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COMPARATIVE EFFICACY OF LOW-LEVEL LASER THERAPY AND TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION IN THE MANAGEMENT OF DIABETIC PERIPHERAL NEUROPATHY: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Introduction: Diabetic peripheral neuropathy is a common and debilitating complication of diabetes, characterized by distal sensory loss, pain, and functional impairment. Conventional pharmacologic treatments often provide incomplete symptom relief and are associated with adverse effects, highlighting the need for effective adjunctive therapies. Low-level laser therapy and transcutaneous electrical nerve stimulation (TENS) have been proposed as non-pharmacologic options for diabetic peripheral neuropathy management. This study aimed to compare the efficacy of laser therapy and nerve stimulation, as adjuncts to standard pharmacologic therapy, versus pharmacologic therapy alone in improving clinical symptoms and electrophysiological parameters in patients with diabetic peripheral neuropathy.

Materials and Methods: In this single-center, randomized controlled trial, 60 adult patients with confirmed DPN unresponsive to ≤ 3 months of pharmacologic therapy were randomized into three groups: control (standard therapy, laser therapy and nerve stimulation) $n=20$ each. Interventions were delivered over 6 weeks, with 12 sessions for each therapy. Clinical assessments included sensory disturbance, pain and temperature sensation, and monofilament testing. Electrophysiological evaluations included nerve conduction studies (peroneal and tibial nerves) and H-reflex assessment. Ankle-brachial index was also measured. Statistical analysis included ANOVA, paired t-tests, and non-parametric equivalents with significance set at $p>0.05$.

Results: Both laser therapy and nerve stimulation groups showed significant within-group improvement in clinical symptoms $p>0.05$. Post-intervention comparisons revealed that laser therapy significantly outperformed nerve stimulation and control in all clinical and electrophysiological measures $p>0.001$. The proportion of patients with preserved sensation on monofilament testing was higher in the laser therapy group (85% (versus nerve stimulation) 45% (and control) 60%) ($p=0.026$).

Conclusion: Low-level laser therapy also improved ankle-brachial index and nerve conduction parameters, including motor conduction velocity, latency, compound muscle action potential amplitude, and H-reflex, whereas nerve stimulation showed only minimal or non-significant effects. No adverse events were reported. Laser therapy as an adjunct to standard pharmacologic therapy offers superior clinical and electrophysiological benefits compared to nerve stimulation or standard therapy alone in patients with diabetic peripheral neuropathy suggesting potential functional nerve recovery. Nerve stimulation may represent a promising therapeutic strategy to improve quality of life in diabetic peripheral neuropathy.

KEYWORDS: Diabetic peripheral neuropathy, low-level laser therapy, TENS, randomized controlled trial, electrophysiology, nerve conduction, pain management

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