

Efficacy of Light-Emitting Diode-Mediated Photobiomodulation in Tendon Healing in a Murine Model

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Abstract : Background: The application of light-emitting diode (LED)-dependent photobiomodulation (PBM) in promoting post-tendon injury healing has been recently reported. Despite the establishment of a theoretical basis for ligament restoration through PBM, the lack of any empirical evidence deems this therapeutic strategy contentious. Therefore, the aim of this study was to investigate the potency of LED-based PBM in facilitating tendon healing in a murine model. Methods: Migration kinetics were analyzed at two specific wavelengths: 630 and 880 nm. The Achilles tendon in the hind limbs of Balb/c mice was severed via Achilles tendon transection. Subsequently, the mice were randomized into LED non-irradiation and LED irradiation groups. Mice with intact tendons were employed as healthy controls. The wounds were LED-irradiated for 20 min daily for two days. Histological properties, tendon healing mediators, and inflammatory mediators were screened on day 14. Results: The roundness of the nuclei and fiber structure, indicating the degree of infiltrated inflammatory cells and severity of fiber fragmentation, respectively, were considerably lower in the LED irradiation group than in the LED non-irradiation group. Immunohistochemical analysis depicted an increase in tenocytes (SCX+ cells) and a recovery of wounds with reduced fibrosis (lower collagen 3 and TGF- β 1) in the LED irradiation group during healing; conversely, the LED non-irradiation group exhibited tissue fibrosis. The ratio of M2 macrophages to total macrophages was higher in the LED irradiation group than in the injured group. Conclusion: LED-based PBM in the Achilles tendon rupture murine model effectuated a rapid restoration of histological and immunochemical outcomes. The aforementioned findings suggest that LED-based PBM presents remarkable potential as an adjunct therapeutic for tendon healing and warrants further research to standardize various parameters to advance and establish it as a reliable treatment regime.

Keywords : photobiomodulation, light-emitting diode, tendon, regeneration

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