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Commentary

Wound Healing and Photobiomodulation Therapy in Diabetic Patients

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DESCRIPTION

Diabetes mellitus is a chronic metabolic disorder that affects millions of people worldwide. It is characterized by high blood glucose levels and impaired insulin secretion or action. Diabetes can lead to various complications, such as cardiovascular diseases, kidney failure, nerve damage, and impaired wound healing. Wound healing is a complex process that involves inflammation, proliferation, and remodeling of tissues. In diabetic patients, wound healing is delayed and impaired due to several factors, such as reduced blood flow, increased inflammation, oxidative stress, infection, and impaired growth factor signaling. Diabetic wounds, especially Diabetic Foot Ulcers (DFUs), are a major cause of morbidity and mortality among diabetic patients. They can result in amputation, disability, and reduced quality of life.

Therefore, there is a need for effective and non-invasive therapies that can enhance wound healing in diabetic patients. One such therapy is Photo-Biomodulation (PBM), which is the application of light at specific wavelengths and doses to modulate cellular and molecular processes. PBM can stimulate tissue repair and regeneration by increasing blood flow, oxygenation, angiogenesis, collagen synthesis, fibroblast proliferation, keratinocyte migration, and growth factor expression. PBM can also reduce inflammation, pain, infection, and oxidative stress by modulating cytokine production, leukocyte infiltration, bacterial load, and antioxidant enzymes. PBM can be delivered by various light sources, such as lasers or Light-Emitting Diodes (LEDs). The most commonly used wavelengths for PBM are red (600-700 nm) and Near-Infrared (NIR) (800 nm-1100 nm), which can penetrate deeper into the tissues and reach the mitochondria. The mitochondria are the main targets of PBM, as they absorb light and produce Adenosine Triphosphate (ATP), the energy currency of the cell. PBM also activates several signaling pathways that regulate gene expression and cellular functions. Several studies have investigated the effects of PBM on diabetic wound healing using animal models or human subjects.

The results have shown that PBM can accelerate wound closure, increase granulation tissue formation, improve epithelialization, and enhance wound tensile strength. PBM can also improve the microcirculation and oxygenation of the wound bed, reduce the bacterial load and infection rate, and modulate the inflammatory response. PBM can also improve the physical performance and functionality of diabetic patients by increasing muscle strength and endurance. The optimal parameters for PBM therapy depend on several factors, such as the type of light source, the wavelength, the power density, the energy density, the irradiance, the irradiation time, the treatment frequency, and the number of sessions. There is no consensus on the best protocol for PBM therapy for diabetic wound healing. However, some general guidelines have been suggested based on the available evidence:

- The wavelength should be between 600 nm-1100 nm.
- The power density should be between 5 m W/cm-100 mW/cm.
- The energy density should be between 1 J/cm-20 J/cm.
- The irradiance should be between 0.5 W/cm-5 W/cm.
- The irradiation time should be between 10-60 seconds per point or area.
- The treatment frequency should be daily or every other day.
- The number of sessions should be between 10-20.

CONCLUSION

PBM therapy is a safe and well-tolerated modality that has minimal adverse effects. The most common side effects are mild erythema or transient pain at the irradiated site. PBM therapy should be avoided in patients with photosensitivity disorders or skin cancer. PBM therapy should also be used with caution in patients with diabetes who are taking medications that can affect blood glucose levels or blood coagulation. PBM therapy is a promising technique that can improve wound healing in diabetic patients by modulating various cellular and molecular processes. PBM therapy can also improve the physical performance and quality of life of diabetic patients. However, more studies are needed to determine the optimal parameters and protocols for PBM therapy for different types of diabetic wounds and to evaluate its long-term outcomes and cost-effectiveness.

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