

Bacteriology of Infected Deciduous Root Canal –A Review

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Abstract:

The vast majority of diseases of the dental pulp & the periradicular tissues are associated with micro-organisms. A thorough understanding of these organisms & their relationship to clinical symptoms is necessary to formulate a sound approach to deciduous root canal therapy. This review article intends to highlight the microflora of infected deciduous root canal.

Key Words: Deciduous root canal, Primary root canal, Micro-organisms

Introduction:

Endodontic infections are symptomatic or asymptomatic inflammatory diseases caused by microbial infection of the root canal system (Siqueira, 2002). It has been shown that endodontic infection comprises of a complex mixture of bacterial species. Dental caries and gingival microbial flora may give different isolation & identification of the microbes in infected deciduous root canals such as *Streptococci*, *Peptostreptococcus*, *Lactobacilli*, *Propionibacterium*, *Actinomyces*, *Eubacterium*, *Veillonella parvula*, *Bacteroides*, *Fusobacterium* etc.

The success of endodontic treatment depends on many factors and the reduction or elimination of bacterial infection is the most important one (Toyoshima et al, 1988). However, for this to occur, it is important to identify which micro-organisms are present. Little research has been done to identify which bacterial species are present in deciduous teeth with pulp necrosis & periapical infections. Many fastidious anaerobic micro-organisms are still difficult to culture and to identify specifically. Various methods are used to detect & identify the micro-organisms eg. Gram's stain, microbial culture, antibiotic sensitivity and phase contrast & dark field microscopy etc. Recently, molecular genetic methods have been used to detect and identify micro-organisms in endodontic infections

(Baumgartner et al, 2000). These methods allow the detection of microbial species directly in clinical samples, without the need for culture. Molecular genetic methods particularly the polymerase chain reaction (PCR), have been widely used for microbial identification purposes. Polymerase chain reaction assays are very sensitive and can enable the reliable identification of microbial species or strains that are difficult or even impossible to culture (Siqueira, 2002). The aim of this review article is to discuss the micro-organisms of infected deciduous root canal.

Bacterial pathways into the deciduous pulp:

Micro-organisms enter the pulp by various ways:

1. Through the crown or root following traumatic exposure of pulp.
2. Through the dentinal tubules following carious invasion.
3. Leaking restorations.
4. From the periodontal tissue through exposed dentinal tubules and accessory canals or apical and lateral foramina.
5. Through external & internal resorption that can lead to pulp exposure.
6. Anachoresis: The transportation of microbes through the blood or lymph to an area of inflammation, such as a tooth with pulpitis.

Dentinal tubules range from 1 to 4 μm , whereas the majority of bacteria are less than 1 μm in diameter (Baumgartner & Hutter, 2002). When a healthy vital pulp is exposed as a result of trauma, the penetration of tissue is relatively slow. Bacterial penetration is less than 2 mm after 2 weeks. If the pulp is necrotic, dead

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tracts of empty dentinal tubules are rapidly penetrated (Cvek et al, 1982).

Micro-organisms of infected deciduous root canal:

The bacterial flora of the root canal has been studied over many years. The micro-organisms associated with endodontic infections comprises of a complex mixture of bacterial species. It has been reported that the root canal microbiota recovered from asymptomatic teeth is different from that isolated from clinically symptomatic teeth (Yoshida et al, 1987).

Both aerobic and anaerobic micro-organisms as well as facultative micro-organisms can be found in the deciduous root canal. A large portion of micro-organisms cultured and identified from root canal of symptomatic teeth with periapical pathosis are anaerobes & aerobes eg.

1. Anaerobes:

- Gram positive cocci - *Peptostreptococcus*
- Gram positive bacilli - *Lactobacilli*, *Propionibacterium*
Actinomyces & *Eubacterium*
- Gram negative cocci - *Veillonella parvula*
- Gram negative bacilli - *Bacteroides* & *Fusobacterium*

2. Aerobes: *Streptococci*, *Staphylococcus* & *Diphtheroids*.

Hu et al (1998) isolated 240 strains of bacteria from 22 infected deciduous root canal. Among 240 strains, 200 strains were obligate anaerobes, belonging to genera *Peptostreptococcus*, *Bacteroides*, *Veillonella*, *Eubacterium*, *Propionibacterium*, *Actinomyces* and *Fusobacterium*. *Bacteroides* & *Fusobacterium* especially *P. gingivalis* and *F. nucleatum* probably were related to acute periapical inflammation & *Veillonella parvula* from chronic periapical inflammation of deciduous teeth.

The organism that predominate in pulpitis and dentoalveolar abscess are *Prevotella*, *Porphyromonas*, *Fusobacterium* and *Peptostreptococcus* (Brook, 2003). Pazelli et al (2003) found that in human deciduous root canals with necrotic pulp and periapical lesions, the infection is polymicrobial with a large number of micro-organisms and a predominance of streptococci, anaerobic micro-organisms and black pigmented bacilli. Cogulu et al (2008) found that the most prevalent species of bacteria in deciduous root canal were *Enterococcus faecalis*, *Porphyromonas gingivalis* and *Treponema denticola*.

The dental pulp is closely connected with the periodontal ligament through the apical foramina,

accessory canal and dentinal tubule. Due to this relationship, pulp diseases may influence gingival health and vice versa, and the periodontal infection may affect the pulp integrity. The periodontal pathogens displayed comparable profile in pulpo-periapical lesions. Kamma et al (2000) examined the composition of the subgingival microbiota of different groups of teeth in children with mixed dentition. *Streptococcus sanguis*, *Streptococcus mitis*, *Prevotella melaninogenica*, *Eikenella corrodens*, *Capnocytophaga gingivalis*, *Capnocytophaga ochracea*, *Actinomyces naeslundii* and *Prevotella intermedia* were among the most frequently detected species in permanent and deciduous teeth respectively. Several suspected periodontal pathogens, such as *Porphyromonas gingivalis*, *Prevotella loescheii*, *Campylobacter gracilis*, *Bacteroides forsythus*, *Campylobacter concisus*, *Peptostreptococcus micros* and *Selenomonas sputigena* were less frequently detected microbiota. Despite the established anatomical relationship between the periodontal and pulpal tissues, bacterial migration between endodontium and periodontium is still under discussion. Rupf et al (2000) examined the profiles of periodontal pathogens in pulpal and periodontal diseases affecting the same tooth. Specific PCR methods were used to detect the presence of the following pathogens: *Actinobacillus actinomycetemcomitans*, *Bacteroides forsythus*, *Eikenella corrodens*, *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Prevotella intermedia* and *Treponema denticola*. The investigated pathogens were proven to be present in the endodontium in all disease categories. Particularly in endodontic samples of "chronic apical periodontitis" and "chronic periodontitis" profiles of the periodontal pathogens were found. The results confirmed that periodontal pathogens often accompany endodontic infections and supported the idea that the periodontic-endodontic interrelationships should be considered as critical pathways which might contribute to refractory courses of endodontic or periodontal diseases.

Patterns of microbial colonization in primary root canal infections:

Siqueira et al (2002) examined the patterns of microbial colonization in primary root canal infections. The root canal microbiota consisted of cocci and/ or rods, often forming mixed communities. Different forms of rods could be found such as filaments, straight rods, curved rods and coccobacilli. Spiral bacterial cells were

occasionally observed as single cells or as small clusters between other bacterial forms. Cocci were the *predominant* bacteria. Different patterns of dentin colonization could be found:

1. Cocci formed dense aggregates into dentin.
2. Each cell was clearly apart from the others.
3. Cells were apparently communicated by fine fibrillar structures.

In some regions dense clusters of rods were seen on tubule entrances but rarely on the intertubular dentin. Bacteria were usually forming dense aggregates on the root canal walls, often penetrating the dentinal tubules, regardless of the root canal location. Although a shallow penetration was the most common finding, bacterial cell penetrating the dentinal tubules up to approximately 300 μm .

Scanning electronic microscopic studies by Sen et al (2006) revealed the presence of cocci, rods and fungi in mixed communities colonizing the root canal. Penetration of bacteria into the dentinal tubules ranged from 10 to 150 μm .

Molven et al (2006) examined the microorganisms in apical part of root canal by scanning electron microscopy. Rod shaped bacteria dominated, but filaments, spirochetes and cocci were also seen. Cocci and rods sometimes formed micro-colonies. Occasionally, cocci were seen attached to filaments forming “corn- cob” like structures. Deposits resembling bacterial plaque were also found inside the root canal.

Table I: Showing correlation between endodontic infections in primary teeth & pathogens (Cogulu et al, 2008):

Micro-organisms	Signs & Symptoms
<i>E. faecalis</i>	Previous pain, Tenderness on percussion, odour, wet canal & periapical radiolucency.
<i>F. nucleatum</i>	Tenderness on percussion & mobility.
<i>P. gingivalis</i>	Previous pain, spontaneous pain, Tenderness on percussion, mobility & periapical radiolucency.
<i>T.denticola</i>	Previous pain, Tenderness on percussion, mobility, odour, swelling & periapical radiolucency.
<i>Parvimonas micra</i>	Spontaneous pain, mobility & periapical radiolucency.
<i>Tannerella forsythensis</i>	Spontaneous pain, Tenderness on percussion, mobility, wet canal & periapical radiolucency.
<i>Streptococcus sp.</i>	Previous pain & periapical radiolucency.

Conclusion:

Endodontic infections in deciduous root canal

are associated with wide diversity of microorganisms. Endodontic treatment are essentially debridement procedures to disrupt and remove the microbial ecosystem that is associated with the disease process. It is important that clinicians understand the close relationship between the presence of microorganisms and endodontic disease processes to develop an effective rationale for treatment. Antimicrobial therapy supplementing the dental care should be considered, especially when local or systemic spread of the infection is suspected. Penicillin or amoxicillin are generally effective against most of the aerobic & anaerobic bacteria recovered. The patient whose oral cavity may harbor penicillin resistant organisms should be considered for treatment with drugs effective against these organisms. These agents include amoxicillin-clavulanate, clindamycin or the combination of metronidazole plus amoxicillin or a macrolide.

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