Original Article

Comparative Assessment of Rate of Enmasse Retraction between Low Friction Self-Ligating Appliance and Conventional Straight Wire Appliance with Low Level Laser Therapy – A Clinical Study

[1]Thripthi Raj P K, [2]Sunil Muddaiah, [3]Goutham Reddy, [4]Sanju Somaiah, [5]Balakrishna shetty, [6]Namitha Nanu

[1]MDS-Post Graduate Student
[2,4,5] Professor
[5]Senior Lecturer
[3]Professor and Head
[1-6]Department of Orthodontics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.

To cite: Thripthi Raj P K, Sunil Muddaiah, Goutham Reddy, Sanju Somaiah, Balakrishna shetty, Namitha Nanu.

Comparative assessment of rate of enmasse retraction between low friction self-ligating appliance and conventional straight wire appliance with low level laser therapy –a clinical study.

J Contemp Orthod 2020;4 (1): 21-32.

Received on: 12-02-2020

Accepted on: 10-03-2020

Source of Support: Nil

Conflict of Interest: None

ABSTRACT

Introduction: Introduction: With the emerging concept of accelerated orthodontics, the duration of treatment has become a prime concern for the orthodontists and the patients. Modern technology has perfected a new equipment that has become almost indispensable in modern dentistry, in accordance with the philosophy of minimally invasive therapy i.e the laser [LIGHT AMPLIFICATION BY STIMULATED EMISSION OF RADIATION]. The purpose of this study was to clinically evaluate and compare the effects of low-level laser therapy (LLLT) and rate of retraction of teeth in conventional and self-ligating bracket systems.

Method: This split mouth study comprised of 20 subjects. The subjects were equally divided into two groups; the first group (Group A) consisted of 10 patients who underwent treatment with low friction self-ligating brackets [Ormco Damon Q] and the second group(Group B) consisted of 10 patients who underwent treatment with conventional straight wire brackets [Koden MBT]. The retraction was carried out in 0.019" × 0.025" SS wires using conventional retraction technique with a constant force of 150 gm. The experimental side was exposed to biostimulation using 810 nm gallium-aluminum-arsenide (GaAlAs) diode laser on days 0,21,42,63,84th of retraction. A total of 10 irradiations for 10 sec per site were given, 5 on the buccal side and 5 on the palatal side of the tooth. A digital vernier caliper with an accuracy of ±0.001 mm was used to measure the distance between the contact points of the maxillary canine and second premolar on 1st and 84th day of retraction.

Result: Rate of retraction was significantly higher in the laser assisted retraction side when compared with conventional retraction side in both DAMON Q & MBT groups, Laser DAMON combination accelerated the orthodontic tooth movement by 5.44% than that of laser MBT combination.

Conclusion: Combination of Laser and self-ligating brackets is a promising method for accelerating tooth movement.

Key words: Low level laser therapy, biostimulation, accelerated orthodontics, Damon Q Brackets, MBT Brackets, self-ligating.

INTRODUCTION

The systematic evolution of dental materials and equipments has led to a constant pursuit of technological innovations in orthodontics. Orthodontic treatment efficiency, appliance biocompatibility and patient convenience are the major issues confronting today's orthodontists. Modern technology has perfected a new equipment that has become almost indispensable in modern dentistry, in accordance with the philosophy of minimally invasive therapy i.e the laser [LIGHT AMPLIFICATION BY STIMULATED EMISSION OF RADIATION]. [1]

One of the major concerns of orthodontic patients is treatment time. Reduction of treatment time requires increase in the rate of orthodontic tooth movement. Many methods have been used in the past to accelerate the orthodontic tooth movement such as electric and magnetic stimulation, drug injections of misoprostol (prostaglandin E1 analog), prostaglandin E2 (PGE2) and parathyroid hormone. Although these substances stimulate the rate of tooth movement, they also have undesirable side effects such as local pain and discomfort during the injections. Recently, in animals, resonance vibration and electric stimulation have been tried but these methods require an apparatus that is not routinely used in dental practice. There have been several studies on the effects of lasers on soft and hard tissues in dentistry. In orthodontics, there are in vivo studies on the biostimulatory effects of lasers in bone remodeling and dental movement.[1-5]

Soft-tissue lasers have numerous applications in orthodontics including gingivectomy, operculectomy, frenectomy, papilla flattening, uncovering temporary anchorage devices, ablation of aphthous ulcerations, exposure of impacted teeth and even tooth whitening. As an adjunctive procedure, laser surgery has helped many orthodontists to enhance the design of a patient's smile and improve treatment efficacy.[3]

Some laser wavelengths, for example erbium family lasers work both on hard and soft tissues (2780 nm, 2940 nm) while other lasers such as the diode lasers have a very good surgical and haemostatic action on soft tissues along with analgesic and biostimulating effect that can help accelerate orthodontic treatment.[1]

Diode lasers are semiconductors that use solid-state elements (ie, gallium, arsenide, aluminum, and indium) to change electrical energy into light energy. Diode laser wavelengths (810–980 nm) approximate the absorption coefficient of soft-tissue pigmentation (melanin). Therefore, the light energy from the diode is highly absorbed by the soft tissues and poorly absorbed by teeth and bone.[3]

Self-ligating (SL) brackets are not new to Orthodontics; they have been resurging from the early 20th century. In the mid 1930s, the Russell attachment was an attempt to enhance clinical efficiency by reducing ligation time. Some of the early SL brackets were the Ormco Edgelok (1972), Forestadent Mobil-Lock (1980), Orec SPEED (1980) and “A” Company Activa (1986).

The Damon self-ligating bracket (Ormco, Glendora, Calif) was developed as an integral component of a low-friction appliance. Damon SL in 1996, Damon 2 in 2000, Damon 3 in 2004, Damon 3MX in 2005 and Damon Q in 2009 were developed based on the theory “**Low Friction and Light Forces Produced More Biologically Stable Results**” by Dwight Damon in 1990’s. It has been suggested that the low-level friction associated with this bracket encourages more rapid leveling and alignment, allowing longer appointment intervals and reducing overall treatment time. Damon Q brackets are more secure and more comfortable for the patient when opened and closed, immune to the effects of calculus accumulation. The brackets are smaller in all dimensions than their predecessors and space has been found for a horizontal as well as a vertical auxiliary slot.

Many advantages of self-ligating bracket systems include reduced friction, less discomfort, more efficient tooth movement, sliding mechanics, less chair-side time and reduced biohostability. However, perhaps the most compelling potential advantage is reduction in overall treatment time; a reduction of up to 7 months was confirmed in retrospective studies with similar occlusal results obtained using the peer assessment rating (PAR) index[4]

The response of the periodontium to the applied orthodontic force provides the fundamental mechanism that allows tooth movement through alveolar bone. The biologic factors were once largely outside the control of the orthodontist. But now with the invent of LASER in accelerating alveolar bone remodelling and the more direct influence achieved by reducing friction with the choice of bracket system and archwire, we may have great benefit in abbreviating the orthodontic treatment period. Hence the combination between self ligating appliances and laser biostimulation could reduce treatment time considerably.

AIM

The purpose of this present study was to clinically evaluate and compare the effects of low-level laser therapy (LLLT) and rate of retraction of teeth in conventional and self ligating bracket systems.

OBJECTIVE:

- To assess the rate of enmasse retraction in low friction self ligating bracket system using low level laser.
- To assess the rate of enmasse retraction in conventional straight wire technique using low level laser.
- To compare the rate of enmasse retraction between low friction self ligating bracket system and conventional straight wire technique using low level laser.
- To draw clinical inferences from the same.

MATERIALS AND METHODS

MATERIALS

810 nm diode laser {figure 1}, Force measuring guage (Morelli ortodontia) {figure 2} and Digital Vernier calliper (workzone) {figure 3}, Low friction self ligating brackets (Ormco DAMON Q), Conventional MBT brackets (Koden), NiTi closed coil springs, Study models for evaluation.

Figure 1: 810 nm diode laser (AMD Picasso®)

Figure 2: Force measuring guage (Morelli ortodontia)

Figure 3: Digital Vernier calliper (workzone)

METHODOLOGY

20 patients in the mean age group of 14 to 30 years requiring extraction of 1st premolars as part of orthodontic treatment were selected. The subjects having the following conditions were excluded from the study: Subjects with a history of long-term medication with NSAIDs [nonsteroidal anti-inflammatory drugs] and hormone supplements, subjects with unilateral chewing or parafunctional habit, skeletal crossbite and occlusal interferences, Periodontally compromised patients. The subjects were equally divided into two groups; the first group (Group A) consisted of 10 patients who were undergoing treatment with low friction self ligating brackets [Ormco Damon Q] and the second group (Group B) consisted of 10 patients who were undergoing treatment with conventional straight wire brackets [Koden MBT]. Before commencement of the study patients were advised good oral hygiene methods and also systematically checked for periodontal problems if any and were given an oral prophylaxis 1 week prior to study. Every patient was briefed about the purpose of the study and an informed consent was taken from the subjects/parents before undertaking of the study.

The subjects were bonded with 0.022×0.028 inch slot Pre-adjusted Edgewise Appliance brackets (10 with MBT koden platinum series and 10 with ormco DAMON Q). Following the extraction of first premolars, initial leveling and alignment was done. A 0.019×0.025 inch SS arch wire was used to obtain standardization (in-situ for four weeks). The experimental side was exposed to biostimulation using 810 nm diode laser and the contralateral side was taken as control. All irradiations were done by the same operator using 810 nm gallium-aluminum-arsenide (GaAlAs) diode laser delivered with a power output of 100 mW in a continuous wave mode. Experimental doses were delivered on the buccal and palatal surfaces. A total of 10 irradiations were given, 5 on the buccal side and 5 on the palatal side, to cover the entire periodontal fibers and alveolar process around the tooth.

The distribution and order was as follows:-

On the buccal and palatal side of canine, lateral and central incisor of experimental side

(1) 2 irradiation doses on the cervical third of the root (1 mesial and 1distal)

{Figure 4,5,6,7,8,9,10,11}

(2) 2 on the apical third of the root (1 mesial and 1 distal)

{Figure 12,13,14,15,16,17,18,19}

(3) 1 on the middle third (center of the root) {Figure 20,21,22,23}

Figure 4: Irradiation dose on the cervical third of the root (mesial) [MBT]

Figure 5: Irradiation dose on the cervical third of the root (distal) [MBT]

Figure 6: Irradiation dose on palatal cervical third of the root (mesial) [MBT]

Figure 7: Irradiation dose on palatal cervical third of the root (distal) [MBT]

Figure 8: Irradiation dose on the cervical third of the root (mesial) [DAMON]

Figure 9: Irradiation dose on the cervical third of the root (distal) [DAMON]

Figure10: Irradiation dose on palatal cervical third of the root (mesial) [DAMON]

Figure 11: Irradiation dose on palatal cervical third of the root (distal) [DAMON]

Figure 12: Irradiation dose on the apical third of the root (mesial) [MBT]

Figure 13: Irradiation dose on the apical third of the root (distal) [MBT]

Figure 14: Irradiation dose on palatal apical third of the root (mesial) [MBT]

Figure 15: Irradiation dose on palatal apical third of the root (distal) [MBT]

Figure 16: Irradiation dose on the apical third of the root (mesial) [DAMON]

Figure 17: Irradiation dose on the apical third of the root (distal) [DAMON]

Figure 18: Irradiation dose on palatal apical third of the root (mesial) [DAMON]

Figure 19: Irradiation dose on palatal apical third of the root (distal) [DAMON]

Figure 20: Irradiation dose on the middle third of the root (center) [MBT]

Figure 21: Irradiation dose on the palatal middle third of the root

(center) [MBT]

Figure 22: Irradiation dose on the middle third of the root (center) [DAMON]

Figure 23: Irradiation dose on palatal middle third of the root (center) [DAMON]

The experimental side was irradiated for 10sec per site. The total energy density (dose) at each application was 10 J (2×50 s×100 mW) with an inter-appointment gap of 3 weeks on days 1, 21, 42 and 63. Enmasse retraction was carried out on 0.019 × 0.025" SS wires using closed coil spring {Figure 24, 25} with a constant force of 150 gm measured with dontrix gauge by same operator. {Figure 26}

Figure 24: Beginning of enmasse retraction using NiTi open coil spring [MBT]

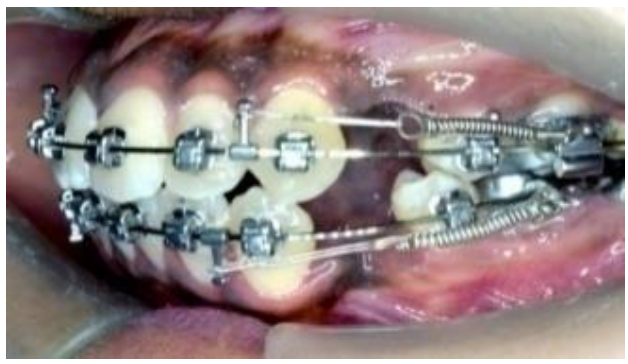


Figure 25: Beginning of enmasse retraction using NiTi open coilspring [Damon Q]

Figure 26: Measurement of a constant force of 150gm force using dontrix gauge

Study models were made prior to retraction and on the 84th day. Digital caliper measurements accurate to ± 0.001 mm was used to record the distance between the contact points of the maxillary canine and second premolar on 1st and 84th day {Figure 27, 28}. Each distance was measured three times and the mean value was used for the data.

E0 - Beginning of enmasse retraction on experimental side

C0 - Beginning of enmasse retraction on control side

E1 - On 84^{th} day of retraction on experimental side

C1 - On 84^{th} day of retraction on control side

The data then subjected to statistical analysis.

Figure 27: Measurement of distance between canine and second premolar in experimental and control sides on 84th day of retraction (E1 and C1) [MBT]

Figure 28: Measurement of distance between canine and second premolar in experimental and control sides on 84th day of retraction (E1 and C1) [Damon Q]

Statistical methods applied:

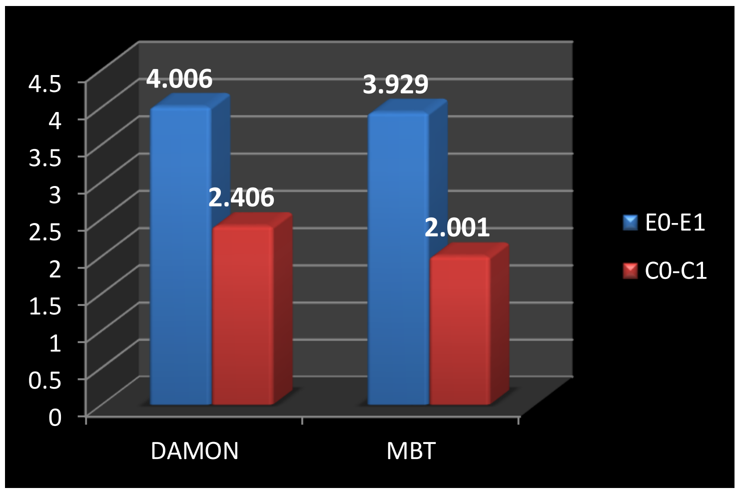
Data was collected, coded and fed in SPSS (IBM version23). Descriptive statistics calculated were mean & standard deviation. Inferential statistics included independent t test. Level of significance was set at 0.05 at 95% confidence interval.

RESULTS

Table 1: Comparison of amount of space closure between experimental side and control side in Damon group & MBT group

		Mean reduction	Standard deviation	T	Significance
Damon	E0-E1	4.0060	.41353	5.331	**0.023 (S)**
	C0-C1	2.4060	.85434		
MBT	E0-E1	3.9290	1.50683	3.545	**0.002 (H.S)**
	C0-C1	2.0010	.82906		

Graph 1:



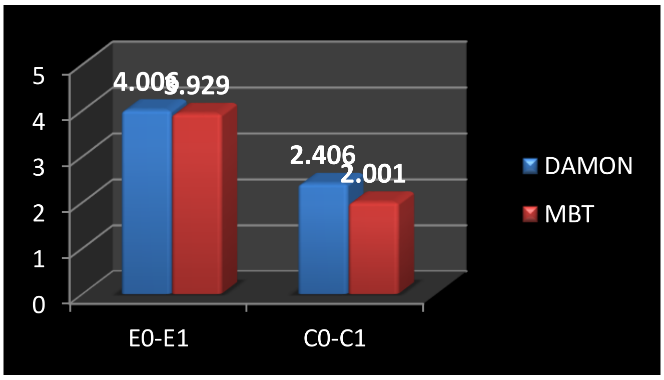
Significant differences were seen on comparing the amount of space closure between experimental and control side of both Damon & MBT groups among which the difference in MBT group was seen to be highly significant. {Table 1, Graph 1}

Table 2: Comparison of amount of space closure between Damon group & MBT group on both experimental side and control side

		Mean reduction	Standard deviation	T	Significance
E0-E1	Damon	4.0060	.41353	0.156	**0.013 (S)**
	MBT	3.9290	1.50683		
C0-C1	Damon	2.4060	.85434	1.076	0.559 (N.S)
	MBT	2.0010	.82906		

Incisor extrusion and first molar intrusion was seen to be more in passive self-ligation appliance.

Graph 2:

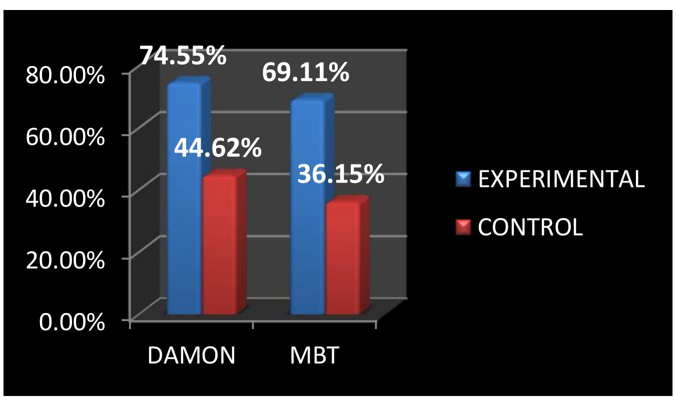


Significant differences were seen on comparing the amount of space closure between Damon & MBT groups on experimental side and no significant differences were seen on comparing the amount of space closure between Damon & MBT groups on control side. {Table 2, Graph 2}

Table 3: Comparison of percentage of space closure between experimental side and control side in both Damon group & MBT group

		Mean % reduction	Standard deviation	T	Significance
Damon	Experimental	74.5450	12.66735	4.569	**0.000 (H.S)**
	Control	44.6150	16.38792		
MBT	Experimental	69.1060	21.88233	3.809	**0.001 (H.S)**
	Control	36.1470	16.42480		

Graph 3:

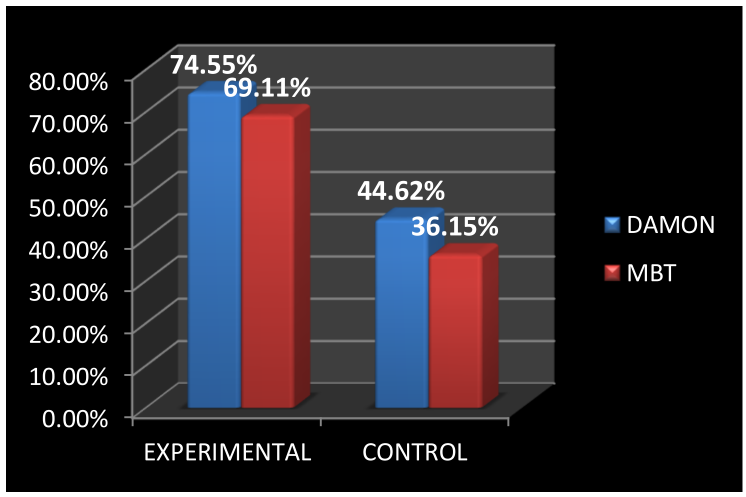


Highly significant differences were seen in the percentage of space closure between experimental and control side of both Damon & MBT groups.The percentage of space closure in Damon group on experimental and control sides were 74.55% & 44.62% respectively; in MBT group were 69.11% & 36.15% respectively. {Table 3, Graph 3}

		Mean % reduction	Standard deviation	T	Significance
Experimental	Damon	74.5450	12.66735	0.680	**0.048 (S)**
	MBT	69.1060	21.88233		
Control	Damon	44.6150	16.38792	1.154	0.264 (N.S)
	MBT	36.1470	16.42480		

Table 4: Comparison of percentage of space closure between Damon group & MBT group on both experimental side and control side.

Graph 4:

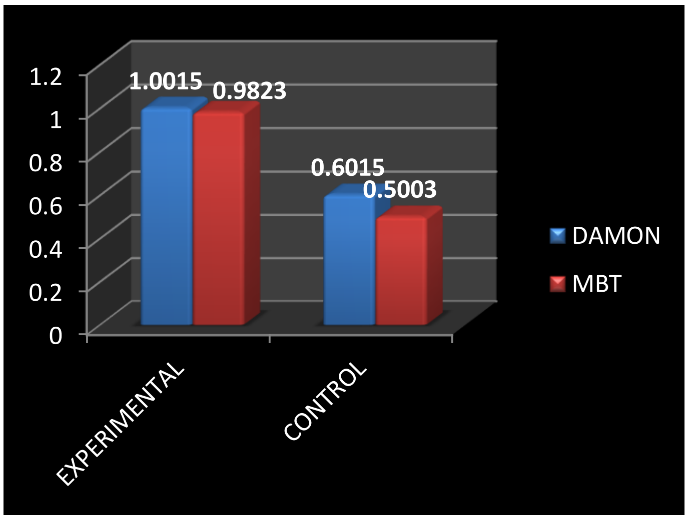


Significant differences were seen in the percentage of space closure between Damon & MBT groups on experimental side, where as on control side it was found to be statistically insignificant. {Table 4, Graph 4}

		Mean rate of retraction	Standard deviation	t	Significance
Experimental	Damon	1.0015	.10338	0.156	**0.013 (S)**
	MBT	.9823	.37671		
Control	Damon	.6015	.21358	1.076	0.296 (N.S)
	MBT	.5003	.20727		

Table 5: Comparison of rate of retraction between Damon group & MBT group on both experimental side and control side

Graph 5



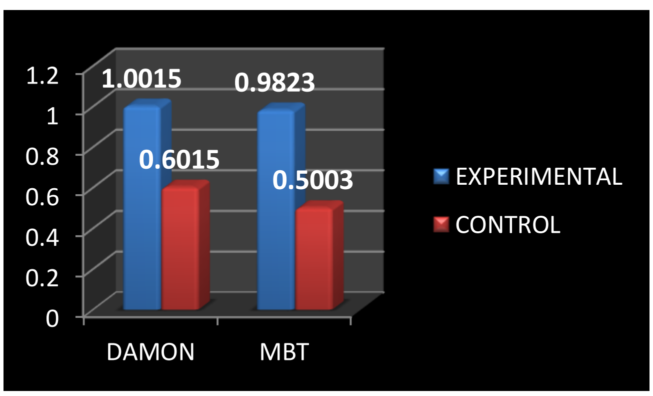
Oh Y ,Park H , Kwon T. Treatment effects of microimplant-aided sliding mechanics on distal retraction of posterior teeth Am J Orthod Dentofacial Orthop 2011;139:470-81

The rate of retraction was measured from the difference in the measurements taken at 1st and 84th day , divided by the number of laser application (4). Significant differences were seen in the rate of retraction between Damon & MBT groups on experimental side, whereas on control side it was found to be statistically insignificant. {Table 5, Graph 5}

Table 6: Comparison of rate of retraction between experimental side and control side in both Damon group & MBT group

		Mean rate of retraction	Standard deviation	T	Significance
Damon	Experimental	1.0015	.10338	5.331	**0.000 (H.S)**
	Control	.6015	.21358		
MBT	Experimental	.9823	.37671	3.545	**0.002 (H.S)**
	Control	.5003	.20727		

Graph 6:



The differences in the rate of retraction between experimental side and control side in both Damon & MBT groups were found to be highly significant.

{Table 6, Graph 6}

The results of the study were :

1. Rate of retraction was significantly higher in the laser assisted retraction side when compared with conventional retraction side in both DAMON Q & MBT groups.{Figure 29,30}

2. Laser assisted teeth moved at a rate of 1.0015 mm in Damon group and 0.9823 mm in MBT group versus 0.6015 mm in Damon group and 0.5003 mm for the conventional retraction side in every dose of laser application (21 days).

3. 74.55 % of space has closed on the laser assisted side in DAMON group where as it was only 69.11% in MBT group. i.e laser DAMON combination accelerated the orthodontic tooth movement by 5.44% than that of laser MBT combination.

Figure 29 : Occlusal photograph at beginning of enmasse retraction & 84th day of retraction [Damon Q]

Figure 30: Occlusal photograph at beginning of enmasse retraction & 84th day of retraction [MBT]

DISCUSSION

Efficiency of treatment mechanics is a major focus in modern orthodontics. The demand for speedy, effective and accurate orthodontic treatment systems has increased calling for shorter treatment period. Long orthodontic treatment time poses several limitations like decreased patient enthusiasm, gingivitis, patient compliance, extra hygiene appointments and dental caries. Unfortunately, many potential orthodontic patients jeopardize their dental health and decline treatment due to the long treatment duration. The search for mechanical orthodontic processes that cause faster and safer tooth movement has been underway with a number of studies focusing on different components like brackets, arch-wires, orthodontic forces, tissue & cellular factors etc. If Low intensity laser therapy can promote wound healing by increased cell proliferation and improved micro circulation, bring about faster bone remodelling at fracture sites; then why not use it with orthodontic forces for better results?

Low Level Laser Therapy

Therapeutic lasers are classified as Class III medical devices and surgical lasers are Class IV. The special wavelengths of laser light with investigated energy densities are suggested to be applied for bone remodelling. The benefit of such irradiations instead of chemicals or medicaments shows that they have no negative systemic effect on the patient body. The interactions of low-level lasers (LLL) with bone components have been studied under different conditions and with different wavelengths and energy densities in the field of medicine. The stimulatory effect of LLLT follows the basic Arndt-Schultz law, which states that "small doses stimulate living systems, medium doses impede and large doses destroy[6-10].

The major components of an LLLT system are the laser device, a delivery system and a controller. Most of the common commercially available LLLT systems use semiconductor diode lasers. These are generally variants of either Gallium: Aluminium: Arsenide (GaAlAs) which emit in the near infrared spectrum (wavelength 700-940 nm) or Indium: Gallium: Arsenide: Phosphorus (InGaAsP) devices which emit in the red portion of the visible spectrum (wavelength 600- 680 nm).

Mechanism of Action of LLLT

- The absorption of light by the photoreceptors within respiratory chain components causes a short-term activation of the respiratory chain and oxidation of the NADH pool. This stimulation of oxidative phosphorylation leads to changes in the redox status of both the mitochondria and the cytoplasm of the cell. The electron transport chain is able to provide increased levels of promotive force to the cell, through increased supply of ATP, as well as an increased in the electrical potential of the mitochondria membrane, alkalization of the cytoplasm and activation of nucleic acid synthesis. Because ATP is the "energy currency" for a cell, LLLT has a potent action that results in stimulation of the normal functions of the cell.
- By increasing the respiratory metabolism of the cell, LLLT can also affect the electro-physiological properties of the cell. This is relevant in terms of mast cells, which are triggered to respond by ionic gradients.
- LLLT has also been shown to cause vasodilatation in PDL, which results in migration of inflammatory cells as well as cytokine production. This in turn helps in bone remodelling.
- Laser irradiation 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.
- Mean value of IL 1β &PG E2 has been found to peak after LLLT which directly stimulate human microvascular endothelial cells in production of RANKL, enabling them to directly promote osteoclast formation and bone resorption, as well as release of other pro resorptive factors such as TNF-α, IL-6, IL-8, fibroblast growth factor-2, platelet derived growth factor-AB.

During orthodontic tooth movement with the pre-adjusted edgewise system, friction generated at the bracket/archwire interface may impede the desired movement. Friction is influenced by the physical characteristics of the archwire and bracket materials and the method of attachment between archwire and bracket. Conventional ligated edgewise brackets incur increased levels of frictional resistance via the elastomeric attachment between bracket and archwire. Self-Ligating (SL) brackets are promoted on the premise that elimination of ligatures creates a friction-reduced environment and allows for better sliding mechanics, which would reduce the overall treatment time.

Damon system (Ormco), advocates a treatment philosophy based on the use of a passive self-ligated bracket design and super-elastic nickel-titanium archwires. According to this system, the low-force and low-friction environment provided by the Damon appliance offers considerable advantages over those with conventional ligation.[11,12] These include greater patient comfort during treatment, fewer visits to the orthodontist & shorter overall treatment time.

The response of the periodontium to the applied orthodontic force provides the fundamental mechanism that allows tooth movement through alveolar bone. Thus the combination of low friction, low force technique and laser induced biostimulation may produce excellent results both in terms of length of therapy and tissue response.

Evaluation of enmasse retraction

In evaluating the rates of teeth movement, results reveal that Laser assisted teeth moved at a rate of 1.0015mm/appointment in Damon group and 0.9823mm/appointment in MBT group versus 0.6015mm/appointment in Damon group and 0.5003mm/appointment for the conventional retraction side. Laser DAMON combination accelerated the orthodontic tooth movement by 5.44% than that of laser MBT combination.

The results implies that teeth moved faster in laser assisted retraction side than conventional retraction side in both Damon & MBT groups, significantly increased tooth movement were seen in laser assisted retraction side of Damon group than the same side of MBT group. It should also be noted that no significant differences were seen in the rate of retraction between conventional retraction side of both Damon & MBT groups. This difference may be attributed to the synergistic effect of increased cellular activity caused by Laser and frictionless mechanism of self ligating brackets. Thus we can consider combination of Laser and self ligating brackets as a promising method for accelerating tooth movement.

Comparison with other similar studies

Our study is in accordance with a study conducted by **Joy GN et al**[6] which concluded that rate of orthodontic tooth movement was greater on the experimental side using a 810 nm diode laser with a power density of 3.97 W/cm^2 at 3 weeks intervals for total duration of 12 weeks during the space closure phase under direct anchorage using miniscrews and the difference between the two sides was statistically significant.

Our study is in accordance with a study conducted by **Doshi MG et al** [5] in which 810 nm laser was applied on days, 0, 3, 7 and 14 in the first month and on every 15th day until complete canine retraction was obtained to the experimental group. The results showed that, an average of 30% increase in the rate of tooth movement with the low intensity laser therapy.

Our study is partially in agreement with the study conducted by **Machibya et al** [13] who compared the treatment time outcome, and anchorage loss of self-ligating and conventional brackets. The results showed that the mean treatment time for Self-ligating brackets did not show a statistically significant difference from that of conventional brackets without any laser biostimulation.

CONCLUSION

Damon System have challenged several aspects of conventional orthodontic thought and treatment pattern. Utilizing bio-adaptive response of the dentition and alveolar bone, dramatic results can be achieved for patients in significantly less time, with fewer appointments and with less discomfort compared to traditional fixed orthodontic treatment approach. It was concluded from the study that biostimulation carried out using a 810 nm diode laser is capable of increasing the rate of extraction space closure which was more in DAMON Q group compared to MBT group. This may be attributed to the synergistic effect of increased cellular activity caused by Laser and frictionless mechanism of self ligating brackets. Thus we can conclude that combination of Laser and self ligating brackets is a promising method for accelerating tooth movement.

REFERENCES

1. Genovese MD,Olivi G Use of laser technology in orthodontics:hard and soft tissue laser treatments.Eur J Paediatr Dent. 2010 Mar;11(1):44-8

2. Wasundhara A. Bhad-Patil Laser therapy for faster orthodontic tooth movement APOS Trends in Orthodontics | September 2014 | Vol 4 | Issue 5

3.Kravitz ND, Kusnoto B Soft-tissue lasers in orthodontics: an overview. Am J OrthodDentofacialOrthop. 2008 Apr;133:S110-4

4.Fleming PS, DiBiase AT, Lee RT. Randomized clinical trial of orthodontic treatment efficiency with self-ligating and conventional fixed orthodontic appliances. Am J OrthodDentofacialOrthop 2010;137:738-42

5.Doshi MG, Bhad PW. Efficacy of low-intensity laser therapy in reducing treatment time and orthodontic pain: a clinical investigation. Am J OrthodDentofacialOrthop 2012;141: 289-297

6.Joy GN ,Singh G, Kannan S, Rai D, Kaul A, Gupta A et al. Effect of 810 nm Diode Laser Therapy on the Rate of Extraction Space Closure .The Journal of Indian Orthodontic Society, July September 2014;48(3):143-148

7. Kawasaki K, Shimizu N. Effects of low-energy laser irradiation on bone remodeling during experimental tooth movement in rats. Lasers Surg Med 2000;26:282-291.

8. Cruz DR, Kohara EK, Ribeiro MS, Wetter NU. Effects of low intensity laser therapy on the orthodontic movement velocity of human teeth: a preliminary study. Lasers Surg Med 2004;35: 117-120.

9. Seii M, Shafeei HA, Daneshdoost S, Mir M. Effects of two types of low-level laser wave lengths (850 and 630 nm) on the

orthodontic tooth movements in rabbits. Lasers Med Sci 2007;22:261-264.

10. Limpanichkul W, Godfrey K, Srisuk N, Rattanayatikul C. Effects of low-level laser therapy on the rate of orthodontic tooth movement. OrthodCraniofac Res 2006;9:38-43.

11. Genc G, Kocadereli I, Tasar F, Kilinc K, El S, Sarkarati B. Effect of low-level laser therapy (LLLT) on orthodontic tooth movement. Lasers Med Sci (2013) 28:41–47.

12. Abi-Ramiaa LPB, Stuanib AS, Stuanic AS, Stuanid MBS, Mendese AM. Effects of Low-Level Laser Therapy and Orthodontic Tooth Movement on Dental Pulps in Rats.Angle Orthod. 2010;80:116–122.

13. Machibya FM1, Bao X, Zhao L, Hu M. Treatment time, outcome, and anchorage loss comparisons of self-ligating and conventional brackets.Angle Orthod. 2013 Mar;83(2):280-5.