REVIEW ARTICLE

LASERS IN PROSTHODONTICS- A REVIEW

Authors:

Aathira Kuruvilla[1]
Pinky Varghese[2]

Private Dental Practitioner[1]

Senior Lecturer[2]
Department of Prosthodontics
Indira Gandhi Institute of Dental Sciences
Nellikuzhi P. O., Kothamangalam 686 691
Kerala

Corresponding author
Dr. Pinky Varghese
Senior Lecturer
Department of Prosthodontics
Indira Gandhi Institute of Dental Sciences
Nellikuzhi P. O., Kothamangalam 686 691
Kerala
Email: pinkyv08@gmail.com

ABSTRACT

The introduction of lasers in the field of prosthodontics has replaced many conventional surgical and technical procedures with more efficient and predictable outcomes. Although lasers were introduced in dentistry as early as the 1960s it gained widespread popularity mainly in the developed countries only from the early 90s. Laser technology has advanced much to equip the present day dentists with a wide range of therapeutic applications. The aim of this review is to describe the current and emerging applications for lasers in prosthetic dentistry.

Key words: Lasers, prosthodontics.

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INTRODUCTION

Laser is the acronym for "Light Amplification by stimulated emission of radiation" named by Gordon Gould in 1957[1,2]. 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 approaches.[3] The purpose of this review is to provide an overview of various laser applications in Prosthodontics, and to discuss in more detail several key clinical applications which are attracting a high level of interest.

History of lasers[4]

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. From then on lasers gradually found application in the oral cavity with further advances in technology and research.

Different types of Lasers used in Dental Treatment[1] (Table 1)

Several types of lasers are available based on the wavelengths.

1. The Er: YAG laser possesses the potential of replacing the drill.
2. CO2 laser can be used to perform gingivecotomy and to remove small tumors.
3. Argon laser is used in minor surgery.
4. Nd: YAG is used in tissue retraction, endodontics and oral surgery.
5. The diode laser is effective for oral surgery and endodontic treatment. This laser helps to correct aesthetics flaws. It is used for soft tissue procedures.

Classification of Lasers

According to ANSI and OSHA standards Lasers are classified as:

Class I - These are low powered lasers that are safe to use. E.g. Laser beam pointer

Class II - Low powered visible lasers that are hazardous only when viewed directly for longer than 1000 seconds, e.g. He-Ne lasers

Class II b - Low powered visible lasers that are hazardous when viewed for more than 0.25 seconds.

Class III a - Medium powered lasers that are nor-

Table 1. Common laser types used in dentistry

Laser type	Construction	Wavelength (s)	Delivery system
Argon	Gas laser	488, 515nm	Optical fiber
KTP	Solid state	532nm	Optical fiber
Helium - Neon	Gas laser	633nm	Optical fiber
Diode	Semiconductor	635, 670,810,980nm	Optical fiber
Nd:YAG	Solid state	1064nm	Optical fiber
Er,Cr:YSGG	Solid state	2780nm	Semiflexible hollow wave guide

mally hazardous if viewed for less than 0.25 seconds without magnifying optics.

Class III b - Medium powered lasers that can be hazardous if viewed directly.

Class IV - These are high powered lasers (> 0.5 W) that produce ocular skin and fire hazards.

Advantages of Laser over other techniques[2]

1. It is painless, bloodless that results in clean surgical field, and fine incision with precision is possible.
2. There is no or minimal need for anesthesia.
3. The risk of infection is reduced as a more sterilized environment is created as the laser kills bacteria.
4. No postoperative discomfort, minimal pain and swelling, generally doesn't require medication.
5. Superior and faster healing, offers better patient compliance.

Disadvantages of Lasers[2]

1. Lasers cannot be used to remove defective crowns or silver fillings, or to prepare teeth for bridges.
2. Lasers can't be used on teeth with filling already in place.
3. Lasers don't completely eliminate the need for anesthesia.
4. Lasers treatment is more expensive as the cost of the laser equipment itself is much higher.

Use of Lasers in Prosthetic Dentistry:

Lasers are now being used in a variety of procedures in prosthetic dentistry.

Fixed prosthesis and esthetics

A. Crown lengthening

Clinical scenarios where crown lengthening procedures are indicated within aesthetic zone require special consideration to achieve predictable aesthetic results. Crown lengthening procedures with the help of lasers are indicated in following conditions:

a. Caries at gingival margin

b. Cuspal fracture extending apical to the gingival margin

c. Endodontic perforations near alveolar crest.

d. Insufficient clinical crown length.

e. Difficulty in placement of finish line coronal to the biological width.

f. Need to develop a ferrule.

g. Unaesthetic gingival architecture.

h. Cosmetic enhancements.

Lasers offer unparallel precision and operator control and may be beneficial for finely tracing incision lines and sculpting the desired gingival margin outline[3].

B. Soft tissue management around abutments[4]

Argon laser energy has peak absorption in hemoglobin, 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.

C. Modification of soft tissue around laminates[4]

The removal and re-contouring of gingival tissues around laminates can be easily accomplished with the argon laser. The laser will remove tissue and provide haemostasis and tissues heal well.

D. Osseous crown lengthening

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[4].

E. Formation of ovate pontic sites

For favorablepontic design re-contouring of soft and bony tissue may be needed. Soft tissue surgery may be performed with any of the soft tissue lasers and osseous surgery may be performed with erbium family of lasers.

F. Altered passive eruption management

Lasers can be used very efficaciously to manage passive eruption problems. When the patients have clinical crowns that appear too short or when they have an uneven gingival line producing an uneven smile, excessive tissue can be easily and quickly removed without the need for blade incisions, flap reflection, or suturing[4].

G. Laser troughing

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 time[4]. It alters the biological width of gingiva. Nd:YAG laser is used.

Lasers in 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 bone[11].

Removal of diseased tissue around the implant: The diode lasers alone or with toludine O dye, CO2 lasers and Er:YAG lasers have been used for implant maintenance, because of their bactericidal effect and technical simplicity[12,13].

Lasers in removable prosthetics[5]

Treatment of unsuitable alveolar ridges[5]: Flabby tissues, undercuts may be rectified with laser application for enhanced retention, stability and support

Treatment of soft tissue lesions: Epulis fissurata, denture stomatitis cases may be treated with soft tissue lasers.

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

Surgical treatment of tori and exostoses[5]: Soft tissue lasers may be use to expose the exostoses and erbium lasers may be use for the osseous reduction.

Lasers in maxillofacial rehabilation[4]

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. This procedure is called Laser Holography Imaging . Laser technology has proved to be particularly useful for planning the shape and position of the prostheses. It has the potential to eliminate the need for conventional impression techniques .

Laser applications in the dental laboratory[4]

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 disso-

lution 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 welding[14].

Laser scanning of casts with CAD-CAM systems has been used in the fabrication of porcelain and other restorative materials.

CONCLUSION

Lasers have become a ray of hope in dentistry. When used effectively and ethically, lasers are an exceptional modality of treatment for many clinical conditions that dentists treat on a daily basis. But lasers has never been the “magic wand” that many dentists may hope for. It has got its own limitations. If a clinician decides to use a laser for a dental procedure, he or she needs to fully understand the character of the wavelength being used, and the thermal implications & limitations of the optical energy. However, the future of the dental laser shows incredible promise with some of the newest ongoing research.

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