

Review Article

Guided Pocket Recolonization: A Short Review

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ABSTRACT:

Periodontitis is one of the most common chronic inflammatory diseases. The etiology is clearly bacterial and a number of putative bacterial pathogens have been associated with the disease, including *Aggregatibacter actinomycetemcomitans*, *Tannerella forsythia* and *Porphyromonas gingivalis*. However, the development of resistance to a range of antibiotics by some important pathogens has raised the possibility of a return to the pre-antibiotic dark-ages. Probiotic technology represents a breakthrough approach to maintaining oral health by using natural beneficial bacteria, commonly found in healthy mouths, to provide a natural defence against those bacteria which are thought to be harmful to teeth and gums. Probiotics provide us an alternative way to combat diseases and has been introduced for prevention and treatment of periodontal diseases.

Key Words: Probiotics, Periodontitis, Microbial interference, Replacement therapy

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INTRODUCTION

Periodontitis is a multifactorial disease that encompasses the hard and soft tissues, microbial colonization (with or without invasion), inflammatory responses and adaptive immune responses. Conventional treatment modalities of periodontal disease include non-surgical and surgical management, which emphasizes mainly on mechanical debridement, often accompanied by antibiotics. These treatment modalities are aimed at eliminating the entire microflora irrespective of their pathogenicity¹. Due to the emergence of antibiotic resistance and frequent recolonization of treated sites with pathogenic bacteria, there was need for a new treatment paradigm to be introduced to periodontal disease. The need was fulfilled by introduction of Probiotics and bacterial replacement therapy in the field of periodontics¹. Probiotics are live microorganisms that when administered in adequate amounts confer health benefits upon the host. Oral administration of probiotics may also benefit oral health by preventing the growth of harmful microbiota or by modulating mucosal immunity in the oral cavity². It refers to genera of microorganisms capable

of halting, altering or delaying periodontal diseases. It poses a great scope in arena of periodontics. It can be of use for plaque modification, altering anaerobic organisms' colonization, altering pocket depth, improving clinical attachment. The application of selected beneficial bacteria, as an adjunct to scaling and root planing, would also inhibit the periodontopathogen recolonization of periodontal pockets and thus achieve and maintain periodontal health³. The treatment strategies conferred by probiotics against periodontal diseases are mainly anticipated to be either by inhibition of specific pathogens or by altering the host immune response through multifactorial factors⁴.

PROBIOTICS AND ORAL HEALTH

Probiotics have emerged as a fascinating scientific area, health-related and commercial target for the last two decades. Endorsed by the Food and Agriculture Organization and the World Health Organization, the definition of probiotics, in 2001, describes them as live microorganisms which when administered in adequate amounts confer health benefits on the host. Commonly, most of the species ascribed as

having probiotic properties belong to the genera *Lactobacillus* and *Bifidobacterium*.⁴ In 1984 Hull et al. introduced the first probiotic species in research, *Lactobacillus acidophilus* followed by *Bifidobacterium bifidum* by Holcomb et al. in 1991. Finally, possibilities to genetically modify or engineer potential probiotic strains may offer all new visions.¹ Better scientific understanding and extended research of these tiny forms of life and their effect on humans in the treatment of periodontal diseases might further broaden the field of potential applications⁵

MECHANISM OF ACTION OF PROBIOTICS

The mechanism of action vary according to the specific strain or combinations of strains used, the presence of prebiotics and the condition that is being treated, as well as the stage of the disease process in which the probiotic is administered.⁶ Stomatova and Muerman (2009)⁷ highlighted the possible mechanism of action of these probiotics as follows: Inhibition of pathogen adhesion, colonization and biofilm formation, Inhibition of pathogen growth by various substances, Modulation of inflammatory pathways induced by pathogens, Inhibition of collagenases and reduction of inflammation associated products.

PROBIOTICS AND PERIODONTAL DISEASES

Despite substantial improvements in the oral health status of populations across the world, periodontal disease yet remains a significant social burden. Periodontal diseases are an end result of host response to the complex action of a group of periodontal bacteria, predominantly Gram negative anaerobes.⁸ Since the primary etiological factors for the development of periodontal disease are bacteria in supra and subgingival biofilm, efforts for disease prevention and treatment are mainly focused on pathogen reduction and strengthening of the epithelial barrier, thus contributing to decreased susceptibility to infection.⁹ Probiotic bacteria, generally regarded as safe, may favor periodontal health if able to establish themselves in oral biofilm and inhibit pathogen growth and metabolism. Probiotics lower the pH so that plaque bacteria cannot form dental plaque and calculus that causes the periodontal disease. They make an excellent maintenance product because they produce antioxidants. Antioxidants prevent plaque formation by neutralizing the free electrons that are needed for the mineral formation. Probiotics are able to breakdown putrescence odours by fixing on the toxic gases (volatile sulphur compounds) and changing them to gases needed for metabolism. *Lactobacilli* can produce different antimicrobial components including organic acids, hydrogen peroxide, low molecular weight antimicrobial substances, bacteriocins and adhesion inhibitors and have gained prominence as Probiotics.¹⁰

Guided periodontal pocket recolonization (Bacterial replacement therapy) in Periodontics

The oral cavity is perpetually populated by pathogenic microorganisms; because there is a constant challenge to the mucosa in the form of these microorganisms and their harmful products, it is difficult to truly characterize the boundary between health and disease activity in the periodontal tissues. Antibiotics destroy the harmful bacteria that can cause infection, while also destroying the good bacteria that help to fight infection. Probiotics, on the other hand, re-populate the beneficial bacteria which can help kill pathogenic bacteria and fight against infection. The application of selected beneficial bacteria, as an adjunct to scaling and root planing, would also inhibit the periodontal pathogen recolonization of periodontal pockets and thus achieve and maintain periodontal health.¹¹ "Replacement therapy" is also known as "probiotic therapy" The concept of bacterial replacement therapy in periodontics was first introduced by Teughels et al in 2007. They reported that the subgingival application of a bacterial mixture including *Streptococcus sanguis*, *S. salivarius*, and *Streptococcus mitis* after scaling and root planing significantly suppressed the recolonization of *Porphyromonas* *gingivalis* (canine *P. gingivalis*) and *P. intermedia* in a beagle dog model.^{1,10} Nackaerts et al observed that the subgingival application of beneficial oral bacteria (i.e. *Streptococcus sanguinis*, *Streptococcus salivarius* and *S. mitis*) delays recolonization by periodontal pathogens, reduce inflammation, and improve bone density and bone levels in a beagle dog model. This guided pocket colonization approach may provide a valuable addition or alternative to the armamentarium of treatment options for periodontitis.¹²

Proof of Concept; Study Explores Probiotic Approach to Treating Gum Disease

A new study published in the November issue of the Journal of Dental Research by an international research team (W. Teughels, M.G. Newman, W. Coucke, A.D. Haffajee, H.C. van der Mei, S. Kinder Haake, E. Schepers, J.-J. Cassiman, J. Van Eldere, D. van Steenberghe, M. Quirynen) entitled "Guiding Periodontal Pocket Recolonization: a Proof of Concept"¹³ shows that application of beneficial bacteria as an adjunct to traditional therapy may become a valid, nonantibiotic treatment approach for periodontitis (gum disease). In this small-scale animal study, researchers tested a concept called Guided Pocket Recolonization, or GPR, by applying a mixture of beneficial bacteria sub gingivally after scaling and root planing (removal of bacterial plaque from the crown and root of the tooth surface). It was found that the sublingual re-colonization was delayed and reduced as was the degree inflammation With the emergence of antibiotic resistance and the lack of non-antibiotic treatment options, this GPR approach may provide a valuable addition or alternative to treatment options for periodontitis in the future.^{11,14} In another pilot study by Olivia Nackaets, Reinhilde Jacobs, Marc Quirynen, Marleen Rober, Yi Sun and

Wim Teughels it was radiologically evaluated, the impact of replacement therapy by monitoring bone density changes and alveolar bone level in periodontal pockets in a dog model. There was significant improvement in jaw bone density and alveolar bone gain was found in periodontal pockets that received beneficial bacteria adjunctive to scaling and root planning. Such significant differences were not found in periodontal pockets that received only scaling and root planing¹⁵.

CONCLUSION

Recent advances in technology have led to a constant drive to develop novel strategies for the treatment of periodontal diseases. Probiotics represent a new area of research in periodontal therapy. In the recent era of antibiotic usage organisms are fast developing resistance to antibiotics. Probiotics are counterparts of antibiotic which do not develop resistance, further they are body's own resident flora hence are biocompatible. With integration of biophysics with molecular biology, designer probiotics poses huge opportunity to treat diseases in a natural and non invasive way. Periodontitis have established risk of various systemic diseases like diabetes, atherosclerosis, hyperlipidaemia, chronic kidney diseases, and spontaneous preterm birth. Thus the need to establish good periodontal health for attaining good systemic health is of utmost importance and probiotics are promising agents which needs in depth research for periodontal application. Although probiotics are in the initial stages of scientific research and application it offers a firm ground for future development.¹⁶.

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