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Probiotics in Periodontics- A Short Review

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Abstract: *Periodontal therapy has been trying out various treatment modalities as a result of technological advancements as well as innovative researches happening in the field.Many therapies have been tried to combat this chronic inflammatory process as well as the regeneration of the lost periodontium.The main culprit in most cases are a group of pathogenic bacteria found in oral biofilm.Scientists have thus come up with the novel idea of using the useful bacteria in the biofilm colonies and body to combat against these pathogens.Thus probiotics came to play a vital role in periodontal treatment.This paper is a very short review of probiotics in Periodontics*
Keywords*: Probiotics, Periodontaldisease, Bifidobacterium ,Guided pocket recolonisation, Halitosis*

I. Introduction

The concept of probiotics was first introduced by Elie Metchnikoff, a Russian scientist, following his observation that Bulgarian people had a longer life span due to the consumption of fermented milk containing viable bacteria. The term "Probiotic" was initially proposed by Lilley and Stillwell in 1965.Etymologically, the term appears to be a composite of the Latin preposition pro ("for") and the Greek noun bios, ("life"). First probiotic species to be introduced in research was Lactobacillus acidophilus by Hull et al in 1984; followed by Bifidobacteriumbifidum by Holcombh et al in 1991[1]

Ideal Characteristics[2]
- Should be non pathogenic
- Should be of human origin
- Should be able to send signals and interact with immune cells
- Have Highcell viability and resistance to low pH
- Adhesion to cancel the flushing effect
- Have capacity to influence local metabolic activity

Mechanism Of Action[3,4]
- By passively occupying a niche that may be otherwise colonised by pathogens
- Actively limitingthe pathogens ability to adhere to appropriate surfaces
- By adversely affecting the vitality or growth of the pathogen
- By affecting the ability of the pathogen to produce virulence factors
- By degrading the virulence factors produced by the pathogen

List Of Different Microorganisms Used As Antibiotics[3,4]
A. Bacteria
I. Lactobacillusspp
Lactobacillus acidophilus
Lactobacillus bulgaricus
Lactobacillus casel
Lactobacillus crispatus
Lactobacillus fermentum
Lactobacillus gasseri
Lactobacillus johnsonii
Lactobacillus lactis
Lactobacillus plantarum
Lactobacillus reuteri
Lactobacillus rhamnosus

II. Bifidobacteriumspp
Bifidobacteriumadolescentis
Bifidobacteriumanimalis

Bifidobacteriumbifidum
Bifidobacteriumbreve
Bifidobacteriuminfantis
Bifidobacteriumlactis
Bifidobacteriumlongum

III. Streptococcusspp
Streptococcus lactis,
Streptococcus cremories,
Streptococcus salivarius,
Streptococcus intermedius

IV. Others
Leuconostac,
Pedicoccus,
Propionibacterium,
Bacillus,
Enterococcus,
E.feacium

B. Yeast And Moulds
Ceresvisiae,
A.Niger,
A.Oryzue
C. Pintolopesii
Sacharomycesboulardii

Studies On Probiotics And Periodontal Disease

Studies on probiotics and periodontal disease are particularly sparse and at present few clinical studies have evaluated the efficacy of probiotic species from a periodontal disease perspective.[5]Streptococcus oralis and Streptococcus uberis have reported to inhibit the growth of pathogens both in the laboratory and animal models. They are indicators of healthy periodontium. When these bacteria are absent from sites in the periodontal tissues, those sites become more prone to periodontal disease.[6]Krasse et al found that intake of L. reuteri for a period of 14 days led to the establishment of the strain in the oral cavity and significant reduction of plaque in patients with moderate to severe gingivitis.[7]Riccia et al studied the anti-inflammatory effects of Lactobacillus brevis in a group of patients with chronic periodontitis. Anti-inflammatory effects of L. brevis could be attributed to its capacity to prevent the production of nitric oxide and, consequently the release of PGE2 and the activation of MMPs induced by nitric oxide.[8]

According to Narva et al, during the fermentation process in milk, Lactobacillus helveticus produces short peptides that act on osteoblasts and increase their activity in bone formation. These bioactive peptides could thereby contribute in reducing bone resorption associated with periodontitis.[9] Oral lactobacilli like Lactobacillus paracasei, Lactobacillus plantarum, Lactobacillus rhamnosus,Lactobacilluscasei and Lactobacillus salivarius exhibited a strong inhibitory effect against Streptococcus mutans, Streptococcus sobrinus, Porphyromonasgingivalis and Actinobacillusactinomycetemcomitans. The inhibitory effect was enhanced in the presence of 5% glucose and lower pH[10]

In a study that evaluated the efficacy of Inersan (contained 10^8colony forming units per gram of Lactobacillus brevis) alone, in combination with 100mg doxycycline and doxycycline alone in treating aggressive periodontitis, plaque index, gingival index, probing depth and clinical attachment levels were reduced in all the three groups, but they were not statistically significant[11.] Use of mouthrinses containing Bacillus subtilis[12]and oral administration of tablets containing Lactobacillus salivarius[13] has shown a reduction in the number of periodontal pathogens

Commercially Available Probiotics With Periodontal Effects

Acilact a biopreperation of live lympholised acidophilic lactobacillus has shown to reduce gingivitis and periodontitis.Gum – perio balance, the first probiotic specifically designed to fight periodontal disease is a lozengecontaining at least 2x 10^8Lactobacillus reuteri belonging to two strains having synergistic properties in fighting cariogenic and periodontopathogenic bacteria. It has to be used daily to allow the bacteria to spread and attach to the oral surfaces Periobiotic is a fluoride free tooth paste containing Lactobacillus paracasei ADP-1 strain. ProBiora3 is a mouthwash containing specific strains of naturally occurring oral bacteria - Streptococcus

oralis strain KJ3sm, Streptococcus uberis strain KJ2sm, and the spontaneous lactiProdentis a Lactobacillus reuteri preparation showed to inhibit plaque formation, exert anti-inflammatory activity and antimicrobial activity. The preparation could be recommended during nonsurgical treatment and during maintenance phase of periodontal treatment[14]

Guided Periodontal Pocket Recolonization

The concept of replacing the pathogenic bacteria in the gingival sulcus with beneficial bacteria is called guided periodontal pocket recolonization. Studies in this aspect was pioneered by Teughels who observed that when a bacterial mixture that contained Streptococcus sangius, Streptococcus mitis and Streptococcus salivarius were applied subgingivally after scaling and root planing in beagle dogs, the recolonisation of canine Porphyromonasgingivalis and Prevotellaintermedia were suppressed[15.] Delay in recolonisation by periodontal pathogens, reduction in inflammation and improvement in bone level and bone density was observed by Nackaerts when Streptococcus sangius, Streptococcus salivarius and Streptococcus mitis were applied subgingivally in dog models acid-deficient variant of Streptococcus rattus, strain JH145.

Probiotics In Halitosis

Halitosis or oral malodour refers to the foul and unpleasant odour emanating from the oral cavity. Volatile sulphur compounds (VSC) are responsible for halitosis. Bacteria responsible for VSC production are Fusobacteriumnucleatum, Porphyromonasgingivalis, Prevotellaintermedia, and Treponema denticola.[16]Kazor et al reported that L. salivarius was the most predominant species detected in healthy subjects, whereas it was detected in only one of the subjects with halitosis at very low levels.[17]Weissella cibaria, a probiotics strain has been shown to inhibit VSC production under both in vitro and in vivo conditions. This is likely to be because of its ability to co-aggregate with VSC producing species like F. nucleatum, thus reducing the source for malodorous compounds in oral cavity and also by producing hydrogen peroxide which inhibit F.nucleatum as reported by Kang et al. [18]Streptococcus salivarius produces bacteriocins which inhibit bacteria producing VSC. It was shown that lozenges and gum containing Streptococcus salivarius decrease VSC in halitosis patients. The use of gum or lozenges containing S. salivarius K12 (BLIS Technologies Ltd., Dunedin, New Zealand) reduced levels of volatile sulphur compounds among patients diagnosed with halitosis. S. salivarius K12 taken in a lozenge after a mouthwash could reduce oral VSC levels in 85% of the test groups according to study by Burton et al[19]

Risks And Side Effects

All the strains of a species do not exhibit similar properties. Hence it is essential that the various strains be carefully studied and selected before their use as a probiotic. This, though difficult and complex, is of utmost importance in minimising the drawbacks and enhancing the benefits associated with the use of probiotics. Side effects caused by probiotics are usually mild and digestive. More serious effects have been reported rarely. Bacteraemia and fungaemia has been reported following use of probiotics in immunocompromised individuals, infants, patients with chronic disease, short gut syndrome and individuals with prior history of prolongedhospitalization and surgical intervention3 Lactobacillus endocaritis was reported following dental treatment in a patient with mitral regurgitation who was taking a probiotic preparation containing Lactobacillus rhamnosus.Following use of probiotic containing Lactobacillus rhamnosus GG (LGG) liver abscess was reported in a 74 year old diabetic female[20]Land et al reported the case of a 4 month old infant who developed LGG endocarditis 3 weeks after being on a probiotic therapy of LGG 1010 CFU/day for antibiotic related diarrhoea after cardiac surgery[21]Richard et al reported four cases of bacteremia that developed following use of an oral preparation containing Bacillus subtilis spores which was used for treatment of tube feeding related diarrhea [22] Lactobacillus and other lactic acid bacteria are capable of preventing pathogenic colonisation in the oral cavity because of its ability to produce acids. However, this can create an environment conducive to the development of caries. None of the cases with serious side effects were reported in healthy individuals

Bottlenecks

The probiotic potential of a microbial species is strain specific. It is necessary to identify the strain that exhibits the highest probiotic potential without exhibiting any pathogenic potential. Though many microbes are being studied to assess their probiotic potential, clarity is still lacking in terms of the concentration of the microbes that is needed to elicit a beneficial or inhibitory effect, the duration for which the probiotic has to be administered, and the possibility for the development of resistant strains of bacteria. Another area of concern is the lack of long term studies that assessed whether the administered microbes have the potential to permanently colonise the oral cavity. The time duration for which these probiotics are available (sustainability of the probiotic) in the oral cavity is an important parameter that decides the long term effect of this treatment modality. Studies comparing the effect of probiotics and antibiotics as adjuncts to scaling and root planing were

few. Studies comparing the bioavailability of the probiotic administered in the various formulations were also lacking[23]

V. Conclusion

The use of harmless bacteria to combat against pathogenic bacteria has found out to be a novel treatment options and this will leads to the use of these agents against various other chronic microbial infections affecting the oral cavity also.More research should happen in this perspective so that we can come up with probiotic bone grafts and all in our regular periodontal surgical practice.

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