AN EFFECT OF THE LOW LEVEL LASER THERAPY (LLLT) IN THE PAIN REDUCTION AFTER THE PRE-BANDING ORTHODONTIC SEPARATION

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ABSTRACT

The aim of the study was to evaluate the efficacy of the Low Level Laser Therapy in the pain reduction in patients undergoing pre-banding orthodontic separation. Thirty orthodontic patients of age 13-32 years were selected; separators placed between the mesial and the distal surfaces of the first molar on the right and the left side. It was a split mouth study where in one quadrant- LLLT (830nm) exposure and in the other quadrant blue light cure (430-490nm) exposure was given. Visual analog scale was used to grade the degree of pain. Results showed that LLLT had a considerable effect on pain reduction after 24 hours compared to the quadrant that was exposed to LED light as placebo. The effect of laser irradiation was less pronounced in females compared to males. The VAS pain assessment scale had a mild variability across the individuals. Even though the study proved the effectiveness of LLLT in pain reduction, we recommend that further studies should be carried out with large sample size along with laser irradiation with increased frequency to support the results of this study. The role of LLLT in pain reduction was proved to be effective and pain reduction by LLLT was much pronounced in males than in females.

KEYWORDS: Orthodontics, Separator & Laser

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INTRODUCTION

During orthodontic treatment, patients experience pain, especially while placing the elastomeric separator¹. The patient often exhibits mild to a great degree of discomfort and pain during treatment. The fear of pain may even discourage them from seeking treatment in few cases^{2,3}. After placement of orthodontic separators, the related areas undergo a painful process triggered by pressure and stress^{4,5}. Pain is subjective and may vary among individuals, studies show that all patients, regardless of age, have reported some degree of pain during treatment^{4,5}. Most of the orthodontists use analgesics or nonsteroidal anti-inflammatory drugs (NASIDS) to reduce pain in an adult patient⁶. Additionally, medications can produce side effects and are contraindicated for allergic patients^{7,8}.

During orthodontic treatment, the type of pain is an inflammatory type, not an infection related pain, it is localised and of short duration. Hence, few authors recommended the use of local analgesics therapy in order to avoid drug regimen. Recent method is to control pain by using low level laser therapy (LLLT). LLLT can modulate the inflammatory process and thus reduce the pain by reducing prostaglandin and interleukin production and henceforth LLLT been proposed as an alternative analgesic in Dentistry⁶⁻¹⁵. Low level light/laser therapy (LLLT) is the application of light (usually delivered via a low power laser or light-Emitting Diode; LED) to promote tissue repair, to reduce inflammation or induce analgesia¹⁶. The aim of this study was to assess pain

perception associated with elastomeric separators with and without a single application of 830nm.

MATERIAL AND METHODS

This study was conducted with 30 volunteers in the age group from 13-32 years of age (15 men, 15women). A written informed consent was obtained from the participants. The following inclusion criteria were adhered to:

- Complete permanent dentition in the maxillary arch
- Good systemic health
- Absence of acute or chronic dental disease
- Absence of periodontal or gum disease
- No consumption of analgesic drugs during the 72 hours preceding the test

Figure 1: Diode Laser (Picasso) with its Accessories

All thirty patients had elastomeric separators placed between the second premolar and first molar (mesial of first molar), and between the first molar and second molar (distal of first molar) ^{7,13 23} in the first and second quadrants. After placement of elastic separators, patients were treated with the laser application and a placebo procedure (**Figure 2**). The first quadrant was exposed to low level laser for 3 seconds while the second quadrant was exposed to blue light for 3 seconds.

Figure 2: Separator being Placed Mesial and Distal Surface of the First Molar

A Diode laser was used for LLLT application in the first quadrant and an LED light cure unit was used to apply light (430-490nm) as placebo in the second quadrant. Quadrants were randomly selected to determine which quadrant in each patient would be irradiated and which (the contra lateral) would serve as the control. The wavelength used for LLLT was 830 nm, with a fluency of 80 J/cm², as recommended by the manufacturer. At the time of laser irradiation, both the patient and the orthodontist wore protective gears in accordance with safety standards.

Three points in the buccal mucosa were irradiated in relation to the participating maxillary first molar, two points in the cervical third – mesial and distal and one in the apical third relating to the apex of roots (**Figure. 3A**). Similar points were irradiated on the palatal mucosa as well. Total time used for single quadrant was 6 minutes. The laser was applied in such a way that it was in direct contact with the mucosa without any pressure. The laser was applied in such a way that it was in contact with the gingival tissue without any pressure during applications.

Figure 3: (a) Low Level Laser Therapy for First Quadrant (b) LED Exposed Side

The same procedure was repeated in the contra lateral quadrant, but with a placebo light (3M LED LIGHT) (**Figure 3b**). A single operator placed the elastic separators and applied the laser and placebo light. All patients were instructed to rate their level of pain experience on a visual analogue scale (VAS). Initial scores were assigned as soon as the patient arrived at the clinic and before any procedure was carried out. Initial score made it feasible to justify whether or not the patient already felt some pain, which was not related to the separation procedure, in the teeth involved in the study. After separation, patients' pain levels were recorded 6 hours, 12 hours and 1, 2 and 3 days following separation. This information was given to the subjects before they started assigning scores on their VAS chart, which patients took home.

RESULTS

Pain perception of the experimental side vs. placebo side (**Figure 4**) the mean VAS pain level reported for the experimental laser side was significantly less than that reported for the control placebo side.

Figure 4: Pain Reduction after LLLT and Placebo in Males and Females

DISCUSSIONS

Different wavelengths can be used in LLLT. The most commonly used are 632.8-, 660-, 780-, 810-, 830, 904 and 980-nm lasers. The laser used in this study was chosen based on a literature review through which it was determined that the 830-nm diode laser appeared to be the one with the greatest analgesic capacity²⁸. The significant reduction in pain by low level light therapy (LLLT) is ascribable to its effect on cellular metabolism. LLLT is proposed to act via mitochondria displacing nitric oxide (NO) from the respiratory chain and increasing levels of adenosine triphosphate (ATP) and reactive oxygen species (ROS). These changes act via intermediaries cyclic adenosine monophosphate (cAMP) and protein kinase D (PKD) to activate transcription factors AP-1 and NF-B resulting in changes in gene expression and subsequent downstream production of chemical messengers implicated in the cellular changes seen following LLLT exposure¹⁷⁻²². Pain is a complex phenomenon with immense individual variability in perception that can be influenced by many external factors, such as the degree of anxiety prior to orthodontic treatment. Some of the patients reported that they perceived as more of a discomfort than a sharp pain, as evidenced by the fact that none of them needed to take drugs for pain. However, at all times, they reported feeling less pain or discomfort on the side where the laser had been applied than on the control side. Previous studies showed that pain on the laser irradiated side was significantly less than that on non-irradiated side²⁴⁻²⁷.

A single application (6 J) of LLLT (808 nm) did not produce significant effects on the perception of pain caused by orthodontic separation. Overall, pain arising from the use of orthodontic pre-banding elastomeric separators was low and transient, and discomfort was reported as relevant only by a minority of patients (18%)²³. In this study, laser group showed a significant pain reduction compared with the control group. This could be attributed to the anti-inflammatory properties and regenerative effect of LLLT on neurons. These effects may be due to the photo proactive reaction that stimulates the proliferation and differentiation of cells. The perception of pain was not significantly different based on age. However, the effect of laser irradiation was more pronounced in male subjects. The frequent low-level laser irradiation

may be an effective way to reduce orthodontic pain during the first day after separator placing.

CONCLUSIONS

The study showed that LLLT had a considerable effect on pain reduction after 24 hours as compared to the quadrant that was exposed to LED light as placebo. The effect of laser irradiation was less pronounced in female compared to male. The VAS pain assessment has a mild variability across individuals. Even though the study proved the effectiveness of LLLT in pain reduction, we recommend, further studies may be carried out with larger sample size along with increased frequency to support the result of this study.

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