Wounded Skin Fibroblasts

The role of laser fluence in cell viability, proliferation, and membrane integrity of wounded human skin fibroblasts following helium-neon laser irradiation[†]

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Abstract

Background

In medicine, lasers have been used predominantly for applications, which are broadly termed low level laser therapy (LLLT), phototherapy or photobiomodulation. This study aimed to establish cellular responses to Helium-Neon (632.8 nm) laser irradiation using different laser fluences (0.5, 2.5, 5, 10, and 16 J/cm2) with a single exposure on 2 consecutive days on normal and wounded human skin fibroblasts.

Materials and Methods

Changes in normal and wounded fibroblast cell morphology were evaluated by light microscopy. Changes following laser irradiation were evaluated by assessing the mitochondrial activity using adenosine triphosphate (ATP) luminescence, cell proliferation using neutral red and an alkaline phosphatase (ALP) activity assay, membrane integrity using lactate dehydrogenase (LDH), and percentage cytotoxicity and DNA damage using the Comet assay.

Results

Morphologically, wounded cells exposed to 5 J/cm2 migrate rapidly across the wound margin indicating a stimulatory or positive influence of phototherapy. A dose of 5 J/cm2 has a stimulatory influence on wounded fibroblasts with an increase in cell proliferation and cell viability without adversely increasing the amount of cellular and molecular damage. Higher doses (10 and 16 J/cm2) were characterized by a decrease in cell viability and cell proliferation with a significant amount of damage to the cell membrane and DNA.

Conclusions

Results show that 5 J/cm2 stimulates mitochondrial activity, which leads to normalization of cell function and ultimately stimulates cell proliferation and migration of wounded fibroblasts to accelerate wound closure. Laser irradiation can modify cellular processes in a dose or fluence (J/cm2) dependent manner.

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