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Direct and Indirect Effect of 532 nm Low-Level Laser on Viability and Migration of 3T3-L1, Fibroblast Cells

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Introduction: The use of lasers in various biomedical applications has gained significant attention due to their ability to modulate cellular functions. The 532 nm laser is known for its potential influence on cellular functions, which makes it a topic of interest in tissue engineering and wound healing. Through direct and indirect exposure, this study examined how the 532 nm low-level laser affects the viability and migration of 3T3-L1, fibroblast cells. **Materials and Methods:** 3T3-L1 cells were directly exposed to a 0.1W of 532 nm laser, whereas for indirect exposure, the media was first exposed to the laser before transferred to the cells. Both techniques employed exposure times of 30, 60, 120, 150, 180, 210, 240, 270, and 300 seconds. The viability of the cells was evaluated using MTT assay and the effect of laser irradiation on cell migration was examined using the scratch assay. After a six-hour incubation post irradiation, real-time imaging was performed and ImageJ was used to analyze the outcomes. **Results:** This research showed that when exposed directly to a 532 nm laser, 3T3-L1 cells promoted cell migration but inhibited cell viability. The 3T3-L1 cells were most significantly inhibited at an exposure of 300s compared to the control ($p<0.0001$). However, it appeared to have the highest rate of migration. In indirect exposure, the results did not significantly differ from the control for both cell viability and migration. **Conclusion:** These findings suggest a dual effect of the 532 nm laser on 3T3-L1 cells, emphasizing the need for further research to understand underlying mechanisms and optimize therapeutic parameters for potential applications in tissue engineering and wound healing.

Keywords: 3T3-L1 cells; 532 nm laser; low-level laser; photobiomodulation