Histological and clinical responses of articular cartilage to low-level laser therapy: Experimental study

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Abstract

This study was carried out to evaluate the effects of low-level laser irradiation on experimental lesions of articular cartilage. A standard lesion was practised on the femoral trochlea of both hindlimbs of 20 clinically normal Californian rabbits. These animals were divided into two groups of 10 individuals each, depending on the laser equipment used for treatment. Onc group was treated with He-Ne laser (8 J cm^{-2}, 632.8 nm wavelength) and the other with infra-red (IR) laser (8 J cm^{-2}, 904 nm wavelength). In both groups, five points of irradiation to the right limb alone were irradiated per session for a total of 13 sessions, applied with an interval of 24 h between sessions. These points were the following: left and right femoral epicondyles, left and right tibial condyles and the centre of articulation. The distance between these points was approximately 1 cm. The untreated left limb was left as a control. During treatment, extension angle and periarticular thickness were considered. At the end of the treatment, samples were collected for histopathologi-cal study and stained with: Haematoxylin-Eosin, PAS and Done. The results show a statistically higher anti-inflammatory capacity of the IR laser ($p < 0.0001$). The functional recovery was statistically similar for both treatments ($p < 0.176$). Histological study showed, at the end of the treatment, hyaline cartilage in the IR group, fibrocartilage in the He-Ne group and granulation tissue in the control limbs. Clinical and histological results indicated that this laser treatment had a clear anti-inflammatory effect that provided a fast recuperation and regeneration of the articular cartilage.

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Effect of low-level laser therapy on osteoarthropathy in rabbit.

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Abstract
The aim of this study was to determine whether low-level laser therapy (LLLT) aided the recovery of damaged articular cartilage in joints with artificially induced osteoarthropathy (OA). OA was induced by injecting hydrogen peroxide (H2O2) into the articular spaces of both knees in rabbits, twice a week for 4 weeks. The induction of OA and the effect of LLLT were evaluated by biochemical, radiological and histopathological analysis. Superoxide dismutase (SOD) activity increased about 40% in the OA group, as compared to the controls. Although SOD activity in the OA group was not significantly different from the 2-week groups, it was significantly different from the 4-week control and treatment groups. There was also a significant difference between the 4-week control and treatment groups. Simple radiographs and three-dimensional computed tomographs (3D CT) did not show detectable arthropathy in the OA group, nor any particular changes in the 2-week groups. In contrast, distinct erosions were seen in the distal articular cartilage of the femur, with irregularity of the articular surface, in the 4-week control group, while the erosions were reduced and arthropathy improved slightly in the 4-week treatment group. Grossly, erosions formed on the articular surface in the OA group. In comparison, severe erosions damaged the articular cartilage in the 4-week control group, but not in the 2-week control and treatment groups. Regeneration of articular cartilage was seen in gross observations in the 4-week treatment group. Histopathologically, there was slight irregularity of the articular surface and necrosis in the OA group, and serious cartilage damage,

despite slight chondrocyte regeneration, in the 4-week control group. Conversely, the 4-week treatment group showed chondrocyte replacement, with sometimes close to normal articular cartilage on the articular surface. These results suggest that LLLT was effective in the treatment of chemically-induced OA.

Effect of low-level helium-neon laser therapy on histological and ultrastructural features of immobilized rabbit articular cartilage.

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Abstract

The present study investigates whether low-level helium-neon laser therapy can increase histological parameters of immobilized articular cartilage in rabbits or not. Twenty five rabbits were divided into three groups: the experiment group, which received low-level helium-neon laser therapy with 13J/cm(2) three times a week after immobilization of their right knees; the control group which did not receive laser therapy after immobilization of their knees; and the normal group which received neither immobilization nor laser therapy. Histological and electron microscopic examinations were performed at 4 and 7 weeks after immobilization. Depth of the chondrocyte filopodia in four-week immobilized experiment group, and depth of articular cartilage in seven-week immobilized experiment group were significantly higher than those of relevant control groups (exact Fisher test, p=0.001; student's t-test, p=0.031, respectively). The surfaces of articular cartilages of the experiment group were relatively smooth, while those of the control group were unsmooth. It is therefore concluded that low-level helium-neon laser therapy had significantly increased the depth of the chondrocyte filopodia in four-week immobilized femoral articular cartilage and the depth of articular cartilage in seven-week immobilized knee in comparison with control immobilized articular cartilage.