PBM Laser therapy- stem cells, bone marrow, mesenchyme

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Low-level laser therapy on the bone marrow reduces scarring and improves heart function after acute myocardial infarction in pigs

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short version

Objective: Cell therapy for myocardial repair is one of the most intensely studied strategies for the treatment of acute myocardial infarction (MI). The aim of the present study was to determine whether the application of low-level laser therapy (LLLT) to stem cells in the bone marrow (BM) can influence the infected pig heart and reduce scarring after an MI.

The Methods: MI was induced in farm pigs by percutaneously inflating a balloon in the left coronary artery for 90 minutes. The tibia and pelvic bones were laser treated 30 minutes and 2 and 7 days after MI induction. Pigs were euthanized 90 days after MI. The extent of scarring was analyzed by histology and MRI, and cardiac function was examined by echocardiography.

Results: The number of c-kit + cells (stem cells) in the circulating blood of the laser-treated (LT) pigs 24 and 48 hours after MI was 2.62 and 2.4 times higher than in the non-laser-treated (NLT)) Pigs. The infarct size [% of the scar tissue from the volume of the left ventricle (LV), measured on the basis of the histology] was significantly lower in the LT pigs with 5.2 - 0.82%, namely 68% ($p < 0.05$), than in the NLT pigs (16.6-3.7%). The mean density of small blood vessels in the infarct area was significantly higher in the LT pigs [6.5 times ($p < 0.025$)] than in the NLT pigs. The analysis of the heart function by means of echocardiography (ECHO) showed that the left ventricular ejection fraction was significantly higher in the LT pigs than in the NLT pigs.

Conclusions: The use of LLLT in BM in the pig model for MI caused a significant reduction in scarring, improved angiogenesis and a functional improvement in both the acute and long-term phases after MI. Key words: angiogenesis, cardioprotection, low-level laser, myocardial infarction, pig model

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Effect of photobiomodulation on mesenchymal stem cells

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short version

Objective: The aim of this study was to review the available literature on the effects of photobiomodulation (PBM) on mesenchymal stem cells (MSC). Background data: The effects of coherent and non-coherent light sources such as low-level lasers and light-emitting diodes (LEDs) on cells and tissues known as PBMs form the basis of photomedicine. This treatment technique affects cell function, proliferation and migration and plays an important role in tissue regeneration. Stem cells have proven to be helpful elements in tissue regeneration, and the combination of stem cell therapy and laser therapy appears to have a positive effect on treatment outcomes.

Materials and methods: An electronic search was carried out in PubMed for publications from the past 12 years. English-language articles related to the topic were found using selected keywords. The full texts of the potentially suitable articles were evaluated according to inclusion and exclusion criteria. Results: After the evaluation, 30 articles were considered relevant according to the inclusion criteria. The energy density of the laser was 0.7-9 J / cm2. The power used for visible light was 30-110 mW and that for infrared light was 50-800 mW. Almost all studies showed that low-level laser therapy had a positive effect on cell proliferation. Similar results were found for LED; however, some studies suggest

Conclusions: PBM has positive effects on MSZ. This review came to the conclusion that doses of 0.7-4 J / cm2 and wavelengths of 600-700 nm are suitable for light therapy. The results were dependent on various parameters; therefore an optimization of the parameters used in light therapy to achieve favorable results is necessary in order to enable a more precise comparison.

Keywords: Lasers with light emitting diodes (LED), low-level laser therapy, photobiomodulation, photochemotherapy, semiconductors

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Low-Level Laser Therapy of Bone Marrow Improves Neurodegenerative Disease Progression in a Mouse Model of Alzheimer's Disease: A Mini Review

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short version

Objective: This communication provides an overview of the ability of low-level laser therapy (LLLT) to stimulate mesenchymal stem cells (MSC) in autologous bone marrow (BM) to increase the ability of the MSC to penetrate the brain, which b -Clear amyloid and improve cognition. Background: We recently reported that the LLLT used in BM increased the proliferation of MSCs and their mobilization towards the ischemic heart region, suggesting a possible application of this approach in regenerative medicine and neurodegenerative diseases. It has also been shown that circulating monocytes can infiltrate the brain and reduce amyloid load on the brain in an Alzheimer's mouse model.

METHODS AND RESULTS: MSCs from wild-type mice stimulated with LLLT showed an increased ability to mature into a monocyte line and to increase the phagocytosis of soluble Ab in vitro. In addition, weekly LLLT for 2 months to BM starting at 4 months of age (progressive stage of disease in these 5XFAD transgenic male mice) improved memory and spatial learning compared to a sham AD

mouse model. The histology showed a significant reduction in the Ab-brain load in the laser-treated mice compared to the non-laser-treated mice.

Conclusions: The use of LLLT in BM is suggested as a therapeutic approach in progressive stages of AD and its potential role in mediating MSZ therapy in brain amyloidogenic disease is suggested.

Keywords: amyloid beta (Ab), bone marrow (BM), mesenchymal stem cells (MSC), Alzheimer's disease (AD), low-level laser therapy (LLLT), exosomes