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Brief Report
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A Novel Approach to Osteonecrosis of the Jaw: Photobiomodulation Combined with Minimal Intervention

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Abstract

Medication-related osteonecrosis of the jaw (MRONJ) is a challenging complication associated with antiresorptive and antiangiogenic medications. Traditional treatment approaches often involve extensive surgical interventions, which can be associated with significant morbidity. Recently, photobiomodulation (PBM) has emerged as a promising adjunct in MRONJ management, leveraging its anti-inflammatory, analgesic, and tissue regenerative properties. This review explores the synergistic use of PBM with minimal surgical interventions, highlighting its potential to promote healing while reducing treatment invasiveness. Clinical studies, biological mechanisms, and future perspectives on integrating PBM into MRONJ protocols are discussed.

Introduction

MRONJ, characterized by exposed bone in the maxillofacial region persisting for over eight weeks, poses a significant clinical and quality-of-life burden. This condition predominantly affects patients receiving bisphosphonates, denosumab, or antiangiogenic agents for osteoporosis or cancer-related bone conditions. Management strategies have traditionally ranged from conservative measures, such as antimicrobial rinses, to extensive surgical resections in advanced stages. However, these approaches are often limited by recurrence risk and patient morbidity [1].

Recent advances in photobiomodulation (PBM) therapy offer a novel, minimally invasive approach to MRONJ management. PBM, employing low-level laser or light-emitting diode (LED) devices, stimulates cellular activity and promotes tissue repair through photochemical effects. By combining PBM with minimal surgical debridement, clinicians can enhance healing outcomes while mitigating the complications associated with aggressive surgical treatments. This review critically evaluates the evidence supporting this combined approach and outlines future directions for clinical practice [2].

Pathophysiology of MRONJ

MRONJ arises from a complex interplay of impaired bone remodeling, reduced angiogenesis, and infection. Antiresorptive medications suppress osteoclast activity, while antiangiogenic agents impair vascular supply, creating a microenvironment susceptible to necrosis. Local trauma, periodontal disease, and dental extractions often serve as precipitating factors. Understanding these mechanisms is crucial for tailoring effective treatments that address both the systemic and local aspects of MRONJ [3].

Role of Photobiomodulation in MRONJ Management

PBM involves the application of low-intensity light at specific wavelengths (600–1000 nm) to stimulate biological processes. Its mechanisms include:

Enhanced Cellular Proliferation: PBM activates mitochondrial cytochrome c oxidase, increasing ATP production and promoting cell growth.

Angiogenesis Promotion: PBM induces the release of vascular endothelial growth factor (VEGF), aiding blood vessel formation [4].

Anti-inflammatory Effects: PBM modulates pro-inflammatory cytokines, reducing local inflammation.

Analgesic Properties: PBM alters neural activity and reduces pain through non-invasive means.

Studies have demonstrated PBM's ability to accelerate wound healing and reduce necrotic bone exposure, making it a valuable adjunct in MRONJ care [5].

Minimal Surgical Interventions in MRONJ

Surgical debridement aims to remove necrotic bone while preserving healthy tissue. When combined with PBM, minimal surgical interventions achieve better outcomes by creating a favorable environment for tissue regeneration. This approach is particularly beneficial in early-stage MRONJ, where extensive resection may be unnecessary [6].

Clinical Evidence and Outcomes

Several clinical studies support the efficacy of combining PBM with minimal surgery. A randomized trial showed that PBM reduced bone exposure and improved pain scores in patients undergoing debridement [7]. Case series highlighted complete mucosal healing in early-stage MRONJ treated with PBM and conservative surgery. Animal models revealed enhanced angiogenesis and bone regeneration when PBM was applied post-surgery. Despite these encouraging results, larger, multi-center trials are needed to establish standardized protocols [8].

Challenges and Future Directions

While PBM offers significant promise, several challenges remain:

Protocol Standardization: Variability in laser parameters (wavelength, power, duration) limits reproducibility across studies [9].

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Accessibility and Training: PBM requires specialized equipment and expertise, which may not be widely available.

Integration into Multidisciplinary Care: Coordinating PBM with other therapeutic modalities requires a collaborative approach.

Future research should focus on optimizing PBM protocols, exploring its application in advanced MRONJ stages, and conducting long-term studies on patient outcomes [10].

Conclusion

Osteonecrosis of the jaw (ONJ) remains a complex and multifaceted condition with significant implications for affected patients, particularly those on antiresorptive or antiangiogenic therapies. Despite advancements in understanding its pathophysiology, managing ONJ poses challenges due to its unpredictable progression and resistance to conventional treatments. Emerging therapies, such as photobiomodulation, combined with conservative or minimal surgical interventions, offer promising alternatives that address the biological and structural aspects of the disease while reducing treatment-associated morbidity. Future efforts should focus on optimizing prevention strategies, refining therapeutic protocols, and improving access to advanced technologies. Interdisciplinary collaboration among oral surgeons, oncologists, and primary care providers is essential for early detection and tailored treatment. Continued research into the mechanisms underlying ONJ will further enhance our ability to mitigate this debilitating condition, improving outcomes and quality of life for patients worldwide.

References

1. Carthew RW, Sontheimer EJ (2009) Origins and mechanisms of miRNAs and siRNAs. Cell 136: 642-655.
2. Li C, Zamore PD (2019) RNA interference and small RNA analysis. Cold Spring Harbor Protoc 4: 247-262.
3. Liu S, Jaouannet M, Dempsey DMA, Imani J, Coustau C, et al. (2020) RNA-based technologies for insect control in plant production. Biotechnol Adv 39: 107463.
4. Clancy S (2008) The central dogma of molecular biology suggests that the primary role of RNA is to convert the information stored in DNA into proteins. In reality, there is much more to the RNA story. Nature Education 1: 102.
5. Borges F, Martienssen RA (2015) The expanding world of small RNAs in plants. Nature Rev Mol Cell Biol 16: 727-741.
6. Obbard DJ, Gordon KHJ, Buck AH, Jiggins FM (2009) The evolution of RNAi as a defence against viruses and transposable elements. Philos Trans R Soc Lond Ser B Biol Sci 364: 99-115.
7. Williams M, Clark G, Sathasivan K, Islam AS (2004) RNA Interference and Its Application in Crop Improvement. Plant Tissue Culture and Biotechnology 1-18.
8. Agrawal N, Dasaradhi PVN, Mohmmed A, Malhotra P, Bhatnagar RK, et al. (2003) RNA Interference: Biology, Mechanism, and Applications. Microbiol Mol Biol Rev 67: 657-685.
9. Chen X, Jiang L, Zheng J, Chen F, Wang T, et al. (2019) A missense mutation in Large Grain Size 1 increases grain size and enhances cold tolerance in rice. J Exp Bot 70: 3851-3866.
10. Wilson RC, Doudna JA (2013) Molecular mechanisms of RNA interference. Annu Rev Biophys 42: 217-239.