Cross Current International Journal of Medical and Biosciences
*Abbreviated Key Title: Cross Current Int J Med Biosci*
**ISSN:** 2663-2446 (Print) & Open Access
**DOI:** 10.36344/ccijmb.2021.v03i05.001

OPEN ACCESS

Volume-3 | Issue-5 | July, 2021 |

**Review Article**

# A Review of Laser Applications in Orthodontics

**Dr. Varsha Joseph[1*], Dr. Bejoy PU[2], Dr. Lakshmi Lakshmanan[3], Dr. Minu C mathews[4]**

[1]Post Graduate Student, Department of Orthodontics & Dentofacial Orthopedics, Malabar Dental College, Malappuram, Kerala, India
[2]Professor & Head, Department of Orthodontics & Dentofacial Orthopedics, Malabar Dental College, Malappuram, Kerala, India
[3]Professor, Department Of Orthodontics & Dentofacial Orthopedics, Malabar Dental College, Malappuram, Kerala, India
[4]Post Graduate Student, Department of Orthodontics & Dentofacial Orthopedics, Malabar Dental College, Malappuram, Kerala, India

***Corresponding author:** Dr. Varsha Joseph
| **Received:** 15.05.2021 | **Accepted:** 20.06.2021 | **Published:** 07.07.2021 |

**Abstract:** Lasers have been widely used in most fields of dentistry for many years, and they have recently gained popularity in orthodontics. Its use has allowed orthodontists to overcome some of the difficulties associated with traditional orthodontic treatment procedures. These include direct chair side clinical orthodontic procedures, adjunctive orthodontic and laboratory procedures. This review article is about the applications of lasers in field of orthodontics.
**Keywords:** Laser; Laser Etching; Laser Debonding; Laser curing Accelerated Orthodontics, Soft tissue laser.

## INTRODUCTION

Laser is an acronym, which stands for Light Amplification by Stimulated Emission of Radiation. A laser is a single wavelength of light traveling through a collimated tube delivering a concentrated source of energy. Laser was developed by Theodore H. Mmaiman in 1960 [1]. The laser technique is now widely used in orthodontic treatment and has proven to have numerous advantages.

### APPLICATION OF LASER IN ORTHODONTICS

There are two types of lasers.
1. Hard tissue laser
2. Soft tissue laser

Both types of laser are used in orthodontics in different procedures.

### LASER ETCHING

The application of laser energy to an enamel surface causes localized ablation and removal of enamel surface [1, 2]. Etching is caused primarily by the micro-explosion of entrapped water in the enamel, as well as some melting of the hydroxyapatite crystals. Laser etching with a neodymium-yttrium-aluminum garnet (Nd:YAG) laser produces lower bond strengths than acid etching [3, 4]. According to Torun et al. [5], a meta analysis on laser etching for orthodontic bonding, comparing the effectiveness of Er,Cr:YSGG with 37% orthophosphoric acid, concludes that the use of Er,Cr:YSGG produces similar results when compared to the use of conventional orthophosphoric acid.

### LASER DEBONDING

Laser debonding is commonly performed with CO2 and ND: YAG lasers. Ceramic brackets can easily be debonded with this technique [6]. Debonding force can be reduced by thermal softening of adhesive resin.The mechanism of laser debonding includes: thermal softening, thermal ablation and photoablation[7].

### LASER CURING

Argon lasers can be used to bond orthodontic brackets, providing bond strengths comparable to traditional light curing [8]. It also significantly reduces chair time while potentially conferring demineralization resistance on the enamel. However, when debonding, it left more adhesive on the tooth surfaces [9].

### ACCELERATED TOOTH MOVEMENTS

Low-level laser therapy stimulates the proliferation of osteoclasts, osteoblasts, and fibroblasts, affecting bone remodelling and accelerating tooth movement. The mechanisms involved in the acceleration of tooth movement are ATP production and cytochrome C activation [10]. and improve the velocity of tooth movement via RANK/RANKL and the macrophage colony-stimulating factor and its receptor expression. However, some studies found insignificant differences [11] or even decreased tooth movement [12]. According to some authors, if a laser dose is too low, it will not have a biostimulating effect, whereas a higher dose can inhibit tooth movement.

Quick Response Code

**Journal homepage:**
https://crosscurrentpublisher.com



**Citation:** Varsha Joseph *et al* (2021). A Review of Laser Applications in Orthodontics. *Cross Current Int J Med Biosci*, *3*(5), 48-50.

## BRACKET MESH DESIGNING

David Hamula introduced titanium brackets with retentive base pads created by a computer-aided laser (CAL) cutting process that generates micro- and macro-undercuts [13]. A sufficiently powerful Nd: YAG laser is used to melt and evaporate the metal and burn hole-shaped retentions on the smooth surface of an injection moulded single piece bracket base.

## LASER WELDING

In orthodontics, welding is a common procedure. Joining two metal surfaces by laser is an efficient procedure.The rapid and repeatable actions of the pulsed neodymium LASER microwelder can be used a safe intraoral welding unit with no damage to the hard tissues. This has an advantage that it minimizes the time consuming procedures. Thus intraoral welders can be used for construction and placement of retention devices, intraoral welding of space maintainers, periodontal splints, ortho-surgical splints, and attachment of archwire, brackets to existing bands and auxillaries [14].

## 3D LASER SCANNING

Laser scanning is a non-invasive technique for 3D analysis of facial morphology, evaluating facial symmetry,assessment of treatment outcomes, evaluating clinical outcomes for surgical cases evaluating patients with CLP, soft tissue changes and scanning dental casts.The laser scanner can detect not only an object's length and width but also its depth [15].

## SOFT TISSUE LASER

Soft-tissue lasers have numerous applications in orthodontics, including gingivectomy, frenectomy, operculectomy, papilla flattening, uncovering temporary anchorage devices, ablation of aphthous ulcerations and exposure of impacted teeth. Diode and erbrium soft-tissue lasers offer many advantages in regard to esthetic finishing, practice efficiencies, and interdisciplinary treatment options [16].

## PAIN CONTROL

Low-level laser therapy has been shown to have analgesic effect in a variety of therapeutic procedures. The analgesic effect is believed to be attributed to its anti-inflammatory effect and direct inhibition of neural activity [17]. Kim et al. Indicated the beneficial effects of laser therapy in controlling pain perceived by the patients during canine retraction or after separation [18]. The laser parameters such as wavelength, power, energy, and irradiation time, frequency of irradiation, power density and energy density could affect the analgesic effect.

# CONCLUSION

Since the introduction of lasers into the dental profession, they have been recognised as a highly effective treatment modality for both hard and soft tissue procedures. Laser treatment will be a routine procedure in orthodontics in the modern era, with the availability of more advanced laser devices at a lower cost.

# REFERENCES


1. Maiman, T. H. (1960). “Simulated optical radiation in ruby laser”. Nature; 187; 493.
2. Brantley, W.A., & Eliades, T. (2001). “Orthodontic Materials”. Stuttgart: Thieme.
3. Kwon, Y. H., Kwon, O. W., Kim, H. I., & Kim, K. H. (2003). Nd: YAG laser ablation of enamel for orthodontic use Tensile bond strength and surface modification. Dental materials journal, 22(3), 397-403.
4. Corpas-Pastor, L. U. I. S., Moreno, J. V., Garrido, J. D. D. L. G., Muriel, V. P., Moore, K., & Elias, A. (1997). Comparing the tensile strength of brackets adhered to laser-etched enamel vs. acid-etched enamel. The Journal of the American Dental Association, 128(6), 732-737.
5. Özer, T., Başaran, G., & Berk, N. (2008). Laser etching of enamel for orthodontic bonding. American journal of orthodontics and dentofacial orthopedics, 134(2), 193-197.
6. Rickabaugh, J. L., Marangoni, R. D., & McCaffrey, K. K. (1996). Ceramic bracket debonding with the carbon dioxide laser. American journal of orthodontics and dentofacial orthopedics, 110(4), 388-393.
7. Azzeh, E., & Feldon, P. J. (2003). Laser debonding of ceramic brackets: a comprehensive review. American journal of orthodontics and dentofacial orthopedics, 123(1), 79-83.
8. Talbot, T.Q. (2000). “Effect of argon laser irradiation on shear bond strength of orthodontic brackets: V An in vitro study”. American Journal of Orthodontics and Dentofacial Orthopedics, 118; 274-279.
9. Hildebrand, N. K., Raboud, D. W., Heo, G., Nelson, A. E., & Major, P. W. (2007). Argon laser vs conventional visible light-cured orthodontic bracket bonding: an in-vivo and in-vitro study. American Journal of Orthodontics and Dentofacial Orthopedics, 131(4), 530-536.
10. Fujita, S., Yamaguchi, M., Utsunomiya, T., Yamamoto, H., & Kasai, K. (2008). Low-energy laser stimulates tooth movement velocity via expression of RANK and RANKL. Orthodontics & Craniofacial Research, 11(3), 143-155.
11. Limpanichkul, W., Godfrey, K., Srisuk, N., & Rattanayatikul, C. (2006). Effects of low-level laser therapy on the rate of orthodontic tooth movement. Orthodontics & craniofacial research, 9(1), 38-43.
12. Seifi, M., Shafeei, H. A., Daneshdoost, S., & Mir, M. (2007). Effects of two types of low-level laser wave lengths (850 and 630 nm) on the orthodontic tooth movements in rabbits. Lasers in medical science, 22(4), 261-264.

13. Hamula, D. W., Hamula, W., & Sernetz, F. (1996). Pure titanium orthodontic brackets. Journal of clinical orthodontics: JCO, 30(3), 140-144.
14. Colby, L. E., & Bevis, R. R. (1978). Simulated intraoral laser microwelding of orthodontic appliances. The Angle Orthodontist, 48(4), 253-261.
15. Kuroda, T., Motohashi, N., Tominaga, R., & Iwata, K. (1996). Three-dimensional dental cast analyzing system using laser scanning. American Journal of Orthodontics and Dentofacial Orthopedics, 110(4), 365-369.
16. Kravitz, N. D., & Kusnoto, B. (2008). Soft-tissue lasers in orthodontics: an overview. American journal of orthodontics and dentofacial orthopedics, 133(4), S110-S114.
17. Harris, D. M. (1991). Editorial comment biomolecular mechanisms of laser biostimulation. Journal of clinical laser medicine & surgery, 9(4), 277-280.
18. Kim, W. T., Bayome, M., Park, J. B., Park, J. H., Baek, S. H., & Kook, Y. A. (2013). Effect of frequent laser irradiation on orthodontic pain: a single-blind randomized clinical trial. The Angle Orthodontist, 83(4), 611-616.