Study of the infection mechanisms of the main periodontal pathogens through the development of *in vitro* infection models

Brief description

Periodontitis is a chronic inflammatory disease characterized by the damage of the periodontium, a collective term referring to the tissues that surround and support the teeth (gingiva, periodontal ligament and alveolar bone). This serious oral disease is the main cause of tooth loss in adults and represents a significant socioeconomic and public health burden, affecting, in its most severe form, approximately 10% of adults (Figure 1).

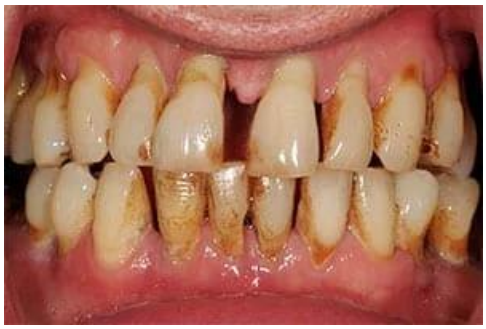

Figure 1. *Patient with periodontitis.*

This disease can affect the chewing, aesthetics and quality of life of patients. Example of figure caption.

This process is initiated by specific bacteria within the subgingival biofilm and progresses due to the immunoinflammatory mechanisms triggered in response to the proliferation of these bacteria. Therefore, this disease is a clear example of how an imbalance of a local microbiome (dysbiosis) and an ineffective and poorly controlled inflammatory response can lead to serious harmful effects in susceptible individuals. As shown in Figure 2, this process is not linear but a positive feedback loop between the dysbiotic microbiome and the patient's inflammatory response, a vicious cycle that drives the pathogenesis of periodontal disease.

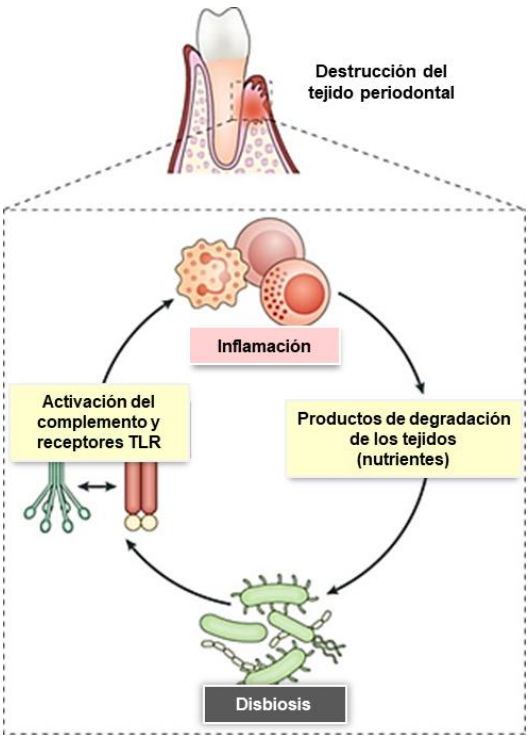

Figure 2*. The alteration of the unstable balance of the oral ecosystem (dysbiosis) increases inflammation, which generates a nutritionally favorable environment for the selective expansion of organisms associated with periodontitis.*

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How does it work?

The study of the *in vitro* response of different cell types of the immune system to an infection is addressed using cell culture techniques.

The development of infection models, where the host-pathogen interaction occurs in a controlled environment of the cellular components that act on periodontal tissues when dysbiosis occur, allows a deeper analysis of the response of these cellular components when they are exposed to key bacteria associated with periodontitis.

What problem does it solve?

- In vitro cell culture allows for the exhaustive and rigorous reproduction of optimized infection models, thus obtaining as many replicas as necessary for the different studies.
- Versatility in being able to study the interaction individually between the main periodontal pathogens and different cell types of interest.
- Precise control and modification, as required, of the experimental infection conditions.

What future products will it develop?

- Provide a better understanding of the host response mechanisms against the main bacteria involved in periodontal disease.
- Assist in the development of new therapeutic targets for periodontitis.

Competitive advantages compared to other research

Although the key bacteria that induce oral biofilm dysbiosis are well known, further study of the host response mechanisms against these periodontal pathogens is needed. In fact, current periodontal therapies are aimed at reducing the bacterial load either mechanically or with adjuvant pharmacological agents, but there is a lack of strategies that address the modulation of the patient's immune response.

Where has it been developed?

The infection models have been developed in the Cell Culture Laboratory of the Department of Clinical Dental Specialties of the Faculty of Dentistry, working together with the Microbiology Laboratory, a unit that is part of the Research Laboratory and that has extensive and proven experience in the development of microbiological culture techniques for the isolation and identification of periodontal pathogens.

And moreover...

In the last decade several studies have shown the dissemination of periodontal microorganisms outside the oral cavity and, therefore, periodontitis can also have systemic effects, increasing the patient's risk of developing cardiovascular, neurodegenerative (Alzheimer's) and autoimmune (rheumatoid arthritis) diseases.

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