

Ministry of Higher Education
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**An Evaluation of Anti-Nociceptive and Anti-Inflammatory
Activity of Low-Level Laser Therapy on
Temporomandibular Joint Induced Arthritis in Rats**

A Thesis

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Abstract

Background: Temporomandibular disorders are the second major cause of pain in the face after dental causes. These disorders are multifactorial diseases and most of them have inflammatory phase. Treatment of temporomandibular disorders may be surgical or non-surgical, invasive or non-invasive, types of these treatments aimed to restore function, decrease pain, and reduce sign and symptoms of these disorders. Many types of therapies are present t, but using low level laser therapy is preferred choice as it is easy to use and comfortable to most patients with very short list of contraindications.

Aims of the study: To evaluate the possible anti-nociceptive and anti-inflammatory effectiveness of low-level laser therapy on temporomandibular joint in Westar albino rats, through studying behavioral changes, weight assessments, facial edema evaluations, histological analysis, and immunohistochemical profiling.

Subjects, Materials, and Methods: Dual phase experiment was used in this study. Phase one was done to evaluate anti-nociceptive of low-level laser therapy, through formalin test, using fifty Westar albino rats assigned into five experimental groups: positive control, negative control, diclofenac treated, low level laser therapy treated using $171\text{J}/\text{cm}^2$, and $74\text{ J}/\text{cm}^2$ groups. Animals were injected with formalin solution directly into the temporomandibular joint then were inspected for forty-five minutes to record behavioral changes, manifested by flinching the head and rubbing the injured area. Phase two was done to evaluate anti-inflammatory effect of low-level laser therapy, through induction of arthritis in temporomandibular joint of Westar albino rats using carrageenan solution injections, one hundred twenty rats were used in this phase, assigned into four experimental groups: positive control, negative control, $171\text{J}/\text{cm}^2$, and $74\text{ J}/\text{cm}^2$ low level laser therapy groups. For clinical assessment animals were

weighted and head circumferences were measured and recorded every day from the induction of arthritis by carrageenan solution injection in rat's joints until the seventh and last day of the experiment. For histological and immunochemical assessment, ten animals were euthanized at day one, three, and seven from each group, head decapitated, skin removed, and temporomandibular joints were isolated and biopsied to be investigated for acute and chronic inflammatory cells infiltrations as well as vascularity assessments. Then the same histological samples were used to evaluate the expression of interleukin 6 and interleukin 4, using immunohistochemical stains, inspected under light microscope.

Results: Low level laser therapy using 74 and 171J/cm² significantly decreased behavioral changes induced by formalin test, manifested by flinching the head and rubbing orofacial region, with no significant differences between low laser therapy groups and diclofenac treated groups.

Low level laser therapy using 74J/cm² had improved rat growth and significantly decreases edema caused by carrageenan injection. Examination temporomandibular samples under light microscope revealed significant decrease of acute phase inflammation, early chronification, and enhanced vascularization. Immunohistochemical analysis revealed significant decrease in interleukin 6 secretion as well as enhancement of interleukin 4 expression. Less satisfied results were obtained from laser dose of 171J/cm², plus there was heat generation causing burns in rat skin were reported in this group.

Conclusions: Low level laser therapy using 74J/cm² or 171J/cm² had efficient anti-nociceptive effect on temporomandibular joint. But only 74J/cm² had a very good anti-inflammatory effect, whereas energy density of 171J/cm² was in or near the borderline between non-thermal and thermal lasers irradiation in considering Westar rat therapy.