

Oral Microbiome Mirror Of Systemic Health- A Review

¹Dr.J.Bhuvanesarri.M.D.S

¹Professor, dept of periodontics, shree balaji dental college, chennai

Abstract: Oral microbiota is an important part of the human microbiome. Oral microbes can be colonized into the intestine in various ways. Oral microbiota is associated with a variety of oral diseases. Recently, much evidence has suggested that the oral microbiota is closely related to the physical state of humans, such as diabetes, obesity, and cancer. Shortly perception, oral microbiota will become a new target for improving the systemic health of humans. The oral cavity has the second largest and diverse microbiota after the gut harboring over 700 species of bacteria. It as numerous microorganisms which include bacteria, fungi, viruses and protozoa. The mouth with its various niches is a very complex habitat where microbes colonize the hard surfaces of the teeth and the soft tissues of the oral mucosa. The oral microbiome is crucial in maintaining oral as well as systemic health.. The existence of new genomic technologies which are next-generation sequencing and bioinformatics has given a complete data analysis of complexities of the oral microbiome. It has provided a powerful means of studying the microbiome.

Keywords: oral microbiota, oral health, systemic health.

INTRODUCTION

Human mouth consists of many types of micro-organisms which includes bacteria, viruses, fungi and protozoan. Oral microbiome is unique because of the constant contact of oral cavity with the external environment. Diets, Temperature, pH of saliva are important factors that contribute to the establishment of oral microbiome. The oral microbiome is imperative to health as it causes both oral and systemic diseases. A dysbiosis microflora influences the development of oral diseases like dental caries, periodontal diseases. Promoting a balanced microbiome is the key to maintain or reestablish oral health. Technological advances in the recent times have started to unwind the mysteries and complexities of the oral microbiome helping us to gain insights into its role in health and disease states.^{2,3,4}

ORAL MICROBIOME AND ORAL HEALTH

The oral microbiota contributes to the health and physiological status of the mouth. The teeth, gingival sulcus, tongue, cheeks, hard and soft palates, and tonsils each provide enriching environments during which microbial can flourish. The oral microbiome is extremely dynamic due to the oral cavity's continuum with the external environment'. The mouth has multiple essential functions that affect bacterial growth and activity: eating, communicating, and defending against infection. Even oral microbial colonies that are less vulnerable to agitation experience changes attributed to diet, age, and health, also as constant changes in pH, redox potential, atmospheric conditions, salinity, and water activity from saliva.^{9,10,11} Colonization resistance, Immunomodulatory activity, enhancement of host defenses and host physiology and generation of antibacterial nitric oxide.^{1,2,3} The oral cavity has evolved to improve oral health and fosters highly personalized microbiomes that exist dynamically in balance with the host. The symbiotic relationship between host and microbiome maintains microbial homeostasis; however, dysbiosis, a breakdown of the microbial homeostasis, induces oral disease and increases the risk for systemic diseases.^{5,6,7} The inseparable relationship between the host and microbiome is formed over a long time by facing various changes that force the adaptation of the oral microbiome to the new environment. A bidirectional relation is characterized by the microbe providing the host with abilities it lacks alone, while the host provides an appropriate environment for microbial growth. The host factors can positively affect the microbiome, making balance and diversity between the species, thus inducing symbiosis and an absence of pathology.^{3,4,5} On the contrary, the host can also create a negative influence. This co-evolution between the host and microbiome succeeded in achieving a complex biological process in which the existence of independent entities would be impossible. The mutual benefits from the maintenance of a balanced host–oral microbiome ecology can be distorted to induce a shift from a healthy and symbiotic relation to a pathologic and dysbiosis one. This distortion can result from changes in the oral microbiome as well as in the host. Even though the host and the microbiome are equivalent factors, early studies have focused on finding the pathological oral microbiome, and the role of the host in maintaining a healthy oral microbiome was overlooked.^{19,20} The recent research studies have moved to focus on the host factors and the role of host–oral microbiome in the development of a healthy and balanced oral ecology, and extended to systemic disease and oral disease. The oral microbiome interaction is connected with a variety of oral diseases. Many studies have proven that oral microbiome and gut microbiome are similar so it plays an important role in physiological status of health.^{17,18} Host Factors to Modulate the Oral Microbiome.

Factor Reference

Genetics

Genetic polymorphism in miRNA202 is involved in hBD1 salivary level as well as caries experience.

Genes expressed in dental enamel development are associated with molar–incisor hypomineralization GLUT2 and TAS1R2 genotypes individually and in combination are associated with caries risk

- Host genetic control of the oral microbiome in health and disease .
- Microbial abundance and some aspects of the microbial population structure are influenced by heritable traits in saliva.

Immunity^{5,6}

- Immune cell network mediating immune surveillance at oral mucosa and gingiva
- The innate host response in caries and periodontitis
- Secretory immunity with special reference to the oral cavity

Attachment surface^{1,2,3}

Surface properties influence oral biofilm formation. Differences in relation to the microbial diversity of modified resins during the initial phase of biofilm maturation - Biomaterial-associated infection of implants and devices .

Diet - Vegan diet influences on the human salivary microbiota. Short- and medium-chain fatty acids exhibit antimicrobial activity for oral microorganisms.

Cigarette

Smoking- decreases structural and functional resilience in the subgingival ecosystem .Firmicutes were statistically elevated in smokers at the expense of Proteobacteria and Fusobacteria in non-smokers.Tobacco smoking affects the salivary gram-positive bacterial population.^{4,5}

Alcohol - Alcohol affects to the oral microbiome composition

Oral hygiene - Toothbrushing frequency is related to the incidence and increment of dental caries

Socioeconomic status

Socioeconomic factors, such as education and income, are associated with disparities in the prevalence and severity of periodontal disease. A strong association between cariogenic bacteria and socioeconomic status was found. Differences in socioeconomic status were reflected in the bacterial profile of saliva.^{1,2,3} With various “omics” studies, information on the composition of oral microbiomes is available. This vast amount of oral microbiome data, which were procured via HMP, could be the fundamental basis of clinical applications including early diagnosis, predictive treatment, and prevention. The general microbial screening for diagnosis is performed using saliva and site-specific screening with gingival crevicular fluid and dental biofilm. Saliva is a useful diagnostic fluid, providing the overall microbiome and proteome or metabolomic data from bacterial metabolic or host inflammatory products for personalized monitoring.^{7,8,9} This combined information from saliva can be used to predict susceptibility to oral diseases, including dental caries or periodontitis, with higher specificity. Microbial screening of the mouth can be applied not only with oral diseases, but also with systemic diseases due to their reciprocal association.^{10,11}

Oral Disease and Systemic Disease

The commensal microbiome plays an important role in maintaining oral and systemic health. The breakdown of the microbial balance induces oral pathologic conditions such as periodontal disease, dental caries, and endodontic disease, which are associated with systemic diseases including diabetes, cardiovascular disease (CVD), respiratory disease, and cancer. The links between oral diseases and systemic health are complicated and bidirectional in many ways. Among many oral diseases, periodontitis has a close relationship with non-communicable diseases (NCDs); particularly, diabetes and CVD. When periodontitis is left untreated, it could lead to the loss of periodontal supporting tissue due to microbial infection. Oral pathologic microbiomes could release virulence factors, inducing an inflammatory response, and invade the body through pathogenic lesions, which increases the risk of exacerbating NCDs.^{4,5,6}

Potential Clinical Application of Oral Microbiomes

With various “omics” studies, on specific oral microbiomes present in the oral cavity is available. This vast amount of oral microbiome data, which were procured could be the fundamental basis of clinical applications including early diagnosis, predictive treatment, and prevention.^{11,12} The general microbial screening for diagnosis performed using saliva and site-specific screening with gingival crevicular fluid and dental biofilm. Saliva is a useful diagnostic fluid, providing the overall microbiome proteome or metabolomic data from bacterial metabolic or host inflammatory products for personalized screening. This combined information from saliva can be used to predict susceptibility to oral diseases, including dental caries or periodontitis, with higher specificity. Microbial screening of the mouth can be applied not only with diseases, but also with systemic diseases due to their bidirectional association.^{16,17,18}

DISCUSSION

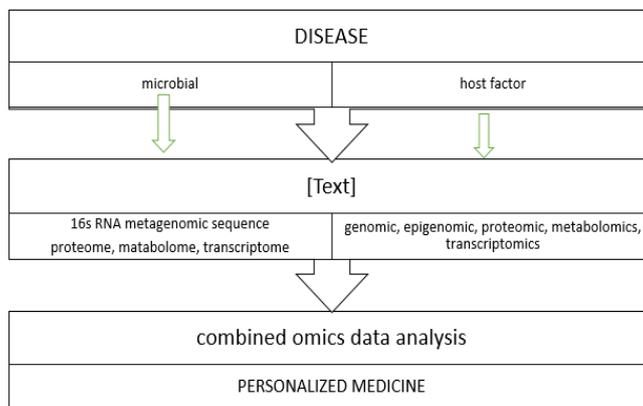
Oral and systemic link

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close relationship with non-communicable diseases; particularly, diabetes and CVD. When periodontitis is left untreated, it could lead to the loss periodontal supporting tissue due to microbial infection.^{12,13,14,15} Oral pathologic microbiomes could release virulence factors, inducing an inflammatory response, and invade the body through pathogenic lesions, which increases the risk of exacerbating of the disease.⁷

Future perspective

The knowledge about oral microbiomes research is in new directions, and extended analysis of transcript (transcriptome), protein (proteome), and metabolic products provides insight into host–microbial interaction in oral and systemic diseases. The current state of this oral microbiome which has been reported so far, shows that oral diseases are complex components and host immune responses, and are interrelated with systemic health. The combined study with multi-omics data from a host their microbiome will facilitate advances in personalized medicine.



CONCLUSION

The microbiome should not be underestimated since it serves as a key determinant of health and disease. In this review, we have discussed how oral microbiota affects systemic health. Many studies suggest that the oral microbiota can affect oral diseases and affect the health of the whole body. In the future perspective according to the microbiome affected we can prescribe target therapy and precision treatment in all the disease. Still wide knowledge and many studies have to be carried out in Indian population. Exploring specific microbes in our population is required to achieve a successful oral and systemic health.

CONFLICT OF INTEREST

Conflict of interest declared none.

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