Lasers: The Magic Wand in Esthetic Dentistry!!
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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           |

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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.

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

Figure 1: Laser assisted ovate pontic site preparation.

Figure 2: Effect of erbium laser on tooth enamel.

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

Figure 4: Laser welding.
4. Laser holography
5. Laser welding
6. Laser spectacular reflectance.

The latest application of lasers includes low-level laser therapy. The biostimulatory effect of lasers is implied in low-level laser therapy. 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.

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.

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