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

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Introduction and Background

we hypothesized that 630/880 nm LED-based PBM might promote rapid healing during the initial phase of tendon healing, and we aimed to analyze the results after PBM treatment in a murine model. Migration kinetics were analyzed at two specific wavelengths: 630 and 880 nm.

Material and Method

The Achilles tendon in the hind limbs of Balb/c mice was severed by 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 total number of mice was 13 for the healthy and injured groups and 14 for the LED-irradiated injured group, and the data presented in this manuscript were obtained from one representative experiment ($n = 4-5$ per group). 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 lower in the LED irradiation group than in the LED non-irradiation group. Immunohistochemical analysis depicted an increase in tenocytes (SCX+ cells) and 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. Overall, the ratio of M2 macrophages to total macrophages in the LED irradiation group was higher than that in the injured group.

Conclusions

LED-based PBM in the Achilles tendon rupture murine model facilitated a rapid restoration of histological and immunochemical outcomes. These findings suggest that LED-based PBM presents remarkable potential as an adjunct therapeutic approach for tendon healing and warrants further research to standardize various parameters to advance and establish it as a reliable treatment regimen.

