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# ENDODONTICS

COLLEAGUES FOR EXCELLENCE

## ORAL DISEASE

and systemic health: What is the connection?

The relationship of our teeth and mouths to overall good health is indisputable. A healthy mouth is important for maintaining good eating habits, verbal communication and a positive self-

image. Endodontic treatment plays an important role in achieving and maintaining good oral health by eliminating infection and pain and preserving our natural dentition.

### Historical perspectives on ERRONEOUS theories

Recognition of the role of bacteria in many diseases led a number of physicians and dentists in the early 1900s to speculate that, because bacteria could be transported by the bloodstream from one site to another (metastatic or focal infection), bacteremias could also result in all kinds of otherwise unexplained degenerative diseases (Theory of Focal Infection). This erroneous concept gained further popularity in 1910, when the British physician William Hunter delivered a paper titled "The Role of Sepsis and Antisepsis in Medicine." While Dr. Hunter was criticizing the practice of placing restorations on teeth

without first eliminating or controlling dento-alveolar infection, others were soon suggesting that teeth with infected necrotic pulps and endodontically treated teeth might leak bacteria or their toxins into the body, causing arthritis and diseases of the kidney, heart, nervous, gastrointestinal, endocrine and other systems.

Many physicians embraced this theory as a way to explain unresolved illnesses that we know today have other causes. This theory resulted in a frightening era of tooth extraction both for the treatment of systemic diseases and as a prophylactic measure against

future illness. In the 1930s, Dr. Weston Price presented research suggesting that bacteria trapped in dentinal tubules during root canal treatment could cause almost any type of "degenerative" systemic disease — pure focal infection theory. Fortunately, subsequent microbiological and epidemiological studies disproved the claims that extraction of endodontically treated teeth could restore the systemically ill person to good health. The extraction tide was stemmed.

## RESURRECTING faulty science

Despite research that dispels the focal infection theory, misinformed individuals are attempting to keep the theory alive based on studies performed by Dr. Price early in the twentieth century. In a recently published book, one author recommends that patients with endodontically treated teeth and teeth with infected and necrotic pulps have these teeth extracted — the most traumatic of all dental procedures. In addition, the author prescribes the removal of one millimeter of the entire bony socket following extraction.

Decades of research contradict the findings of Dr. Price, yet, some patients still hear about the focal infection theory as proposed in the 1930s. They

learn about it from friends, relatives, practitioners involved in holistic or alternative medicine or dentistry and while surfing the Web. Patients searching for relief from debilitating and life-threatening illnesses often will consider many forms of treatment, proven and otherwise.

Holistic medicine is basically defined as the art and science of healing that addresses the whole person — body, mind and spirit. While there is emerging evidence linking the mind, body and spirit, there is no evidence that bacteria present in the dentinal tubules of teeth with infected and necrotic pulps or endodontically treated teeth cause systemic disease. Our job as dentists is to assure patients concerned about the

safety of endodontic therapy that we also are concerned about their overall well-being and that endodontic treatment is a safe, successful path to continued good health.

To assist dentists in explaining this issue to patients, the AAE weighed in on the subject to the dental profession through an issue of this newsletter. The Fall/Winter 1994 issue of *Endodontics: Colleagues for Excellence*, subtitled "Root Canal Therapy Safe and Effective," remains a frequently requested AAE publication.

## Definitions

**Infection:** Invasion and proliferation of bacteria — or other pathogenic microorganisms — in body tissues and the reaction of the tissues to their presence.

**Focus of Infection:** A localized area of infection.

**Metastatic or secondary infection** (formerly described as a focal infection): An infection initiated at another site by microorganisms that have traveled through the bloodstream from a focus of infection.

**Bacteremia:** The presence of bacteria in the bloodstream.

**Theory of Focal Infection:** A theory described by Rosenow in 1909 as a localized or generalized infec-

tion caused by bacteria traveling through the bloodstream from a distant focus of infection. Numerous degenerative diseases were implicated in the Theory of Focal Infection. Some of the illnesses erroneously associated with this theory included: arthritis, dyspepsias, intestinal disorders, anemias, and nervous complaints.

**Pulpless tooth:** A tooth from which the pulp has been removed. When associated with the Theory of Focal Infection, it was used to describe teeth with infected necrotic pulps.

## So why are we still talking about FOCAL INFECTION and endodontics?

The Internet quickly is becoming the first stop for many people seeking information on everything from hiccup remedies to cancer cures to root canal treatment. The challenge on the unregulated Web is to sort through the daunting amount of information to get at the best, most reliable resources for your needs.

Plenty of good information about endodontics is available for public education; so is a great deal of questionable information. It is just a matter of determining the difference. The AAE recommends that dentists, other healthcare professionals and patients refer to [www.aae.org](http://www.aae.org) for information relating to endodontics.

Because of the proliferation of information available, this issue of *ENDODONTICS: Colleagues for Excellence* examines recent research and current thinking on the relationship between oral disease and systemic health.

## Oral bacteria and the importance of endodontic treatment

Oral bacteria enter the bloodstream in many ways including chewing, tooth brushing, flossing and dental procedures. Research shows that the healthy immune system takes care of such transient bacteremias in a matter of minutes.

A bacteremia can also be produced as a result of poor oral hygiene and the presence of oral bacteria from periodontal or acute periradicular infections. The American Heart Association states in its 1997 statement *Prevention of Bacterial Endocarditis*, "The incidence and magnitude of bacteremias of oral origin are directly proportional to the degree of oral inflammation and infection." The incidence and magnitude of bacteremias also can be related directly to the level of trauma inflicted by various dental procedures. While tooth extraction

causes a great deal of trauma and a high incidence of bacteremias, endodontic treatment confined to the root canal system produces much less trauma and a much lower incidence and magnitude of bacteremia.

The American Heart Association currently does not recommend antibacterial prophylaxis for injection of local anesthetic (nonintraalveolar), rubber dam placement, intracanal endodontic treatment, post placement and build up. It is believed that under normal circumstances these procedures do not produce a transient bacteremia. A recent study, however, showed a low incidence of bacteremia associated with nonsurgical cleaning of infected root canals even when the instruments were confined to the root canal system.

The AHA does recommend antibacterial prophylaxis for at-risk individuals before the following dental procedures: tooth extractions; periodontal surgery, scaling and root planing, probing and recall maintenance; dental implant placement and replantation of avulsed teeth; subgingival placement of antibiotic fibers or strips; initial placement of orthodontic bands but not brackets; intraalveolar local anesthetic injections; and prophylactic cleaning of teeth or implants where bleeding is anticipated. Also included on the AHA list is endodontic surgery or instrumentation beyond the apex.

### What is the relationship between bacterial infection and the acute periradicular abscess?

Sometimes, bacteria from infected pulp tissue spread to adjacent tissues, forming an acute periradicular abscess. If large numbers of bacteria from infected pulp tissue gain entry into the periradicular tissues and the patient's immune system is overwhelmed by the numbers of bacteria, the patient will present with signs and symptoms of an acute periradicular abscess. The abscess is characterized by rapid onset, spontaneous pain, tenderness of the tooth to

palpation and percussion, pus formation and eventual swelling of associated tissues.

The affected tissues may appear normal on a radiograph, because acute infections have not had time to resorb enough hard tissue to produce a radiolucency.

Resolving the infection while retaining the natural tooth requires endodontic treatment. In some cases, incision and drainage may be needed in conjunction with endodontic treatment. Antibiotic therapy may be indicated if the patient

has a compromised immune system, fascial space involvement or the presence of systemic symptoms such as fever or lymphadenopathy. The acute periradicular abscess is different from a focal infection, where bacteria travel through the circulatory system and establish an infection at a site distant from the primary focus of infection.

### Nonsurgical endodontic treatment

The basic elements of endodontic treatment — cleaning, shaping and obturation — are designed to eliminate bacteria from the infected root canal and to prevent re-infection.

Research has shown that the use of appropriate bactericidal irrigating solutions, such as sodium hypochlorite, during the cleaning and shaping phase of treatment will

help eliminate bacteria and bacterial substrate from the root canal and dentinal tubules. In addition, obturation followed by a permanent restoration decreases substantially the likelihood that bacteria remaining in the root canal system will survive in critical numbers. No evidence supports the theory that bacteria or their toxins in the dentinal tubules cause chronic systemic diseases.

## Tooth extraction vs. saving it through endodontic treatment

Choosing endodontic treatment over extraction whenever possible is the safer, less invasive option and less expensive in the long run. To restore chewing function and to prevent adjacent teeth from shifting, an extracted tooth must be replaced with an implant or bridge. This requires implant surgery or dental procedures on adjacent healthy teeth, which may require root canal treatment later. These

procedures can be far more costly and time-consuming than endodontic treatment and restoration of the natural tooth.

As effective as modern tooth replacements may be, *nothing is as good as a natural tooth*. Endodontic treatment has been proved time and again to be a safe and effective way to preserve a patient's natural dentition for many years.

## Periodontal disease and systemic health

While there is no evidence linking endodontically treated teeth and systemic disease, a growing body of epidemiological evidence seems to support the premise that nonendodontic oral infections, specifically periodontal disease, appear to be associated with diseases such as infective endocarditis, cardiovascular disease, stroke, diabetes mellitus, respiratory disease and adverse pregnancy outcomes. The

possibility of a connection between periodontal disease and a variety of disorders led the American Academy of Periodontology in 1998 to issue a position paper, *Periodontal Disease as a Potential Risk Factor for Systemic Diseases*, in which it reviewed "recent studies that have suggested the potential for periodontal infections to influence several important systemic diseases."

## The relationship between preterm, low birth weight and periodontal disease

A case control study showed that mothers of preterm, low-birth-weight infants had significantly more periodontal attachment loss than control mothers giving birth to normal weight infants. Bacterial components, such as endotoxin, are believed to result in the release of

inflammatory mediators that may ignite a chain of events that ultimately influences pregnancy outcomes. Data analysis has shown that patients with periodontal disease have six times greater risk of delivering preterm, low-birth-weight babies. However, no actual

cause-and-effect relationship has been shown. It remains possible that unknown environmental confounders such as poor nutrition and oral hygiene may put pregnant women at risk for both preterm, low-birth-weight babies and periodontal disease.

## Looking at the evidence – epidemiological vs. cause-and-effect

Most of the research linking periodontal disease and heart disease has been epidemiological, or population-based, studies comparing health records of individuals with certain diseases against control groups with no history of the specified disease. This type of research, while

valuable, can show relationships only, not the causes.

Rather than being the cause of systemic diseases, periodontitis may be an oral feature of a disease or simply another independent disease present in the patient without relationship. The American Academy

of Periodontology suggests that interventional studies that would "attempt to reduce the risk for cardiovascular disease following treatment or prevention of periodontal infections" are the logical next steps.

## Periodontal disease as a risk indicator for cardiovascular disease

Cardiovascular diseases, including atherosclerosis, coronary thrombosis, ischemic heart disease as well as stroke, are the major causes of death in the U.S. today. While acknowledged risk factors for cardiovascular diseases include hypertension, high cholesterol and cigarette smoking, new evidence suggests that periodontal disease may be a contributor. Population studies have indicated a 1.5- to 2.0-times greater risk of fatal cardiovascular disease in patients with periodontal disease. In study after study, a positive connection has been found between oral disease and cardiovascular health.

Atherosclerosis is a form of arteriosclerosis in which plaque containing cholesterol and lipids is deposited on the inner walls of the arteries. In atherosclerosis, it is an inflammatory cell infiltrate in the major blood vessels that causes intravascular coagulation. The atheroma, the advanced lesion in the atherosclerotic blood vessel, contains plaque that attracts platelets. In coronary heart disease, the blood clot will occur where the platelets aggregate.

What is the biological association between periodontal disease and the formation of an

atheroma? Endotoxins from the cell wall of Gram negative bacteria present in periodontal disease cause the release of inflammatory mediators, which can result in the formation of atheromas and subsequent atherosclerosis. Studies have shown that certain strains of *Streptococcus sanguis* and *Porphyromonas gingivalis* were found to have a role in platelet aggregation.

Researchers have found that patients respond differently to bacterial challenge. Some patients exhibit a hyperinflammatory macrophage response. In these individuals, macrophages release inflammatory mediators at three to 10 times higher than normal levels. Patients with early onset periodontitis, refractory periodontitis and insulin dependent diabetes possess this trait, known as a macrophage positive phenotype. The cytokines produced by the macrophages also play a critical role in the formation of the atheroma in atherosclerosis. This hyperinflammatory response trait may also be a factor in pre-term low birth weight and the more severe cases of periodontitis.

## Responding to patient concerns

What do you do when a patient asks you if endodontic treatment is safe? Following are talking points to assist you in a thorough explanation of the safety of endodontic treatment and the importance of saving the natural tooth:

1. Discuss the patient's health concerns.
2. Explain that you are pleased that the patient is serious about his/her health.
3. Stress that optimum health is your main goal for every patient.
4. Refrain from maligning any health care practitioner the patient quotes. Science is on your side.
5. Explain that studies have shown no correlation between the presence of endodontically treated teeth and the presence of systemic illness and that what the patient has heard may be based on outdated theories from the early 1900s.
6. Point out that extracting a tooth and enlarging the socket with a bur is an extremely radical treatment. Discuss the fact that endodontic treatment is recommended over extraction for medically compromised patients because it is less traumatic. Stress that endodontic treatment is considered safer than extraction for people who are predisposed to bacterial endocarditis and joint infections, because it introduces fewer microorganisms into the bloodstream.
7. Emphasize that the patient would need extensive restorative procedures after extractions in order to continue to enjoy the foods he or she likes to eat. Explain that these restorative procedures can cause further pulp damage and could be very expensive.
8. Explain that once a root canal has been filled, the tooth must be restored permanently within a short period of time. Root canal treatment without a permanent restoration is not complete and could cause further damage and possible loss of the tooth.
9. Explain that some bacteria may remain within the dentinal tubules of an endodontically treated tooth. However, there is no evidence that these bacteria release toxins resulting in chronic systemic disease or travel to other parts of the body.

Nearly a century of sound research has proven time and again the safety and efficacy of endodontic treatment for the elimination of pain and infection and the preservation of natural teeth.

## Research directives in endodontics

The AAE encourages and supports ongoing research into focal infection including the study of the fate of remaining bacteria in endodontically treated teeth and the supporting periodontium; the systemic response or reaction to remaining bacteria in endodontically treated teeth and the supporting periodontium; and the epidemiological relation-

ship between endodontic treatment and chronic systemic disease. Recent AAE-funded studies include *Permeability of the smear layer to Enterococcus faecalis*; *New approach for in vitro disinfection of dentinal tubules*; and *Invasion of coronary artery cells by microorganisms associated with endodontic infection*.

## On the Horizon...

While some researchers continue to investigate possible connections between oral disease and systemic health, others are looking at various pathogens *not of oral origin* as the causes of some of man's oldest and most common diseases.

Early in the twentieth century, vaccines and antibiotics were developed against previously devastating diseases including smallpox, bubonic plague, whooping cough, TB and others. The killer diseases that remained — heart disease and cancer to name only two — were ascribed largely to lifestyle, and genetic and environmental influences.

The discovery in 1982 of *Helicobacter pylori* as the bacterium responsible for most duodenal and gastric ulcers opened the door a little wider for theorists who believe that many chronic diseases traditionally thought to be noninfectious, including cancer and heart disease, actually may be caused by pathogenic bacteria.

In 1985, Finnish researchers first implicated *Chlamydia pneumoniae* in the development of heart disease and estimated that as much as 80 percent of all such disease could be linked to the bacterium. Yet, while *C. pneumoniae* has been identified in coronary-artery tissues during autopsies and in live tissue, a cause and effect relationship has not yet been established experimentally.

As epidemiological evidence grows, other disease/pathogen connections are being examined. *Streptococcus* infection is being investigated for links to certain mental disorders because it has been found in the brains of patients with Alzheimer's disease.

As with oral disease and systemic health, many questions remain. Much work is still needed to prove whether these and other pathogens are in fact causes of these types of diseases.

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, questions and suggestions to the American Association of Endodontists at the address below.

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



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