No treatment is necessary

and the tooth should simply be monitored at periodic recall. (7)

Summary

Determination of the etiology of the patient's chief complaint and a correct diagnosis are paramount prior to a recommendation of endodontic therapy. Reproduction of the patient's chief complaint is critical. If the chief complaint cannot be reproduced, consider consultation with or referral to an endodontist or orofacial pain specialist.

The diagnostic terminology presented in this Clinical Update and summarized in the table that follows provides for a more accurate description and communication of the health or pathological conditions of both pulpal and periradicular tissues.

References

1. Glossary of Endodontic Terms. 7th ed. American Association of Endodontists; 2003.
2. Dorland's illustrated medical dictionary. 29th ed. Philadelphia: W. B. Sanders Co.; 2000. p. 490.
3. Montgomery S, Ferguson CD. Endodontics. Diagnostic, treatment planning, and prognostic considerations. Dent Clin North Am 1986 Jul;30(3):533-48.
4. Cohen S, Liewehr F. Diagnostic procedures. In: Cohen S, Burns RC, editors. Pathways of the pulp. 8th ed. St Louis: Mosby, Inc.; 2002. p. 3-30.
5. Simon JHS, Walton RE, Pashley DH, Dowden WE, Bakland LK. Pulpal pathology. In: Ingle JI, Bakland LK, editors. Endodontics. 4th ed. Baltimore: Williams & Wilkins; 1994. p. 419-38.
6. Torabinejad M, Walton RE. Periradicular lesions. In: Ingle JI, Bakland LK, editors. Endodontics. 4th ed. Baltimore: Williams & Wilkins; 1994. p. 439-64.
7. Simon JHS. Periapical pathology. In: Cohen S, Burns RC, editors. Pathways of the pulp. 7th ed. St Louis: Mosby, Inc.; 1998. p. 425-62.
8. Nair PNR. Pathobiology of the periapex. In: Cohen S, Burns RC, editors. Pathways of the pulp. 8th ed. St Louis: Mosby, Inc.; 2002. p. 457-500.
9. Hargreaves, KM. Pain mechanism of the pulpodentin complex. In: Hargreaves, KM, Goodis, HE, editors. Seltzer and Bender's Dental Pulp. Carol Stream, IL: Quintessence Publishing Co, Inc; 2002, p. 188-194.
10. Eliasson S, Halvarsson C, Ljungheimer C. Periapical condensing osteitis and endodontic treatment. Oral Surg Oral Med Oral Pathol 1984 Feb;57(2):195-9.

CAPT McClanahan is the Chairman of the Endodontics Department. CAPT Goodell is the Assistant Department Head on the staff of the Endodontics Department. CDR Tordik is on the staff of the Endodontics Department.

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PULPAL AND PERIRADICULAR DIAGNOSES

<i>Pulpal Diagnosis</i>	Chief Complaint	History	Radiographic Findings	EPT	Thermal Testing	Percussion	Palpation	Mobility	Other
Normal Pulp	None		Normal	R	R, NL				
Reversible Pulpitis	Hot &/or Cold Sensitivity		Normal	R	Exaggerated, NL				Caries, Cracks, Restorative Procedures, or Trauma
Irreversible Pulpitis	Lingering Hot & / or Cold Sensitivity	Spontaneous Pain	Normal, PRL, or Widened PDL	R	Exaggerated, L				
Necrotic Pulp		Variable	Normal, PRL, or Widened PDL	NR	NR				
Pulpless Tooth		Previous Pulpotomy / Pulpectomy / RCT	Normal, Widened PDL, Or PRL	NR	NR				

<i>Periradicular Diagnosis</i>	Chief Complaint	History	Radiographic Findings	EPT	Thermal Testing	Percussion	Palpation	Mobility	Other
Normal Periradicular Tissues	None		Normal	R	R, NL	NS	NS	WNL	
Acute Periradicular Periodontitis	Discomfort When Biting or Chewing	Recent Restoration?	Normal or Widened PDL	R / NR	Variable	S	S or NS	+ / -	Occlusal Traumatism?
Acute Periradicular Abscess	Pain with Slight to Large Swelling	Coronal Microleakage?	Normal, Widened PDL, or PRL	NR	NR	Exquisitely S	S	+ / -	Necrotic or Pulpless
Chronic Periradicular Periodontitis	None	Asymptomatic	PRL	NR	NR	NS	NS	WNL	Necrotic or Pulpless
Chronic Periradicular Periodontitis With Symptoms	Spontaneous or Discomfort When Biting / Chewing	Coronal Microleakage?	PRL	NR	NR	S	S or NS	+ / -	Necrotic or Pulpless
Chronic Periradicular Abscess (Suppurative Periradicular Periodontitis)	Bad Taste or "Gum Bump"	Asymptomatic	PRL	NR	NR	NS	NS	WNL	Necrotic or Pulpless with <u>Sinus Tract</u>
Focal Sclerosing Osteomyelitis (Condensing Osteitis)	Asymptomatic or Variable Pulpal Symptoms	Extensive Restorative History / Crack	Increased Radiodensity / Opacity	R / NR	Variable	S or NS	S or NS	WNL	
Focal Osteopetrosis / Periapical Osteosclerosis	Asymptomatic	Virgin Tooth or Normal Pulp	Increased Radiodensity / Opacity	R	R, NL	NS	NS	WNL	

WNL = Within Normal Limits L = Lingering NL = Non-lingering S = Sensitive NS = Non-sensitive R = Responsive NR = Non-responsive
PRL = Periradicular Radiolucency