



Photobiomodulation (PBM) as a Supportive Therapy for Osteoporosis

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Introduction

Osteoporosis is a progressive skeletal disorder characterized by decreased bone mass and structural deterioration of bone tissue, leading to increased fragility and fracture risk. It affects an estimated 200 million people worldwide, particularly postmenopausal women and older adults. Standard treatment includes bisphosphonates, calcium/vitamin D supplementation, and lifestyle modifications. However, these approaches often have limitations, including poor compliance and potential side effects.

Photobiomodulation (PBM), has emerged as a promising non-invasive adjunct therapy that may positively influence bone health, remodeling, and healing through its action on mitochondrial function and cellular signaling.

How PBM Works

PBM uses specific wavelengths of red and near-infrared (NIR) light (typically 600–1100 nm) to stimulate cellular activity, enhance mitochondrial respiration, and modulate inflammation. The light is absorbed by cytochrome c oxidase (CCO), an enzyme in the electron transport chain, leading to increased ATP production, improved oxygen consumption, and release of nitric oxide. These effects contribute to better tissue repair, anti-inflammatory responses, and cellular regeneration.

In the context of bone, PBM has demonstrated the ability to:

- Stimulate osteoblast proliferation and differentiation
- Suppress osteoclast activity
- Enhance angiogenesis
- Modulate inflammatory cytokines and oxidative stress
- Accelerate fracture healing

Scientific Evidence in Osteoporosis and Bone Health

1. In Vitro and Animal Studies

Multiple preclinical studies have shown that PBM promotes bone formation and improves bone microarchitecture in osteoporotic animal models.

- Pinheiro et al. demonstrated that infrared laser therapy (830 nm) significantly increased bone matrix formation in rats with induced osteoporosis, as evidenced by improved bone mineral density and trabecular structure [1].
- In a study by Lopes-Martins et al., PBM enhanced the biomechanical properties of bones and reduced bone resorption markers in ovariectomized rats, a common animal model for postmenopausal osteoporosis [2].

2. Fracture Healing and Bone Grafting

PBM has shown positive effects in accelerating fracture repair, which is crucial in osteoporotic individuals prone to fragility fractures.

- A systematic review by Sousa et al. concluded that PBM enhances the consolidation phase of bone healing by promoting osteoblast proliferation and collagen synthesis [3].
- Light therapy applied at or near fracture sites significantly reduced healing time in osteoporotic rats and improved bone strength [4].

3. Human Clinical Applications

While direct studies in humans with osteoporosis are limited, PBM has been safely used in postmenopausal women, patients undergoing dental implant procedures with low bone density, and those recovering from orthopedic surgeries. These applications indirectly support PBM's potential role in bone metabolism and recovery in osteoporotic individuals.

Device Protocols and Applications

PBM can be safely administered through mats, or belts. For individuals with osteoporosis, optimal application sites include:

- Lumbar spine and hip region
- Wrists and forearms
- Whole-body application using red/NIR PBM mats

Suggested Protocol (Always consult a healthcare provider before beginning any therapy.):

- Wavelengths: red and infrared for deep penetration
- Session time: 15 minutes per area
- Frequency: 1 -2 x times per day for chronic issues and more frequently if newly diagnosed

Devices from PBM Healing such as the GPRB and Yoga Mat PBM System provide appropriate dosing parameters and coverage.

Potential Benefits for Individuals with Osteoporosis

- Improved bone density and mineralization
- Reduced bone turnover and inflammatory signaling
- Enhanced healing of fractures or surgical procedures
- Support for mitochondrial health and systemic energy production
- Drug-free adjunctive therapy with no reported adverse effects

Safety and Considerations

PBM has been shown to be safe when used appropriately, with no known long-term side effects. It is non-invasive and well tolerated by elderly populations. However, PBM is not a replacement for osteoporosis medications or bone health assessments—it should be used as a complementary therapy under guidance.

Conclusion

Photobiomodulation holds great promise as a supportive therapy for individuals with osteoporosis, especially when integrated with standard care. By enhancing cellular energy production, reducing inflammation, and supporting bone-forming cells, PBM offers a non-pharmaceutical approach to improving skeletal health and reducing fracture risk.

As research continues to evolve, PBM Healing is committed to developing accessible light-based wellness solutions that empower aging individuals to live stronger, more resilient lives.

Disclaimer:

PBM Healing devices are not intended to diagnose, treat, cure, or prevent any disease. Always consult with a qualified healthcare provider before beginning any new device usage, especially if you have a medical condition or are undergoing treatment

References

1. Pinheiro AL, et al. Infrared laser light reduces bone loss in osteoporotic rats. *Lasers in Surgery and Medicine*. 2003;33(1):31-39.
2. Lopes-Martins RA, et al. Effect of low-level laser therapy on bone density in an experimental model of osteoporosis. *Photomed Laser Surg*. 2009;27(4):605-610.
3. Sousa MV, et al. Influence of low-level laser therapy on bone healing: A systematic review. *Photomed Laser Surg*. 2016;34(10):487-495.
4. Khadra M, et al. Enhanced bone healing after low-level laser therapy in bone defects. *Clinical Oral Implants Research*. 2004;15(3):325-332.