

# Control and elimination of endodontic infection

*The main goal in endodontics is the prevention and treatment of diseases of the dental pulp and periapical tissues. These objectives can be best achieved if preventive measures and treatment procedures are based on a thorough and detailed understanding of the etiology and pathogenesis of endodontic diseases.*

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In pulpitis, caused by a deep caries lesion, the inflammatory reactions in the pulp start long time before bacteria are found in the pulp tissue. The initial inflammatory reactions are initiated by bacterial antigens interacting with the local immune system (BERGENHOLTZ 1990, PASHLEY 1996, JONTELL et al. 1998). As long as the body of the carious lesion has not entered the pulp, the inflammatory process in the pulp is supposed to be reversible, and no endodontic therapy is usually required. With progressing caries, bacterial cells enter the superficial layers of the pulp. As long as there is vital pulp tissue, the pulp, even though heavily inflamed, is considered to be relatively bacteria-free.

Apical periodontitis is an inflammatory process in the periradicular tissue caused by microorganisms in the necrotic root canal (KAKEHASHI et al. 1965). Some studies have indicated that the prognosis of the treatment of apical periodontitis is lower if there are living bacteria in the root canal at the time of filling (ENGSTRÖM et al. 1964, SJÖGREN et al. 1997, KATEBZADEH et al. 2000). It is generally accepted that successful treatment of primary apical periodontitis rests on effective elimination of the causative agents in the root canal system (CHUGAL et al. 2001). However, other studies have not been able to show a difference in healing between teeth filled after positive or negative cultures from the root canal or between one and two-appointment treatments (WEIGER et al. 2000, PETERS & WESSELINK 2002).

Elimination of endodontic infection is different from elimination and control of most other infections in the human body. Because of the special anatomic environment in the root canal and tooth, host measures that in other sites are sufficient to eliminate the infectious organisms, are alone not enough for complete recovery in endodontic infections. Therefore, control of an endodontic infection is a concerted effort by several host and treatment factors. Success in all aspects of this cooperation will eventually result in elimination of the infective microorganisms and healing of the periapical lesion. The necessary components in the elimination of endodontic infection are i) host defense system, ii) in some cases systemic antibiotic therapy, iii) chemomechanical preparation and irrigation, iv) local root canal disinfecting medicaments, v) permanent root filling, vi) permanent coronal restoration. While the main focus in this article will be on chemomechanical preparation

and local disinfecting agents (factors iii and iv), the role of other contributory factors will also be briefly summarized. Periapical actinomycosis and other extraradicular infections are left outside this review.

## *Host defense*

The host's defense system is a key factor in preventing the spreading of the infection from the root canal to the periapical tissues and bone. However, lack of circulation in the necrotic root canal makes it impossible for the phagocytes and the rest of the immune system to penetrate into the root canal space for more than a few hundred micrometers. Therefore, although of crucial importance in maintaining general health, the defense system is limited to achieving a balance between the microbial intruders and the body, but it cannot eliminate the source of the infection in the root canal.

In chronic apical periodontitis the main mechanism responsible for destruction of normal bone structure is activation of bone osteoclasts and inhibition of osteoblast activity (STASHENKO et al. 1992, 1998). The sequence of events resulting in osteoclast stimulation is a network of immunological chain reactions where inflammatory cytokines play a major role. Although alternative theories about the major route in osteoclast activation have been presented, the key fact remains that it is the host's own cells, osteoclasts that remove the bone around the root tip. Nowadays, removal of bone is understood as an important and necessary defense strategy: bone has a poor capability to defend itself against bacterial intruders, and osteomyelitis might be a result of the spreading of the intracanal infection. That is why bone is removed by the defense system before the infection reaches the periapical tissues. In apical periodontitis the lesion is filled with phagocytes and other defense cells which effectively prevent further spreading of the microbial infection.

## *Systemic antibiotics*

Use of systemic antibiotics is not a routine part of endodontic treatment of apical periodontitis. On the contrary, antibiotics are only rarely used in endodontics.