EFFECTS OF LOW LEVEL LASER THERAPY ON STEM CELLS FROM THE HEART AND BONE MARROW-OVERVIEW OF IN-VIVO AND IN-VITRO STUDIES

Uri Oron, Hanna Tuby, Lidya Maltz, Vladimir Sorin, Abraham Czerniak, Gabi Sheffer

Tel Aviv University Tel Aviv, Israel

Background: Low-level laser therapy (LLLT) has been shown to biostimulate various biological processes. Our research was focused on the beneficial effect of LLLT application to stem cells prior to their implantation to injured skeletal muscle and the ischemic heart. The aim of another study was to evaluate the possible beneficial effects of implantation of mesenchymal stem cells (MSCs) that had been laser irradiated prior to their implantation into the infarcted rat heart.

Study: MSCs have been isolated from rat bone marrow and grown in culture. The cells were laser irradiated with Ga-Al-As laser (810 nm wavelength), labeled with 5-Bromo-2\'deoxyuridine (BrdU), and then implanted (control or laser-treated) into infarcted rat hearts. Hearts were excised three weeks later and cells were stained for BrdU and c-kit immunoreactivity.

Results: A better cell survival was achieved following implantation of cells that were pre-treated with laser. In the regenerative liver application of LLLT caused a significant increase in c-kit positive stem cells in the regenerative liver. Infarcted hearts that were implanted with laser-treated cells showed a significant reduction of 53% in infarct size compared to hearts that were implanted with non laser-treated cells. The hearts implanted with laser-treated cells prior to their implantation demonstrated a 5 and 6.3-fold significant increase in cell density that positively immunoreacted to BrdU and c-kit respectively as compared to hearts implanted with non laser-treated cells.

Conclusion: The findings of the present study provide the first evidence that LLLT can significantly increase survival and/or proliferation of MSCs post implantation into the ischemic/ infarcted heart, followed by a marked reduction of scarring, and enhanced angiogenesis.