



## Clinical implications of *Enterococcus faecalis* microbial contamination in root canals of devitalized teeth: Literature review

### *Implicancias clínicas de la contaminación microbiana por Enterococcus faecalis en canales radiculares de dientes desvitalizados: Revisión de la literatura*

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#### ABSTRACT

Dental caries is a highly prevalent disease in the world. Endodontic treatment is an option to treat teeth widely destroyed by dental caries. Even though this type of therapy offers favorable prognosis in most cases, scientific literature suggests there is a possibility for failure. In endodontic treatments, one of the most prevalent causes for treatment failure is permanence of microorganisms within root canals. Among the numerous existing bacterial species, *Enterococcus faecalis* is one of the most frequently found in teeth with pulp necrosis (lacking previous history of endodontic treatment). It is equally the most frequently isolated species in teeth with infection recurrence (teeth exhibiting evidence of recurrent treatment). To achieve successful endodontic treatment in devitalized teeth it is of the utmost importance to study and be aware of endodontic microbiology. This leads then to the need of studying bacterial behavior within the system of root canals as well as their resistance and defense mechanisms in order to best manage their interaction with the tooth and achieve bacterial obliteration. The present article purports to offer a bibliographic review of existing literature on *Enterococcus faecalis*, its main characteristics as well as resistance mechanisms. Bibliographic search was conducted through electronic databases (EBSCO, Cochcrane, Medline and Lilacs), using search engines (Pubmed and Decs). Included articles were written in Spanish and English and published during the last 30 years. Out of a total 52 articles, 26 were selected; they corresponded to experimental studies and literature reviews.

#### RESUMEN

La caries dental es una enfermedad altamente prevalente en el mundo. Una opción para tratar dientes ampliamente destruidos por caries dental es la realización de tratamientos de endodoncia. Aun cuando estas terapias tienen un pronóstico favorable en la mayoría de los casos, la literatura señala que existe la posibilidad de fracaso. Una de las principales causas de fracaso en los tratamientos de endodoncia es la permanencia de microorganismos en los canales radiculares. Dentro de las numerosas especies bacterianas existentes, una de las más frecuentemente encontradas en dientes con necrosis pulpar (sin historia previa de endodoncia) y la más aislada en aquellos con recidiva de infección (dientes con indicación de re-tratamiento) es *Enterococcus faecalis*. Estudiar y conocer la microbiología endodóntica es requisito fundamental para lograr un tratamiento de endodoncia exitoso en dientes desvitalizados. Surge así la necesidad de conocer el comportamiento de las bacterias dentro del sistema de canales radiculares, así como sus mecanismos de defensa y resistencia, para manejar de la mejor manera posible su interacción con el diente y lograr su eliminación. El siguiente artículo corresponde a una revisión bibliográfica de la literatura existente acerca de *Enterococcus faecalis*, sus características principales y mecanismos de resistencia. La búsqueda bibliográfica se realizó a través de bases de datos electrónicas (EBSCO, Cochcrane, Medline y Lilacs), utilizando motores de búsqueda (Pubmed y Decs); se incluyeron artículos en inglés y español, publicados durante los últimos 30 años. De un total de 52 artículos, se seleccionaron 26, correspondientes a estudios experimentales y revisiones de literatura.

**Key words:** *Enterococcus faecalis*, endodontics, failed endodontic treatment, endodontic infection.

**Palabras clave:** *Enterococcus faecalis*, endodoncia, tratamiento de endodoncia fallido, infección endodóntica.

#### INTRODUCTION

In many countries, oral cavity diseases represent a public health issue. Dental caries is one of the most prevalent diseases. In Chile the MINSAL (Chile's Health Ministry) established the fact that 66% of total population was afflicted with dental caries.<sup>1-4</sup> Endodontic treatment represents one option to treat teeth widely destroyed by this condition. Endodontic treatment's objective is to execute a meticulous

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chemical and mechanical cleansing of root canals to later achieve tri-dimensional seal with inert material and thus prevent re-infection. After this, rehabilitation of the dental crown is undertaken, thus dental caries containment and tooth loss prevention is finally achieved. Even though this kind of therapies, when suitably prescribed, exhibit favorable prognosis, scientific literature indicates there is a possibility of failure. One of the main causes of failure in endodontic treatments is incomplete removal of pulp tissue or micro-organisms present within the root canals. These micro-organisms might have survived biochemical procedures or have invaded root canals through crown filtration in teeth with filled roots.<sup>5</sup> Several studies have revealed the fact that microbiota present in root canals of endodontically treated roots differ from microbiota normally found in untreated teeth.<sup>5</sup> When analyzing the micro-organism factor, literature suggests that bacteria most frequently found in first time treatments, as well as treatments with infection recurrence, are limited to a very specific variety of micro-organisms, where gram positive anaerobic facultative species predominate, especially *Enterococcus faecalis*.<sup>5</sup> This bacteria has been isolated within root canal systems as well as in periapical lesions. It has equally been found in infected teeth that had not been previously endodontically treated. Nevertheless, it is most frequently observed in teeth that have suffered recurrence, that is to say failure of previous endodontic treatment.<sup>5-9</sup>

## MATERIALS AND METHODS

Bibliographic review was undertaken through internet search of different scientific articles collected from electronic databases such as EBSCO, Cochcrane, Medline and Lilacs, using electronic search engines such as Pubmed and Decs.

To undertake the search, the following key words were used: *Enterococcus faecalis*, endodontics, failed endodontic treatment, endodontic infection.

Experimental studies, written in Spanish and English as well as literature reviews published during the preceding 30 years (1985 to 2014) were used. The search was not limited to search by country or by type of study. Once the articles were downloaded, they were stored in pdf format to preserve their originality.

In order to proceed to selection, abstracts were reviewed, and when needed, full articles were examined, so as to decide whether their information was related (or unrelated) to the target of the present work.

After initial search, 52 articles were located, out of which 22 were discarded due to lack of relevance

to the target of this review. 26 articles were finally selected.

## CAUSES FOR ENDODONTIC TREATMENT FAILURE

Bacteria and their by-products are considered primary etiological agents for pulp necrosis and periapical lesions. For this reason, their complete elimination is one of the most important steps of endodontic treatment.<sup>10</sup>

In most cases, treatment failure sets in when procedures undertaken within root canals do not achieve a satisfactory control and infection elimination. Incomplete removal of pulp tissue and microorganisms present in the root canal systems have been proposed as main causes for endodontic treatment failure.<sup>11,12</sup> In many cases, full debridement of infected canals can be unattainable due to inaccessibility of infection sites, for example, when there is presence of accessory canals which are totally unreachable to instruments, medication or irrigants.<sup>13</sup> In most cases, endodontic treatment failures are due to the activity of microorganisms which are surviving within the apical portion of root canal systems, even in well-treated teeth. It has been demonstrated that parts of the root canal frequently remain intact during the process of chemical and mechanical preparation, regardless of technique employed or instruments used. Areas untouched by instruments may contain bacteria or rest of necrotic tissue, even though root canals filling might appear radiographically adequate.<sup>14</sup>

Within the canal system, bacteria are found located in areas such as isthmus ramifications, deltas, canal irregularities and dentine tubules.<sup>14-16</sup> In those cases when use of bio-mechanical instruments, irrigator materials or medication are unable to reach those sites, it is probable that nutrient supply for bacteriae placed therein remain unaltered after root therapy. Nevertheless, bacteria present in areas such as dentin tubules might have a drastically reduced substrate. In those anatomical regions, bacteria isolated by root filling normally die. Nevertheless, some bacterial species might survive for relatively long periods. Thus, in cases when root filling materials fail, and provide incomplete sealing, fluid filtration from the periapical tissue might provide a substrate suitable for bacterial growth.<sup>14</sup> The same situation might take place in cases when there are filtrations from the crown.

Depending on the circumstances present in root canals, some bacteria might be more capable to survive and multiply than others. Thus, even though it is possible to find facultative anaerobes in teeth

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