Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 32s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Efficacy Of Low-Level Laser Therapy To Reduce Intensity Of Pain In Fixed Orthodontic Treatment-A Prospective Study

Dr. Naziya Kauser[1], Dr. Saurabh Rastogi[2], Dr. Piyush sharma[3], Dr. Aslam Hisam Qasmi[4], Dr. Navneet Baranwal[5], Dr. Avinash Jaiswal[6]

[1]PG 3rd yr, Department of Orthodontics & Orofacial Orthopedics, Dental college azamgarh

[2]Professor head of department,Department of Orthodontics & Orofacial Orthopedics, Dental college azamgarh.

[3]Professor,Department of Orthodontics & Orofacial Orthopedics,Dental college azamgarh.

[4]Asstt professor,Department of orthodontics and dentofacial orthopaedics. Dental College. Azamgarh.

[5]PG 1st yr,Department of Orthodontics & Orofacial Orthopedics, Dental college azamgarh.

[6]Associate Professor,Department of Orthodontics & Orofacial Orthopedics, Dental college azamgarh

[*]**Corresponding author:**

Dr. Avinash Jaiswal
Associate Professor, Department of Orthodontics & Orofacial Orthopedics,Dental college azamgarh

Cite this paper as: Dr. Naziya Kauser, Dr. Saurabh Rastogi, Dr. Piyush sharma, Dr. Aslam Hisam Qasmi, Dr. Navneet Baranwal, Dr. Avinash Jaiswal (2025) Efficacy Of Low-Level Laser Therapy To Reduce Intensity Of Pain In Fixed Orthodontic Treatment-A Prospective Study. *Journal of Neonatal Surgery*, 14 (32s), 6079-6088.

ABSTRACT

Introduction: Pain and discomfort frequently arise as complications during fixed orthodontic treatment. Low-level laser therapy has previously been introduced as an alternative approach for alleviating orthodontic pain. Hence the present clinical prospective cohort study evaluates the effect of using LLLT & lidocaine in reducing intensity of pain in fixed orthodontic treatment ie elastomeric separators and initial archwire.

Materials & methods: A total sample of 85 patients (12-26 years) who needed fixed Orthodontic appliance placed, In the first quadrant, LLLT and lignocaine gel in combination was used. In the second quadrant, only the anesthetic was used. Third quadrant as placebo. In the fourth quadrant, only the LLLT. Pain Evaluation via VAS. The participants were being followed up at 6, 24, 48 and 72 hours. After elastomeric separator were removed bonding done and initial archwire was given, laser irradiation was done in upper maxillary arch and control in lower mandibular arch and pain values were recorded.

Results: Moderate pain was in L+A group, severe pain in control group (14%). Initial arch wire was given, NRS scale and VNS scale at 6 hrs where control group experienced worst pain when compared to laser group. At 24 hrs moderate level of pain in control group and no pain in laser group. In 48 hrs mild pain was seen in laser group and moderate in control group. In 72 hrs no pain was felt in laser group and higher in control group.

Conclusion: LLLT with anesthetic gel proved to effective in reduction in spontaneous, chewing pain with patient satisfaction after the application of Orthodontic forces

Keywords: Low level laser therapy, Anesthetic gel, Orthodontic forces, Pain, Separators

1. INTRODUCTION

During active orthodontic treatment with fixed appliances, pain and discomfort are common complications. Another strategy for reducing orthodontic pain has been the introduction of low-level laser therapy (LLLT). Current clinical prospective cohort study thus assesses the impact of lidocaine and low-level laser therapy in lowering severity of discomfort in fixed orthodontic treatment, such as initial archwire and elastomeric separators.

During orthodontic operations, pharmacological interventions are important for managing pain. Efficacy of non-steroidal anti-inflammatory drugs (NSAIDs) in reducing pain was evaluated in meta-analysis study by Angelopoulou et al.1-3

Effectiveness of lidocaine/prilocaine topical anaesthetic on pain, as well as discomfort related to elastomeric separator insertion, was investigated in recent research by M. Abu Al-Melh and Andersson. Results showed that overall mean discomfort/pain had decreased statistically significantly.4,5

The pain and effects of fixed orthodontic appliances may be lessened by using chewing gum and biting wafers as alternative

orthodontic treatment alternatives. Bite wafers (BW) were found to be as effective as over-the-counter (OTC) analgesics in treating pain in adolescents, according to another study.6,7

Low-level laser therapy has previously been considered as alternative approach for alleviating orthodontic pain. In addition to its analgesic properties, Teeth movement is accelerated and tissue repair is encouraged by LLLT.

Patients having maxillary canine retractions showed improvement in their orthodontic pain with single-dose helium-neon laser therapy, with a 12.1% decrease in pain in comparison to placebo group.8,9 However, this investigation exhibited limitations, and no previous study has examined efficacy of other laser types in comparison to helium-neon laser therapy.10,11

2. MATERIAL AND METHODS

A clinical prospective cohort study was carried out among 12 to 26-year- old participants at Department of Orthodontics and Dentofacial Orthopedics', Dental College Azamgarh and Hospital, Uttar Pradesh. Conducted research to assess effectiveness of LLLT and lidocaine gel 5% in placement of elastomeric separators, and LLLT in initial arch wire on PP in cases having fixed orthodontic treatment. Sample size for current investigation was evaluated by employing GPower software (latest ver.3.1; Heinrich-Heine-Universi-ta"t Du"sseldorf, Du" sseldorf, Germany).

Sample size estimation was conducted with a 5% alpha error (α=0.05), effect size of 0.39, and a power of 80%. Results indicated that minimum of 85 samples will be needed for current investigation. Final sample for current study is 85 samples. Study selected a total of 85 patients having moderate-to-severe anterior crowding who had their fixed appliance installed, as well as their pre- and postoperative cephalometric radiographs, while considering inclusion and exclusion criteria. Orthodontic department archives at Azamgarh Dental College and Hospital, Uttar Pradesh, were the source of radiographs analyzed for this study. During this study all four quadrants were involved and elastomeric separators were placed in first molar region while performing this study.

The irradiation of laser therapy was done at inter dental papilla at mesial, distal and root apex both buccally and lingually at 5sec at each point a total of 30sec each tooth at 650nm. Elastomeric separators placing area were treated with local anesthetic agent lidocaine 5% gel, 2min before placement of separator with cotton applicator in quadrant to be treated with anesthesia according to study. The respective experimental therapies were given 72hrs before the initial placement of super elastic Nickel-Titanium arch wire (Prime Ortho NiTi Arch wireTM) and isolating (via cotton roll) the area under study. This initial procedure was maintained same for all the four quadrants and experimental therapy to avoid procedural bias. Data analysis was carried out by employing SPSS software version-26.0 (IBM, Chicago). Association between four groups and questions was done using chi square test.

DATA COLLECTION PROCEDURE:

Pain Evaluation, which was to be the major outcome of the experiment during all four procedures was carried out via visual analog scale (VAS) given by Hayes and Patterson in year 1921. The three-point descriptors were marked at 0,5 and 10 representing no pain, moderate and severe pain respectively. The participants were followed up regarding the same and level of pain at 6, 24, 48 and 72hrs after procedures were recorded. Both elastomeric separator and arch wire placement were followed up and pain intensity was recorded. Questionnaire form and Google form were used consequently.

The verbal and visual analogue pain scale was categorized into

No pain- 0

Mild- 1 to 3

Moderate- 4 to 6

Severe- 7 to 9

Worst- 10

3. RESULTS

TABLE 1: Sociodemographic details of study participants

VARIABLES		FREQUENCY	PERCENTAGE

GENDER	MALE	39	46
	FEMALE	46	54
AGE	12-18 yrs	32	37
	19-26 yrs	53	63
TYPE OF MALOCCLUSION	ANGLES CLASS 1	46	54
	ANGLES CLASS 2	30	35
	ANGLES CLASS 3	9	11

85 participants were selected for study. The gender distribution was male (46%) and female (54%). The distribution of study participants was 37% in 12-18 years and 63% in 19-26 years age group. Among the types of malocclusion, 54% belonged to Angles class I, 35% to Angles class II and 11% to Angles class III.

TABLE 2: Association between four techniques and pain perception question using Chi square test

QUESTIONS	OPTIONS	Control	Anaesthesia	Laser	Laser + Anaesthesia	P Value
Where you satisfied with the treatment provided?	Yes	55	63	61	65	**0.015***
	No	27	22	24	20	

Pain experienced following the insertion of separators was felt more among the Control group (90%) when compared to Laser + Anaesthesia group (18%), with significant statistical differences among 4 techniques had been there. Most participants felt the pain within 6 hours which was higher in Control (41%) and lower in Laser + Anaesthesia group (30%), No significant statistical difference among4 techniques had been there. 62% of participants experienced continuous pain in control group whereas only 49% in Laser + Anaesthesia. Intermittent type of pain was higher among 50% in Laser + Anaesthesia followed by Laser group 45% and Anaesthesia group (40%). Control group (50%) and Anaesthesia group (41%) were the most experienced pain at night. Control group (63%) felt more difficulty while chewing followed by Anaesthesia (61%), Laser (62%) and Laser + Anaesthesia (56%). Diet modification due to pain was seen mostly among Control group (62%) when compared to Laser + Anaesthesia group (51%). 48% of Control group changed their chewing side due to pain when compared to Laser + Anaesthesia (32%). All these questions had not been statistically significant ($p>0.05$). 24% of Control group affected their social life when compared to 15% in Laser + Anaesthesia moreover was significant statistically ($p<0.015$). Only 30% of the study participants who took medication for pain relief were statistically significant ($p<0.016$). 50% felt it was hurting little bit. 76% felt that the treatment provided was satisfactory in Laser+ Anaesthesia group in contrast to other groups and it was observed to be statistically significant ($p<0.015$).

TABLE 3: Association between four techniques and analogue pain scale question using Chi square test

QUESTIONS	OPTIONS	Control	Anaesthesia	Laser	Laser + Anaesthesia	P VALUE
Verbal		2	12	11	9	

	Numerical Analog Pain Scale	No Pain					
		Mild	35	38	48	47	0.008*
		Moderate	25	17	19	22	
		Severe	20	12	4	5	
*		Worst	3	6	3	2	

p<0.05 – significant

Verbal numerical analogue pain scale showed moderate level of pain among all four techniques and in Laser + Anaesthesia group only 10% felt no pain. Severe level of pain was found among control group (23%). These four techniques had been statistically significant (p<0.008). Visual analogue pain scale was statistically significant (p<0.001) among four techniques. When compared to verbal and visual analogue scales visual analogue scale showed more pain perception in all the groups. Laser + anaesthesia group (7%) was found to be better when compared to all other groups.

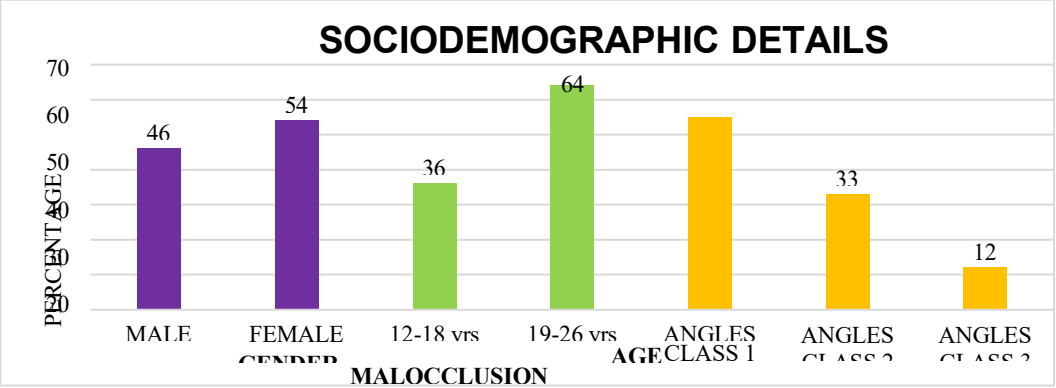
TABLE 4: Association between techniques and pain intensity at 6 hours for maxilla & mandible using analogue pain scale & verbal numerical analogue pain scale question with Chi square test

QUESTIONS	OPTIONS	Control		Laser		P VALUE
		NRS	VAS	NRS	VAS	
Visual Analog Pain Scale & Verbal Numerical Analog Pain Scale (6 hours)	No Pain	2	2	6	6	0.001* *
	Mild	23	23	27	27	
	Moderate	33	33	38	38	
	Severe	12	12	8	8	
	Worst	10	10	6	6	

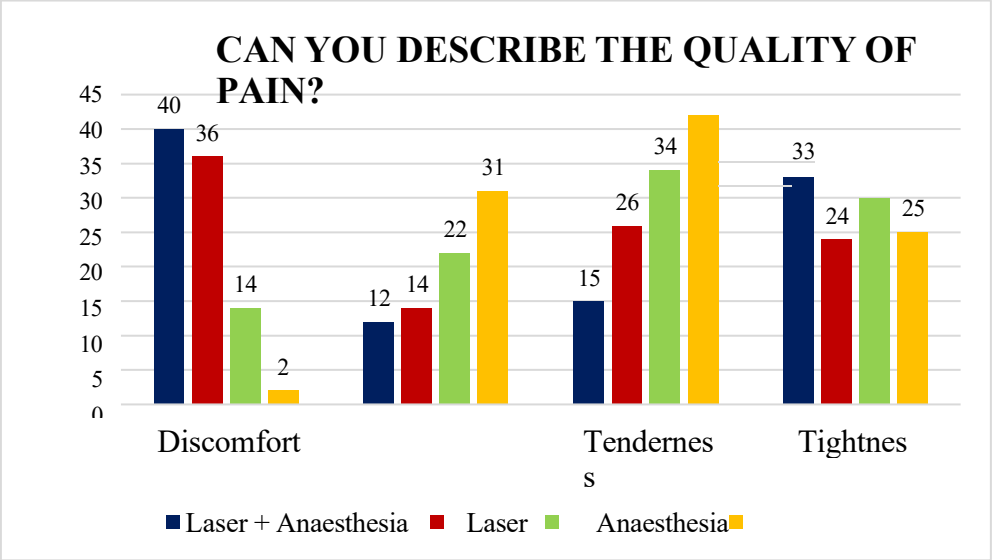
After elastomeric separator was removed molar bands were placed in molar areas, upper and lower bonding was done and initial arch wire was given, laser irradiation was done in upper maxillary arch and control in lower mandibular arch and pain values were recorded shows the Verbal numerical analogue pain scale and Visual analogue pain scale at 6 hrs where control group experienced worst pain (11%) when compared to laser group (7%). At 24 hrs moderate level of pain (37%) in control group and no pain (24%) in laser group was found to be higher. In 48 hrs mild pain was seen in laser group (32%) and moderate (34%) in control group. In 72 hrs no pain was felt by 31% in laser group and 28% in control group

.

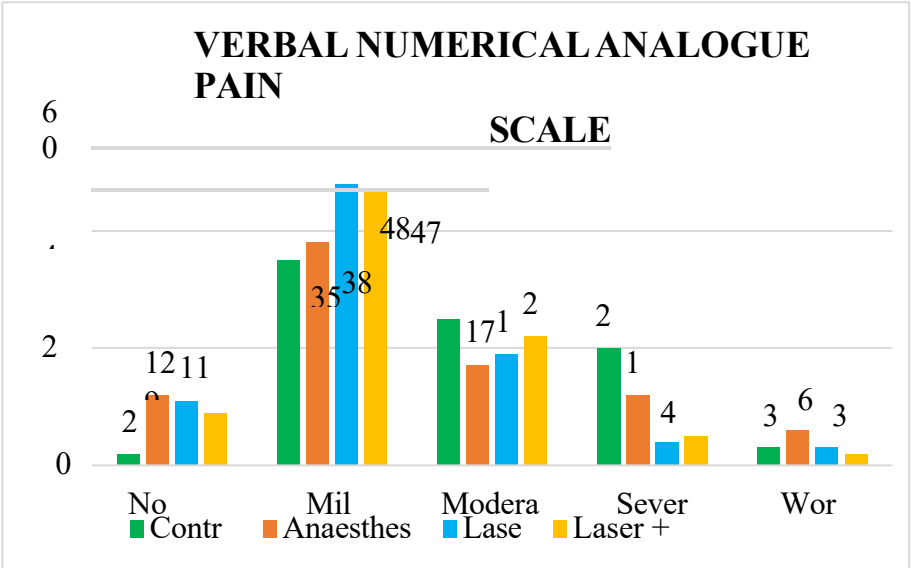
GRAPH 1: Sociodemographic details of study participants



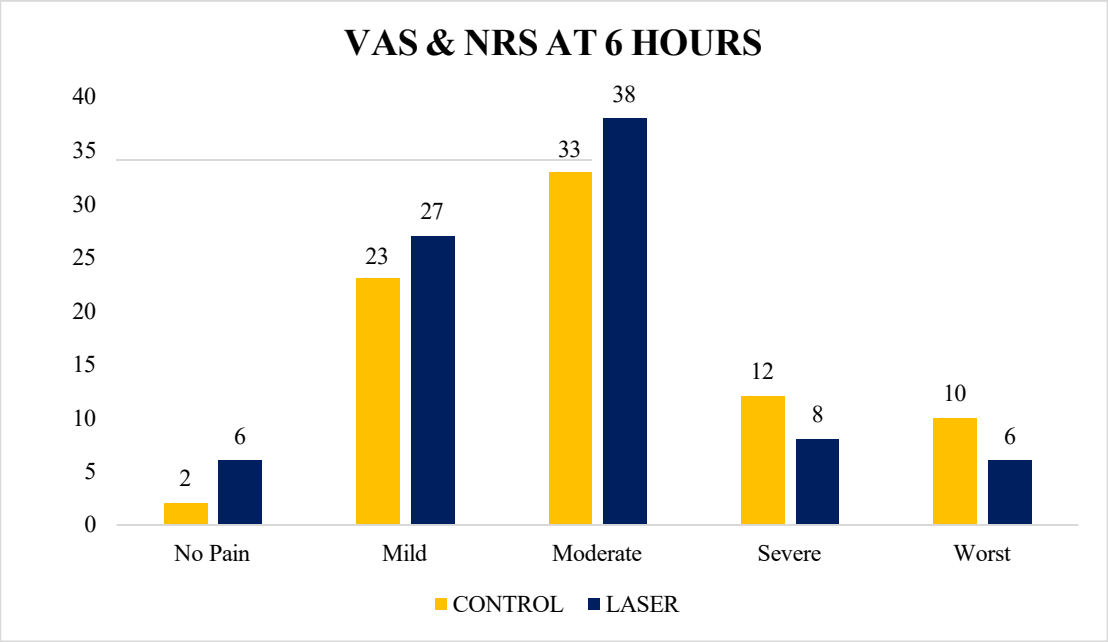
GRAPH 2: Quality of pain experienced by different groups



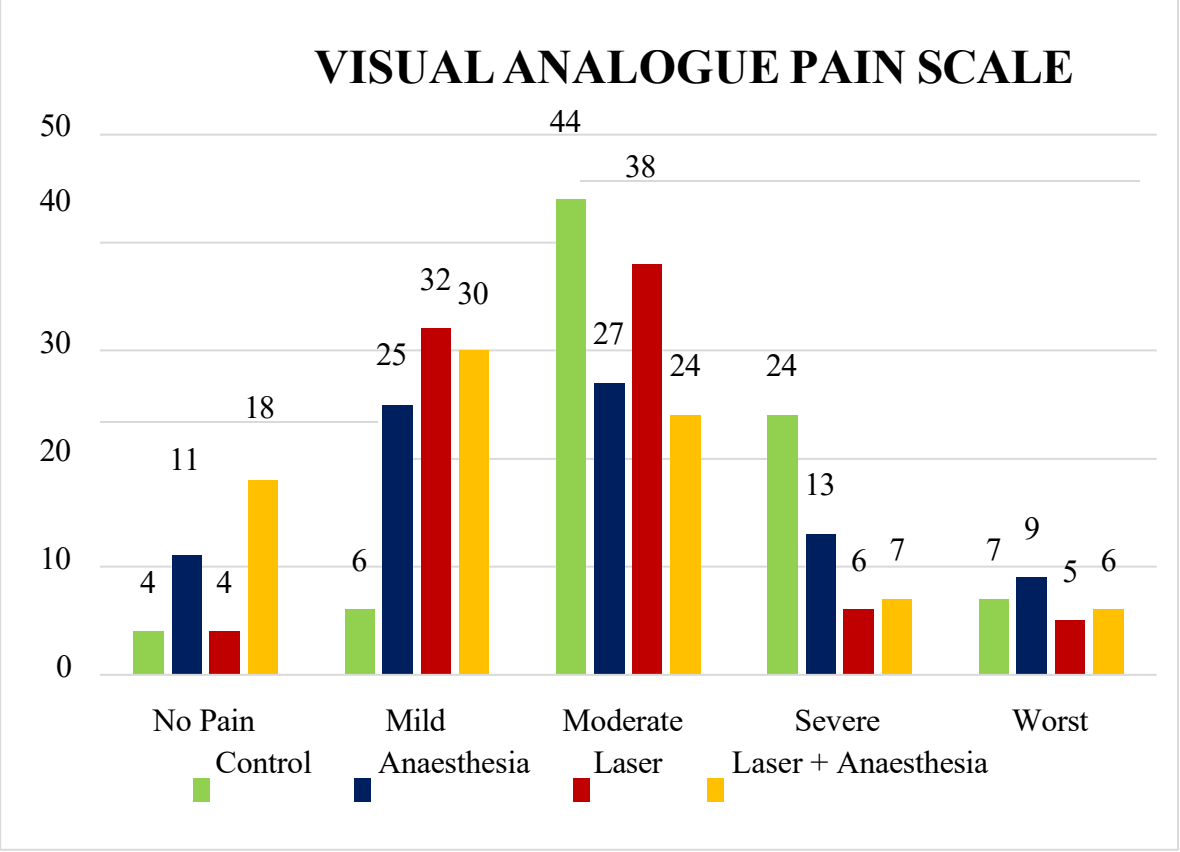
GRAPH 3: Verbal numerical analogue pain scale by different groups



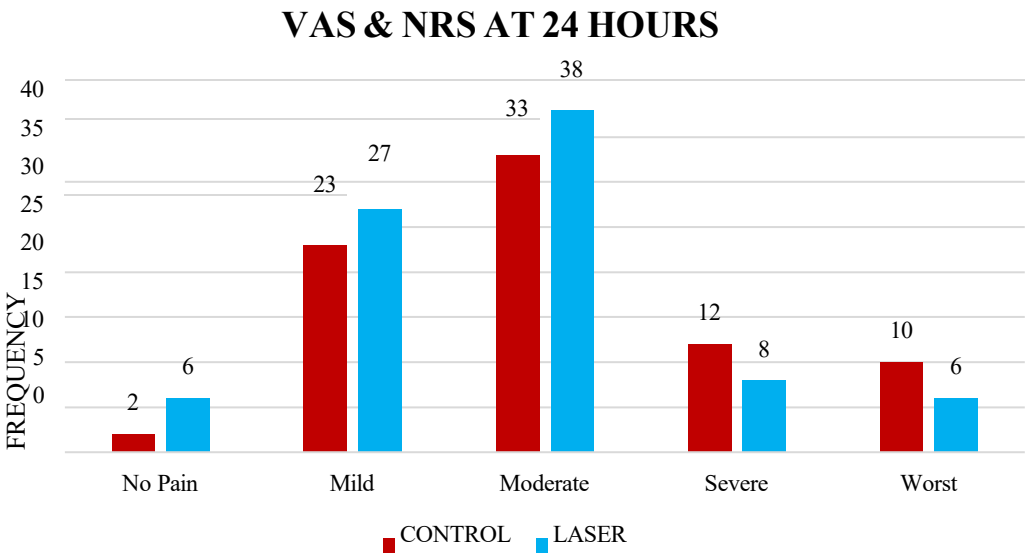
GRAPH 4: Visual analogue pain scale by different groups



GRAPH 5: Verbal numerical analogue pain scale and Visual analogue pain scale at 6 hours



GRAPH 6: Verbal numerical analogue pain scale and Visual analogue pain scale at 24 hours



4. DISCUSSION

Similar to our findings, Domínguez et al.[12] conducted an RCT where they applied several diode laser applications having wavelengths of 670 nm to maxillary 1stpremolars during their retraction. They found that pain perception of laser-irradiated teeth was slightly reduced. In a different trial, scientists applied a 1dose laser treatment (830nm wavelength) to upper 6anterior teeth right after fixed appliances had been placed. Outcomes implied that laser patients had less discomfort than controls. But only 72 hours after braces had been put in did difference become noticeable.[13,14]

However, patients in LLLT group reported significantly less pain during1st 3days after El-Bialy et al.[15] delivered infrared laser with wavelength of 810 nm once a week to maxillary teeth throughout their distalization. Brito et al.[16] (2022) conducted 1dose irradiation of all teeth for patients undergoing non-extraction fixed orthodontic treatment using an infrared laser (808nm wavelength).

They compared pain perception of laser group with that of control group, reporting significantly lower pain scores as well as shorter overall pain duration.[15] Wide range of adjustable parameters when employing LLLT, including varying wavelengths from 635nm to 980nm, power outputs, along with energy densities, may account for outcome variations. Matys et al., Qamruddin et al. as per *meta*-analysis by Deana et al., most efficient method for treating orthodontic pain was an infrared laser with wavelength between800 as well as 830nm.[17-20]

As per Bjordal et al.[21], for reducing inflammation as well as getting best effects of LLLT on acute pain, dose of 7.5J/cm2 should be administered within 72hours of injury. In subsequent days, dose should be lowered, usually to 2J/cm2, to encourage tissue repair. For avoiding inhibiting cell activity, Lizarelli[22] recommended a dosage of ≥5 as well as <20J/cm2 for severe pain. As per some experts, 5J/cm2 doses have been ineffective at reducing orthodontic pain; greater doses, including 35J/cm2, have been required.

Farias et al[23], Furquim et al[24], and Abtahi et al[25] utilized same total energy (6J/tooth); nevertheless, Farias et al[23] and Furquim et al[24] utilized similar wavelengths; consequently, only Farias et al[23] reported pain reduction.

Qamruddin et al[26] along with Artés-Ribas et al[27] employed distinct wavelengths, 940nm as well as 830nm, correspondingly, but same total energy (12J/tooth); both achieved successful treatment. Artés-Ribas et al[27] and Bicakci et al[28], while using similar wavelengths as well as doses (J/cm2/tooth), were alike successful in reducing orthodontic pain, employed different total energies (12J as well as 1J, respectively). As mentioned, we agree with research showing LLLT's success is correlated with energy amount used. With wavelength of 800–830nm along with total energy of ≤12J/tooth/treatment session, laser therapy works better. Energy density varies extensively, moreover applications ranging from 5-160J/cm^2 per tooth can provide pain alleviation. Clinical situation, lesion's current phase, optical properties of tissue to be irradiated, as well as laser irradiation technique (contact or noncontact, point or sweep) must all be taken into account when choosing laser irradiation settings. Type of device employed to apply laser determines region to be irradiated; altering spot size can alter dose given to tissue. Therefore, decreasing spot size can enhance energy density applied to tissue, which will also boost laser irradiance as well as penetration into biological tissue.

5. CONCLUSION

After orthodontic pressures were applied, LLLT and anaesthetic gel were found to be beneficial in reducing spontaneous chewing pain and increasing patient satisfaction. Local anesthetic gel and LLLT application help lessen pain related to the orthodontic treatment's alignment and levelling stage. As a noninvasive analgesic, it can reduce need for NSAIDs and, when used appropriately, presents relatively little risk of adverse reactions. Orthodontists must examine each patient's pain threshold using their best professional judgment. To a certain degree, patients' pain and discomfort may be avoided with aid of focused nutritional advice and efficient orthodontist-patient communication. However, pain management is a complicated phenomenon. Therefore, more investigation is needed that combines several orthodontic pain management techniques with suitable study designs and large sample sizes.

REFERENCES

[1] Romero-Reyes M., Uyanik J.M. Orofacial pain management: Current perspectives. J. Pain Res. 2014;7:99–115.

[2] Angelopoulou M.V., Vlachou V., Halazonetis D.J. Pharmacological management of pain during orthodontic treatment: A meta-analysis. Orthod. Craniofac. Res. 2012;15(2):71–83.

[3] Possi Alessandro, Gallelli Luca. Pain management for dentists: The role of Ibuprofen. Annali di Stomatologia. 2011;11(Supply 3-4):3–24.

[4] Sergl H.G., Klages U., Zentner A. Pain and discomfort during orthodontic treatment: Causative factors and effects on compliance. Am. J. Orthod. Dentofacial Orthop. 1998;114(6):684–691.

[5] Al-Melh M.A., Andersson L. The effect of a lidocaine/prilocaine topical anesthetic on pain and discomfort associated with orthodontic elastomeric separator placement. Prog. Orthod. 2017;18(1):1.

[6] Yang X, Wei X, Mu Y, Li Q, Liu J. A review of the mechanism of the central analgesic effect of lidocaine. Medicine. 2020;99:17(e19898).

[7] Murdock S., Phillips C., Khondker Z., Hershey H.G. Treatment of pain after initial archwire placement: a noninferiority randomized clinical trial comparing over-the-counter analgesics and bite-wafer use. Am. J. Orthod. Dentofacial .2010;137(3):316– 323.

[8] Marques L.S., Paiva S.M., Vieira-Andrade R.G., Pereira L.J., Ramos-Jorge M.L. Discomfort associated with fixed orthodontic appliances: Determinant factors and influence on quality of life. Dental Press J. Orthod. 2014;19(3):102–107.

[9] Ren C., McGrath C., Yang Y. The effectiveness of low-level diode laser therapy on orthodontic pain management: A systematic review and meta-analysis. Lasers Med. Sci. 2015;30(7):1881–1893.

[10] Sobouti F., Khatami M., Chiniforush N., Rakhshan V., Shariati M. Effect of single-dose low-level helium-neon laser irradiation on orthodontic pain: A split-mouth single-blind placebo-controlled randomized clinical trial. Prog. Orthod. 2015;16:32.

[11] Koritsánszky N., Madléna M. Pain and discomfort in orthodontic treatments. Literature review. Fogorv. Sz. 2011;104(4):117–121.

[12] 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 Jan;31(1):36-40.

[13] AlSayed Hasan MMA, Sultan K, Hamadah O. Evaluating low-level laser therapy effect on reducing orthodontic pain using two laser energy values: a split-mouth randomized placebo-controlled trial. Eur J Orthod. 2018 Jan 23;40(1):23-28.

[14] Domínguez A, Gómez C, Palma JC. Effects of low-level laser therapy on orthodontics: rate of tooth movement, pain, and release of RANKL and OPG in GCF. Lasers Med. Sci., 2015; 30: 915-923,

[15] El-Bialy M, Tawfek MA, Hafez AM, Hammad AM. Effect of laser application on pain control during orthodontic tooth movement. Ann. Dental Special., 9 (2021), pp. 62-66

[16] Brito MH, Nogueira CQ, Cotrin P, Fialho T, Oliveira RC, Oliveira RG, Salmeron S, Valarelli FP, Freitas KMS, Cançado RH. Efficacy of Low-Level Laser Therapy in Reducing Pain in the Initial Stages of Orthodontic Treatment. Int J Dent. 2022 Jun 14;2022:3934900.

[17] Deana NF, Zaror C, Sandoval P, Alves N. Effectiveness of Low-Level Laser Therapy in Reducing Orthodontic Pain: A Systematic Review and Meta-Analysis. Pain Res Manag. 2017;2017:8560652.

[18] Qamruddin I, Alam MK, Mahroof V, Fida M, Khamis MF, Husein A. Photobiostimulatory Effect of a Single Dose of Low-Level Laser on Orthodontic Tooth Movement and Pain. Pain Res Manag. 2021 May 10;2021:6690542.

[19] Qamruddin I, Alam MK, Mahroof V. Effects of low-level laser irradiation on the rate of orthodontic tooth movement and associated pain with self-ligating brackets. Am. J. Orthod. Dentofac. Orthop., 2017; 152: 622-630.

[20] Matys J, Jaszczak E, Flieger R, Kostrzewska-Kaminiarz K, Grzech-Leśniak K, Dominiak M. Effect of ozone and diode laser (635 nm) in reducing orthodontic pain in the maxillary arch-a randomized clinical controlled trial. Lasers Med. Sci., 2020; 35: 487-496.

[21] Bjordal J. M., Johnson M. I., Iversen V., Aimbire F., Lopes-Martins R. A. B. Photoradiation in acute pain: A systematic review of possible mechanisms of action and clinical effects in randomized placebo-controlled trials. Photomedicine and Laser Surgery. 2006;24(2):158–168.

[22] Lizarelli R. F. Z. Protocolos Clínicos Odontológicos: Uso Do Laser De Baixa Intensidade. São Carlos, Brazil: Gorham Design; 2007.

[23] Farias R. D., Closs L. Q., Miguens S. A. Q. Evaluation of the use of low-level laser therapy in pain control in orthodontic patients: A randomized split-mouth clinical trial. Angle Orthodontist. 2016;86(2):193–198

[24] Furquim RD, Pascotto RC, Rino Neto J, Cardoso JR, Ramos AL. Low-level laser therapy effects on pain perception related to the use of orthodontic elastomeric separators. Dental Press J Orthod. 2015 May-Jun;20(3):37-42.

[25] Abtahi S. M., Mousavi S. A., Shafaee H., Tanbakuchi B. Effect of low-level laser therapy on dental pain induced by separator force in orthodontic treatment. Dental Research Journal. 2013;10(5):647–651.

[26] Qamruddin I, Alam MK, Mahroof V. Effects of low-level laser irradiation on the rate of orthodontic tooth movement and associated pain with self-ligating brackets. Am. J. Orthod. Dentofac. Orthop., 2017; 152: 622-630

[27] Artés-Ribas M, Arnabat-Dominguez J, Puigdollers A. Analgesic effect of a low-level laser therapy (830 nm) in early orthodontic treatment. Lasers Med Sci. 2013 Jan;28(1):335-41.

[28] Bicakci A.A., 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):460–465.