Review Article

Indian Journal of Dental Education
Volume 7 Number 1, January - March 2014

Low Level Laser Therapy for Orthodontic Pain: Is it Useful?

Kumar Senthil P.*, Baliga Mohan*

Abstract

This review article was intended to assimilate the existing evidence for low level laser therapy (LLLT) in people with orthodontic pain through an evidence-informed search of literature in PubMed.The existing evidence included one systematic review and nine clinical trials, conducted on a total 332 orthodontic patients and 159 healthy volunteers who were given intra-oral appliances such as elastomeric separators, archwires and minibrackets and were administered LLLT for both short-term and long-term. The limited evidence thus favors the use of LLLT to reduce procedural orthodontic pain in terms of intensity, shortening the pain episode, and higher incidence of complete absence of pain.

Keywords: Orthodontic pain; Orthodontic rehabilitation; Laser therapy; Pain management.

Introduction

This review article was intended to assimilate the existing evidence for low level laser therapy (LLLT) in people with orthodontic pain through an evidence-informed search of literature in PubMed.

Systematic Review

He *et al* performed a systematic review and meta-analysis by searching CENTRAL, PubMed, Embase, Medline, CNKI, and CBM, and identified four RCTs, two quasi-RCTs, and two CCTs from 152 relevant studies, including 641 patients from six countries. The meta-analysis demonstrated that LLLT reduced the risk of pain incidence by 24%, LLLT brought forward "the most painful day," and an earlier end of pain than control group and the pseudo-laser groups.[1]

Clinical Trials

Bicakci *et al* evaluated levels of prostaglandin-E(2) (PGE(2) ingingival crevicular fluid (GCF) to investigate the effect of low-level laser therapy (LLLT) on reducing post-adjustment orthodontic painin 19 patients and randomly selectedfirst molar at one side was irradiated (ë820 nm; continuous wave; output power: 50 mW; focal spot: 0.0314 cm(2); exposure duration: 5 sec; power density: 1.59 W/cm(2); energy dose: 0.25 J; energy density: 7.96 J/cm(2) for each shot), while the other side molar was served as placebo control.The laser group had significant reductioninPGE(2) levels 24 h after application.[2]

Domínguezand Velásquez [3] evaluated the efficacy of GaAlAs laser light to reduce pain in 60 patients of whom 30 patients were treated with mini brackets Equilibrium(®) (Dentaurum, Ispringen, Germany) and 30 with self-ligation In-Ovation C(®) (GAC/Dentsply, Tokyo, Japan) slot 0.022 inch brackets. In a divided mouth design, the dental arches were randomly assigned to receive one dental arch irradiation with 830 nm 100mW therapeutic laser (Photon Lase II), for 22 sec 2.2 J, 80 J/cm(2)) along the vestibular surface and 22 sec

Author's Affilation: *Professor, Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation (Maharishi Markandeshwar Universtiy), Mullana - Ambala, Haryana, **Professor and Head, Dept. of Oral and Maxillofacial Surgery, Manipal College of Dental Sciences (Manipal University), Mangalore, Karnataka, India.

Reprints Requests: Senthil P. Kumar, Professor, Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation (Maharishi Markandeshwar University), Mullana - Ambala, Haryana, India.

E-mail: senthilparamasivamkumar@gmail.com

(2.2 J, 80 J/cm(2)) along the palatal surface of the root in the randomly selected arch. Sham laser was given to the opposite dental arch.The LLLT application reduced pain which was time-independent and irrespective of any kind of bracket.

Doshi-Mehta and Bhad-Patil evaluated the efficacy of low-intensity laser therapy in reducing orthodontic treatment duration and pain in 20 patients requiring extraction of first premolars who were randomly assigned by incomplete block split-mouth design where the experimental side received infrared radiation from a semiconductor (aluminium gallium arsenide) diode laser with a wavelength of 810 nm. The laser regimen was applied on days 0, 3, 7, and 14 in the first month, and thereafter on every 15th day until complete canine retraction was achieved on the experimental side. An average increase of 30% in the rate of tooth movement was observed with the low-intensity laser therapy. Pain scores on the experimental sides were also much lower compared with the control sides.[4]

Eslamian *et al* assessed the effect of 810-nm continuous wave low-level laser therapy (LLLT) on the pain caused by orthodontic elastomeric separators in 37orthodontic patients. Four elastomeric separators (Dentarum, Springen, Germany) were placed for the first permanent molars (distal and mesial), either for maxillary (22 patients) or mandibular (15 patients) arches; and one quadrant was randomly given placebo.The patients received 10 doses (2 J/cm(2), 100 mW, 20 s) of laser irradiation on the buccal side (at the cervical third of the roots), for distal and mesial of the second premolars and first permanent molars, as well as distal of second permanent molars (five doses). Significant differences in the pain perception (PP) were found between the laser and placebo groups at 6, 24, 30 h, and day 3 of the experiment. The 810-nm continuous wave LLLT significantly reduced the pain perception at 6h, 24h, 30h and day 3 after orthodontic separation procedures.[5]

Lim *et al* studied 39 volunteers on whom elastomeric separators were placed to induce orthodontic pain. The tip of a 30 mW gallium-arsenide-aluminium (830 nm) diode laser probe was then placed at the buccal gingiva and directed at the middle third of the root. Three different treatment durations of 15, 30, and 60 seconds and one placebo treatment of 30 seconds were tested within each subject. Between-group differences were noted for change in pain scores for laser compared to placebo, without within-subject differences.[6]

Marini *et al* studied 120 subjects with experimentally induced orthodontic pain who were randomly assigned to upper (U, N = 60) or lower (L, N = 60) jaw groups. The subjects received 4 elastomeric separators medial and distal to the upper (U group) or lower (L group) right first molar and bicuspids. Each subject of the U and L groups was randomly assigned to laser, placebo or control sub-groups. Subjects in laser groups received a single GaAs diode SLLLT application (910 nm, 160 mW, beam diameter of 8 mm, applied for 340 s) immediately after placing orthodontic separators. Placebo groups received a simulated SLLLT and controls did not receive any therapy. The laser group was found to have lower pain intensity and earlier end of pain episode, compared to placebo and control groups.[7]

Nóbrega *et al* evaluated the effectiveness of the use of LLLT using wavelength 830 nm, for treating pain inherent to tooth movement caused by positioning interdental elastomeric separators in 60 orthodontic patients who were randomly assigned to two groups: GAwas the control, and GBthe intervention group.The intervention group (GB) received irradiation with LLLT (aluminum gallium arsenide diode), by a single spot in the region of the radicular apex at a dose of 2 J/cm(2) and application along the radicular axis of the buccal surface with three spots of 1 J/cm(2) (wavelength 830 nm; infrared). Control group (GA) received irradiation with a placebo light in the same way. The patients in the intervention group (LLLT) had lower mean pain scores and higher incidence of complete absence of pain.[8]

Tortamano *et al* evaluated the effect of LLLT for reducing pain placement of first

orthodontic archwires in 60 orthodontic patients who had fixed orthodontic appliances placed in 1 dental arch (maxillary or mandibular), received the first archwire, and were then randomly assigned to the experimental (laser), placebo, or control group. Each tooth received a dose of 2.5 J per square centimeter on each side (buccal and lingual). The placebo group had the laser probe positioned into the mouth at the same areas overlying the dental root and could hear a sound every 10 seconds. The control group had no laser intervention. The patients in the LLLT group had lower mean scores for oral pain and intensity of pain on the most painful day, with sooner ending of pain episode.[9]

Turhani *et al* analyzed the effect of single LLLT irradiation on pain perception in 76 patients having fixed appliance treatment who were assigned to 2 groups: group 1 received a single course of LLLT (Mini Laser 2075, Helbo Photodynamic Systems GmbH & Co KG, Linz, Austria; wavelength 670 nm, power output 75 mW) for 30 seconds per banded tooth; and group 2 received placebo laser therapy without active laser irradiation. The number of patients reporting pain at 6 hours was significantly lower in G1 than in G2, which persisted at 30 hours.[10]

The existing evidence included one systematic review and nine clinical trials, conducted on a total 332 orthodontic patients and 159 healthy volunteers who were given intra-oral appliances such as elastomeric separators, archwires and minibrackets and were administered LLLT for both short-term and long-term. The limited evidence thus favors the use of LLLT to reduce procedural orthodontic pain in terms of intensity, shortening the pain episode, and higher incidence of complete absence of pain.

References

1. He WL, Li CJ, Liu ZP, Sun JF, Hu ZA, Yin X, *et al*. Efficacy of low-level laser therapy in the management of orthodontic pain: a systematic review and meta-analysis. *Lasers Med Sci*. 2012 Sep 22. [Epub ahead of print]
2. Bicakci AA, Kocoglu-Altan B, Toker H, Mutaf I, Sumer Z. Efficiency of low-level laser therapy in reducing pain induced by orthodontic forces. *Photomed Laser Surg*. 2012; 30(8): 460-5.
3. Domínguez A, Velásquez SA. Effect of low-level laser therapy on pain following activation of orthodontic final archwires: a randomized controlled clinical trial. *Photomed Laser Surg*. 2013; 31(1): 36-40.
4. Doshi-Mehta G, Bhad-Patil WA. Efficacy of low-intensity laser therapy in reducing treatment time and orthodontic pain: a clinical investigation. *Am J Orthod Dentofacial Orthop*. 2012; 141(3): 289-97.
5. Eslamian L, Borzabadi-Farahani A, Hassanzadeh-Azhiri A, Badiee MR, Fekrazad R. The effect of 810-nm low-level laser therapy on pain caused by orthodontic elastomeric separators. *Lasers Med Sci*. 2013 Jan 20. [Epub ahead of print]
6. Lim HM, Lew KK, Tay DK. A clinical investigation of the efficacy of low level laser therapy in reducing orthodontic postadjustment pain. *Am J Orthod Dentofacial Orthop*. 1995; 108(6): 614-22.
7. Marini I, Bartolucci ML, Bortolotti F, Innocenti G, Gatto MR, Alessandri Bonetti G. The effect of diode superpulsed low-level laser therapy on experimental orthodontic pain caused by elastomeric separators: a randomized controlled clinical trial. *Lasers Med Sci*. 2013 May 11. [Epub ahead of print]
8. Nóbrega C, da Silva EM, de Macedo CR. Low-level laser therapy for treatment of pain associated with orthodontic elastomeric separator placement: a placebo-controlled randomized double-blind clinical trial. *Photomed Laser Surg*. 2013; 31(1): 10-6.
9. Tortamano A, Lenzi DC, Haddad AC, Bottino MC, Dominguez GC, Vigorito JW. Low-level laser therapy for pain caused by placement of the first orthodontic archwire: a randomized clinical trial. *Am J Orthod Dentofacial Orthop*. 2009; 136(5): 662-7.
10. Turhani D, Scheriau M, Kapral D, Benesch T, Jonke E, Bantleon HP. Pain relief by single low-level laser irradiation in orthodontic patients undergoing fixed appliance therapy. *Am J Orthod Dentofacial Orthop*. 2006; 130(3): 371-7.