



Published for the
dental professional
community by the
American
Association of
Endodontists

Spring/Summer
2001

ENDODONTICS

COLLEAGUES FOR EXCELLENCE

Pulpal/Periodontal Relationships

Redefined through an Integrated Approach
to Diagnosis and Treatment

Proper diagnosis is the important first step in any treatment. Careful assessment is critical to a satisfactory outcome in the presence of a suspected pulpal-periodontal lesion. While important rules of thumb exist – ‘a healthy pulp rules out endodontic treatment’ – when the periodontium is involved, treatment and prognosis are affected by the etiology. The best policy is to evaluate both aspects thoroughly.

This issue of *ENDODONTICS: Colleagues for Excellence* presents case studies illustrating a variety of challenges – common and not so common – in the diagnosis, treatment and resolution of pulpal and/or periodontal pathosis.

Definitions

Healthy pulp: An asymptomatic pulp without inflammation that responds within normal limits to thermal or electrical testing.

Vital pulp: A pulp that may or may not be healthy but responds to thermal or electrical testing.

Pulpal/periodontal lesion: A process involving interaction of diseases of the pulp and periodontium. The etiology, diagnosis and prognosis classify these interactions or lesions as follows:

Pulpal lesions: These lesions are strictly of pulpal origin but may mimic combined lesions and will resolve with root canal treatment alone.

Periodontal lesions: These lesions are strictly of periodontal origin but may mimic combined lesions and will resolve with periodontal treatment alone.

Combined lesions: 1. Primary pulpal lesions with extension to the periradicular tissues with secondary imposition of periodontal disease; 2. Primary periodontal lesions with extension to the pulpal tissues; 3. Concomitant pulpal-periodontal lesions in which disease processes exist independently in both tissues.

Diagnosis of pulpal and periodontal status

A step-by-step plan for accurate diagnosis of the pulpal and periodontal status of a tooth can be found in the insert, “Systematic Pulpal Diagnosis,” enclosed with this newsletter.

Assessment

Put simply, the status of the pulp is of great importance when there is a deep periodontal pocket or furcation involvement. If the pulp is healthy, the lesion is totally periodontal. If the pulp is unhealthy or necrotic, the attachment apparatus has the capacity to regenerate following root canal treatment. Radiographs alone do not provide enough information to make a correct diagnosis. Always use the periodontal probe in a clinical assessment before recommending root canal treatment.

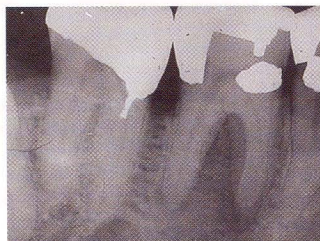
Pulpal and periodontal relationships

The relationship that exists between the pulp of a tooth and the surrounding periodontium is undisputed. Healthy periodontal tissue provides nourishment and support for the roots. Unhealthy pulpal tissue or an infected pulpal space can contribute to loss of the periodontal attachment. Direct communication exists between the pulp and periodontal ligament by way of dentinal tubules, lateral and/or accessory canals and the apical foramina.

While pulp vitality may not often be affected by periodontal disease, evidence exists that periodontal disease can affect the health of the pulp. For example, in the presence of long-standing periodontal disease, the pulp may exhibit degenerative changes such as internal resorptions, calcifications and infarctions. Some researchers have identified the existence of similar microflora in noncarious, intact teeth with nonvital pulps and deep periodontal pockets. Additionally, the byproducts of an inflamed, infected or necrotic pulp may move through main or accessory canals to produce damage to periodontal tissues.

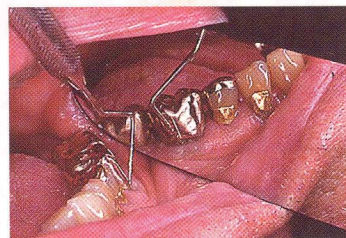
I. Pulpal lesions

What may first appear as a periodontal pocket, accompanied by drainage and swelling, may be a sinus tract originating from the apical foramina or a lateral canal. Such a tract, draining along the periodontal ligament, may simulate periodontal disease. Different patterns of bone loss may be apparent on radiographs depending on the pathway of drainage. A gutta-percha cone should be inserted into the sinus tract and radiographs taken to help determine the origin of the lesion. (figure 1)

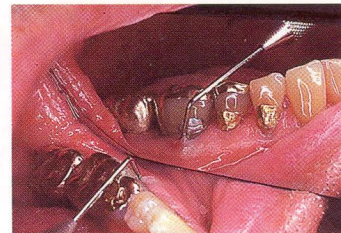


Ia. Mandibular first molar with large periradicular lesion extending into the furcation.

I d. Nine month recall – no probing into sulcus.

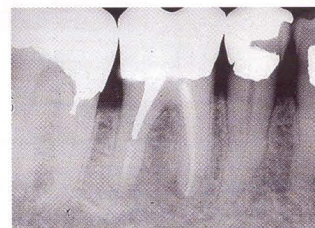


Ib. Deep probing into sinus tract that has exited through the sulcus.



Ic. Following root canal treatment.

Ie. Nine-month radiograph showing excellent, but not complete, healing.

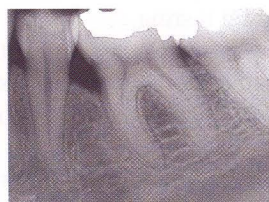


II. Periodontal lesions

In cases of periodontal disease, pulp testing procedures usually will indicate a vital pulpal response. Periodontal probing will show increased pocket depth, with plaque and calculus formation. The bony lesion is usually more widespread and generalized than are lesions of pulpal origin (figure 2). Untreated, the periodontal lesion may progress along the root surface to the apical region, mimicking a combined lesion.

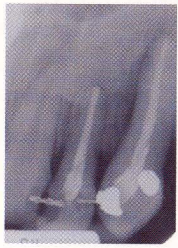


2a. Vertical pocket on mesial of mandibular molar. Tests indicate a responsive pulp.



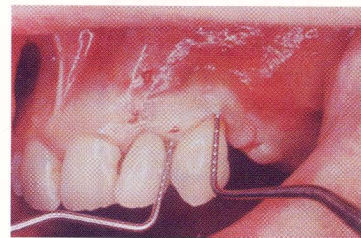
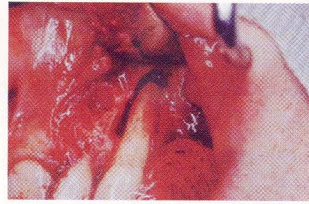
2b. One year after periodontal surgery and bone grafting. Osseous healing is noted and tooth responds favorably to pulp tests.

Combined lesions 1: Primary pulpal, secondary periodontal



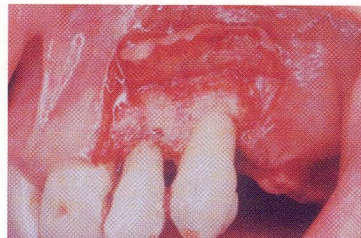
3a. Preoperative radiograph.

3b. When the periodontist reflected the labial gingiva over this tooth, complete dehiscence of bone was noted. Root planing was performed.



3c. At four months, the periodontist noted that probing depths were only 3 mm.

3d. Upon re-entering the area, complete bone regeneration in the area of the dehiscence was noted.



III. Combined lesions

Combined lesions 1. Primary pulpal lesions with extension to the periradicular tissues with secondary imposition of periodontal disease.

Untreated inflammation/infection of pulpal origin that extends crestally may lead secondarily to periodontal disease. Plaque forms at the resulting sulcular defect, leading to calculus formation and gingivitis. Without intervention, periodontitis will follow, affecting the treatment and prognosis.

When root canal treatment is complete, the prognosis depends upon the degree of periodontal involvement and quality of the periodontal treatment. With root canal treatment alone, only one aspect of the lesion is addressed, and healing will be incomplete. Combined therapy should resolve both pulpal and periodontal defects (figure 2).

Combined lesions 2. Primary periodontal lesions with extension to the pulpal tissues.

A tooth with periodontal disease that does not respond to periodontal treatment alone may have an unhealthy or necrotic pulp. When the pulp becomes inflamed, it contributes to the persistence of the periodontal lesion.

Combined lesions 3. Concomitant pulpal-periodontal lesions in which disease processes exist independently in both tissues.

Both pulpal and periodontal disease may be present independently of each other or may progress until the lesions unite to produce a radiographic and clinical picture similar to other lesions discussed above. A necrotic pulp, plaque, calculus and periodontitis will be present in varying degrees. If the lesions join, they may be indistinguishable from categories one or two above. Both endodontic and periodontal treatments are necessary (figure 4). If possible, root canal treatment should precede periodontal treatment.

Combined lesions 3: Concomitant pulpal-periodontal



4a. Root canal therapy was initiated and the patient was referred to a periodontist for evaluation.



4b. At three-months post-op, after completion of root canal treatment and a bone grafting procedure by the periodontist, periapical healing was evident, and the gingival tissues appeared healthy.



4c. After one year, the periapical lesion continued to improve, and the distal periodontal defect still appeared to be doing well. The tooth probed within normal limits and the gingival tissues appeared healthy.



4d. Two years after surgery, the periradicular lesion had healed, while the periodontal defect had worsened. It probed to four millimeters and the gingival tissues appeared inflamed.

Prognosis

Lesions affecting the periodontium may be the result of inadequate or incomplete root canal treatment, perforations, fractures, resorptions, or coronal leakage, in addition to an unhealthy or necrotic pulp. Treatment may involve nonsurgical retreatment and/or surgical management. When the etiology is removed, the potential for healing exists.

The greater the periodontal involvement, the poorer the prognosis. The healing potential should dictate the course of treatment.

Pulpal lesions usually heal whether alone or in the presence of periodontal lesions. This may not be the case with bony destruction of periodontal disease, although it can be reversible depending on the extent of the disease.

On the Horizon

Many combined lesions once considered therapeutically hopeless are now the subject of much interest. Clinical researchers continue to investigate innovative concepts of endodontic and periodontal treatment. New materials, such as sulcular antimicrobials, offer additional treatment options for patients to preserve their teeth. Combined therapeutic surgical modalities have also been instrumental in tooth retention. Stay tuned.

The information in this newsletter is designed to aid dentists. Practitioners must use their best professional judgment, taking into account the needs of each individual patient when making diagnoses/treatment plans. The AAE neither expressly nor implicitly warrants any

positive results nor expressly nor implicitly warrants against any negative results associated with the application of this information.

If you would like more information, call your local endodontist or contact the AAE.

Did you enjoy this issue of *ENDODONTICS*? Did the information have a positive impact on your practice? Are there topics you would like *ENDODONTICS* to

cover in the future? We want to hear from you! Send your comments and questions to the American Association of Endodontists at the address below.



ENDODONTICS: *Colleagues for Excellence*
American Association of Endodontists
211 E. Chicago Ave., Ste. 1100
Chicago, IL 60611-2691
www.aae.org



Systematic Pulpal Diagnosis

Published as an insert to the Spring/Summer 2001 edition of *ENDODONTICS: Colleagues for Excellence*

The following outline provides a quick review of the steps taken in pulpal diagnosis:

I. Chief Complaint—Record symptoms or problems expressed by the patient in his or her own words.

II. Health History

A. Medical history

1. Take a complete medical history for each new patient.
2. Update the medical history of each patient of record.

B. Dental history

1. Summarize present and past dental treatment
2. May provide subtle clinical findings or identify source of patient's complaint
3. Attitudes toward dental health and treatment may affect treatment planning.

C. Present signs and symptoms

III. Diagnostic Evaluations

A. Subjective Examination—obtain information by question and answer regarding history of the present illness and symptoms.

1. Location—In some cases the patient may be able to identify
2. Intensity—The more the pain disrupts the patient's lifestyle, the more likely it is caused by irreversible pathosis.
3. Duration—Does pain linger after the stimulus is removed?
4. Stimulus—Pulp tests should be chosen based upon what provokes the patient's chief complaint.
5. Relief—Medications or actions (such as sipping ice water) taken to relieve pain.
6. Spontaneity—Pain occurring without stimulus.

Tentative Diagnosis

After taking histories and identifying signs and symptoms, the practitioner may reach a tentative diagnosis. The objective examination will gather the information necessary to confirm this diagnosis.

B. Objective Examination

1. Extraoral Examination

- a. Check general appearance, skin tone, and facial asymmetry.
 - b. Note any swelling, redness, sinus tracts, tender or enlarged lymph nodes, or tenderness or discomfort upon palpation or movement of the TMJ.
2. Soft Tissue—Examine the mucosa and gingiva visually and digitally for discoloration, inflammation, ulceration, swelling, and sinus tract formation.
 3. Dentition—Examine teeth for discoloration, fracture, abrasion, erosion, caries, large restorations, discoloration or other abnormalities.

4. Clinical Tests—Most tests have inherent limitations. They require care on application and interpretation. The objective is to discover which tooth is different from the patient's other teeth. Always test healthy control teeth first.

a. Periradicular Tests

- (1) Percussion—a painful response is an indicator of periradicular inflammation.
- (2) Palpation—same as above

b. Pulp Vitality Tests—These determine response to stimuli and may identify the offending tooth with an abnormal response. Always include stimuli similar to those that provoke the patient's chief complaint.

(1) Cold Test

- (a) Intense, prolonged pain indicates an irreversible pulpitis.
- (b) Necrotic pulps do not respond.
- (c) A false-negative response may occur with constricted canals.

(2) Heat Test—same as for cold test

Electric Pulp Testing

Contrary to popular opinion and persistent notion, different response levels in electric pulp testing do not indicate different stages of pulp degeneration. Electric pulp testers do not measure the degree of health or disease of a pulp. A "yes or no" response is merely a rough indicator of the presence or absence of vital nerve tissue in the root canal system.

(3) Electric Pulp Testing

- (a) Before testing, clean, dry, and isolate the teeth, then place a small amount of toothpaste or other conductor on the electrode. Be sure to follow your manufacturer's instructions for establishing an electrical circuit and to ensure accurate measurement with your instrument.
- (b) Sensation may be described as tingling, stinging, or a feeling of heat, "fullness," or pressure.

(4) Test cavity—may be helpful, especially for a tooth with a porcelain-fused-to-metal crown (PFM). Sudden, sharp sensation when the bur cuts dentin indicates that the pulp contains vital tissue.

c. Periodontal Examination—periodontal probing cannot be overemphasized, since pulpal and periodontal pathosis sometimes mimic each other and must be differentiated.

C. Radiographic Examination

1. Limitations
 - a. Pathologic vital pulps are not visible on radiographs.
 - b. Necrotic pulps may not produce radiographic changes in early stages.
 - c. To be visible, the inflammatory process must spread to cortical bone.
2. Periradicular
 - a. Periradicular lesions of pulpal origin tend to have three characteristics:
 - (1) Loss of lamina dura apically
 - (2) Radiolucency remaining at the apex regardless of cone angle
 - (3) Radiolucency resembling a "hanging-drop"
 - b. If a radiolucency is in the periradicular region of a tooth with a vital pulp, it cannot be of pulpal origin and will be either a normal structure or another type of pathosis.
 - c. Follow up or biopsy may be required with radiolucencies not of pulpal origin.
3. Pulpal
 - a. Radiographically visible pulpal pathoses are only rarely related to irreversible pulpitis.
 - b. Internal resorption or extensive diffuse calcification in the chamber may indicate long-term, low-grade irritation.
 - c. "Obliteration" of canals (usually with history of trauma) does not, in itself, indicate need for treatment.

D. Special Tests—if special circumstances prevent making a definitive diagnosis, additional tests may be indicated.

1. Caries Removal—in an asymptomatic vital case, caries is removed as a final test. Penetration into the pulp indicates an irreversible pulpitis requiring root canal treatment.
2. Selective Anesthesia—useful in painful teeth, particularly when the patient cannot isolate the offender to a specific arch.
3. Transillumination—for identification of vertical crown fractures, since fractured segments do not transmit the light similarly. Dark and light shadows appear at the fracture site.

IV. Analyze the data you have obtained—Findings may not always be consistent, and the process of arriving at a final diagnosis depends heavily on the practitioner's critical evaluation of the findings.

V. Formulate an appropriate diagnosis and treatment plan—In addition to diagnosing pathoses and their indicated treatments, the practitioner must take into account the patient's overall needs, know the indications and contraindications for root canal therapy, and recognize those conditions that make treatment difficult.

The American Association of Endodontists cannot guarantee success in every case. Practitioners must always use their best professional judgment in individual situations. The AAE neither expressly nor implicitly warrants any positive results nor expressly nor implicitly warrants against any negative results associated with the application of this information.

If you would like more information on endodontic pulpal considerations, call your local endodontist or write to the American Association of Endodontists, 211 E. Chicago Ave., Ste. 1100, Chicago, IL 60611-2691, 312/266-7255, fax 312/266-9867. References are available upon request.



Spring/Summer 2001 ENDODONTICS: Colleagues for Excellence
Pulpal/Periodontal Relationships Selected References

Classification/Assessment

Gutmann JL, Dumsha TC, Lovdahl PE, and Hovland EC. *Problem Solving In Endodontics*. Chapter 9, Mosby-Year Book, Inc., St. Louis, 1997.

Peters DD, Baumgartner JC, Lorton L. Adult pulpal diagnosis. I. Evaluation of the positive and negative responses to cold and electrical pulp tests. *Journal of Endodontics* 20:506-511, 1994.

Himel VT. Diagnostic procedures for evaluating pulpally involved teeth. [Review]. *Current Opinion in Dentistry* 2:72-77, 1992.

Klausen B, Helbo M, Dabelsteen E. A different diagnostic approach to the symptomatology of acute dental pain. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, & Endodontics* 59:297-301, 1985.

Morse DR, Seltzer S, Sinai I, and Biron G. Endodontic classification. *Journal of the American Dental Association* 94(4):685-689, 1977.

Cecic PA, Hartwell GR, Bellizzi R. Cold as a diagnostic aid in cases of irreversible pulpitis. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, & Endodontics* 56:647-650, 1983.

Dummer PM, Hicks R, and Huws D. Clinical signs and symptoms in pulp disease. *International Endodontic Journal* 13(1):27-35, 1980.

Facial Pain

Ingle JI and Bakland LK. *Endodontics*. Chapters 10 & 11 Williams & Wilkins, Baltimore, 1994.

Klausner JJ. Epidemiology of chronic facial pain: diagnostic usefulness in patient care. [Review]. *Journal of the American Dental Association* 125(12):1604-1611, 1994.

Pertes RA and Heir GM. Chronic orofacial pain. A practical approach to differential diagnosis. [Review]. *Dental Clinics of North America* 35(1):123-140. 1991.

Bennett GJ and Sessle BJ. Basic science issues related to improved diagnoses for chronic orofacial pain. [Review]. *Anesthesia Progress* 37(2-3):108-112, 1990.

Emergency Treatment

Gutmann JL, Dumsha TC, Lovdahl PE, and Hovland EC. *Problem Solving In Endodontics*. Chapter 9, Mosby-Year Book, Inc., St. Louis, 1997.

Fouad AF, Rivera EM, Walton RE. Penicillin as a supplement in resolving the localized acute apical abscess. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, & Endodontics* 81(5):590-595, 1996.

Hasselgren G and Calev D. Endodontics emergency treatment sound and simplified. *New York State Dental Journal* 60:31-33, 1994.

Torabinejad M and Walton RE. Managing endodontic emergencies. *Journal of the American Dental Association* 122(6):99, 1991.

Cooper SA. Treating acute pain: do's and don'ts, pros and cons. *Journal of Endodontics* 16:85-91, 1990.

Hasselgren G, Reit C. Emergency pulpotomy: pain relieving effect with and without use of sedative dressings. *Journal of Endodontics* 15:254-256, 1989.

Radiographic Assessment

Gutmann JL, Dumsha TC, Lovdahl PE, and Hovland EC. *Problem Solving In Endodontics*. Chapter 2, Mosby-Year Book, Inc., St. Louis, 1997.

Walton RE. Radiology and endodontics [editorial]. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, & Endodontics* 80(5):495, 1995

Nattress BR and Martin DM. Predictability of radiographic diagnosis of variations in root canal anatomy in mandibular incisor and premolar teeth. *International Endodontic Journal* 24(2):58-62, 1991.

Molven O, Halse A, and Grung B. Observer strategy and the radiographic classification of healing after endodontic surgery. *International Journal of Oral & Maxillofacial Surgery* 16(4):432-439, 1987.

Walton RE. Endodontic radiographic technics. *Dental Radiography & Photography* 46(3):51-59, 1973.

Operating Microscope

Weller RN, Niemczyk SP, Kim S. Incidence and position of the canal isthmus. Part 1. Mesio Buccal root of maxillary first molar. *Journal of Endodontics* 21:380-383, 1995.

Cohen S and Burns RC. Ed *Pathways of the Pulp*. Chapter 15, 6th Ed., Mosby-Year Book, Inc., St. Louis, 1994.

Pecora G and Andreana S. Use of dental operating microscope in endodontic surgery. *Oral Surgery, Oral Medicine, Oral Pathology* 75(6):751-758, 1993.

Carr G. Advanced techniques and visual enhancement for endodontic surgery. *Endodontic Report* 7(1):6-9, 1992.

Carr GB. Microscopes in endodontics. *Journal of the California Dental Association* 20(11):55-61, 1992.