A Review

Periodontal Healing by Improving Gut Health

Anurag Satpathy

Professor
Dept. of Periodontics & Oral Implantology
Institute of Dental Sciences,
Siksha 'O' Anusandhan University,
Khandagiri, Bhubaneswar,
Odisha, India-751003
drasatpathy@gmail.com

Access this article online

Website:
www.healtalk.in

DOI:
https://doi.org/10.5281/zenodo.7928182

Quick Response Code:

Abstract

Periodontal disease is a chronic inflammatory ailment, its pathogenesis is substantially influenced by dysbiosis, which refers to an imbalance in the oral microbiota. There exists a correlation between the gut microbiota and periodontal disease, whereby changes in the gut microbiota may play a role in the development of dysbiosis and the subsequent onset of periodontal disease. Changes in the configuration of the gastrointestinal microbiota have been linked to conditions such as metabolic, immunological, neurological, and cardiovascular disorders. The prevention and management of periodontal disease may be contingent upon the maintenance of harmonious microbiota within the oral and gastrointestinal regions. These objectives can be attained by means of probiotics, prebiotics, a well-balanced diet, and consistent oral hygiene practices such as brushing and flossing.

INTRODUCTION

Periodontal disease is a persistent inflammatory ailment that impacts the periodontium, which comprises the gums, ligaments, and bones that provide structural support to the teeth.[1] The emergence of this phenomenon is attributed to the interplay among pathogenic microorganisms, the immune responses of the host, and various environmental factors.[1-3]

An imbalance in the oral microbiota is referred to as oral microbial dysbiosis, and it can influence the onset and progression of periodontal disease.[4] . The community of bacteria, viruses, fungi, and protozoa that live in the oral cavity is known as the oral microbiota. Pathogenic bacteria can dominate the microbiota and contribute to the onset of periodontal disease when the ratio of commensal to pathogenic bacteria is upset. [5, 6] .Oral microbial dysbiosis appears to be a key factor in the development and progression of periodontal disease.[7,8]

Oral Dysbiosis and the Periodontal Disease

Oral dysbiosis is a condition characterized by an uneven distribution of microorganisms in the oral cavity that may play a role in the onset and advancement of periodontal pathology.[8] The oral microbiota is a multifaceted assemblage of microorganisms that inhabit the oral cavity, and its constitution is impacted by a range of determinants, such as dietary habits, oral hygiene, and overall state of health.[9] Dysbiosis refers to the alteration in the microbial communities that are characteristic of a specific micro environment. The phenomenon of bacterial translocation, which has been implicated in the development of various diseases, maybe more accurately conceptualized as atopobiosis.[10] . This refers to the presence of microorganisms that are typical of a particular micro environment in an atypical location. Atopobiosis may manifest through various pathways and is a significant mechanism in the involvement of the oral microbiota in numerous conditions and illnesses.[11].

Certain bacteria have been linked to periodontal disease more frequently than others, according to studies. "red complex" bacteria, such as Porphyromonas gingivalis, Tannerella forsythia, and Treponema denticola, are strongly linked to periodontal disease.[12] . Proteases and lipopolysaccharides are examples of virulence factors produced by these bacteria, and they can cause inflammation and bone loss in the host. Apart from the bacterial group known as the "red complex," several other bacterial species have also been shown to have a strong association with periodontal diseases, such

How to cite this article: Anurag Satpathy.: Periodontal Healing by Improving Gut Health HTAJOCD 2023; March-April(4):10-13

as Fusobacterium nucleatum, Prevotella intermedia, and Aggregati bacteractinomy cetemcomitans. These bacteria can generate virulence factors which can lead to inflammation and damage to the periodontal tissues.[13].

Additionally, scholarly studies have demonstrated that periodontal disease has the potential to cause alterations in the oral microbiota, thereby playing a role in the development of dysbiosis.[2] As the disease advances, there is a transition towards a higher prevalence of pathogenic bacteria and a reduction in commensal bacteria.

Periodontal disease and the Gut Flora

Recent studies have indicated that the gut microbiota may have a potential involvement in the pathogenesis of oral dysibiosis and periodontal disease. Research has indicated that alterations in the composition of the gut microbiota can exert an influence on the immune system and inflammation, thereby potentially influencing the oral microbiota and contributing to the onset of periodontal disease. Additionally, current studies have demonstrated a potential correlation between the microbiota present in the oral cavity and that of the gastrointestinal tract, as a result of the ingestion of saliva, which may facilitate the transmission of oral microorganisms to the gut. The reciprocal transfer of gut microbiota to the oral cavity is also a plausible occurrence.

Several studies have reported that specific gut microbiota may confer a safeguarding influence against periodontitis, whereas others may elevate the susceptibility to the disease. The study found that there was a significant difference in the abundance of specific gut bacteria, namely Lachnospiraceae and Ruminococcaceae, between individuals with periodontal disease and those who were considered healthy.Preventing and properly managing periodontal disease may depend in part on keeping a balanced microbiota in the mouth and gastrointestinal tract. This can be accomplished with the help of probiotics and prebiotics, as well as a balanced diet and regular brushing and flossing.

Gut flora and systemic health

The gastrointestinal tract harbors a complex community of microorganisms known as the gut microbiota, which is essential for the maintenance of overall health. The microbiota present in the gastrointestinal tract has the potential to exert an impact on various systemic health conditions, such as metabolic, immunological, neurological, and cardiovascular disorders.

Alterations in the composition of gut microbiota have been associated with metabolic disorders, including but not limited to obesity and type 2 diabetes. Individuals who are obese exhibit a reduced variety of gut microbiota and an increased prevalence of specific bacteria that could potentially lead to insulin resistance and weight gain. The immune system and inflammation can be influenced by the gut microbiota, and dysbiosis may play a role in the onset of autoimmune and inflammatory conditions such as inflammatory bowel disease, rheumatoid arthritis, and psoriasis.

Moreover, the gut microbiota has the potential to exert an impact on neurological disorders, including but not limited to depression, anxiety, and autism spectrum disorders. The gut-brain axis is a two-way communication system that involves neural, endocrine, and immune pathways between the gut and the brain. The gut microbiota has the ability to produce neurotransmitters, modulate brain function, and influence behavior. As a result, it may have a role in the development of these conditions.In addition, the gut microbiota has the potential to impact cardiovascular well-being. The association between dysbiosis and the onset of atherosclerosis, a condition that may result in myocardial infarction and cerebrovascular accidents, has been established.

The Gut-brain axis and periodontal disease

The gut-brain axis refers to a two-way communication system that exists between the central nervous system and the enteric nervous system.[14] This network is responsible for regulating a wide range of physiological processes, including but not limited to digestion, metabolism, and immune responses.[15].

The hypothalamic-pituitary-adrenal axis (HPA), the immune system, the microbiota, and their metabolites are all connected to this axis in various ways. Essential vitamins, secondary bile acids, amino acids, and short-chain fatty acids are just a few examples of the neurotransmitters and metabolites that modulate numerous immune system pathways, which in turn affect behavior, memory, learning, locomotion, and neurodegenerative disorders. The inflammasome was identified as a key player in several of these pathways, including those that regulate mood, anxiety, and movement. The exact mechanism behind these phenomena still needs to be understood, but it has been suggested that dysbiosis plays a role in causing these mood and behavioral defects.

Recent studies have suggested a potential association between the gut-brain axis and periodontal disease. The gut microbiotaplays a pivotal role in modulating immune responses and inflammatory processes. The alteration in the gut microbiota's composition, commonly referred to as dysbiosis, has been linked to various medical conditions, including periodontal disease.[16] Periodontal disease has the capacity to elicit modifications in the gut microbiota's composition, which could contribute to the development of dysbiosis.[17] Furthermore, the existence of gingival inflammation may lead to the release of pro-inflammatory agents that can permeate the circulatory system and activate the immune response.[18] This process has the potential to induce systemic inflammation and increase the vulnerability to the development of other chronic conditions. Furthermore, the impact of stress on the gut-brain axis may potentially play a role in the onset and advancement of periodontal disease.[19] The composition of gut microbiota can undergo modifications due to stress, thereby causing immune responses and inflammation to be altered, ultimately exacerbating the periodontal disease.

Probiotics and Periodontal Disease

Probiotics refer to living microorganisms that can confer health advantages upon consumption in sufficient quantities. These entities have the potential to modulate the composition of the oral microbiota and regulate immune responses and inflammation, thereby exerting an influence on periodontal disease.

The administration of probiotics has been found to have a positive impact on periodontal health through the mitigation of inflammatory processes and the inhibition of pathogenic bacterial proliferation within the oral cavity.[20] Studies have demonstrated that probiotics possess the ability to impede the proliferation of periodontal pathogens, specifically Porphyromonasgingivalis, while simultaneously augmenting the prevalence of advantageous bacteria, namely lactobacilli and bifidobacteria, within the oral microbiome.[21]

In addition, probiotics have the potential to exert a positive impact on the immune system by mitigating systemic inflammation and potentially enhancing periodontal health.[22] A published study reported that the administration of a probiotic blend comprising Lactobacillus reuteri and Lactobacillus rhamnosus resulted in a reduction in the depth of periodontal pockets and an enhancement in clinical attachment levels among individuals diagnosed with chronic periodontitis.[23].

Oral Probiotics

Oral probiotics refer to viable microorganisms that are ingested orally with the aim of inhabiting the oral cavity and enhancing oral well-being. The probiotics encompass a range of bacterial strains, including but not limited to Streptococcus salivarius, Lactobacillus reuteri, and Bifidobacterium lactis. They have been found to have potential benefits for a range of oral health conditions such as periodontal disease, dental caries, and halitosis. Additionally, they have been shown to be efficacious in mitigating the risk of dental caries.[24] Incorporation of a probiotic blend that comprises Streptococcus salivarius has resulted in a decrease in the concentration of volatile sulphur compounds, which are commonly linked to halitosis. Common probiotic microbes include Lactobacillus rhamnosus, Lactobacillus reuteri, bifidobacteria, and specific strains of Lactobacillus casei, Lactobacillus acidophilus-group, and Bacillus coagulans; Escherichia coli strain Nissle 1917; Enterococcus faecium SF68; and the yeast Saccharomyces boulardii.[25]

Although the current research on oral probiotics displays potential, additional investigations are required to establish the most effective strains, dosages, and treatment durations for oral health conditions. It is imperative to acknowledge that the utilization of oral probiotics must not be deemed a substitute for effective oral hygiene measures, including but not limited to, brushing, flossing, and periodic dental examinations.

Probiotic Products

Probiotic products encompass both dietary supplements and food items. The products may comprise diverse bacterial strains, including Lactobacillus acidophilus, Bifidobacterium bifidum, and Streptococcus thermophilus.

Probiotic products are commercially accessible in diverse formats such as capsules, tablets, powders, and liquids. In addition, it is a common practice to incorporate them into comestibles such as yogurt, kefir, and fermented vegetables.[26] Some products are marketed specifically for certain health conditions, such as digestive health, immune support, and women's health.

When selecting a probiotic product, it is crucial to consider the bacterial strain, dosage, and duration of treatment.[27] The effects of various bacterial strains on the human body can vary, and the ideal dosage and duration of treatment may differ based on the individual's health status and the particular health ailment being targeted.[28]Selecting a probiotic product of superior quality from a reputable manufacturer is crucial since the effectiveness and strength of probiotic products can exhibit significant variations. It is advisable to seek out commodities that have undergone independent quality and purity assessments and to verify the expiration date to ascertain their continued efficacy.

Probiotic Regimen

The most effective probiotic regimen may differ based on an individual's health status and the particular health condition being targeted. Nonetheless, there exist certain overarching principles that can be adhered to while selecting a probiotic regimen.

Initially, it is necessary to select a probiotic product of superior quality from a trustworthy producer. It is advisable to seek out commodities that encompass a diverse array of strains of advantageous microorganisms and have undergone impartial assessments to ascertain their quality and purity.[29] The optimal dosage of probiotics may vary depending on the specific product and the health status of the individual. Certain products suggest a daily intake of 1-10 billion colony-forming units (CFUs), whereas others may suggest a greater dosage for health conditions.[30] Adherence to the guidelines provided by the manufacturer and seeking guidance from a healthcare expert in case of uncertainty regarding the suitable dosage is crucial.

Probiotics are widely acknowledged to possess a favorable safety profile, albeit some individuals may experience unfavorable effects such as abdominal distension, flatulence, and loose stools. In general, the negative responses are of a mild and temporary nature and can be alleviated by initiating therapy with a small amount and gradually increasing it. The duration of treatment may exhibit variability contingent upon the health status of the individual and the health condition under consideration. Certain probiotic products may be suggested for brief periods to target a particular health issue, whereas others may be suggested for extended periods to sustain general well-being.

In general, the selection of a probiotic product of superior quality and adherence to the manufacturer's guidelines can contribute to the promotion of overall health and wellness. It is advisable to seek guidance from a healthcare practitioner prior to commencing any novel dietary supplement or therapeutic regimen.

CONCLUSION

Regardless of periodontal health, a wide range of oral species is capable of swallowing their way into the intestinal microbiota; however, only a subset of these bacteria appears to colonise the gut when the microbiota here is dysbiotic. Whether a dysbiotic oral microbiota is necessary for this colonisation is unclear, but cannot be ruled out. Regardless, ectopic colonisation of oral bacteria may be encouraged by severe diseases and the host's genetic susceptibility. Oral hygiene, periodontal therapy, prebiotics, and probiotics may all play a role in relieving the gastrointestinal symptoms caused by oral bacteria. Oral bacteria may use the intestinal link to spread inflammation throughout the body. But this field of study is just getting started, so more research is needed before any definitive conclusions can be made.

REFERENCES

1. Kinane DF, Stathopoulou PG, Papapanou PN. Periodontal diseases. Nat Rev Dis Primers. 2017;3:17038.
2. Hajishengallis G, Chavakis T. Local and systemic mechanisms linking periodontal disease and inflammatory comorbidities. Nat Rev Immunol. 2021;21(7):426-40.
3. Pattnaik S, Anand N, Chandrasekaran SC, Chandrashekar L, Mahalakshmi K, Satpathy

A. Clinical and antimicrobial efficacy of a controlled-release device containing chlorhexidine in the treatment of chronic periodontitis. European journal of clinical microbiology & infectious diseases : official publication of the European Society of Clinical Microbiology. 2015;34(10):2103-10.

4. Levy M, Kolodziejczyk AA, Thaiss CA, Elinav E. Dysbiosis and the immune system. Nat Rev Immunol. 2017;17(4):219-32.
5. Abusleme L, Hoare A, Hong BY, Diaz PI. Microbial signatures of health, gingivitis, and periodontitis. Periodontol 2000. 2021;86(1):57-78.
6. Sedghi LM, Bacino M, Kapila YL. Periodontal Disease: The Good, The Bad, and The Unknown. Front Cell Infect Microbiol. 2021;11:766944.
7. Nath SG, Raveendran R. Microbial dysbiosis in periodontitis. J Indian Soc Periodontol.2013;17(4):543-5.
8. Kumar PS. Microbial dysbiosis: The root cause of periodontal disease. J Periodontol.2021;92(8):1079-87.
9. Zhang Y, Wang X, Li H, Ni C, Du Z, Yan F. Human oral microbiota and its modulation for oral health. Biomed Pharmacother. 2018;99:883-93.
10. Potgieter M, Bester J, Kell DB, Pretorius E. The dormant blood microbiome in chronic, inflammatory diseases. FEMS Microbiol Rev. 2015;39(4):567-91.
11. Gomez LA, De Avila J, Castillo DM, Montenegro DA, Trujillo TG, Suarez LJ, et al. Porphyromonas gingivalis Placental Atopobiosis and Inflammatory Responses in Women With Adverse Pregnancy Outcomes. Front Microbiol. 2020;11:591626.
12. Suresh S, Mahendra J, Saketharaman P, Sivsankar P, Selvakumar J, Elangovan R. Evaluation of Reactive Oxygen Metabolites, Resistin, and Red Complex Bacteria in Obese Subjects with or without Periodontitis. J Contemp Dent Pract. 2022;23(7):703-8.
13. Suresh S, Alva PP, Premanath R. Modulation of quorum sensing-associated virulence in bacteria: carbohydrate as a key factor. Arch Microbiol. 2021;203(5):1881-90.
14. Socala K, Doboszewska U, Szopa A, Serefko A, Wlodarczyk M, Zielinska A, et al. The role of microbiota-gut-brain axis in neuropsychiatric and neurological disorders. Pharmacol Res. 2021;172:105840.
15. Goralczyk-Binkowska A, Szmajda-Krygier D, Kozlowska E. The Microbiota-Gut- Brain Axis in Psychiatric Disorders. Int J Mol Sci. 2022;23(19).
16. Kitamoto S, Nagao-Kitamoto H, Hein R, Schmidt TM, Kamada N. The Bacterial Connection between the Oral Cavity and the Gut Diseases. J Dent Res. 2020;99(9):1021-9.
17. Sansores-Espana LD, Melgar-Rodriguez S, Olivares-Sagredo K, Cafferata EA,Martinez-Aguilar VM, Vernal R, et al. Oral-Gut-Brain Axis in Experimental Models of Periodontitis: Associating Gut Dysbiosis With Neurodegenerative Diseases. Front Aging. 2021;2:781582.
18. Mahapatra A, Nayak R, Satpathy A, Pati BK, Mohanty R, Mohanty G, et al. Maternal periodontal status, oral inflammatory load, and systemic inflammation are associated with low infant birth weight. J Periodontol. 2021;92(8):1107-16.
19. Martinez M, Postolache TT, Garcia-Bueno B, Leza JC, Figuero E, Lowry CA, et al. The Role of the Oral Microbiota Related to Periodontal Diseases in Anxiety, Mood and Trauma- and Stress-Related Disorders. Front Psychiatry. 2021;12:814177.
20. Myneni SR, Brocavich K, H HW. Biological strategies for the prevention of periodontal disease: Probiotics and vaccines. Periodontol 2000. 2020;84(1):161-75.
21. Ishikawa KH, Mita D, Kawamoto D, Nicoli JR, Albuquerque-Souza E, Lorenzetti Simionato MR, et al. Probiotics alter biofilm formation and the transcription of Porphyromonas gingivalis virulence-associated genes. J Oral Microbiol. 2020;12(1):1805553.
22. La Fata G, Weber P, Mohajeri MH. Probiotics and the Gut Immune System: Indirect Regulation. Probiotics Antimicrob Proteins. 2018;10(1):11-21.
23. Zhang Y, Ding Y, Guo Q. Probiotic Species in the Management of Periodontal Diseases: An Overview. Front Cell Infect Microbiol. 2022;12:806463.
24. Hasslof P, Stecksen-Blicks C. Chapter 10: Probiotic Bacteria and Dental Caries. Monogr Oral Sci. 2020;28:99-107.
25. Gulzar N, Muqaddas Saleem I, Rafiq S, Nadeem M. Therapeutic Potential of Probiotics and Prebiotics. Oral Health by Using Probiotic Products2019.
26. Puebla-Barragan S, Reid G. Probiotics in Cosmetic and Personal Care Products: Trends and Challenges. Molecules. 2021;26(5).
27. Sniffen JC, McFarland LV, Evans CT, Goldstein EJC. Choosing an appropriate probiotic product for your patient: An evidence-based practical guide. PLoS One. 2018;13(12):e0209205.
28. Zaura E, Twetman S. Critical Appraisal of Oral Pre- and Probiotics for Caries Prevention and Care. Caries Res. 2019;53(5):514-26.
29. Jayaram P, Chatterjee A, Raghunathan V. Probiotics in the treatment of periodontal disease: A systematic review. J Indian Soc Periodontol. 2016;20(5):488-95.
30. Luo W, Li H, Ye F. Clinical therapeutic effects of probiotics in combination with antibiotics on periodontitis: A protocol for systematic review and meta-analysis. Medicine (Baltimore). 2021;100(4):e23755.