

Oral Microbiome and Multiple Sclerosis? A Novel Concept!

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ABSTRACT

Human oral microbiota refers to the significant number of microorganisms that exist in the human mouth. It is one of the most intricate microbial populations in the human body. Recent studies have suggested the role of the oral microbiome in diverse nervous system diseases. Consequently, investigating the impact of the oral microbiome in patients with Multiple Sclerosis (MS) could reveal potential associations with the disease. In this review, the role of oral microbiota in MS patients has been addressed. The findings of this study hold promise for future approaches to oral and dental health in patients with Multiple Sclerosis. Also, In the future, oral microbiota may become a new target for uncovering novel approaches to prevent and/or treat MS.

Keywords: Central Nervous System, MS, Multiple Sclerosis, Oral Microbiome.

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1. INTRODUCTION

The term “microbiome” refers to the presence of microorganisms existing in a commensal or symbiotic relationship within the bodies or on the skin of eukaryotic organisms [1], [2]. These microorganisms contribute to the genetic variety of host-associated entities. The microbiome constitutes approximately 1%–3% of one’s total body weight, and this proportion tends to rise with age. Various studies emphasize the considerable influence the human microbiome exerts over immune regulation, management of inflammation, physiological processes, and the synthesis of vitamins and antimicrobial compounds [1]. It’s been postulated that the Interactions between hosts and microorganisms play a pivotal role in the development of Central Nervous system diseases such as Autism, Alzheimer’s, Parkinson’s, and Multiple Sclerosis [3].

The oral cavity harbors microorganisms collectively termed oral microflora, oral microbiota, or oral microbiome. This environment supports the presence of roughly 800 distinct bacterial species due to its conducive temperature for bacterial growth. These encompass *Veillonella atypica*, *Selenomonas* spp, *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, *Capnocytophaga* spp., *Prevotella intermedia*, *Streptococcus faecalis*, and *Lactobacilli* [4]. Moreover, there are microorganisms that are challenging to cultivate, identified exclusively through molecular techniques such

as 16S rRNA DGGE and Next Generation Sequencing (NGS) [5]. Evidence suggests that oral microbiota can be closely related to systemic diseases such as dental ailments, cardiovascular issues, respiratory diseases, and diabetes [5]. Gum inflammations, for instance, have been correlated with an elevated risk of developing throat and mouth cancers. Bacterial infections trigger inflammatory responses, leading to alterations in signaling pathways like the Nuclear Factor Kappa Beta (NFκB) pathway. This sequence of events triggers cytokine production and the release of free oxygen radicals, which can directly or indirectly contribute to malignancy onset [6], [7].

Recent investigations have highlighted the contribution of the oral microbiome to various diseases of the nervous system. Consequently, examining the potential impact of the oral microbiome on individuals with MS could uncover associations with the disease. This review delves into the role of oral microbiota in patients with MS, with findings holding the promise of introducing novel strategies for preventing and managing MS.

2. REVIEW OF THE LITERATURE

The *microbiome* is defined as a commensal, symbiotic inhabitant microorganism inside the human body. Microorganisms in the oral cavity are named oral microflora, oral microbiota, or oral microbiome. There are some reports that have suggested the impacts of the human

microbiome on immune modulations, and inflammation [8], [9]. Regarding MS some studies have found a correlation between the oral cavity and Multiple Sclerosis as an autoimmune disease [10]. The oral cavity has an optimum temperature for various bacterial species including *Veillonella atypica*, *Porphyromonas gingivalis*, *Selenomonas* spp, etc. [10].

Multiple sclerosis is an autoimmune disease. The exact mechanics of pathophysiology are not yet explored. Inflammatory Th1 and Th17 in the Intestine are each driven by functionally specialized dendritic cells and are involved in inflammatory diseases of the gut. Nevertheless, both Th1 and Th17 pathways were also found to be involved in MS pathogenesis and axonal demyelination [11]. Bacterial infections and gut microbiota have recently been postulated as one of the environmental factors in MS as well as Experimental autoimmune encephalomyelitis (EAE) [2], [5], [10]. Although there is little evidence on animals, we have scarce evidence in the field of human oral health and multiple sclerosis [11].

The mechanism is still under debate but evidence shows that some commensal bacteria might be able to activate Th17 cells [12]. Consequently, Th17 cells trigger IL-21, IL-17, and IL-22 productions [10]. Moreover, some gut microbiota are able to activate regulatory T lymphocytes (T-reg) cells which in [13] produce anti-inflammatory cytokines like IL-10 [14]. So, gut microbiota has an impact on immune system regulation.

Therefore, it seems that assessing the effects of the oral microbiome might affect MS prevention and treatment. Although there are some studies that have found a correlation between gut microbiome and Multiple Sclerosis [15]–[19], scarce evidence is present specifically addressing oral microbiome and Multiple Sclerosis. In contrast to the gut, the oral microbiome of MS patients has not been characterized. This might be a very hot topic in this era which opens a path for scientists to work on it.

In this regard, in a study, authors compared the bacterial diversity in the oral cavity between MS and healthy people. As a result, they found that some microbiota including genera *Fusobacterium*, *Staphylococcus*, *Porphyromonas*, *Veillonella*, *Bacteroides*, *Actinomyces*, *Prevotella*, *Propionibacterium*, and uncultivable bacteria, and some un-culturable strains were significantly higher in the MS group. This is while *Lactobacillus* and *Peptostreptococcus* were more prevalent in the normal healthy group [20].

Another Study on twins relapsing-remitting MS and clinically isolated syndrome showed 2036 bacterial Species diversity was greater in MSF2, and 20 abundant species differed at least 2-fold between the two groups. This might show that even bacteria might guide us through the exact type of Multiple Sclerosis [19]. These very few studies show a novel hot topic idea in the field of dentistry and oral health conjugated with Multiple sclerosis. Much evidence is needed to confirm this theory but as a start, this is a novel idea in the field of science.

3. CONCLUSION

In conclusion, we might be hopeful in the future that Examination of the oral microbiome could help diagnosis

of MS and its exact type and might be helpful in MS severity, and treatment.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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