

## Antiinflammatory Effect and CRP Levels

# Assessment of Anti-Inflammatory Effect of 830nm Laser Light Using C-Reactive Protein Levels

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The anti-inflammatory effect of non-surgical lasers has been proposed previously, however it was not scientifically proven. One method to assess levels of inflammation is the measurement of C-reactive protein (CRP), which is increased with the course of inflammation. The aim of this study was to assess the effect of 830nm laser irradiation

after the removal of impacted third molars using the CRP as the marker of inflammation. Twelve patients were irradiated with 4.8 J of laser light per session 24 and 48 h after surgery. A control group (N=12) was treated with a sham laser. Blood samples were taken prior to, and 48 and 72 h after surgery. CRP values were more symmetric and better distributed for the irradiated group (0.320 mg/dl) than for the control (0.862 mg/dl) 48 h after surgery, however there was no statistically significant difference. After 72 h, both groups had statistically similar CRP levels (0.272 and 0.608 mg/dl), because of the normal tendency of decreasing CRP levels.

Key Words: dental surgery, inflammation, non-surgical lasers.

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## INTRODUCTION

Lasers have been used in several medical specialties and recently the dental profession has used laser both as a surgical tool and a biomodulating agent (1). Laser development began in 1917, when Albert Einstein proposed the principles of the stimulated emission of radiation. In 1958, Shawlow and Townes suggested the basic principles of light amplification (2).

Laser is a non-ionizing electromagnetic highly concentrated light, which, in contact with different tissues, results in several effects in tissue depending upon the wavelength and the optical properties of the irradiated tissue. Because it is a non-ionizing form of radiation, laser light can be used repeatedly within the parameters used currently because it does not induce mutagenic response. The use of laser light is not contraindicated for pregnant women, pacemaker users, and does not interfere with monitoring in the operating room (3).

Medical lasers can be classified into three main groups: Low Intensity Laser Therapy (LILT), High Intensity Laser Therapy (HILT) and Selective Laser Therapy (SLAT). LILT is also known as Low Level Laser therapy or LLLT and can modify cell metabolism, improve wound healing, reduce pain and edema, and speed inflammation and wound healing (4,5).

Inflammation occurs when immunocompetent cells are activated in response to foreign bodies or antigenic proteins. This response may have a beneficial effect (e.g. phagocytosis) or a deleterious effect (e.g. destruction of bone and cartilage in arthritis) (6).

Anti-inflammatory agents are drugs used for the treatment of non-specific inflammatory process to control signs and symptoms such as: heat, redness, pain and lack of function. There are two kinds of anti-inflammatory agents available on the market: steroids and non-steroids. The use of these drugs may result in undesirable side effects; thus, the constant search for alternative methods to control inflammation without deleterious effects to the patient.

LLLТ has been used as an important tool for the control of the inflammatory process. Its anti-inflammatory effect has been studied and its ability to induce analgesia under different conditions has also been reported (7).

The serial determination of the levels of some serum proteins may be useful for the

differentiation of inflammatory and non-inflammatory conditions, as well as between clinical conditions which are known to show increased or decreased acute phase response. One of these proteins is the C-reactive protein (CRP). The magnitude of the CRP response varies directly with the severity of tissue damage, type of the inflammatory stimuli, organ or tissue involved in the process, as well as on the monitoring of the natural course of the disease and the disease response to treatment (8). CRP plasma concentration is usually low (9), increases quickly at the onset of an acute inflammatory process and quickly falls when effective control of the process occurs (10,11).

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## MATERIAL AND METHODS

This study was approved by the Ethical Committee of the Hospital das Clínicas of the Universidade Federal de Pernambuco, Brazil. Twenty-four patients gave signed informed consent as determined by Brazilian regulations. The patients were selected according to the following criteria: lower wisdom tooth, older than 16 years of age and younger than 30 years of age, symptom free at the time of surgery, lack of pericoronaritis for at least 30 days prior to surgery. One week before surgery, a blood sample was taken to determine the baseline of CRP prior to surgery and irradiation. Patients with elevated CRP levels were dismissed from the study. Under local anesthesia, a maximum of two wisdom teeth were surgically removed using rotary and manual instruments. All patients received 500 mg of paracetamol after surgery. This drug was chosen because its very low anti-inflammatory action at usual doses (12). The drug was used immediately after surgery and repeated every six hours if necessary, not exceeding 2000 mg/day.

The patients were randomly divided into two groups (even numbered patients were placed in the test group and odd numbered patients in the control group). Twenty-four and forty-eight hours after surgery, the twelve test patients received the irradiation at the Laser Center with an 830nm diode laser (40 mW; Laser Beam, Rio de Janeiro, RJ, Brazil) for a total dose of 4.8 J/cm<sup>2</sup>. Control patients were treated with a sham laser. Forty-eight and seventy-two hours after surgery, blood samples were taken and the CRP level was determined by nephelometry (13-15).

Statistical analysis was based upon the comparison between groups using the Kolmogorov-Smirnov, Mann-Whitney and Shapiro-Wilks tests (16).

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## RESULTS

Comparison of groups at baseline is shown in [Table 1](#). Both groups had very similar levels of CRP (Kolmogorov-Smirnov = 0.17; critical value, at 5% = 0.50). Forty-eight hours after treatment (Table 2), CRP levels of irradiated patients showed a very symmetric distribution around the mean with a very small variability when compared to the controls. The Shapiro-Wilks test indicated that there was a normal distribution for the test group (S-W = 0.95; p = 0.438). However, the control group had a positive asymmetric distribution (S-W = 0.83; p = 0.021). Although there was a numerical

difference between the two groups, the Mann-Whitney test did not show a significant difference between the medians of the two groups ( $W = 133.3$ ;  $p = 0.338$ ). The results of the Kolmogorov-Smirnov test for two samples indicated at significance level of 5%; after 72 h the CRP levels showed the same distribution for both groups ( $K-S = 0.333$ ; critical value at 5% = 0.50). Table 3 show a symmetric positive distribution for both groups. The differences of the distribution on the graphs is a reflex of the random variation.

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## DISCUSSION

Surgical removal of a wisdom tooth may result in edema, pain and slight bleeding. However, if these conditions are exacerbated or if there is the presence of infection or trismus, these can be considered as complications. The lack of previous studies comparing the use of LLLT and other types of drug treatment for inflammatory conditions of the oral cavity makes it difficult to compare the results of this study. There was modification of the CRP level immediately after the surgical removal of the wisdom teeth and increased levels of CRP were found in both groups in agreement with other reports (10,11). This inflammatory response has been reported previously (17). The level of CRP and the clinical stage of the disease have a direct relationship to the evolution of the disease and the plasma level of CRP (18). Despite the fact that several authors consider an increase of CRP levels to be an unspecific response to infection, inflammation or tissue damage (19), in this study, CRP levels were used to assess the anti-inflammatory action of the 830nm diode laser, based on other studies that used CRP levels for monitoring inflammation (17). CRP response allows monitoring of the anti-inflammatory effect of drugs. The use of aspirin, steroids, penicillin and other non-hormonal drugs will often result in a reduction of the CRP level as these drugs will suppress the underlying inflammatory process (20). However, paracetamol was used as the analgesic drug in this study because of its very low anti-inflammatory effect in usual doses (12).

The aim of post-operative therapeutics is not the suppression of inflammation, because this process is extremely important for wound healing. Therapeutic methods and drugs used in the post-operative process aim to minimize symptoms and provide more comfort for the patient. Thus, the use of a non-invasive treatment such as LLLT is a major step in clinical therapeutics because of the lack of side effects of LLLT.

Statistical analysis of the results detected a very symmetric distribution of CRP levels at the post-operative period of patients who had wisdom teeth surgically removed and were irradiated with 830nm laser light when compared to the levels observed for the controls. Although this study failed to statistically confirm an anti-inflammatory effect of LLLT after surgical removal of wisdom teeth, the results show a reduction in the level of CRP in irradiated patients which may indicate attenuation of the inflammation; however, a larger sample is necessary to confirm this aspect. It is also important to observe that the complete treatment consisted of four minutes of irradiation within two days and that there was no additional cost for the patient, no need to use other drugs or any interference with routine life (3).

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## RESUMO

de Freitas AC, Pinheiro ALB, Miranda P, Thiers FA, Vieira ALB. Avaliação do efeito anti-inflamatório do laser diodo infravermelho de 830 nm através da monitorização da proteína c-reativa. *Braz Dent J* 2001;12(3):187-190.

A atividade anti-inflamatória da radiação Laser ainda não está muito bem estabelecida. Dentre as diferentes formas de avaliação da resposta inflamatória aguda encontra-se, a dosagem da proteína C-reativa (PCR), que na inflamação encontra-se elevada. O objetivo deste trabalho foi avaliar a capacidade anti-inflamatória do Laser Diodo Infra-Vermelho de 830nm no pós-operatório de cirurgias para remoção de terceiros molares retidos, através da análise cinética da variação dos níveis da PCR. A irradiação foi realizada a uma distância focal de 0,5cm, por um tempo total de dois minutos em corrente contínua, nos pontos preestabelecidos. As cirurgias foram realizadas no Bloco Cirúrgico do Departamento de Prótese e Cirurgia Buco Facial da Universidade Federal de Pernambuco. A população alvo foi de 24 pacientes divididos aleatoriamente em dois grupos. O grupo teste foi submetido à Laserterapia nas 24 e 48 horas pós-operatório (PO). O grupo controle foi submetido a uma falsa irradiação, com os mesmos intervalos do grupo teste. As amostras de sangue, para a dosagem da PCR foram colhidas antes da cirurgia e após 48 e 72 horas. Os valores da PCR no grupo teste 48 horas PO apresentou uma distribuição bastante simétrica em torno de sua média e com a variabilidade bem menor comparada com o grupo controle, porém não encontramos diferenças estatisticamente significante. Nas 72 horas PO os valores da PCR foram bastante semelhantes o que pode ser explicado, por uma tendência natural da queda desta proteína nesta fase.

Unitermos: cirurgia odontológica, inflamação, laser não cirúrgico.

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