



## Anti- Inflammatory Effect of Low Level Laser Therapy on Tissue Injury (By Using C - reactive protein)

Authors

**Dr. Hareth. H. Kaskos<sup>1</sup>, Dr Jiyar M.Naji Mohammed<sup>2</sup>**

<sup>1</sup>MS.C in Oral and Maxillofacial Surgery, Assistant Professor At Polytechnic University- Duhouk  
(Prosthetic Dentistry Department)

<sup>2</sup>MS.C, PhD, Lecturer in Molecular Biology, At Dukok Polytechnic University  
(Prosthetic Dentistry Department)

### ABSTRACT

*The aim of this experimental study was to assess the effect of low level laser therapy LLLT (He-Ne) on the degree of inflammation by using C-reactive protein as parameter.*

**Materials & Methods:** *Twenty healthy rats of both sexes were used ,they were received the surgical procedure by doing one incision on the dorsum surface of the animal for a depth of full thickness cutaneous tissue depth .They were divided into two groups, the control group including (10) rats received the surgical procedure without exposure to laser irradiation and the experimental group including (10) rats received the surgical procedure with laser irradiation at the dose of 0.15 J/cm<sup>2</sup> for 5 days.*

**Results:** *statistically using Duncan multiple range test, they showed that there were only significant differences at the day 2 and 3 post operatively.*

**Conclusion:** *The laser irradiation to the tissue injury can reduce the time but not suppress the inflammatory phase.*

**Key words:** *Low level laser, anti inflammatory, healing.*

### Introduction

The natural wound healing can be divided into 3 phases, the inflammatory phase, proliferative phase and the remodeling phase. The inflammatory phase although it is caused an unpleasant effect to the patient , like it is caused pain but it is necessary for tissue repair in that it is

increased the cellular infiltration (like macrophage) that will clean the area and then releasing of growth factors which stimulate the second phase (proliferative phase). To reduce the signs of inflammation, using anti- inflammation drugs such as steroids or non-steroidal anti inflammation drugs .The use of these drugs result

in undesirable side effect, thus the constant search for alternative methods to control of inflammation without side effect to the patient, low level laser therapy ( LLLT )has been used as important tools for control of inflammation process<sup>1</sup>. The truly unique characteristic of LLLT as promote wound healing is by enhancing leuckocyte infiltration, macrophage activity and increased in neovascularization, thus shorter the time of inflammatory phase<sup>2</sup>.

A clinical study developed by using laser light irradiation at the dose of 4.8J/cm<sup>2</sup> for 24,48h after surgical removal of impacted lower third molar ,using C –reactive protein as parameter of degree of inflammation ,the authors found that C -reactive protein value were more better distributed for irradiated group than for control<sup>3</sup>. laser photo stimulation can facilitate healing of impaired wounds in experimental diabetic rat. Reduction the time of inflammation of tissue in rabbit tendon and ligament injury from 6- 8 weeks to 7-10 days by using He-Ne laser at wave length 632.8 nm have been recorded .<sup>4,5</sup>

Beside that treated inflamed temporomandibular joint retrodiscal tissue of rabbits by using adose of 12J/cm<sup>2</sup> for 2 weeks ,the results observed that the group treated with low level laser at this dose significantly reduction of inflammation compared to control one .<sup>6</sup>

An anti-inflammatory effect of LLLT characterized by inhibition of either total or differential leukocyte influx, exudation in addition to Cytochrome oxidase (is an integral membrane protein)that contains four redox active metal centers and has a strong absorbance in the infar-

red to near-IR spectral range detectable in vivo by near-IR spectroscopy.<sup>7,8</sup>

### **Materials & Methods**

Twenty healthy rats weighted (250-350) gs, aged (3-5) months were used in this experimental study.

### **Anesthesia of animal:**

Ketamine solution, (Claris, India) is given by intramuscular injection in a dose of 80 mg/kg and Xylazine (Sanofi, France) is given by intramuscular injection in a dose of 10 mg/kg.

### **Laser system**

The characteristics of Laser system which is used in the current study are as follows: Laser system class IV, Output power He-Ne 0.006 mW, beam wavelength 632.8 nm. the beam should be at the distance of 30cm from the surface of the wound according to the manufactural instructions.Fig. (1)

### **Surgical procedure:**

The surgical field was done on the dorsum surface of the rat. One incision was done parallel with long axis of rat by blade No. 11. The length of incision was 2 cm and the depth of incision was full thickness of rat skin, after the wounded area was irrigated with normal saline then it is sutured by 3/0 black silk suture. Fig (2)

### **Animals grouping:**

The animals were divided into 2 groups:

1. Control group: The number of animals introduced to this group is (10)rats

received the surgical procedure but without exposure to laser irradiation.

2. Experimental group: The number of animals introduced to this group is (10) rats received the surgical procedure but with laser irradiation.

#### Animal irradiation:

After completing the surgical operation ,the animal exposed to laser irradiation then dialy till day 5 postoperatively, the exposure time is 5 minutes, so the dose of each session is  $0.15 \text{ J/cm}^2$  (power  $0.006\text{mW} \times 5 \text{ minutes} \times 60 \text{ sec}/12\text{cm}^2 = 0.15 \text{ J/cm}^2$ ).Fig(3)

#### Blood Sampling:

A sample of blood about 1 ml was taken from rat( from the heart directly), one sample is taken before the surgical operation and other samples daily from day One till day 5 postoperative and samples of blood was collected for biochemical analysis of CRP (laboratory procedure).

#### Results

Statistical comparison between Non laser treated group (NLTG) and laser treated group (LTG) showed that increased of the mean of CRP at the day 1, mean is (7.40) of NLTG to reached to (7.80) and but not reached to the level of statistical significancy. At day 2, the mean is (7.30) of NLTG to reached the mean (10.30) Of LTG ,day 3 the mean was (7.41) on NLTG to reached to the mean (10.70)of LTG .Statistical significant was only reached to the level of significancy at day 2 and 3 at ( $p < 0.01$ ) ,and no

statistical significant differences was observed at day 4 and 5 at ( $p > 0.01$ )according to Duncan multiple range test. Table (1)



Figure (1) Laser system



Figure (2) Incision on the skin



Figure (3) animal irradiation method

**Table (1)** Comparison between Non laser treated group and laser treated group.

| Post operative Days | Non laser treated group |        | laser treated group |        |
|---------------------|-------------------------|--------|---------------------|--------|
|                     | Mean (Mg/L)             | +SE    | Mean (Mg/L)         | SE+    |
| Day 1               | 7.40                    | 0.31   | 7.80                | 0.29   |
| Day 2               | 7.30                    | 0.30** | 10.30               | 0.36** |
| Day 3               | 7.41                    | 0.31** | 10.70               | 0.30** |
| Day 4               | 8.20                    | 0.25   | 7.44                | 0.29   |
| Day 5               | 7.90                    | 0.23   | 8.50                | 0.31   |

\*\* Highly significant at level ( $p < 0.01$ ) according to Duncan multiple range test.

## Discussion

The aim of postoperative therapeutic medications is not the suppression of inflammatory because this process is extremely important for wound healing ,therapeutic method of anti inflammatory drug postoperatively aimed to minimized symptom of inflammation and provide more comfortable to patient ,thus the use of non invasive treatment such as LLLT is a major step in clinical therapeutic.

CRP level have been used in many literatures to assess and evaluate the degree of inflammatory process <sup>3</sup> In this experimental study the rats that are exposed to adose of  $0.15\text{J}/\text{cm}^2$  for 5 minutes for 5 days regularly ,the mean CRP level although the mean increased for day one only but not reached to the level of statistical significancy till day 2and 3 post operatively ,this can be explained that CRP level begin to increased 6h to reached to it is maximum after 50h (2-3days) <sup>9</sup>after of tissue injury (begin of inflammation) and the ability of LLLT to reduce the time of inflammatory process and the early released of growth factors that is necessary required to go to

the second phase of tissue healing which is the proliferative phase<sup>10</sup> and all signs of inflammatory process will be reduced in time generated ,the same results and observations have been recorded by many authors then were recorded that reduction of inflammatory process in experimental animal (Rabbits & Rats) as they documented their results by histopathologically, immunohistochemically. The photophysical effect of laser light on the cellular changes and that increases of macrophage and lymphocyte have been detected experimentally. <sup>11,12,13,14</sup>

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