

Lasers: The Magic Wand in Esthetic Dentistry!!

P A Shajahan¹, P Ranjith Kumar¹, A Hariprasad², Jyothis Mathew³, A P Shaji⁴, M Fazeel Ahammed⁵

Contributors:

¹Professor, Department of Prosthodontics, Royal Dental College, Chalissery, Palakkad, Kerala, India; ²Professor, Department of Orthodontics, Royal Dental College, Chalissery, Palakkad, Kerala, India; ³Senior Lecturer, Department of Prosthodontics, Royal Dental College, Chalissery, Palakkad, Kerala, India; ⁴Reader, Department of Orthodontics, Royal Dental College, Chalissery, Palakkad, Kerala, India; ⁵Reader, Department of Oral Medicine and Radiology, Malabar Dental College, Edappal, Malappuram, Kerala, India.

Correspondence:

Dr. Shajahan PA. Department of Prosthodontics, Royal Dental College, Chalissery, Palakkad, Kerala, India. Phone: +91-9072277275. Email: drshajahanpa@gmail.com

How to cite the article:

Shajahan PA, Kumar PR, Hariprasad A, Mathew J, Shaji AP, Ahammed MF. Lasers: The magic wand in esthetic dentistry!! J Int Oral Health 2015;7(6):119-121.

Abstract:

In this era of fast developing technologies and innovative ideas, the need for faster treatment has become a necessity. Treatment with lasers that is much less time-consuming and painless is accepted and appreciated by the patient. Use of Lasers is not new; they have been in use for decades since their development by Maiman in 1960. Lasers have travelled a long way from ruby lasers to erbium lasers and are being fondly used in every aspect of dental treatment. This article aims at elaborate the use and applications of lasers in the field of esthetic dentistry.

Key Words: Esthetic dentistry, chromophore, complete dentures, dental laboratory, fixed prosthodontics, implantology, lasers, maxillofacial prosthodontics, removable prosthodontics

Introduction

Lasers are the acronym for "light amplification by stimulated emission of radiation" named in 1957 by Gordon Gould. The first laser to be used was that introduced by Theodore Harold Maiman in 1960 was the Ruby laser.¹ Lasers are now being used extensively as an adjunct to dental treatment to increase the prediction and precision of the treatment.

Laser Physics

Light is a form of electromagnetic energy that behaves as a particle wave. The basic unit of this energy is called as photon.²

Laser light has three main properties that differentiate it from normal light.³ They are:

1. Collimation: Refers to the beam having specific spatial boundaries which ensure that there is a constant beam size and shape that is emitted from the laser unit.

2. Coherence: A unique property of lasers that states that they have identical frequency and identical wavelength.
3. Monochromatism: The property of lasers that it possesses one specific color which is finely focused.

Laser tissue interaction

Absorption

The amount of energy that is absorbed by the tissue depends on the tissue characteristics, primarily water content, presence of pigments, laser wavelength and their emission modes. In general, shorter wavelengths are readily absorbed in pigmented tissue and blood elements.⁴

Transmission

The second effect is transmission of the laser energy directly through the tissue with no effect on the target tissue, inverse of absorption. This effect is also dependent on the wavelength of laser light.²

Reflection

The third effect is a reflection, which is the beam redirecting itself off the surface, having minimal or no effect on the target tissue.⁵

Scattering

The fourth effect is a scattering of the laser light which weakens the intended energy and possibly produces no useful biological effects instead scattering causes heat transfer to the tissue adjacent to the surgical site, and unwanted collateral damage could occur.⁶

The main effect of laser is due to the absorption of laser by various components of the tissue it is exposed to. The primary component that absorbs specific laser energy is termed as chromophores. The chromophore for various lasers differs (Table 1).

Application of Lasers to Aid in Dentistry

The successful of prosthetic treatment mainly depends on the pre-operative evaluation of the supporting hard and soft tissue structures and their proper preparation.⁷

Table 1: Chromophores of various lasers.

Laser	Chromophore
Erbium laser	Water > tooth enamel
Carbon dioxide laser	Tooth enamel > water
Diode laser	Hemoglobin > melanin
Nd-YAG laser	Melanin > hemoglobin

Fixed prosthodontics

- i. Crown lengthening
- ii. Soft tissue management around abutments
- iii. Modification of soft tissue around laminates
- iv. Osseous crown lengthening
- v. Troughing
- vi. Formation of ovate pontic sites (Figure 1)
- vii. Altered passive eruption management
- viii. Veneer removal
- ix. Dentinal hypersensitivity
- x. Tooth preparation (Figure 2).

Implantology

- i. Second stage uncovering
- ii. Implant site preparation
- iii. Peri-implantitis.

Removable prosthetics

- i. Tuberosity reduction
- ii. Torus reduction
- iii. Soft tissue modification
- iv. Epulis fissurata
- v. Denture stomatitis
- vi. Residual ridge modification.



Figure 1: Laser assisted ovate pontic site preparation.

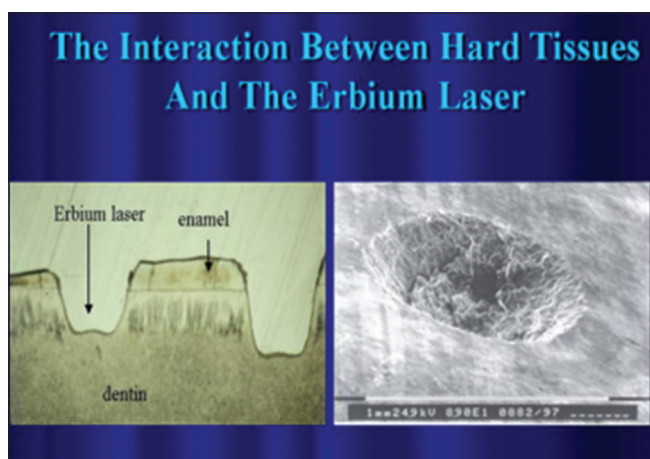


Figure 2: Effect of erbium laser on tooth enamel.

Complete denture prosthodontics

- i. Prototyping and computer aided design and computer aided manufacturing (CAD/CAM) technology.
- ii. Analysis of occlusion by CAD/CAM.
- iii. Analysis of accuracy of impression by the laser scanner.

Laser application in dental laboratory

- i. Laser titanium sintering – direct metal laser sintering (Figure 3)
- ii. Laser ablation of titanium surfaces
- iii. Laser assisted hydroxyapatite coating
- iv. Laser welding of titanium components of the prostheses (Figure 4).

Laser in maxillofacial prosthodontics

- i. Planning the shape and position of the prostheses
- ii. Three-dimensional acquisition of optical data of the extra-oral defects - selective laser sintering technology.

Esthetic procedures

- i. Laser bleaching
- ii. Laser depigmentation.

Orthodontic esthetic enhancement⁸

1. Laser etching
2. Laser debonding
3. Laser scanning



Figure 3: Metal crowns formed with direct metal laser sintering.



Figure 4: Laser welding.

4. Laser holography
5. Laser welding
6. Laser specular reflectance.

The latest application of lasers includes low-level laser therapy. The biostimulatory effect of lasers is implied in low-level laser therapy.⁹ The various applications of low-level laser therapy are:

1. Dentinal hypersensitivity
2. Temporomandibular disorders
3. Treatment of pain during orthodontic tooth movement
4. Bone implants interphase for better healing.

Lasers are also used effectively in pediatric and apprehensive patient with much cooperation and helps in better treatment.¹⁰

Conclusion

Lasers have become a ray of hope in dentistry. When used ethically and effectively, lasers are an exceptional “magic wand” in the treatment for many clinical conditions that dentists treat on a daily basis. However, lasers have never been the “magic tool” that many people have hoped for. It has got its own limitations. The addition of laser to dental treatment enhances the dentist’s ability to perform more clinical procedures, increase confidence and experience.

References

1. Moritz A. Oral Laser Application, Berlin: Quintessenz Verlags-GmbH; 2006.
2. Coluzzi DJ. Fundamentals of dental lasers: Science and instruments. *Dent Clin North Am* 2004;48(4):751-70, v.
3. Steven P. The uses of lasers in fixed prosthodontics. *Dent Clin North Am* 2004;48:971-98.
4. Emile M. Lasers in dental implantology. *Dent Clin North Am* 2004;48:999-1015.
5. Jyoti N. Dental lasers - A Boon to Prosthodontics: A review. *Int J Dent Clin* 2010;2(2):13-21.
6. Kesler G. Clinical applications of lasers during removable prosthetic reconstruction. *Dent Clin North Am* 2004;48(4):963-9, vii.
7. Nachrani P. Lasers in Prosthodontics: A review. *Natl J Dent Sci Res* 2014;2(1):74-7.
8. Karra A, Begum M. Lasers in orthodontics. *Int J Contemp Dent Med Rev* 2014;2014. doi: 10.15713/ins.ijcdmr.4.
9. Saquib S, Jadhav V, Priyanka N, Perla N. Low level laser therapy in dentistry: A review. *Int J Contemp Dent Med Rev* 2014;2014. doi: 10.15713/ins.ijcdmr.24.
10. Neena IE, Poornima P, Edagunji G, Roopa KB, Bharath KP. Lasers in pediatric dentistry: A review. *Int J Contemp Dent Med Rev* 2015;2015. doi: 10.15713/ins.ijcdmr.29.