

Lasers in Prosthodontics- A Review

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Abstract:

In this changing era all the disadvantages of the conventional methods are being overcome by newer technology like lasers. Lasers are introduced in every field of dentistry including prosthodontics. Lasers are widely used in every aspects of Prosthodontics. The aim of this article is to elaborate the applications and uses of the lasers in Prosthodontics.

Key words : Lasers, Removable Prosthesis, Fixed Prosthesis, Implant Dentistry, esthetics.

Introduction:- In the changing face of prosthodontics lasers plays an important role. Lasers is the acronym for "Light Amplification by stimulated emission of radiation" named by Gordon Gould in 1957¹. In 1997, the Erbium family of lasers, consisting of Er:YAG and Er,Cr:YSGG wavelengths, was introduced in the United States. These instruments have indications for use for both soft and hard tissue². In clinical dentistry, there is a growing awareness of the usefulness of lasers in the armamentarium of the modern dental practice, where they can be used as an adjunct or alternative to traditional approaches³. This article describes the uses of lasers in dentistry.

History of lasers⁴:- Theodore Harold Maiman is generally given credit for building the first working ruby laser and operating it for the first time on May 16, 1960 at the Hughes Research Laboratory in Malibu, California. MASER a microwave amplifier by Charles H. Townes, P. Gordon et al became the basic principle for laser pumping. This set the stage for a "snowball effect" which would

lead to the development of many laser systems, which we utilize in healthcare today. The application of a laser to dental tissue was reported by Stern and Sognnaes and Goldman et al. in 1964, describing the effects of ruby laser on enamel and dentine with a disappointing result.

A. FIXED PROSTHETICS/ESTHETICS³

- i. Crown lengthening
- ii. Soft tissue management around abutments
- iii. Osseous crown lengthening
- iv. Troughing
- v. Formation of ovate pontic sites
- vi. Altered passive eruption management
- vii. Bleaching⁵
- viii. Veneer removal⁵
- ix. Tooth preparation for veneers and full coverage crowns and bridges⁴
- x. Removal of carious lesion and faulty composite restorations before placement of final restorations⁴.
- xi. Crown fractures at the gingival margins Enamel and dentin Etching⁶.

B. IMPLANTOLOGY³

- i. Second stage uncovering.
- ii. Implant site preparation.

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- iii. Peri-implantitis

C. REMOVABLE PROSTHETICS³

- i. Tuberosity reduction
- ii. Torus reduction
- iii. Soft tissue modification
- iv. Epulis fissurata
- v. Denture stomatitis
- vi. Residual ridge modification
- vii. Treatment of flabby ridges
- viii. Vestibuloplasty
- ix. Sulcus deepening
- x. frenectomies
- xi. Osseotomy during tooth/root extraction or ridge recontouring
- xii. Treatment of soft tissue and hard tissue undercuts

D. LASER APPLICATIONS IN THE DENTAL LABORATORY⁴

- i. Laser titanium sintering
- ii. Laser ablation of titanium surfaces
- iii. Laser assisted hydroxyapatite coating
- iv. Laser welding of titanium components of the prostheses

E. LASERS IN MAXILLOFACIAL REHABILITATION⁴

- i. Planning the shape and position of the prostheses.
- ii. Three dimensional acquisition of optical data of the extraoral defects.

Fixed Prosthetics/Aesthetics:

Crown lengthening⁴: Lasers have an advantage in crown lengthening regard as they cut only at the tip and can be held parallel to long axis of the tooth to remove bone immediately adjacent to cementum without damaging it. Also, using lasers is less complicated and achieves maximum patient comfort. However, it is argued that lasers do not work well for crown lengthening procedures and there are no studies indicating a lack of damage to the bone from a laser and that adequate correction is achieved only with

conventional flap surgery with ostectomy and osteoplasty to reduce the bone level and thickness to a normal form around each tooth⁷

Soft tissue management around abutments³: Argon laser energy has peak absorption in haemoglobin, thus lending itself to providing excellent haemostasis and efficient coagulation and vaporization of oral tissues. These characteristics are beneficial for retraction and haemostasis of the gingival tissue in preparation for an impression during a crown and bridge procedure. Argon laser with 300 um fiber, and a power setting of 1.0W, continuous wave delivery and the fiber is inserted into the sulcus in contact with the tissue.

Modification of soft tissue around laminates³: The removal and re-contouring of gingival tissues around laminates can be easily accomplished with the argon laser.

Osseous crown lengthening³: Like teeth mineralized matrix of bone consists mainly of hydroxyapatite. The water content and hydroxyapatite are responsible for the high absorption of the Er: YAG laser light in the bone. Er: YAG laser has very promising potential for bone ablation.

Laser troughing³: Lasers can be used to create a trough around a tooth before impression taking. This can entirely replace the need for retraction cord, electrocautery, and the use of haemostatic agents. The results are predictable, efficient, minimize impingement of epithelial attachment, cause less bleeding during the subsequent impression, reduce postoperative problems, and reduce chair time⁴. It alters the biological width of gingiva. Nd:YAG laser is used.

Bleaching⁵: Aesthetics and smile has become important issues in modern society. Bleaching has become the common method for tooth whitening. Bleaching using diode lasers results in immediate shade change and less tooth sensitivity and is preferred among in office bleaching systems.

Veneer removal : Lasers like Er:YAG and Er Cr:YSGG can be used to remove unwanted or failed veneers⁴.

Crown fractures at the gingival margins: Er:YAG or Er, Cr:YSGG lasers can be carried out to allow correct exposure of the fracture margin⁸.

Formation of ovate pontic sites: The use of an ovate pontic receptor site is of great value when trying to create a natural maxillary anterior fixed bridge. This is easily accomplished with the use of a laser⁹.

IMPLANTOLOGY: Dental lasers are used for a variety of procedures in implantology like implant recovery, implant site preparation and removal of diseased tissue around the implant.

Implant recovery: One advantage of use of lasers in implantology is that impressions can be taken immediately after second stage surgery because there is little blood contamination in the field due to the haemostatic effects of the lasers. There also is minimal tissue shrinkage after laser surgery, which assures that the tissue margins will remain at the same level after healing as they are immediately after surgery^{10,11}.

Implant site preparation: Lasers can be used for the placement of mini implants especially in patients with potential bleeding problems, to provide essentially bloodless surgery in the bone¹¹.

Removal of diseased tissue around the implant: The diode lasers alone or with toluidine O dye, CO2 lasers and Er:YAG lasers have been used for implant maintenance, because of their bactericidal effect and technical simplicity¹². Debridement of implant abutment surface with lasers can effectively decontaminate the surfaces, reduce the bacterial count and improve the success rate of ailing

implants. Schwarz et al. demonstrated the effectiveness of Er:YAG laser treatment to remove subgingival calculus from surfaces of titanium implant fixtures without any thermal damage. Among the disadvantages of using lasers for the purpose are that not all the lasers can be used, for example, Nd:YAG lasers and Ho:YAG lasers are unsuitable for peri-implantitis and caused melting, loss of porosity and other surface alterations even with the lowest settings¹³.

REMOVABLE PROSTHETICS⁵

Treatment of unsuitable alveolar ridges⁵: Hard tissue surgery may be performed with the erbium family of wavelengths.

Treatment of undercut alveolar ridges⁵: Osseous surgery may be performed with the erbium family of lasers.

Treatment of enlarged tuberosity⁵: The soft tissue reduction may be performed with any of the soft tissue lasers. Erbium laser is the laser of choice for the osseous reduction.

Surgical treatment of tori and exostoses⁵: Soft tissue lasers may be used to expose the exostoses and erbium lasers may be used for the osseous reduction.

LASERS IN MAXILLOFACIAL REHABILITATION⁴:-

The use of lasers in the maxillofacial prosthetics is mainly for the initial work up of three dimensional acquisition of optical data of the extraoral defects. Laser technology has proved to be particularly useful for planning the shape and position of the prostheses. Lasers can totally eliminate the need for conventional impression techniques and associated disadvantages like deformation of the soft tissue and discomfort to patients. Lasers also overcome the drawbacks of 3D CT and MRI reconstruction as the patient is not exposed to considerable radiation and any stress

LASER APPLICATIONS IN THE DENTAL LABORATORY⁴

Lasers have been used for deposition of hydroxyapatite (HA) thin films on titanium implants. pulsed laser deposition (PLD) has proven to be a promising method to produce pure, crystalline and adherent HA coatings which show no dissolution in a simulated body fluid .

Use of lasers for surface treatment of titanium castings for ceramic bonding have shown improved bond strength when compared to acid etching techniques which are commonly used. Lasers can also be used for welding¹⁴.

CONCLUSION : Lasers the upcoming new technology replacing the shortcomings of the conventional methods have its own disadvantages, limitations and risks. All the risks can increase in magnitude due to lack of knowledge about lasers.

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