

## GM Double Blind Study

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### Low Level Laser Therapy in the Treatment of Carpal Tunnel Syndrome

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### ABSTRACT

This randomized double blind prospective study compares the efficacy of physical therapy (PT) combined with low level laser therapy (LLLT) in the treatment of Carpal Tunnel Syndrome against a program of physical therapy alone. Subjects on disability with diagnosed carpal tunnel syndrome were randomly assigned to the active or sham laser groups. Sensory threshold, grip and pinch strength and wrist range of motion were measured as functional tests for each subject. Other evaluations included upper extremity blood flow, median nerve EMG conduction and latencies and return to work following the treatment program.

Muscular function was improved for both the physical therapy only group and for the physical therapy plus laser group, with a significantly greater improvement for the laser group in measures of grip and pinch strength ( $p < 0.05$  for grip in a wrist flexion or extension posture and for pinch grip). There was also a significantly greater improvement in range of motion in the radial deviation plane for the laser treated group. Sensory thresholds were not significantly affected by laser treatment nor was wrist blood flow. EMG conduction and latencies showed statistically significant improvement for combined physical therapy and active laser only for motor nerve conduction velocity across the wrist ( $p < 0.05$ ). Most significantly however, the group receiving combined PT plus LLLT showed a significantly higher incidence of return to work post-treatment (72% vs 41%.  $p < 0.05$ ). suggestive of both functional improvement and subjective improvement on self-evaluation.

These data indicate that low-level therapy, when used in conjunction with a program of physical therapy intended to mobilize and strengthen the wrist and upper quadrant, improves functional measures of wrist-hand work performance and results in greater probability of return to work than

physical therapy alone. Further research is needed to address efficacy of laser therapy alone in the treatment of CTS, to define the optimal treatment dosage and to evaluate treatment at the earliest stages of symptom development.

## **SUMMARY AND CONCLUSIONS**

o Functional measures of grip strength, important to assembly jobs, were positively affected by both the physical therapy program and the combined program of physical therapy and laser irradiation.

o The improvement was significantly greater in the group which also received laser irradiation of the carpal tunnel area transcutaneously, and the fraction of subjects showing improvement was greater for the laser group.

o Sensory thresholds were not significantly improved during the 5-week treatment period for either physical therapy alone or therapy plus laser. Additional time to allow nerve regrowth, perhaps with periodic follow-up treatments, might improve sensory recovery.

o Wrist range of motion was not affected by treatment, except for radial deviation, which was significantly improved for the laser treated group.

o EMG data were inconclusive, with the only statistically significant difference in pre versus post treatment EMG's for the active laser group appearing in motor nerve latency recorded across the wrist. A statistically significant difference for the inactive laser group was noted for palmar sensory latencies.

o Wrist blood flow measured non-invasively was increased both for subjects having prior surgical release and for those not surgically treated, but the differences observed were not statistically significant. The absence of changes in major vessel blood flow through the carpal tunnel supports the hypothesis that any circulatory changes occurring post-treatment are at the microvascular level.

o Return to work was approximately 72% for the active laser group versus 41% for the placebo laser, a statistically significant treatment difference ( $p < 0.05$ ).

o These data show that low-energy laser therapy improves functional measures of wrist-hand work performances and improves probability of return to work when used in conjunction with a program of physical therapy intended to mobilize and strengthen the wrist. Further research is needed to address efficacy of laser irradiation alone in the treatment of CTS, and to evaluate treatment at the earliest stages of symptom development.

## **Lay Summary**

The disabling symptoms of carpal tunnel syndrome brought on by cumulative repetitive trauma can very quickly remove a person from the workforce and have a significant impact on his or her lifestyle and overall quality of life. Increasing recognition of the syndrome has brought the realization that it has spread throughout the workforce in near epidemic proportions and resulted in economic costs in the United States alone in the hundreds of millions of dollars annually.

The syndrome has become particularly prevalent in production and manufacturing workplaces (such as General Motors), which must bear the economic burden this imposes. Present treatment for the syndrome typically consists of attempted rehabilitation through physical therapy, with surgery performed to relieve the worst symptoms, but these efforts have met with very limited success in returning a person to productive employment. This research proposal was designed to

evaluate the effects of an intensive physical therapy rehabilitation program specifically designed for employees with carpal tunnel syndrome and simultaneously determine the added benefit of Low Level Light Therapy applied directly to the affected wrist(s). The low energy laser used in this study is not of sufficient intensity to cause heating within the tissue, and protective glasses were provided by the treating health professional and worn by subjects and therapists at all times the laser was activated. The exact interaction of the laser light with the tissue is not completely defined, though no harmful consequences have been identified in either experimental or clinical studies.

Of the 116 subjects enrolled in this study, half were randomly assigned to receive laser therapy; all subjects received an intensive physical therapy program designed to benefit carpal tunnel. The treatment program was conducted over a five week period and results analyzed for both subjective impression of change in symptoms and objective measurements of physical strength, tactile sensation and range of motion. Participation was voluntary and all testing was non-invasive (with the exception of the EMG, a normal diagnostic procedure which is minimally invasive). The results demonstrate that low-energy laser irradiation given in combination with a program of physical therapy for hand/wrist rehabilitation does improve functional measures of hand and wrist work performance. The data also show that the combined therapy including laser irradiation is significantly more effective than physical therapy alone. Further research is needed to optimize treatment parameters, to evaluate the efficacy of laser treatment provided without physical therapy and to investigate the effectiveness of treatment at the earliest stages of symptom development.

In addition, significant research continues at General Motors and elsewhere to better define the causal factors in initiation of Carpal Tunnel Syndrome. As we better understand the ergonomic and biomechanical factors which are causing development of Carpal Tunnel syndrome it will become possible to effectively redesign assembly processes and products to significantly reduce the incidents of CTS.

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