LASERS A BOON TO ORTHODONTICS

Dr. Tharun Francis Chungath 1 Dr. Reji Abraham 2 Dr. Chethan 3

1 Final Year PG Student, Deptment Of Orthodontics, Sri Hasanamba Dental College, Vidya nagar ,Hassan, Karanataka, India 2 Head, Department of Orthodontics, Sri Hasanamba Dental College, Vidya nagar ,Hassan, Karanataka, India 3 Reader, Deptment Of Orthodontics, Sri Hasanamba Dental College, Vidya nagar ,Hassan, Karanataka, India.

Address for Correspondence: Dr. Tharun Francis Chungath, Sri Hasanamba Dental College, Vidya nagar ,Hassan, Karanataka, India.
E-mail: thanrunfrancis014@gmail.com

ABSTRACT

A major concern for patients is longer duration time for orthodontic treatment. So they opt for other modalities like veneers and FPD. Continuous researches were carried out to accelerate tooth movement and Low level laser therapy (LLLT) is one of the option. Its non-invasive and accelerate tooth movement by 30%. A thorough knowledge of laser unit, mode of action and key factors to gain therapeutic effects should be known.

KEYWORDS: Low Level Laser Therapy, OTM, Biostimulation.

INTRODUCTION - Sleep Orthodontics has been developing greatly in achieving the desired results both clinically and technically. This is especially so by using new technologies, like stimulation software that can assist in treatment planning and translational products. In addition, continuous modification of wires and brackets as a result of the biomechanical efficiencies in orthodontics has greatly improved. However, these biomechanical systems may have reached their limit and there is a need to develop new methods to accelerate teeth movement.1 One main issue in orthodontics is prolonged treatment time, leading patients, especially adults, to avoid treatment or seek alternative options such as implants or veneers with less than optimal results. Therefore, the search for methods that decrease the treatment duration without compromising the outcome is the main challenge in orthodontic research. Whereas clinician-optimized treatment through careful diagnosis and treatment planning, as well as patient cooperation, can affect treatment duration, the main factor controlling the rate of the tooth movement is the biologic response to the orthodontic forces. But what controls the biologic response is not clearly understood.2

LOW LEVEL LASER THERAPY (LLLT)

The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation". It is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. Lasers differ from other light sources by their coherence which allows them to be focused to a limited spot, to stay narrow over long distances or to have a very narrow spectrum (emitting a single color of light). In medicine, lasers
have many important applications: bloodless surgery, laser healing, surgical treatment, kidney stone treatment, eye treatment and many others. The laser technique has also been widely applied in Dentistry; in orthodontic treatment, it has proved to have many benefits. They can be used to perform gingivectomy, frenectomy, surgical exposure of tooth (with less bleeding and swelling, improved precision, reduced pain and improved healing), enamel etching, bonding, bracket debonding, pain control, treatment of traumatic ulcers in the oral mucosa and to accelerate tooth movement.\textsuperscript{4,5}

Lasers can be classified as low and high-intensity lasers of which main differences are their potency and mechanism of action.\textsuperscript{6} High-intensity lasers, such as the CO2 laser, Nd laser: Yttrium aluminum garnet (Nd:YAG), argon laser, Er:YAG laser, and the excimer laser act by increasing the temperature, showing a destructive potential, and are usually used in surgical procedures. Meanwhile, the low-intensity laser (also known as soft laser, cold laser or laser therapy) does not have a destructive potential. Its photobiomodulation mechanism of action penetrates tissues and stimulates cellular metabolism, bone remodelling and tooth movement which is of greatest interest in Orthodontics.\textsuperscript{7} Different low-energy laser modalities have been used in different doses and in various treatment protocols, including helium-neon (632.8 nm wavelength) and semiconductor lasers (emitting light in the range of 780-950 nm), gallium-aluminum-arsenide (Ga Al As) (805 ± 25 nm wavelength) and gallium-arsenide (904 nm wavelength).\textsuperscript{8} Ga Al As diode laser has been repeatedly used in the past years and has proved to have higher depth of tissue penetration in comparison to other modalities, therefore, providing the clinicians with a suitable penetrative instrument with great efficiency in orthodontic treatment.\textsuperscript{9}

The exact mechanism of laser-cell interaction is still to be investigated. The stimulation of photoreceptors in the mitochondrial respiratory chain, changes in cellular ATP levels and cell membrane stabilization have been discussed.\textsuperscript{10} It has generally accepted that laser effects on cells are wavelength and dose-dependent. The existence of a "window of specificity" at certain wavelengths and energy dosages has been postulated. Molecular absorption of laser light is a prerequisite for any cellular effect.\textsuperscript{11}

Low-level laser therapy (LLLT) stimulates cellular proliferation and differentiation of osteoblast lineage nodule-forming cells, especially in committed precursors, resulting in an increase in the number of differentiated osteoblastic cells as well as in bone formation.\textsuperscript{12} Recent studies\textsuperscript{IL-1, RANKL, M-CSF, MMP-9, cathepsin K, and α(v)β3 integrin were stimulated via their respective pathways during the differentiation of bone cells, and the amount of tooth movement was increased by low-energy laser irradiations showed that low-energy laser irradiation accelerated orthodontic movement of human teeth.\textsuperscript{13,14}

In orthodontics, it can be used for the
1. reduction of post-adjustment pain
2. bone regeneration in the midpalatal suture area after rapid maxillary expansion
3. acceleration of tooth movement

**PROCEDURE**
A 860 nm continuous wave of Ga Al As laser with power output 100 mW, spectral area 0.09 cm², power density 1.11 W/cm², energy dose 2.3 J/point and energy density 25 J/cm²/site was used to irradiate the alveolar mucosa at three points on buccal[1,3,2] and palatal(Fig 1) sides[5,7,6], and two points at the distal [4,8]of the canine. LLLT procedure was applied immediately after spring attachment, and reapplied on the next two days. Exposure was done on 0,3,7,14,21,28 days. (Figure 1)

Discussion

Cruz et al 16 were the first to carry out a study on human over a period of 60 days. Doshi-Mehta 17 evaluated the efficacy of LLLT in reducing orthodontic treatment duration and pain. Laser regimen was applied on days 0, 3, 7, and 14 in the 1st month, and thereafter on every 15th day until complete canine retraction was achieved on the experimental side.

CONCLUSION

Low-intensity laser therapy increases the rate of OTM in a physiologic manner. It causes no side effects on the vitality or the periodontium of the teeth. Low-intensity laser therapy also is an effective method of analgesia during orthodontic treatment or to relieve from pain immediately after placement of separators.

Further studies are required to study the efficacy of LLLT during comprehensive orthodontic treatment for reducing the treatment time, and effect of LLLT on periodontal tissue remodeling during relapse and retention of orthodontically moved teeth.

Figure: 1

1: Probe positioned at the gingival margin of the canine at the buccal side.
2: Probe positioned at 8 mm from the gingival margin of the canine at the buccal side.
3: Probe positioned at 4 mm from the gingival margin of the canine at the buccal side.
4: Probe positioned at the gingival margin of the canine at the distolabial line angle.
5: Probe positioned at the gingival margin of the canine at the palatal side.
6: Probe positioned at 8 mm from the gingival margin of the canine at the palatal side.
7: Probe positioned at 4 mm from the gingival margin of the canine at the palatal side.
8: Probe positioned at the gingival margin of the canine at the distopalatal line angle.

REFERENCES


11. Shimizu n, Yamaguchi m, Goseki t, Shibata y, Takiguchi h, Iwasawa t, et al. Inhibition of prostaglandin e2 and interleukin 1-beta production by low-power laser irradiation in stretched


