

Effects of Photobiomodulation and Mesenchymal Stem Cells on Articular Cartilage Defects in a Rabbit Model

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Abstract

Objective: The aim of this study was to evaluate the effectiveness of the application of cultured autologous bone marrow mesenchymal stem cells (BMSCs) with scaffold and low-level laser therapy (LLLT) on the repair of articular cartilage defects in rabbits.

Background data: For healing of the articular cartilage defects, although positive effects of BMSCs and LLLT have been demonstrated, their combination effect is still unknown; therefore, we investigated combining these two techniques has a synergistic effect.

Materials and methods: After bone marrow aspiration from 10 rabbits, BMSCs were isolated, cultured in monolayer, suspended on a type I collagen scaffold and then implanted onto a full-thickness osteochondral defect (4mm in diameter), artificially made on the patellar groove of both knees in the same rabbits. Then a knee was selected randomly in each rabbit as the experimental group, and subjected to Ga-Al-As (810 nm) laser irradiation with energy density of 4 J/cm² every other day for 3 weeks. As the control group, the other knee did not receive LLLT. After this period, animals were euthanized and osteochondral defects were evaluated by histomorphometric methods.

Results: No significant difference in new cartilage formation and inflammation was found between the groups ($p > 0.05$). However, there was significantly more new bone formation in the experimental group ($p < 0.05$).

Conclusions: In terms of our research, although better healing in osteochondral defects was seen when combining BMSCs and LLLT compared with the use of BMSCs alone, this improvement was predominantly caused by new bone formation rather than new cartilage formation.