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ORIGINAL RESEARCH

Application of therapeutic laser in some orthodontic movements**

Aplicación de láser terapéutico en algunos movimientos ortodónticos

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ABSTRACT

Purpose: To characterize radiographically the periodontal ligament thickness (PLT) and pain perception (PP) at the beginning of orthodontic treatment by activating and applying infrared laser of 810 nm each month for three months. **Methodology:** It was a quasi-experimental, descriptive and longitudinal study with a non-probabilistic sample consisting of 10 patients from the clinic of Orthodontics and Orthopedics at the Autonomous University of Sinaloa. 200 measurements were performed in teeth #11 and 12 (laser-treated); and 21 and 22 (non-treated control). To measure the PLT periapical radiographs were analyzed with Motic software 3V Advance. For PP determination, visual analog scale (VAS) was used. Descriptive statistical analysis was performed with SPSS v-19 (confidence interval of 95%). **Results:** In laser-treated teeth, PLT increased significantly 0.719 μm from the first to the second measurement and decreased 0.648 μm in the third measurement. In non-treated control teeth, PLT increased averaging 1.011 μm without significant change in the third measurement. PP in control teeth averaged 3.7 ± 3.2 on the VAS scale in the first measurement and 2.3 ± 2.3 in the second; while in the irradiated zone they averaged 2.9 ± 2.8 in the first month and 1.4 ± 1.2 in the second. **Conclusion:** With laser treatment, PLT is significantly reduced in comparison to the group that did not receive the treatment. At one and two months of treatment, average of PP decreased both in teeth where the laser is applied as in those without.

RESUMEN

Propósito: Caracterizar radiográficamente el grosor del ligamento periodontal (gLPD) y la percepción dolorosa (PD) al inicio de tratamiento ortodóntico activando y aplicando láser infrarrojo de 810 nm cada mes durante tres meses. **Metodología:** Estudio cuasiexperimental, descriptivo, longitudinal, muestra no probabilística de 10 pacientes de la Clínica de Ortodoncia y Ortopedia de la Universidad Autónoma de Sinaloa. Se realizaron 200 mediciones en las piezas 11 y 12 (con tratamiento láser); y 21 y 22 (sin tratamiento). Para medir el gLPD se analizaron radiografías periapicales con el software Motic Advance 3V. Para la PD se usó la escala visual analógica (EVA). El análisis estadístico descriptivo se realizó con SPSS v-19 (intervalo de confianza de 95%). **Resultados:** En las piezas tratadas con láser, el gLPD aumentó significativamente 0.719 μm de la primera a la segunda medición, y disminuyó 0.648 μm en la tercera medición. En las piezas control, el gLPD aumentó promediando 1.011 μm sin cambio significativo en la tercera medición. La PD en las piezas control en la escala EVA promediaron 3.7 ± 3.2 en la primera medición, y 2.3 ± 2.3 en la segunda; mientras que en la zona irradiada promediaron 2.9 ± 2.8 en el primer mes y 1.4 ± 1.2 en el segundo. **Conclusión:** El gLPD disminuye significativamente al aplicar el láser con respecto al grupo que no se le aplicó tratamiento. El promedio de la PD al mes y a los dos meses de tratamiento, disminuyó tanto en las piezas donde se aplicó el láser como en las que no.

Key words: Low-level laser therapy, orthodontics, visual analog scale.
Palabras clave: Terapia por láser de baja intensidad, ortodoncia, escala visual analógica.

INTRODUCTION

Laser radiation has been given numerous utilities in the medical area; various diseases can be treated or cured through its use. The first publications in the area of dentistry were associated with analgesic properties, where the results demonstrated that its implementation resulted in lower levels of pain in the visual analogue

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scale (VAS). Its application also generated a significant impact on cases of bone remodeling and anti-inflammatory effects in periodontal tissue.[1-3]

Among the commonly used types of laser there are the solid-state ones Er:YAG (λ = 2,940 nm), with effective absorption in water and hydroxyapatite; Er,Cr:YSGG (λ = 2780 nm), which is absorbed efficiently in hydroxyapatite; CO2 (λ = 9,400-10,600 nm), with good absorption in water; and others, such as the helium-neon (λ = 633 nm); GaAlAs (λ = 980 nm); the solid glass Nd: YAG laser (λ = 1,064 nm) and the infrared diode-laser (with l = 810 and 980 nm).[4] The last-mentioned lasers with emission in the near infrared (NIR, near infrared) are characterized by being highly absorbed by the chromophores that are found in soft tissues, for example hemoglobin. This has the effect of obtaining excellent performance and efficiency in treatments of incision, ablation and coagulation, as well as antimicrobial action; that is due to the fact that tissue warming occurs in a very localized region and at a relative depth.[4] On the other hand, lasers for hard tissue are highly absorbed by carbonate hydroxyapatite and chromophores in water, so it is possible to perform a hard-tissue fine ablation without heating the surrounding tissue.

Several lasers appeared in the middle of the 90, among which are those based on semiconductor diodes. The latter offered several advantages, such as their small size, price, and versatility. Diode-based lasers today represent a very important technological resource available for the dentist. Diode lasers can be used in several procedures that predominantly involve soft tissue and soft-tissue surgery,[1-3] as well as therapy for the treatment of periodontal plates.[4] Among the low power lasers (of the order of mW) there are the AsGa (λ = 904 nm); GaAlAs (λ = 830 nm) and He-Ne (λ = 632.8 nm) within the visible spectrum, in the red one; while Er:YAG laser that is applied on the hard tissues of the tooth, has high power –in the order of tens of watts–.[4] The low-power laser has remarkable therapeutic activity in various types of pathologies, where scarring is important, and is considered as a great tissue regenerator since it increases availability of cellular ATP as well as photoelectric activity that acts over membrane polarization, re-polarizing it thus increasing its threshold of excitation. The above leads to an excellent anti-inflammatory and analgesic action.[5] For its part, diode laser (λ = 904 nm), due to the specificity of photoelectric action of impulses, is a medium-power laser, which acts on the normalization of cell metabolism in inflamed tissues.[6] With intense and highly focused laser beams, it is possible to cut and cauterize certain tissues in a fraction of a second, without damage to the surrounding healthy tissue.[7]

The analgesic effect of laser in dentistry, according to a study reported in 2008,[8] is based on the normalization of the concentration of some substances in the tissue, which interferes with the electrical message of sensory nerves. This fact has led to the application of low-intensity laser therapy seen as a method to help reduce pain induced by the orthodontic movement.[9] Therefore, among several treatment alternatives to decrease pain of orthodontic origin, low-intensity laser is cited.[10]

In order to examine the effectiveness of low-intensity laser therapy in the reduction of pain caused by the first orthodontic archwire, Tortamano et al.[11] conducted a pilot study with 60 orthodontic patients, divided into two groups, one under treatment with therapeutic application of laser and a placebo or control group. They found that the group where laser therapy was applied presented lower values in the scales of pain and pain duration was lower. In another study conducted by Turhani et al.[12] with 76 orthodontic patients, divided in a control group and a group with laser therapy, the perception of pain was evaluated in the first 6, 30 and 54 hours after bonding. It was concluded that the application of low-intensity laser reduces the perception of pain in the first 6 and 30 hours. Fujiyama et al.[13] performed a study with 90 patients (also divided in 2 groups: control group and low-intensity CO_2 laser treatment group) in whom separator elastic modules were placed mesial and distal to the first molars. The authors concluded that the application of laser reduces pain perception according to the visual analog scale, without interfering with tooth movement.

Holmberg et al. found that laser can be effective as an adjuvant in the management of pain. However, no significant differences were found.[14] In a study conducted in Brazil on 55 volunteers with fixed orthodontic appliances, divided into four groups called control, placebo, laser and LED; a visual analog scale (VAS) was applied at 2, 24, 48, 72, 96 and 120 hours after the placement of orthodontic appliances.[15] The results indicated that there was no significant difference between the group treated with laser and the group treated with LED in regard to the levels of pain analyzed through the VAS. Traviesas Herrera et al.[16] assessed the reduction of chronic edematous and fibro-edematous gingivitis in a group treated with helium-neon laser compared to another group treated with chlorhexidine. Their results showed a significant decrease in chronic edematous and fibro-edematous gingivitis in both groups, but