



## COMPARATIVE EVALUATION OF THE INFLUENCE OF DIFFERENT LASER MODALITIES ON POST ENDODONTIC PAIN FOLLOWING A SINGLE VISIT RCT.

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### Abstract

The purpose of this in vivo study was to compare the efficacy of different laser modalities on post endodontic pain after a single visit root canal treatment.

**Aim:** To evaluate and compare the influence of different laser modalities on Post endodontic pain (PEP) following a single visit RCT.

**Materials and Methods:** Thirty molars with symptomatic apical periodontitis were divided into three groups (n=10). The first group was mock laser or placebo group (ML), with normal root canal treatment and mock laser intervention (ML group). The second group was provided photobiostimulation in the periapical region (PBS). The third group got Laser-activated irrigation (LAI). Postoperative pain was recorded using visual analogue scale (VAS) after 24, 48 and 72 hours.

**Result:** All the three groups showed reduction in their pain scores over the time, with statistically significant reduction found after 48 hours duration (p=0.007) and 72 hours duration (p=0.004).

**Conclusion:** Laser stimulation had a positive effect on Post Endodontic pain (PEP). Minimum PEP was seen in patients in which lasers were used for Canal Disinfection, which was better than Periapical Biostimulation (PBS). However, it was found to be statistically not significant. Canal Disinfection activated using laser therapy was as effective as conventional irrigation in relation to postoperative pain. This study proved that laser therapy can be an effective alternative for the conventional use of nonsteroidal anti-inflammatory drugs in controlling postendodontic pain thereby eliminating the adverse effects of such drugs on the patients.

**Keywords:** Post endodontic pain, Photobiostimulation, LASER, VAS scale.

## Introduction

Post-endodontic pain (PEP) control is one of the main targeted areas of concern in endodontics. The term "post-endodontic pain" (PEP) refers to any level of discomfort that develops following the commencement of root canal therapy (RCT). Acute inflammatory responses in the periradicular tissues are typically the cause of PEP development. It commences within few hours or days after the treatment.<sup>[1]</sup> Acute inflammatory responses in the periradicular tissues caused by inflammatory mediators generated by mechanical, chemical, and microbiological damage to the pulp or periradicular tissues, which are made worse during root canal therapy, are typically the cause of postoperative discomfort.<sup>[2]</sup>

These mediators activate sensitive nociceptors and lead to central and peripheral hyperalgesia mechanisms.<sup>[3]</sup> The therapeutic properties of lasers, such as tissue repair, regulation of inflammatory processes, and analgesia in acute and chronic pain, as well as improvement of local microcirculation aids in reduction of PEP.<sup>[4]</sup> The advantages of the laser make it a viable treatment option for endodontics because of its ability to remove smear layers, minimize germs, and reduce apical leaking.<sup>[5,6]</sup> Our aim was to compare different laser treatment modalities of pain control on Post endodontic pain after endodontic treatment.

## Material and methods

For this in vivo study, thirty patients having molars with symptomatic apical periodontitis were chosen. The teeth which had Periapical radiolucency of not more than 2 mm, teeth with no history of RCT and teeth with no pus or inflammatory exudate draining out of the canal along with sound periodontal apparatus, were included. All teeth with defects, open apices, patients with systemic diseases and who have taken analgesic at least 6 hours prior were excluded.

After a routine coronal access, biomechanical preparation was carried out. Canals were irrigated using 30 G side-vented needles with sterile saline and 2 ml of 2.5% NaOCl. The final irrigation was performed using 1.5 ml of 17% EDTA followed by 1.5 ml of normal Saline. The Epic X Biolase Laser was used for this study. It utilizes a solid-state diode as a semiconductor source for invisible infrared radiation.

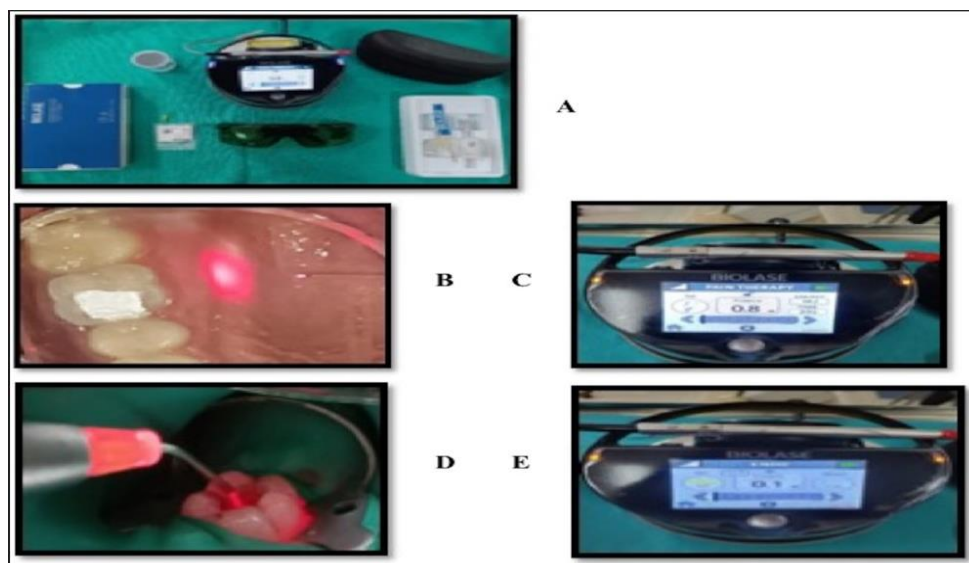
In Group 1 (Mock Laser [ML] / placebo), Normal root canal treatment and mock laser intervention after obturation was done. The patient was recalled after 48 hours for postendodontic restoration and were asked to rate the postoperative pain using visual analogue scale (VAS) after 24, 48, and 72 hours.

In Group 2 (photobiostimulation in the periapical region), laser therapy was performed after obturation and temporary restoration. The laser tip was applied to both buccal and lingual/palatal mucosa at the right angle to the mucosa. Laser specifications: semiconductor diode laser was used with a wavelength of  $940 \pm \text{nm}$  at  $70 \text{ J/cm}^2$  at 0.8 W at continuous mode for 2 intervals of 20 seconds each with a gap of 5 seconds in between each interval on each individual root apex. The end of the fiber was kept 10 mm away from the tissue. The patient was recalled after 48 hours for post-endodontic restoration. They were asked to rate the postoperative pain using visual analogue scale (VAS) after 24, 48 and 72 hours.

In Group 3 (Laser-activated irrigation (LAI)/ Canal Disinfection activated using laser therapy ,after instrumentation, the laser tip was placed 1 mm short of working length in the wet canal moving from

the orifice to the apex. The tip was withdrawn in a circular motion. This step was repeated four times per canal at intervals of 10 seconds between each activation. Laser specifications: semiconductor diode laser was used with a wavelength of  $940 \pm \text{nm}$  at 0.1 W in continuous mode. Obturation and temporary filling material was placed and the patient was recalled after 48 hours for post-endodontic restoration. Visual analogue scale (VAS) scores after 24, 48 and 72 hours were recorded.

**Figure 1:** A) Epic X Biolase Laser. B) and C) Photobiostimulation in the periapical region. D) and E) Canal Disinfection activated using laser / Laser-activated irrigation.



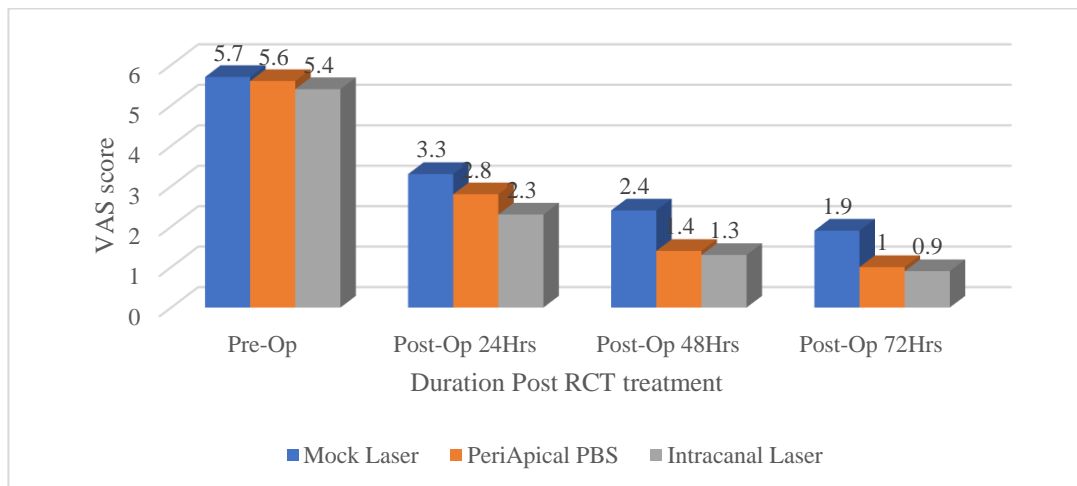
## Result

All the groups showed a reduction in pain scores over time. Statistically significant reduction was found after 48 hours duration ( $p=0.007$ ) and 72 hours duration ( $p=0.004$ ). Laser-activated irrigation (LAI) is superior to Photobiostimulation(PBS)and Mock laser(ML) group after 24 hours, while after 48 hours, both LAI and Photobiostimulation were equally effective, when compared to ML group. (Table 1).

Periapical Photobiostimulation showed significant reduction after 48 hours of therapy, and when no laser was used, the VAS score reduced significantly post 72 hours of the treatment. The VAS score reduction was almost similar in intracanal disinfection and periapical laser after 24, 48 and 72 hours ( $p > 0.05$ ) (Graph 1).

**Table 1:** Mean and SD of pain score over time duration.

Groups		Pre Op (1)	Post-Op24 (2)	Post-Op 48 (3)	Post-Op72 (4)	Intragroup Comparison
Mock Laser (N=10)	Mean $\pm$ Sd	5.7 $\pm$ 1.16	3.3 $\pm$ 1.06	2.4 $\pm$ 0.7	1.9 $\pm$ 0.57	1>2>3>*4
PeriApical PBS (N=10)	Mean $\pm$ Sd	5.6 $\pm$ 1.174	2.8 $\pm$ 0.632	1.4 $\pm$ 0.84	1.0 $\pm$ 0.66	1>2>*3>4
Light activated laser LAI (N=10)	Mean $\pm$ Sd	5.41 $\pm$ 1.337	2.3 $\pm$ 1.418	1.3 $\pm$ 0.823	0.9 $\pm$ 0.738	1>*2>3>4
Total (N=30)	Mean $\pm$ Sd	5.53 $\pm$ 1.196	2.8 $\pm$ 1.124	1.7 $\pm$ 0.91	1.27 $\pm$ 0.78	1>2>*3>4
Significance level		0.752	0.139	0.007	0.004	
Intergroup Comparison		NS Difference	C<*A, (0.042) B & C NS	C<*A, (0.012) B<*A, (0.023) B & C NS	C<*A, (0.007) B<*A, (0.014) B & C NS	



**Graph 1- Comparison of VAS Scores under various treatment modalities post-endodontically.**

### Discussion

The control of postoperative pain is a golden target with miscellaneous tactics to achieve as it is a frequent sequelae after endodontic treatment.<sup>[7, 8]</sup> Laser act on the biostimulation because of the increase in the production of mitochondrial ATP, increasing the threshold of the free nerve endings, providing an analgesic effect due to an increase of  $\beta$ -endorphine in the cephalorrhachidian liquid,<sup>[1]</sup> repolarization of the cell membrane and the synthesis of ATP tends to cause biostimulation. Because the cyclooxygenase enzyme is inhibited, the conversion of arachidonic acid to prostaglandin is delayed, resulting in a reduction of discomfort.<sup>[1, 9]</sup>

They inhibit the concentration of acetylcholine, a pain mediator, cause vasodilatation and increase blood flow to tissues.<sup>[1, 10]</sup> This causes better circulation, which leads to a decrease in edema by increasing lymph drainage, tends to remove the pressure on nerve endings, resulting in decrease sensitivity of pain receptors as well as transmission of impulses. Neuronal hyperpolarization is brought on by a decrease in  $\text{Na}^+$  and  $\text{K}^+$  cell membrane permeability, which raises the pain threshold.<sup>[1, 9]</sup>

Laser-activated irrigation (LAI) aids in removal of debris and smear layer using chemo mechanical preparation.<sup>[1]</sup> Since the size of the dentinal tubules progressively decreases apically, the penetration of the irrigant becomes restricted.<sup>[3, 11]</sup> The laser light has minimal dispersion and so increased local intensity, resulting in improved antibacterial activity. In the unaltered area, a diode laser produces a thermal photo disruptive action, leading to an improved root canal dentin bactericidal action.<sup>[4, 11]</sup> Diode laser compounded with a fiber optic tip could provide greater accessibility to unreachable parts with its inherent properties of light scattering, local intensity enhancement, and attenuation allows light penetration deeper in the dentin tubules, resulting in the superior bactericidal effect in the root canal dentin.<sup>[1, 12]</sup>

### Conclusion

Laser stimulation had a positive effect on PEP. Minimum PEP was seen in patients in which lasers were used for canal disinfection which was better than Periapical Biostimulation. However, it was found to be statistically not significant. Canal Disinfection activated using laser therapy was as effective as conventional irrigation in relation to postoperative pain.

The recent developments in laser technology and better understanding of bio-interactions of different laser systems have broadened new horizons for clinical use of laser in contemporary endodontics.

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