

Comparative Study of Effects of LASER, TENS, and Anesthetic Gel for Controlling Pain after Placement of Elastomeric Separators: A Clinical Trial

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ABSTRACT

Aim: This study aimed to study the intensity and duration of patients' pain perception after placement of elastomeric separators and the effects of various methods to reduce the pain.

Materials and methods: Elastomeric separators were placed on either side of first molars in 120 patients which were divided into 4 groups. Patients in group I were control group, group II underwent low-level LASER therapy, group III were subjected to topical anesthetic gel, and group IV underwent TENS (transcutaneous electric nerve stimulation). And then they were asked to measure pain using a visual analog scale (VAS) at 5 intervals of time, i.e., immediately after separator placement, after day 1, day 2, day 3, and day 4.

Results: Turkey's *post hoc* test showed that pain score after immediate placement of separators was found to be the least in the anesthetic gel than that in other groups and pain score was least in the LASER group out of all four groups on day 1, 2, 3, and 4.

Conclusion: It was found that low-level LASER therapy was more effective in reducing pain after placement of elastomeric separators.

Keywords: Anesthetic gel, Low-level LASER, Transcutaneous electric nerve stimulation, Visual analog scale.

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INTRODUCTION

Pain can be defined as an unpleasant experience of emotion that begins with a noxious stimulus and it is transmitted toward the specialized neural network and ultimately to the central nervous system.¹

Thereafter, a series of self-limiting inflammatory reactions occur that involves various reactions such as cellular, vascular, neural, and immunological. These reactions finally lead to orthodontic pain as well as tooth movement. Various products released due to local inflammation such as prostaglandin and bradykinin has an impact on sensory endings which begins painful sensations.²⁻⁴

Every orthodontic procedure, right from placing the separators, archwire placement and activations, applying orthopedic forces as well as debonding procedure induces pain in the patients.⁵

However, we chose to study the pain perception after placing the elastomeric separators.

It is required to create some space both mesially and distally to teeth, before banding it, in pediatric dentistry as well as fixed orthodontic mechanotherapy. We are familiar with the fact that placement of orthodontic separators generates painful stimuli for almost all patients whether it is made of brass wire, elastics, steel, or latex.⁶

The current study attempts to assemble literature regarding pain that already exists. This study appears to be addressing the questions that may occur during dental treatment as per the belief of clinicians and patients/parents. Additionally, this study provides an outline of the contemporary strategic direction employed to relieve dental pain.

Therefore, this study compares the effectiveness of anesthetic gel, transcutaneous electric nerve stimulation (TENS), and low-level LASER therapy for pain control, after placing the elastomeric separators.

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MATERIALS AND METHODS

A randomized, double-blinded controlled trial was conducted with a total of 130 patients with a mean age of 18.04 ± 3.4 years which were arranged to receive fixed orthodontic treatment at the Department of Orthodontics and Dentofacial Orthopaedics, Manubhai Dental College, Vadodara, India.

Out of 130 patients, 10 patients were excluded as they did not match the inclusion criteria which are shown in Table 1. Hence, 120 patients, out of which, 47 were males and 73 were females, were randomly divided into 4 groups.

- Group I—control group.
- Group II—low-level LASER group.
- Group III—topical anesthetic gel group.
- Group IV—TENS group.

Table 1: Inclusion and exclusion criteria

<i>Inclusion criteria</i>	<i>Exclusion criteria</i>
All four first permanent molars present	Spacing in the posterior segment
With adjacent 2nd premolar and 2nd permanent molar in all quadrant	Congenitally missing posterior teeth
No history of previous orthodontic treatment	Incomplete eruption of 2nd molars
No caries or restorations on posterior teeth	Missing 1st molars
Tight interproximal contacts and age group of 11–32 years	Severely rotated 1st or 2nd molars

0–10 numeric pain rating scale

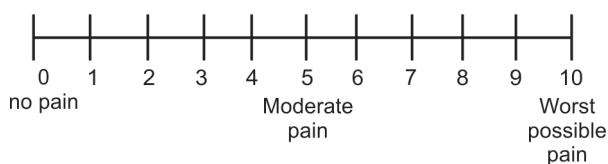


Fig. 1: Visual analog scale



Fig. 3: Transcutaneous electric nerve stimulation using 2 electrodes

The patients were instructed to quantify the discomfort/pain with the help of a visual analog scale (VAS) (Fig. 1), noting the intensity on a scale of 0 to 10 according to the participant's self-perception, where 0 indicated "no pain or discomfort" and 10 indicated "unbearable pain". This evaluation was done after separator placement at the following times, i.e., after 5 minutes (T0), 24 hours (T1), 48 hours (T2), 72 hours (T3), and 96 hours (T4). The marking the patient made on the VAS was measured and recorded in millimeters (10 mm).

The elastomeric separators (Captain ortho, India) were inserted mesially and distally of the first permanent molars in all the quadrants on day 1 with the help of separator placing pliers (CAT, India).

Subjects of group I were kept as a control group in which patients neither undergo any procedures like LASER, TENS, or



Fig. 2: Low-level LASER therapy using a diode LASER

anesthetic gel and nor took any analgesics after placement of the elastomeric separators.

After 5 minutes of separator placement, subjects of group II underwent low-level laser therapy using soft tissue diode LASER (Picasso, Dentsply, Sirona, USA) at 3 points on the buccal mucosa for 20 seconds each in first visit in each quadrant with an 830-nm gallium-aluminum-arsenic diode laser on continuous mode and power set at 200 mW on non-contact mode (Fig. 2).⁷

Subjects of group III were subjected to topical anesthetic gel (20% benzocaine) (Mucopain, Benzocaine 20%, ICPA health products, India) which was applied by the operator using an applicator tip on buccal attached gingiva and embrasure of the first molars of each quadrant.

The gel was applied to the buccal mucosa on the attached gingiva in relation to the first molars, covering an area of about 1.5 cm in diameter for 4 minutes.

Subjects of group IV underwent TENS therapy. The frequency and intensity were set at 0.8 Hz and 50 mA, respectively. First molars on both sides of the arch, i.e., buccal and lingual/palatal experienced 6 seconds of current. The study comprised the use of two internal electrodes. Out of them, one was placed on the occlusal surface of each tooth and the other one over the palatal mucosa or buccal mucosa besides the tooth (Fig. 3).⁸

RESULTS

Turkey's *post hoc* test (Table 2) shows that immediately after placement of the separators, the VAS score noted in the anesthetic gel group was least as compared to TENS, LASER, and anesthetic gel groups and the VAS score was significantly less in anesthetic gel group than that in TENS group by 1.57 and control group by 2.97 and that was statistically significant ($p \leq 0.001$) (Table 2).

On day 1, VAS scores in the LASER group were less than that other 3 groups and were less in the control group by 1.83 which was statistically significant ($p \leq 0.001$) (Table 2). On day 2, VAS scores in the LASER group were less than the other 3 groups and was significantly less than that in the anesthetic gel by 2.23 and that was statistically significant ($p \leq 0.001$) (Table 2). On day 3, the VAS score was found to be least in the LASER group compared to that in other groups but was not statistically significant (Table 2). On day 4, VAS pain scores in the LASER group were less than the

Table 2: Tukey's *post hoc* test for comparing the VAS score between the groups

Dependent variable	Group	Group	Mean difference	p value
Immediate pain	Group I (control)	Anesthetic gel	2.97	*<0.001
		LASER	2.53	*<0.001
		TENS	1.40	0.001
	Group II (LASER)	Anesthetic gel	0.43	0.615
		Control	-2.53	*<0.001
		TENS	-1.13	0.010
	Group III (anesthetic gel)	LASER	-0.43	0.615
		Control	-2.97	*<0.001
		TENS	-1.57	*<0.001
	Group IV (TENS)	Anesthetic gel	1.57	*<0.001
		LASER	1.13	0.010
		Control	-1.40	*0.001
Pain on day 1	Group I (control)	Anesthetic gel	1.13	0.061
		LASER	1.83	*<0.001
		TENS	1.20	0.042
	Group II (LASER)	Anesthetic gel	-0.70	0.405
		Control	-1.83	*<0.001
		TENS	-0.63	0.495
	Group III (anesthetic gel)	LASER	0.70	0.405
		Control	-1.13	0.061
		TENS	0.07	0.999
	Group IV (TENS)	Anesthetic gel	-0.07	0.999
		LASER	0.63	0.495
		Control	-1.20	0.042
Pain on day 2	Group I (control)	Anesthetic gel	-1.03	0.078
		LASER	1.20	0.029
		TENS	0.13	0.989
	Group II (LASER)	Anesthetic gel	-2.23	*<0.001
		Control	-1.20	0.029
		TENS	-1.07	0.065
	Group III (anesthetic gel)	LASER	2.23	*<0.001
		Control	1.03	0.078
		TENS	1.17	0.036
	Group IV (TENS)	Anesthetic gel	-1.17	0.036
		LASER	1.07	0.065
		Control	-0.13	0.989
Pain on day 3	Group I (control)	Anesthetic gel	-0.13	0.983
		LASER	1.03	0.029
		TENS	0.37	0.750
	Group II (LASER)	Anesthetic gel	-1.17	0.010
		Control	-1.03	0.029
		TENS	-0.67	0.270
	Group III (anesthetic gel)	LASER	1.17	0.010
		Control	0.13	0.983
		TENS	0.50	0.524
	Group IV (TENS)	Anesthetic gel	-0.50	0.524
		LASER	0.67	0.270
		Control	-0.37	0.750
Pain on day 4	Group I (control)	Anesthetic gel	-0.53	0.357
		LASER	0.73	0.113
		TENS	0.37	0.671

Contd...

Contd...

Dependent variable	Group	Mean difference	p value
Group II (LASER)	Anesthetic gel	-1.27	*0.001
	Control	-0.73	0.113
	TENS	-0.37	0.671
Group III (anesthetic gel)	LASER	1.27	*0.001
	Control	0.53	0.357
	TENS	0.90	0.032
Group IV (TENS)	Anesthetic gel	-0.90	0.032
	LASER	0.37	0.671
	Control	-0.37	0.671

*Statistically significant

other 3 groups and were significantly less than that in the anesthetic gel by 1.27 and it was statistically significant ($p \leq 0.001$) (Table 2).

DISCUSSION

In the present study, a technique to measure discomfort/pain was VAS. Huskisson⁹ in his study found that most patients with pain understand the concept of the VAS scale and can quickly make the measurement. In this study, the average age of subjects was 18 ± 3 years. In one of the studies which utilize VAS, Ngan et al.⁶ did not find any statistically significant difference in relation to pain perception whether the subject is an adolescent or an adult.

In the control group, maximum VAS score was observed immediately after placing the separators as compared to TENS, LASER, and anesthetic gel group which did not reduce much till day 1 as shown in Table 1. Then, after first day, the VAS score reduced consistently till the fourth day as shown in Table 1. Our results regarding the pain perception are in accordance with the results of Bergius et al.,¹⁰ who noticed that after placing the elastomeric separators, the maximum pain intensity remains for 1 day.

The VAS score in the LASER group immediately after placement of elastomeric separators and after day 1 was less than that in the control group and it was statistically significant ($p \leq 0.001$) which reduced consistently till day 4 (Table 1).

Findings similar to our study were found by Eslamian et al.,¹¹ who showed that low-level LASER therapy was efficacious in decreasing the pain after placing the elastomeric separators within the first 3 days in comparison to the control group.

In our study, the VAS score in the anesthetic group was least after immediate placement of separators as compared to the LASER, TENS, and control group and it was statistically significant ($p \leq 0.001$) as shown in Table 1. The VAS score increased significantly after day 1 and continued to increase till day 2 and then it reduced consistently after day 2 till day 4.

The use of topical anesthetics is commonly found in various dental procedures to reduce discomfort and pain. For an instance, one of the studies concluded that the use of wax which contains benzocaine to relieve irritation in oral mucosa was found to be more effective viz unmedicated wax; and also it was instantly effective, as its anesthetic effect remained maintained with time because its application was prescribed 6 hourly.¹² However, in our study, it was a single application after immediate placement of the separators.

In our study, in the TENS group, the immediate VAS score was more than that in comparison to LASER and anesthetic gel group which was not statistically significant till day 1, then reduced significantly after day 1 and gradually reduced thereafter from day 2–3 as shown values (Table 1). Roth and Thrash⁸ in their study

proposed that there was a significant amount of reduction in pain in those individuals which represented the TENS group at the 24-, 36-, and 48-hour evaluation time in comparison to either the placebo or control group. Similarly, in our study, it was found that VAS score reduced immediately after placement of separators and consistently reduced in comparison to the control group, though was not statistically significant.

CONCLUSION

- From this study, it can be concluded that the low-level LASER therapy has a more profound effect in controlling pain as compared to TENS, anesthetic gel, and control group, over some time.
- The topical anesthetic gel was found to be more effective in reducing pain immediately after placing the elastomeric separators as compared to the LASER, TENS, and control groups. But as the single dose was used in this study the pain did not reduce after day 1. Hence, frequent application of anesthetic gel can be suggested as an effective way in reducing pain consistently after placement of the elastomeric separators.
- The patients in the TENS group showed a consistent reduction in pain perception after immediate placement of the separators till day 4 as compared to the control group but was not statistically significant.
- There was no difference found between the pain perception between males and females.
- After the second day of placement of the separators, orthodontic pain was found to be reduced consistently in all four groups, i.e., LASER, TENS, anesthetic gel, and control group.

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