Protection of Skeletal Muscles from Ischemic Injury

Protection of skeletal muscles from ischemic injury: low-level laser therapy increases antioxidant activity.

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Objective: The aim of this study was to investigate the effect of low-level laser therapy (LLLT) on ischemic-reperfusion (I-R) injury in the gastrocnemius muscle of the rat. Background Data: Ischemic injury in skeletal muscle is initiated during hypoxia and is aggravated by reoxygenation during blood reperfusion and accumulation of cytotoxic reactive oxygen superoxides. LLLT has been found to biostimulate various biological processes, such as attenuation of ischemic injury in the heart. Materials and Methods: The injury was induced in the gastrocnemius muscles of 106 rats by complete occlusion of the blood supply for 3 h, followed by reperfusion. Another group of intact rats served to investigate the effect of LLLT on intact nonischemic muscles. Creatine phosphokinase, acid phosphatase, and heat shock protein were determined 7 days after I-R injury and antioxidant levels 2 h after reperfusion. Results: Laser irradiation (Ga-As, 810 nm) was applied to the muscles immediately and 1 h following blood supply occlusion. It was found that laser irradiation markedly protects skeletal muscles from degeneration following acute I-R injury. This was evident by significantly ($p < 0.05$) higher content of creatine phosphokinase activity and lower ($p < 0.05$) activity of acid phosphatase in the LLLT-treated muscles relative to the injured non-irradiated ones. The content of antioxidants and heat shock proteins was also higher ($p < 0.05$) in the LLLT-treated muscles relative to that of injured non-irradiated muscles. Conclusion: The present study describes for the first time the ability of LLLT to significantly prevent degeneration following ischemia/reperfusion injury in skeletal muscles, probably by induction of synthesis of antioxidants and other cytoprotective proteins, such as hsp-70i. The elevation of antioxidants was also evident in intact muscle following LLLT. The above phenomenon may also be of clinical relevance in scheduled surgery or microsurgery requiring extended tourniquet applications to skeletal muscle followed by reperfusion.