

ABSTRACT

The biological effects of laser therapy and other physical modalities on connective tissue repair processes

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Connective tissue injuries, such as tendon rupture and ligamentous strains, are common. Unlike most soft tissues that require 7-10 days to heal, primary healing of tendons and other dense connective tissues take as much as 6 - 8 weeks during which they are inevitably protected in immobilization casts to avoid re-injury. Such long periods of immobilization impair functional rehabilitation and predispose a multitude of complications that could be minimized if healing is quickened and the duration of cast immobilization reduced. In separate studies, we tested the hypothesis that early function, ultrasound, 632.8 nm He-Ne laser, and 904 nm Ga-As laser, when used singly or in combination, promote healing of experimentally severed and repaired rabbit Achilles tendons as evidenced by biochemical, biomechanical, and morphological indices of healing. Our results demonstrate that: (1) appropriate doses of each modality, i.e., early functional activities, ultrasound, He-Ne and Ga-As laser therapy augment collagen synthesis, modulate maturation of newly synthesized collagen, and overall, enhance the biomechanical characteristics of the repaired tendons. (2) Combinations of either of the two lasers with early function and either ultrasound or electrical stimulation further promote collagen synthesis when compared to functional activities alone. However, the biomechanical effects measured in tendons receiving the multi-therapy were similar, i.e., not better than the earlier single modality trials. Although tissue repair processes in humans may differ from that of rabbits, these findings suggest that human cases of connective tissue injuries, e.g., Achilles tendon rupture, may benefit from appropriate doses of He-Ne laser, Ga-As laser, and other therapeutic modalities, when used singly or in combination. Our recent meta-analysis of the laser therapy literature further corroborates these findings.