



## MICROBIAL ETIOLOGY FOR ROOT CANAL TREATMENT FAILURE

Suhashini Ramanathan\*

Saveetha dental college and hostipals, Chennai.

\*Corresponding Author Email: [suhasnathan@yahoo.in](mailto:suhasnathan@yahoo.in)**ABSTRACT:**

Root canal treatment which is an embark on dentistry may face a threat because of microorganisms. This paper gives further information about the common microorganisms which cause the primary and secondary infection in the root canal and causes persistent apical periodontitis. The data on the biological causes of endodontic failures is one of the latest trends. This helps to achieve a comprehensive overview of the etio-pathogenesis of apical periodontitis and the causes of failed endodontic treatments.

**KEYWORDS:**

etiology, endodontic failure, microflora.

**INTRODUCTION**

Oral diseases impact our quality of life and may lead to systemic and life threatening diseases<sup>1</sup>. Root canal treatment is the most common endodontic procedure practiced in clinics and essentially aims at complete debridement of the root canal space to achieve healing of the periradicular tissues. The probability of success and influencing factors for primary and secondary root canal treatments is by absence of apical periodontitis and tooth survival. The utmost goal of the endodontic treatment is to prevent or heal apical periodontitis. Therefore, treatment must be done in order to achieve success in both clinical and radiographic normalcy. Presence of emerged or persistent apical periodontitis lesion in the radiograph and occurrence of clinical signs or symptoms of the disease are considered as indicative of unsuccessful outcome. There can be several factors which decrease the success rate of a root canal treated tooth. However, epidemiologic studies performed in different countries have demonstrated that the prevalence of apical periodontitis lesion in root canal-treated teeth may actually range from 35% to 60%.<sup>2-7</sup>

**Infections**

Intraradicular infection is caused by microorganisms colonising the root canal system. It can be subdivided into three types based on the duration of effect on the root canal.

Primary infection-caused by microorganisms that initially invade and colonise the necrotic pulp tissue.

Secondary infection-caused by microorganism that were not present in the primary infection but that were introduced in the root canal at sometime after professional intervention.

Persistent infection-caused by microorganism that were members of a primary and secondary infection and that in some way resisted intracanal antimicrobial procedures and were able to endure period of nutrient deprivation in treated canals.

Extra radicular infection are present in the periradicular region and in the bone tissues. Microbial products diffuse through them and are able to produce and perpetuate periapical pathosis.<sup>8</sup>

### Pathogenesis of failure of well treated root canal

Root canal treatment failure takes place in cases of improper treatment and in under sterilized conditions. However, there are some cases in which the treatment has followed the established protocol and obeys the standards yet still results in failure. Several studies shows the evidence of some factors that may be associated with failure of treatment even in well-treated cases. They include microbial factors, comprising extraradicular, intraradicular infections, and intrinsic or extrinsic nonmicrobial factors. The endodontic failure usually results from persistent or secondary intraradicular infection.<sup>9</sup>

### Causes for root canal failure

Causes for root canal treatment failure can be majorly categorized as pre-operative, operative and post operative causes. The preoperative reasons may be the wrong diagnosis by the clinician, systemic diseases like Pagets disease, local tissue resistance, local factors like age, sex, nutrition, hormonal factors, endoperio lesions and traumatic injury.

The operative causes may include anatomical variations, infections, technical difficulties, poor debriment, broken instruments, mechanical and chemical irritants, incorrect access cavities, improper cleaning and shaping, haematoma, over extended and under extended fillings and a few iatrogenic causes also.

The post operative causes are failure of retreatment and failure of surgical retreatment.<sup>10</sup>

In many cases errors that takes place during the time of procedure does not cause a greater impact on the failure of the treatment unless the canal is retained with pathogenic microorganisms. Procedural exposure to microorganisms during treatment of infected root canal makes it difficult to achieve the success rate of the treatment. Another major cause may be the biofilm formation in the root canal. A biofilm can be defined as a microbial population attached to an organic or inorganic substrate, surrounded by microbial extracellular products, which form an intermicrobial matrix.<sup>11</sup>

Biofilms consists of microcolonies of bacterial cells that are distributed in a vast matrix bed which consists of exopolysaccharides, proteins, salts and cell material in an aqueous solution. The matrix makes upto about 85% of the volume of a biofilm. persistent inflammation are seen in places with bacterial biofilm<sup>12</sup>. The prologue of the concept of biofilm to endodontic microbiology was the major leap forward towards the understanding of root canal infections. These biofilms supports the bacteria and make them more resistant to normal immunological reactions like phagocytosis, antibodies and antimicrobial reactions.

### Micro flora of root canal

According to a study conducted on Pulp and periapical pathosis are bacterial biofilm mediated infections (Svensata and Bergenholz) the prevalence of bacteria present in teeth with necrotizing pulp and unsuccessful endodontic treatment has been demonstrated<sup>13</sup>. This shows that there is a high prevalence percentage of *Peptostreptococcus spp*, *Streptococcus spp*, *Porphyromonas* and *Enterococcus faecalis*. There is also a possible role played by *Staphylococcus salivarius*, *Prevotella*, *Lactobacillus* and *Actinomyces*. There can be colonisation of bacteria seen in the root canals of necrotic pulp tissue and in ill-treated ones. The common microflora in the root canals are Gram negative bacteria, obligatory anaerobes, Gram positive bacteria and treponemal species. According to various study conducted it is seen that *Enterococcus faecalis* a gram positive bacteria is the most common resident of root canal treated tooth and the main cause of apical periodontitis<sup>14-16</sup>.

Other isolated species included *A. odontolyticus*, *L. aerophilus*, *S. salivarius*, *S. sanguis*, *P. corporis*, *P. gingivalis*, and *P. odontoma*. Bacterial colonisation and percentage of prevalence of endodontic microbiota may vary from every individual teeth which shows that it's not just a single species which evokes the failure but it's a multiple combination of various bacterial species which stands behind the failure of the treatment the

failure. For the pathogens to stay in the root canal after treatment it has to resist and thrive standing the several intra canal medicaments and the harsh environmental caused by the treatment. Therefore the microorganisms present in the root canal should have the ability to withstand this unfavourable condition of growth. The bacteria present are able to withstand all these starvation periods by various regulatory mechanisms and by the tissue fluid which can sweep into the canal space. Culture methods revealed that the bacterial aetiology of post-treatment apical periodontitis are mostly due to Gram-positive bacterial infection. However, molecular methods have show that a more complex microbiota with the association of several Gram-negative bacteria, such as *Prevotella* spp., *Porphyromonas* spp. and *Treponema* spp.

The presence of eight species of *Treponema* (*T. denticola*, *T. amylovorum*, *T. maltophilum*, *T. medium*, *T. socranskii*, *T. pectinovorum*, *T. vicentii*, and *T. lecithinolyticum*) has been show to be the cause of retreatment and root canal failure in a PCR based work<sup>17</sup>. The frequent isolation of *Treponema* spp from the root canals of ill-treated teeth shows that they play a supportive role in causing secondary infection. Microbiological reports from treated root canals with persistent periapical disease have shown a high proportion of *enterococci*, ranging from 29% to 77%<sup>18-21</sup>. This is because there is a high chance of the bacteria to enter the root canal in the process of treatment, during or between treatment procedures<sup>22</sup>. These bacteria are found to have some virulence factors which enables them to survive in the harsh environments and can stand prolonged periods of starvation with nutritional deprivation. They are found to have some secreted factors, adhesins, surface structures such as capsular polysaccharide and antibiotic resistance determinant. This unwelcome species which is a pivotal in root canal failure seem to have special capacities as an endopathogen which invades the dentinal tubules and adhere to dentin surface<sup>23</sup>. It also plays a role in the

immune system and alters the host response and suppresses the action of lymphocytes. They may also contain lytic enzymes, cytolysin, aggregation substance, pheromones and lipoteichoic acid. They are found to resist intracanal medicaments i.e. calcium hydroxide by maintaining their pH haemostasis. Its strains have been demonstrated to be extremely resistant to several medicaments, including calcium hydroxide. Therefore, when *E. faecalis* is established in the root canal, it becomes a difficult task for their eradication from the root canal by conventional means.<sup>24</sup>

Some characteristics of yeasts are found to be common with *enterococci*. One of them is that both these microorganisms can survive as a mono infection and even invade dentinal tubules. Yeast-like microorganisms have also been found in root canals of obturated teeth in which treatment has failed<sup>25</sup>. This suggests that they may be therapy-resistant which overcomes all the intracanal medicaments. In fact, it has been demonstrated that *Candida* spp. are resistant to some medicaments commonly used in endodontics. Fungi are occasionally found in primary infection but candida species have been detected in root canal treated teeth upto 18%. *Candida albicans* is so far the most commonly detected fungal species in root canal treated teeth. They can resist calcium hydroxide which is the most commonly used intracanal medicament and has the properties to colonise and invade the dentine.

Another exclusive category for endodontic infections may be *Actinomyces species* and *Propioni bacterium propionicum*. They are usually found in extra radicular infections like swelling, induration of soft tissues, multiple abscesses and draining sinus tracts. However the existence of periapical actinomycosis in the root canal treated teeth is low but still can be a reason for the failure of the treatment<sup>26</sup>.

#### **METHODS OF MANAGEMENT**

The bacterial biofilm is commonly seen in carious infected teeth or even in a pulp necrosis root. The most

common reasons for failures in conservative root canal therapy are related to problems in instrumentation. However, occasionally, bacteria resistant to conservative therapy may also be involved. Bacteria-associated with endodontic failures together with pulp-periapical infections in conventional treatment represent the unresolved bacteriological problems in endodontics. Numerous studies have shown that persistent endodontic infections are often caused by *Enterococcus faecalis*<sup>27</sup>. The presence of these biofilms can be seen in scanning electron microscopy and by various culture methods. It can be seen that the rate of biofilm formation is increased when the incubation time is increased. The sterilization of the canal with biofilms become more difficult since it's a heterogeneous mixture with various microorganisms present in them and which are more resistant to biomechanical preparations and intracanal medicaments<sup>28</sup>. There are few methods in which the irritants in the root canal can be activated those include the sonic, ultrasonic and laser activation. These new advancements help in removal of more debris from the root canals, better cleansing of the root canals with high speed oscillations and more acoustic streaming and cavitation<sup>29</sup>. Lasers and optic fibres also give better results in the removal of the smear layer with usage of Ni-Ti instruments and better irrigants like ethylene diamine tetraacetic acid with cetavlon (EDTAC)<sup>30</sup>. The most important intracanal medicaments used include calcium hydroxide, triple antibiotic paste (metronidazole, ciprofloxacin and minocycline), chlorhexidine, champhorated chloramphenicol. these medicaments have a sweeping action on the canal as well as some therapeutic advantages. Most of them are biocompatible and increases the success rate of the treatment.

## CONCLUSION

Though the properties that enable these bacteria to establish in the periapical tissues are not fully understood, but their cytological changes and the ability to build cohesive colonies that enable them to escape the

host defense system are keyroles to be noted. The detection of a wide variety of microflora in persistent/secondary infection indicates that the root canal microbiota seems to be a complex in teeth with endodontic treatment failure than in normal. This review further adds on about the various distinct types of bacteria present in the root canals of treated teeth and the greater role of microorganisms in causing the failure of the treatment.

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**\*Corresponding author address:**

***Email address:***

**[suhasnathan@yahoo.in](mailto:suhasnathan@yahoo.in)**