Analysis of experimental tendinitis in rats treated with laser and platelet-rich plasma therapies by Raman spectroscopy and histometry

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Abstract

The objective of this controlled experimental study was to analyze the changes in the Achilles tendons of rats with experimentally induced tendinitis after treatment with platelet-rich plasma (PRP) and/or laser therapies by histometry to quantify fibroblasts and by Raman spectroscopy to determine the biochemical concentration of collagen types I and III. Fifty-four male Wistar rats were divided into six treatment groups: control (G1); PRP only (G2); irradiation with 660 nm laser (G3); irradiation with 830 nm laser (G4); PRP plus 660 nm laser irradiation (G5); and PRP plus 830 nm laser irradiation (G6). Injuries (partial tenotomy) were inflicted in the middle third of the Achilles tendon, with PRP added prior to suture in the appropriate experimental groups. A diode laser (model Laser Flash® III, DMC Equipamentos Ltda, São Carlos, SP, Brazil) that can be operated in two wavelengths 660 and 830 nm was used for irradiation treatments. The irradiation protocol was energy density of 70 J/cm^2, 20 s irradiation time, and 0.028 cm^2 spot area, per point in three points in the injured. The histometry was made in micrographical images of the H&E stained sections and evaluated by ImageJ (version 1.46r)®. Raman spectra were collected using a dispersive spectrometer at 830 nm excitation, 200 mW power, and 10 s integration time (P-1 Raman system, Lambda Solutions, Inc. MA, USA). The relative amount of type I collagen was significantly greater in the PRP plus 830 nm laser irradiation group (468 ± 188) than in the control (147 ± 137), 630 nm laser only (191 ± 117), and 830 nm laser only (196 ± 106) groups ($p < 0.01$), while the quantity of type III collagen was significantly greater in the PRP-only group compared to both irradiated groups without PRP ($p < 0.05$). Treatment with PRP combined with irradiation at 830 nm resulted in a larger number of fibroblasts and increased concentration of type I collagen, thus accelerating the healing of the injured tendon.