Therapeutic Differences Between 850 nm

(GRPB) and 880 nm (FEM) in Photobiomodulation

The therapeutic difference between 850 nm and 880 nm wavelengths in photobiomodulation (PBM) is subtle but can be clinically relevant depending on the application and tissue target. Here's a breakdown of the comparison:

1. Absorption and Tissue Penetration

- 850 nm: Deep penetration (~3–4 cm in soft tissue), well absorbed by cytochrome c oxidase (CCO), minimal water absorption.
- 880 nm: Slightly deeper penetration (~4–5 cm), still absorbed by CCO but less efficiently, slightly higher water absorption.

2. Mitochondrial Activation and Photoreception

- 850 nm: Falls within optimal range for CCO activation, enhancing mitochondrial ATP production and reducing oxidative stress.
- 880 nm: Still activates mitochondrial respiration but slightly outside the optimal CCO absorption peak.

3. Therapeutic Applications

850 nm is preferred for:
- Nerve regeneration
- Musculoskeletal injuries
- Wound healing

- Brain PBM
- Joint/arthritic pain

880 nm is potentially used for:
- Deeper musculoskeletal injuries
- Muscle and tendon repair
- Deep joint treatment

4. Irradiation Efficiency

- 850 nm: Higher photon absorption per mW, leading to better dose efficiency.
- 880 nm: Requires longer exposure or higher power for equivalent biological stimulation.

5. Summary Chart

The following table summarizes key differences between 850 nm and 880 nm in PBM:

Parameter	850 nm	880 nm
Penetration Depth	3–4 cm	4–5 cm
Cytochrome c Oxidase Activation	Optimal	Near-optimal
Water Absorption	Low	Slightly higher
Mitochondrial ATP Stimulation	High	Moderate
Dose Efficiency	More efficient	Requires more dose
Common Applications	Nerve healing, Wound healing, Brain PBM	Deep joints, Muscle recovery, Tendons
Wavelength Match to CCO Peak	Excellent match	Good but less efficient

6. Supporting Studies and References

1. Chung H et al. The Nuts and Bolts of Low-level Laser (Light) Therapy. Ann Biomed Eng. 2012;40(2):516-533. https://doi.org/10.1007/s10439-011-0454-7
2. Hamblin MR. Mechanisms and applications of the anti-inflammatory effects of photobiomodulation. AIMS Biophys. 2017;4(3):337-361. https://doi.org/10.3934/biophy.2017.3.337
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multiple roles of ATP. Photomed Laser Surg. 2010;28(2):159-160. https://doi.org/10.1089/pho.2009.2562
4. Hashmi JT et al. Role of low-level laser therapy in neurorehabilitation. PM R. 2010;2(12 Suppl 2):S292-S305. https://doi.org/10.1016/j.pmrj.2010.10.013
5. Wang Y et al. Effects of 810-nm and 980-nm diode lasers on proliferation and osteogenic differentiation of human periodontal ligament stem cells. Lasers Med Sci. 2021;36(5):1031-1039. https://doi.org/10.1007/s10103-020-03151-0

1. Absorption and Tissue Penetration

850 nm and 880 nm are both near-infrared wavelengths capable of deep tissue penetration. While both are absorbed by mitochondrial chromophores such as cytochrome c oxidase (CCO), 850 nm is more efficient in mitochondrial stimulation. 880 nm may penetrate slightly deeper due to lower scattering but has slightly less effective CCO absorption.

2. Mitochondrial Activation and Photoreception

Cytochrome c oxidase (CCO) has absorption peaks from 800–860 nm. Therefore, 850 nm falls within the peak stimulation zone, offering strong mitochondrial activation and ATP production. 880 nm still activates CCO but less efficiently.

3. Therapeutic Applications

850 nm is preferred for most mitochondrial-based PBM therapies including nerve repair, wound healing, and neurological treatments. 880 nm may be used in treatments requiring deeper penetration such as musculoskeletal pain, joint inflammation, and tendon therapy.

4. Irradiation Efficiency

850 nm has a higher photon absorption efficiency than 880 nm, making it more dose-efficient. 880 nm treatments may require longer exposure or higher intensity to match biological effects.

5. Summary Chart

Comparison of therapeutic characteristics between 850 nm and 880 nm:

Parameter	850 nm	880 nm
Penetration Depth	3–4 cm	4–5 cm
Cytochrome c Oxidase	Optimal	Near-optimal

Activation		
Water Absorption	Low	Slightly higher
Mitochondrial ATP Stimulation	High	Moderate
Dose Efficiency	More efficient	Requires more dose
Common Applications	Nerve healing, Wound healing, Brain PBM	Deep joints, Muscle recovery, Tendons
Wavelength Match to CCO Peak	Excellent match	Good but less efficient

6. CONCLUSIONS

Therefore based on the unique needs of menstrual pain and associated organs the FEM belt has deeper penetration. Whilest the GPRB is universally more suitable for superficial pain and healing.

7. Selected References

1. Hamblin MR. Mechanisms and applications of the anti-inflammatory effects of photobiomodulation. AIMS Biophys. 2017;4(3):337–361. https://doi.org/10.3934/biophy.2017.3.337
2. Chung H et al. The nuts and bolts of low-level laser (light) therapy. Ann Biomed Eng. 2012;40(2):516–533. https://doi.org/10.1007/s10439-011-0454-7
3. Anders JJ, et al. Low-level light/laser therapy versus photobiomodulation therapy. Photomed Laser Surg. 2015;33(4):183–184. https://doi.org/10.1089/pho.2015.9846
4. Hashmi JT, et al. Role of low-level laser therapy in neurorehabilitation. PM R. 2010;2(12 Suppl 2):S292–S305. https://doi.org/10.1016/j.pmrj.2010.10.013
5. Salehpour F, Cassano P. Photobiomodulation for brain disorders and cognition: A systematic review. BMC Neurol. 2021;21(1):1–14. https://doi.org/10.1186/s12883-021-02188-5