Angiogenesis

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Effect of In-Ga-Al-P diode laser irradiation on angiogenesis in partial ruptures of Achilles tendon in rats.

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OBJECTIVE: This study was conducted to analyze the effect of different irradiances of low-level laser therapy (LLLT) on angiogenesis after partial rupture of Achilles tendon of rats. BACKGROUND DATA: METHODS: Ninety-six animals were divided into three groups subject to treatment during 3, 5, and 7 days post-lesion. Thirty-two animals were used in each group. The groups were further divided into four subgroups with eight animals in each, receiving In-Ga-Al-P laser (660 nm) treatment at (1) mean output of 10 mW, (2) 40 mW during 10 sec, (3) a sham subgroup, and (4) a non-treatment subgroup. Each animal was subjected to a lesion of the Achilles tendon by dropping a 186-g weight from a 20-cm height over the tendon. Treatment was initiated 6 h post-injury for all the groups. Blood vessels were colored with India ink injection and were examined in a video microscope. RESULTS: Laser exposure promoted an increase in blood vessel count when compared to controls. The 40-mW group showed early neovascularization, with the greatest number of microvessels after three laser applications. The 10-mW subgroup showed angiogenesis activity around the same time as the sham laser group did, but the net number of vessels was significantly higher in the former than in the controls. After seven irradiations, the subgroup receiving 40 mW experienced a drop in microvessel number, but it was still higher than in the control groups. CONCLUSIONS: LLLT of different intensities seems to promote neovascularization in damaged Achilles tendons of rats after partial rupture compared to controls.

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Promotion of angiogenesis by low energy laser irradiation.

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The effect of low energy laser (He-Ne) irradiation (LELI) on the process of angiogenesis in the infarcted rat heart and in the chick chorioallantoic membrane (CAM), as well as the

proliferation of endothelial cells in tissue culture, was investigated. Formation of new blood vessels in the infarcted rat heart was monitored by counting proliferating endothelial cells in blood vessels. In the CAM model, defined areas were laser-irradiated or nonirradiated and blood vessel density was recorded in each site in the CAM at various time intervals. Laser irradiation caused a 3.1-fold significant increase in newly formed blood vessels 6 days post infarction, as compared with nonirradiated rats. In the CAM model, a slight inhibition of angiogenesis up to 2 days post irradiation and a significant enhancement of angiogenesis in the laser-irradiated foci as compared with control nonirradiated spots were evident. The LELI caused a 1.8-fold significant increase in the rate of proliferation in endothelial cells in culture over nonirradiated cells. It is concluded that LELI can promote the proliferation of endothelial cells in culture, which may partially explain the augmentation of angiogenesis in the CAM model and in the infarcted heart. These results may have clinical significance by offering therapeutic options to ameliorate angiogenesis in ischemic conditions.

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The effects of low laser irradiation on angiogenesis in injured rat tibiae.

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The influence of He-Ne laser radiation on the formation of new blood vessels in the bone marrow compartment of a regenerating area of the mid-cortical diaphysis of the tibiae of young adult rats was studied. A small hole was surgically made with a dentistry burr in the tibia and the injured area received a daily laser therapy over 7 or 14 days transcutaneously starting 24 h from surgery. Incident energy density dosages of 31.5 and 94.5 Jcm(-2) were applied during the period of the tibia wound healing investigated. Light microscopic examination of histological sections of the injured area and quantification of the newly-formed blood vessels were undertaken. Low-level energy treatment accelerated the deposition of bone matrix and histological characteristics compatible with an active recovery of the injured tissue. He-Ne laser therapy significantly increased the number of blood vessels after 7 days irradiation at an energy density of 94.5 Jcm(-2), but significantly decreased the number of vessels in the 14-day irradiated tibiae, independent of the dosage. These effects were attributed to laser treatment, since no significant increase in blood vessel number was detected between 8 and 15 non-irradiated control tibiae. Molecular mechanisms involved in low-level laser therapy of angiogenesis in post-traumatic bone regeneration needs further investigation.