

The Fluence Effects of Low-Level Laser Therapy on Inflammation, Fibroblast-Like Synoviocytes, and Synovial Apoptosis in Rats with Adjuvant-Induced Arthritis

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Abstract

Objective: The aim of this study was to evaluate the effect of low-level laser therapy (LLLT) operating at low and high fluences on joint inflammation, fibroblast-like synoviocytes (FLS), and synovial apoptosis in rats with adjuvant-induced arthritis.

Background data: Rheumatoid arthritis (RA) is characterized by pronounced inflammation and FLS proliferation within affected joints. Certain data indicate that LLLT is effective in patients with inflammation caused by RA; however, the fluence effects of LLLT on synovium are unclear.

Methods: Monoarthritis was induced in adult male Sprague–Dawley rats (250–300 g) via intraarticular injection of complete Freund’s adjuvant (CFA) into the tibiotarsal joint. Animals were irradiated 72 h after CFA administration with a 780 nm GaAlAs laser at 4.5 J/cm² (30 mW, 30 sec/spot) and 72 J/cm² (80 mW, 180 sec/spot) daily for 10 days. After LLLT, the animals were euthanized and their arthritic ankles were collected for histopathological analysis, immunoassays of tumor necrosis factor (TNF)- α , matrix metalloproteinase (MMP)3 and 5B5, and terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL) assays.

Results: LLLT at a fluence of 4.5 J/cm² significantly reduced infiltration of inflammatory cells and expressions of TNF- α , MMP3- and 5B5-like immunoreactivities, as well as resulting in more TUNEL-positive apoptotic cells in the synovium. No significant changes were observed in these biochemicals and inflammation in arthritic animals treated with 72 J/cm².

Conclusions: LLLT with low fluence is highly effective in reducing inflammation to sites of injury by decreasing the numbers of FLS, inflammatory cells, and mediators in the CFA-induced arthritic model. These data will be of value in designing clinical trials of LLLT for RA.