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LETTER TO EDITOR

Remodeling Periodontal Treatment: The Role of Host Modulation Therapy

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ABSTRACT

Periodontal diseases are primarily driven by microbial infections, but the severity and progression are significantly influenced by the host's inflammatory response. Traditional treatments, such as scaling and root planning (SRP), often fail to address the underlying host factors, leading to disease recurrence. Host Modulation Therapy (HMT) offers a promising adjunctive approach, targeting the host's immune and inflammatory responses to prevent tissue destruction and promote healing. This review explores the mechanisms and clinical applications of HMT, including the use of anti-proteinases, anti-inflammatory agents, bone-sparing drugs, and probiotics. The effectiveness and safety of these therapies, along with potential future developments in periodontal care, are discussed. HMT represents a significant advancement in the treatment of periodontal disease, particularly for patients with chronic or recurrent conditions.

Periodontal disease is a prevalent chronic infectious condition of the periodontium, recognized as a major cause of tooth loss[1]. While microbial plaque is the primary etiologic agent in periodontal disease development, the severity, progression, and clinical manifestations of the disease cannot be solely explained by the amount of plaque present[2]. Pathogenic bacteria within the microbial biofilm triggers the disease process by producing harmful by-products and enzymes, such as hyaluronidases, collagenases, and proteases. These enzymes break down extracellular matrices, such as collagen, and host cell membranes, creating favorable conditions for bacterial

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growth and potentially leading to tissue invasion[3]. Traditionally, periodontal diseases have been managed through mechanical debridement, including scaling and root planning (SRP). While SRP is effective in reducing bacterial load, it is less efficient in addressing the underlying inflammatory processes that drive disease progression, contributing to relapse or disease recurrence in many patients. Data show that periodontal diseases often recur even after mechanical treatment alone, underscoring the need for adjunctive therapies that address the host's inflammatory response. This limitation of SRP is particularly evident in patients with systemic conditions like diabetes or genetic predispositions, where inflammation persists despite adequate plaque control[4].

Host Modulation Therapy (HMT) was first introduced by Golub et al. in 1992 and has since been expanded by various researchers. Unlike traditional treatments that focus solely on bacterial reduction, HMT aims to modify the host's inflammatory response, thereby mitigating tissue destruction. While traditional approaches target bacterial biofilms to reduce plaque accumulation, HMT works by influencing host factors such as immune response and matrix degradation, thereby reducing the harmful effects of bacterial invasion[5].

Several categories of host-modulating agents have been investigated for periodontal therapy:

Anti-proteinases

Tetracyclines, such as doxycycline, possess both antimicrobial and anti-inflammatory properties. Doxycycline reduces the activity of matrix metalloproteinases (MMPs), a family of enzymes that degrade the extracellular matrix and are implicated in periodontal tissue breakdown[5,6].

Anti-inflammatory drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs) inhibit the formation of prostaglandins, particularly PGE2, which is elevated in periodontal disease. PGE2 contributes to inflammation, inhibits fibroblast function, and impairs immune response[7].

Bone-sparing drugs

Bisphosphonates, such as alendronate, inhibit bone resorption by disrupting osteoclast activity. These agents also affect osteoblast metabolism and secretion of lysosomal enzymes, helping prevent bone loss in periodontal disease[8].

Probiotics

Probiotics modulate the oral microbiota and the immune response. Recent studies have demonstrated that probiotics can influence cytokine secretion and T-lymphocyte populations, which may help mitigate inflammation in periodontal tissues. Research by Teughels et al. suggested that probiotics offer a promising approach to manipulating the periodontal microbiota for improved periodontal health[9].

Mechanical debridement alone is often insufficient in managing the inflammatory response to periodontal disease. Recurrence rates are high, especially when the inflammatory processes persist in the absence of additional therapy. For example, studies have shown that while SRP can reduce bacterial load, inflammation and bone loss continue in patients with systemic conditions, indicating a need for complementary therapies to modulate the host response[4].

Host Modulation Therapy (HMT) differs fundamentally from traditional biofilm-targeting approaches by focusing on the host's response rather than solely eliminating bacteria. While antimicrobial treatments target the biofilm to reduce bacterial load, HMT aims to modulate the host's immune and inflammatory responses, such as inhibiting MMP activity and reducing the effects of pro-inflammatory cytokines. This dual approachaddressing both bacterial and host factorscould enhance the long-term effectiveness of periodontal therapy. While HMT is promising, it is not without potential risks. Long-term use of anti-inflammatory drugs such as NSAIDs can have side effects, including gastrointestinal issues, kidney damage, and cardiovascular risks. Bisphosphonates, although effective in preventing bone resorption, may lead to adverse effects such as osteonecrosis of the jaw, particularly in high-risk patients[7]. Further clinical trials are necessary to assess the long-term safety of HMT.

Various studies have demonstrated the clinical efficacy of HMT agents. For instance, doxycycline has been shown to significantly reduce MMP activity in periodontal tissues and improve clinical attachment levels in patients with periodontitis[3-5]. NSAIDs, despite their side effects, have also shown promise in reducing inflammation in periodontal tissues[7]. Similarly, bisphosphonates have been found to prevent alveolar bone loss in patients with periodontitis[8]. These agents have been validated in clinical trials, providing substantial evidence for their use in periodontal therapy.While NSAIDs are commonly used to inhibit PGE2, there are concerns about their long-term safety. As such, alternative anti-inflammatory agents, such as selective COX-2 inhibitors, are being explored for periodontal applications. These drugs may provide anti-inflammatory effects without the gastrointestinal and cardiovascular risks associated with traditional NSAIDs[7].

Clinicians can integrate HMT into existing periodontal treatment protocols by considering it as an adjunct to mechanical debridement, especially in cases where inflammation persists. HMT should be considered for patients with systemic conditions or those who experience recurrent disease despite conventional therapy. Guidelines for the use of HMT are still being developed, but clinical judgment should be used to determine the most appropriate time to incorporate it[10].

While HMT shows great promise, much of the research remains in the experimental or early clinical trial stages[11]. The optimal combination and timing of HMT agents with traditional therapies are still unclear, and more large-scale, long-term studies are needed to better understand the full range of effects and potential adverse events associated with these treatments.The future of HMT in periodontal therapy is promising. Advancements in molecular biology and immunology may lead to more targeted therapies, allowing for personalized periodontal care. Additionally, the development of novel biomaterials and delivery systems for host-modulating agents may enhance the precision and effectiveness of treatment. Over the next decade, HMT is likely to become an increasingly mainstream adjunctive therapy in periodontal treatment. As research progresses, more clinicians will integrate HMT into their clinical practice, especially for patients with chronic or recalcitrant periodontal disease.

CONCLUSION

Host Modulation Therapy represents a significant advancement in periodontal care, complementing traditional treatment modalities by addressing both microbial and host factors. As research continues to evolve, dental professionals must stay informed about these developments to provide the most effective, evidence-based care for their patients.

Author Contributions

MR: Contributed to the conception and drafting of the letter, provided critical revisions for important intellectual content, and approved the final version of the manuscript. Ensured the accuracy and integrity of the work. BF: Contributed to the conception and drafting of the letter, reviewed and critically revised the content, and approved the final version of the manuscript. Ensured the accuracy and integrity of the work.

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Conflict of Interest:

The author reports no conflicts of interest.

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