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Probiotics and Its Implications In Periodontal Therapy- A Review

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Abstract: *Chemotherapeutics are widely used to prevent and treat infections caused by indigenous and exogenous microbes. Widespread use of antibiotics is reflected in the level of resistance in the subgingival microbiota of adult periodontitis patients. These developments have encouraged researchers in various fields of healthcare to develop alternative antimicrobial approaches. The application of 'health-promoting' bacteria for therapeutic purposes is one of the strongest emerging fields in this regard. Although the use of such probiotics specifically to improve oral health is still in its infancy, oral healthcare workers are probably confronted with dietary probiotics on a daily basis. The widespread oral intake of probiotics as preventive and therapeutic products for gastrointestinal health makes it of considerable interest for oral healthcare workers. These products usually contain streptococci, lactobacilli or bifidobacteria.*

Keywords: *probiotic, prebiotic, microbiota, periodontal disease*

I. Introduction

The term 'probiotic' is a relatively new word meaning 'for life' and it is currently used when referring to bacteria associated with beneficial effects on humans and animals. The use of microorganisms to promote health is very ancient and can even be traced back to the classical Roman literature where food fermented with microorganisms was used as a therapeutic agent. Observations showing that relatively harmless bacteria can be introduced into the indigenous microbiota of humans, either to enhance resistance to or to treat infections.

The term 'probiotics', the antonym of the term 'antibiotics', was introduced in 1965 by Lilly & Still-well as 'Substances produced by microorganisms which promote the growth of other microorganisms'.

The importance of living cells in probiotics was emphasized by Fuller, in 1989, WHO defined probiotics as 'A live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance'[1].

The World Health Organization and by the Food and Agriculture Organization of the United States, they defined probiotics as 'Live microorganisms which when administered in adequate amounts confer a health benefit on the host'.

'prebiotics' are generally defined as 'not digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacterial species already established in the colon, and thus in effect improve host health' (Gibbson GR et al 1995).

II. Mechanisms Of Probiotic Action

It as direct & indirect actions in the oral cavity (Meurman JH et al Eur Jr Sci 2005).

Direct interactions in dental plaque:

- Involving in binding of oral micro-organisms to proteins (biofilm formation).
- Action on plaque formation & on its complex ecosystem by competing & intervening with bacteria attachments.
- Involvement in metabolism of substrate.
- Production of chemicals that inhibits oral bacteria.

Indirect probiotic actions in the oral cavity:

- Modulating systemic immune function.
- Effect on non-immunologic defence mechanism.
- Regulating of mucosal permeability.
- Selection pressure on developing oral microflora towards colonization by less pathogenic species.

Uses:

Thus conceptually, the use of probiotics constitutes a purposeful attempt to modify the relationship with our immediate microbial environment in ways that may benefit general health (Golledge and Riley, 1996). Probiotic bacteria have been shown to influence the immune system through several molecular mechanisms (Gibson, 1998). A number of potential benefits arising from the use of probiotics have been proposed, including

- Increased resistance to infectious diseases (Perdigon et al, 1995; Arunachalam et al, 2000),
- Alleviate lactose intolerance (McDonough et al, 1987),
- Prevention from gut (Naidu et al, 1999), diarrhea (Vanderhoof et al, 1999), gastritis (Elmer et al, 1996), vaginal and urogenital infections (Hilton et al, 1992),
- Reduction in blood pressure and regulation of hypertension (Fuller, 1997), serum cholesterol concentration (Fuller, 1997),
- Reduction in allergy (Bengmark, 2000), respiratory infections (Hatakka et al, 2001) and
- Resistance to cancer chemotherapy and decreasing risk of colon cancer (Von Bultzingslowen et al, 2003).
- Dietary supplements.
- Able to exert a beneficial effect without permanently colonizing the site.
- Causes rarely dramatic & long term microbiological changes.
- Exerts beneficial effects by influencing the immune system.

III. Probiotics Compete Against Resistant Bacteria

A. Outnumbering the pathogens:

Probiotics used in high concentrations will slant the population toward beneficial bacteria. The beneficial bateria starve the resistant pathogens so that they can not grow. Introduce susceptible bacteria to compete with the pathogens and the susceptible bacteria will eventually eliminate the resistant pathogens.

B. Direct Competition:

One on one combat by Probiotics is the use of enzymes to inhibit the growth of pathogens. Bacteriocins and other antibiotic enzymes will directly inhibit growth of specific pathogenic bacteria.

C. Biodegradation:

Eliminate the food resources and the pathogens have no food to turn into toxins. Probiotics have the bacteria that can digest all the food substances, carbohydrates, proteins, fats, and fiber. Dr. Metnikoff of Russia found that beneficial fermentation bacteria are able to digest spoiled putrescence food particles to compete against pathogens. The benficial bacteria turn the food into lactic acid, which is beneficial to good health.

Probiotics produce the enzymes to digest and breakdown malodors in the mouth. Certain bacteria are able to change sulfur compounds, nitrogen compounds, phosphorus compounds and any other toxic gases and turn them into useful gases needed for metabolisms.

D. Lowering the pH:

Lowering the pH eliminates most of the food pathogens. Using lactic acid bacteria and certain beneficial yeast and mold s eliminates the tooth decay pathogens. Lowering the pH to under 7 in saliva prevents plaque formation. Probiotics may be the only product that lowers the pH and controls growth of resistant bacteria and other potential pathogens.

E. Antioxidants:

The key factor to an alkaline envirnoment is the propensity for oxidation. Oxidation is caused by oxidants. To prevent oxidants from oxidizing, use antioxidants. Oxidation is the grabbing of electrons from other chemical compounds. In the mouth, the grabbing of electrons forms rust with inorganic compounds. The rust is in the form of dental plaque and calculus deposits on teeth. Resistant bacterai develop in an alkaline environment because the electricity stresses them into activating existing resistant genes or creating new resistant genes. Antioxidants neutralize the electricity so that susceptible bacteria can grow and eliminate the resistant bacteria. Antioxidants breakdown mineral deposits so that they become water soluble. In the case of dental plaque, calcium carbonate is broken down into calcium bicarbonate that is water soluble. Dental stains are due to oxidation of both organic and inorganic compounds. Antioxidants are best to remove the stains and prevent the new stains from forming.

F. Magnetic Field:

Bacteria have what is called a magnetic field that spins around the outer surface of the cell. In an alkaline solution, the spin is in the direction of the South pole to attract calcium to the outer surface. The spin is reversed by changing the alkaline solution to an acid solution. The spin is now in the direction of the North pole and the spin repels calcium. Probiotics can change the spin around plaque bacteria to repel calcium. (Buryl Payne, The Body Magnetic).

IV. Probiotic Bacteria

Today, research regarding probiotics concentrates essentially on L. acidophilus, L. casei, L. reuteri and Bifidobacterium bifidum while practically ignoring the vast array of other species that inhabit the oral tract of humans. Some microorganisms are beneficial to the human body. In the gut microflora of newborn, breast fed children, bifidobacteria represents one of the predominant groups of intestinal bacteria. However the presence of bifidobacteria decreases after weaning, and potentially pathogenicbacteria begin to predominate. Some bifidobacteria are recognized today as probiotic, that is to say, bacteria, which improve the properties of the intestinal flora and contribute to better health (Haschke et al, 1998).

While defined in term as 'medical probiotics' (microbial preparation) and 'other probiotics '(functional food), probiotics are provided in products in one of four basic ways:

- as a culture concentrate added to a beverage or food (such as fruit juice),
- inoculated into prebiotic fibers,
- inoculated into a milk-based food (dairy products such as milk, milk drink, yoghurt, yoghurt drink, cheese, kefir, biodrink) and
- As concentrated and dried cells packaged as dietary supplements (non-dairy products such as powder, capsule, gelatin tablets).

V. Probiotics On Periodontal Infections

The effect of probiotics on plaque-related periodontitis is even more striking. Dental biofilms are considered to be difficult therapeutic targets (socranky SS et al 2002).

Etiology of plaque-related periodontal inflammation considers three factors that determine whether disease will develop in a subject:

- A susceptible host;
- The presence of pathogenic species
- The reduction or absence of so-called 'beneficial bacteria.

The worldwide treatment strategy applied for periodontal disease is to make a reduction in the sungingival microflora but recolonization of these bacteria after treatment is possible so restoring these reduced numbers of beneficial bacteria via probiotic might be considerable interest in the treatment of plaque-related periodontal disease. Probiotics might not only suppress the emergence of endogenous pathogens or prevent the superinfection with exogenous pathogens; they might also protect us through the promotion of a beneficial host response.

The use of a Russian probiotic preparation called Acilact, a complex of five live lyophilized lactic acid bacteria, with or without 'Bifidumbacteriri (probably Bifidobacterium) is claimed to improve both clinical and micro-biological parameters in patients with gingivitis and mild periodontitis. A periodontal dressing consisting of collagen and L. casei 37 was reported to exert a beneficial effect on the subgingival microbiota of periodontal pockets. L.salavaricus strain is currently as the potential supresss periodontal pathogens & improves periodontal health.

Chronic periodontitis, could also benefit from orally administered probiotics. The presence of periodontal pathogens could be regulated by means of antagonistic interactions. A decrease in gum bleeding and reduced gingivitis has been observed by Krasse et al (2006) with the application of L. reuteri. Koll-Klais et al (2006) reported that resident lactobacilli flora inhibits the growth of Porphyromonas gingivalis and Prevotella intermedia in 82% and 65%, respectively.

Probiotic strains included in periodontal dressings at optimal concentration of 108 CFU ml)1 were shown to diminish the number of most frequently isolated perio-dontal pathogens: Bacteroides sp., Actinomyces sp. and S. intermedius, and also C. albicans (Volozhin et al, 2004). These authors registered a 10- to 12-month remission period after periodontal treatment by application of the periodontal dressing that comprised collagen

and L. casei. Nevertheless, similar to the case with dental caries, however, there is not yet any true evidence on the effect of probiotic therapy on periodontal disease.

Probiotics and imbalanced oral ecosystem Halitosis, the oral malodor, is a condition normally ascribed to disturbed commensal microflora equilibrium. It has recently been positively affected by regular administration of probiotics. Kang et al (2006) have shown a definite inhibitory effect on the production of volatile sulfur compounds (VSC) by F. nucleatum after ingestion of Weissella cibaria both in vitro and in vivo. In children, a marked reduction in the levels of H2S and CH3SH by approximately 48.2% ($P < 0.01$) and 59.4% ($P < 0.05$), respectively, was registered after gargling with W. cibaria containing rinse. The possible mechanism in the VSC reduction is the hydrogen peroxide generated by W. cibaria that inhibits the proliferation of F. nucleatum. Streptococcus salivarius, also a possible candidate for an oral probiotic, has demonstrated inhibitory effect on VSC by competing for colonization sites with species causing an increase in levels of VSC (Burton et al, 2005, 2006a,b). Burton et al (2006a,b) further reported that S. salivarius strain K12 produced two lantibiotic bacteriocins, compounds that are inhibitory to strains of several species of gram-positive bacteria implicated in halitosis. However, the few studies published on the role of probiotics in the treatment of halitosis do not entitle any evidence-based conclusions. Nevertheless, we think that this might be an area where probiotic therapy indeed could bring something new if the preliminary observations on the 'balancing' effect of probiotics on VSC-generating microflora are confirmed.[7,8]

VI. Effective Microorganisms Of Probiotics

The oral cavity contains over 400 different bacteria, many who may be resistant to antibacterial agents. Resistant genes have been passed among the bacteria by gene transfer. Many of the harmless bacteria have been changed into potential pathogens. Probiotics for the oral cavity needs to contain a plethora of different kinds of bacteria to compete with the many kinds of potential pathogens in the oral cavity.

Understanding science and the recent information of the last decade shows that antibacterial agents should be reduced or eliminated in the oral cavity. In their place, the best supplement is Probiotics that prevent dental disease and mouth malodor. The dental proffession have not been able to conquer dental disease because they may have been approaching the solution from the wrong aspect. Instead of curing dental disease, they may be causing the disease to grow. Clinical tests have been done to prove that antioxidant powder does inhibit progression of preiodontal disease. Use of mild acid solutions have been shown to reduce plaque.

Clinical trials on older people prove that Probiotics help digest food particles in the mouth and eliminate mouth odor. Probiotics and antioxidant powder make the perfect combination to maintain good dental health. Holistic doctors have been using probiotics for over 60 years to treat dysbiosis of the gut. Now is the time to use probiotics to treat dysbiosis of the oral cavity.

The combination of different bacteria in Effective Microorganisms™ (available as PROEM•1 Probiotic) makes an ideal probiotics for the mouth. There are over 400 different species of bacteria known in the oral cavity. Many of these species are resistant bacteria because of the daily abuse of antibacterial oral hygiene products. To compete with these bacteria, the probiotics must have different kinds of bacteria. There must be bacteria to compete for all the 4 major foods substances of carbohydrates, proteins, fats, and fiber. There must be bacteria to breakdown gases of sulfur, nitrogen, and phosphorus. There must be antibiotic and bacteriocin producers to keep the pathogens under control. The final ingredient must be a general to keep the different species from competing against each other. Effective Microorganisms is the only kjjkprobiotic available in solution form that has all the necessary bacteria. Finally, the probiotic product should be an antioxidant because oxidation is the cause of stains, plaque, and malodors. The ideal product for the oral cavity is competition of good bacteria against bad bacteria, enzymes to giest all foods and odors, and antioxidant action. This makes Effective Microorganisms perhaps the best natural supplement for the oral cavity. The bonus is that fermentation bacteria lower the pH to where most of the known pathogens simply disappear. The time has come when antibacterial agents should be used only in the case of emergency. This will keep resistant bacteria from causing disease.

VII. Installation Of Probiotics In The Oral Cavity

Probiotics should adhere to dental tissue for them to establish a cariostatic effect and thus should be a part of the bio-film to fight with cariogenic bacteria (Grudianov et al, 2002). For this action, installation of probiotics in oral environment seems important. However the contact time between probiotics and plaque would be short, that the activity will be weak. This activity increases if probiotics could be installed in the oral environment for longer duration. At this point, ideal vehicles of probiotic installation should be determined.

A.Yoghurt

Dental research revealed results for the oral installation that lactobacilli cannot be installed by the consumption of probiotic yoghurt. Studies concluded that yoghurt microorganisms did not have some activity against salivary microorganisms, with no relation thought to be found with the installation mechanism (Busscher et al, 1999; Petti et al, 2001). Conversely, in a research paper, it was concluded that subjects consuming daily bio-yoghurt with L rhamnosus GG, harbored this microorganism in their saliva up to 2 weeks after discontinuing consumption of probiotics (Meurman et al, 1994). Up to date, it could be assumed that it is questionable if probiotics can colonize in the mouth. Regular consumption of probiotics (dairy products) can decrease the numbers of salivary Streptococcus mutans and lactobacilli, however do not have any residual antibacterial activity after discontinuation. However it must be recognised that there may be different activities in other forms of probiotics such as milk, juice or cheese.

B. Milk And Cheese

Milk and cheese are known to contain compounds that reduce the risk of dental caries (Jenkins and Hargreaves, 1989; Bowen and Pearson, 1993; Nase et al, 2001). Regarding milk and cheese, one should also recognize the large body of evidence relating to casein phospho-peptides and other milk-derived materials and their role in bio-mineralization and other processes. At this point, research focusing beneficial effects of probiotic milk and cheese seems to be further investigated.

In a recent study, it was examined whether milk containing LGG has an effect on caries and the risk of caries in children when compared with normal milk. LGG was found to reduce the risk of caries significantly Thus, milk containing the probiotic LGG bacteria may have beneficial effects on children's dental health (Nase et al, 2001).

It was also examined whether short-term consumption of cheese containing LGG and Lactobacillus rhamnosus LC 705 would diminish caries-associated salivary microbial counts in young adults. In this double-blinded, randomized, placebo-controlled study, during the 3-week intervention, the subjects ate 5 x 15 g cheese per day. The results showed no statistically significant difference between the groups in Streptococcus mutans counts after the intervention, but during the post-treatment period there was a significantly greater reduction in these counts in the intervention group compared to the control group. However, Streptococcus mutans counts decreased in 20% of all the subjects, regardless of the intervention group. Authors stated that probiotic intervention might reduce the risk of the highest level of Streptococcus mutans (Ahola et al, 2002). However there is no evidence of a longer term effect of selected strain on oral tissue.

VIII. Conclusion:

Probiotic have made their way into oral healthcare and are more likely to be our friend than our enemy. Despite our rapidly increasing knowledge of pathogen–host interactions, the role of beneficial bacteria in preventing the emergence of pathogenic species and oral health remains obscure. There is a great need to elucidate the role of the oral beneficial microbiota, to identify beneficial bacteria and to conduct proper large-scale studies on the usefulness of probiotics to maintain or improve oral health.

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