Review Article

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Lasers and its Applications in Prosthodontics

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ABSTRACT

Background: Although lasers were introduced in dentistry as early as the 1960s it has gained widespread popularity mainly in the developed countries only from the early 90s. Lasers were first introduced into the field of dentistry with the perception of overcoming few of the drawbacks set by conventional methods of dental procedures. A remarkable paradigm shift is occurring in the field of dentistry with a technology breakthrough that gives dentists the capability to perform a wide range of hard and soft tissue procedures with which improved patient outcomes, minimal trauma and reduced postoperative complications are achieved. Lasers can be applied to diverse areas in the field of dental research. Basic research offers a plethora of newer possibilities by advancing laser technology. Its diverse applications in the field of endodontics, periodontics, implant ology, and in the treatment of soft tissue tumors and lesions have been well established. There are specific soft tissue indications for clinical use of lasers. Advances in the use of lasers and light sources enable clinicians to effectively treat lesions that were previously deemed untreatable. The specialty of Prosthodontics takes all concepts of dentistry and integrates effective comprehensive treatment planning. The practice will necessarily include a wide variety of patients seeking a diverse range of care. These include individuals who are highly fearful of dentistry and have long-term neglected care and those who have complex medical histories and require more specialized, advanced procedures. Some also have phobias and/or allergies to anesthetics. Lasers have become an integral part of treatment for these patients. Used in conjunction with or as a replacement for traditional methods, it is observed that specific laser technologies are becoming an essential component of contemporary dental practice over a decade. Today, prosthodontists can select from a variety of laser wavelengths available in dentistry. This has led to great confusion regarding laser operation and selection of the most appropriate laser wavelength for a given procedure. The aim of this review is to describe the current and emerging applications for lasers in prosthetic dentistry.

Keywords: Lasers, Removable Prosthesis, Fixed Prosthesis, Implant Dentistry, Radiation.

INTRODUCTION

The word **LASER**[1,2,3,4] is an acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. A crystal or gas is excited to emit light photons of a characteristic wavelength that are amplified and filtered to make a coherent light beam. The effect of laser depends upon the power of the beam and the extent to which the beam is absorbed. Laser technology has evolved in recent years and has been incorporated into most dental

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treatment modalities in different forms. Ever since its first inception for dental application in the early 1960's, significant studies have been made in the last couple of decades. Competition amongst the manufacturers of dental laser technologies has revolutionized the varied application and maneuverability of the laser hand piece for use during hard and soft tissue treatments. Lasers have transformed the working style and image of dental clinician as a more precision oriented, efficient and updated clinician. However, the success of any procedure using laser is solely the result of knowledge, understanding and adequate experience regarding lasers. Dental lasers can be used to cut, incise and ablate hard and soft tissue, although conventional and traditional dental treatment carries an advantage of removing infected or pathologic tissue by either drilling or cutting away the diseased component. Lasers offer unparallel precision and operator control and show less thermal necrosis of adjacent tissue than electrosurgical devices, while also achieving excellent hemostasis and post-surgical healing. Once regarded as a complex technology with limited uses 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. Its diverse applications have been well established in the field of endodontics, periodontics, implant ology, and in the treatment of soft tissue tumors and lesions. Though at present we are unable to use lasers for all dental procedures, hopefully in the near future, with more studies and better understanding of them we will be able to use them in almost all areas of dentistry. Laser use during removable, fixed, implant and maxillofacial dentistry has provided for the restorative appliance to be near to ideal in fit, form and function. Also, the outcome of laser surgeries are more predictable and offer improved foundation. In view of the advancing technology, it is prudent for the prosthodontists to keep themselves abreast with the various lasers used and their current applications in the field of prosthodontics. Dental lasers are becoming an integral part of contemporary cosmetic dentistry. They can artistically sculpt soft tissues while providing precision, increased visibility, improved impression techniques, predictable healing with decreased scarring, reduced anesthesia and postoperative swelling. The purpose of this review is to provide a complete understanding of the fundamentals of lasers and 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.

RATIONALE BEHIND THE DEVELOPMENT OF LASERS [4,5,6]

In clinical dentistry, lasers were introduced with the hope of overcoming some of the drawbacks posed by the conventional methods of dental procedures. Conventional methods of cavity preparation with low- and high-speed hand pieces involve noise, uncomfortable vibrations and stress for patients. Although pain may be reduced by local anesthesia, fear of the needle and of noise and vibration of mechanical preparation remains causes of discomfort. These disadvantages have led to a search for new techniques as potential alternatives for dental hard tissue removal. The fears of dentists and dental pain have influenced dentists to find pain-free ways to treat patients. The introduction of lasers in the field of prosthodontics has replaced many conventional surgical and technical procedures and is beginning to replace the dental hand piece. The specialty of prosthodontics takes all concepts of dentistry and integrates effective comprehensive treatment planning. The practice will necessarily include a wide variety of patients seeking a diverse range of care. These include individuals who are highly fearful of dentistry and have long-term neglected care and those who have complex medical histories and require more specialized, advanced procedures. Some also have phobias and/ or allergies to anesthetics. Lasers have become an integral part of treatment for these patients. Lasers are contemporary co-adjuvant tools to conventional dental procedures, which could favor the treatment in order to reach successful final results.

Historical Review[3,6,7,8,9]:

The idea and concept of laser capability was acknowledged in 1917, wherein Albert Einstein first conceptualized the use of stimulated emission, which serves as the foundation of laser. In the early to mid 1950's, Bell Labs 'Arthur L Schawlow and Charles H.Townes invented the MASER (microwave amplification by stimulated emission of radiation), by means of ammonia gas and microwave radiation. The MASER was invented prior to optical laser, by theorizing that photoelectric amplification could emit a single frequency, or stimulated emission. The term LASER is an acronym for 'Light Amplification by the Stimulated Emission of Radiation' and was first introduced to the public in 1959, in an article by a Columbia University graduate student, GORDON GOULD. Theodore Maiman, at the Hughes Research Laboratories in Malibu, California, built the first functioning laser, by using a mixture of helium and neon. On May 16, 1960 Theodore Maiman's ruby laser became the first working laser in history. In the 1960's, Dr. Ali Javan invented the first gas laser with Helium Neon. In 1962, the argon laser was developed, whereas, the ruby laser became the first medical laser to coagulate retinal lesions, when it was used in 1963. In 1961, a laser generated from crystals of yttrium-aluminum-garnet treated with 1-3% neodymium (Nd: YAG) was developed. In 1964, the carbon dioxide laser was successfully shaped by Kumar Patel at Bell Laboratories. A new realization of commercial and research opportunities through laser technology became wide spread and substrates and ions such as rare earths (Nd, Pr, Tm, Ho,Er, Yb, Gd, and Ur) were all eventually successfully "lased". Over the years, Goldman and other researchers documented the ability of various types of lasers to cut, coagulate, ablate and vaporize biologic tissues. Historically, the first lasers to be marketed for intraoral use generally were CO_2 lasers. The Nd:YAG laser was developed in 1964 but it was over shadowed by the ruby laser and CO_2 laser, and it was only made available in the 1990's for dental use. Hibst and Pashidiwala described in detail the effect of the Er: YAG laser on dental hard tissues. Erbium family of laser has an emission wavelength which coincides exactly with the absorption peak of water, giving strong absorption in all biological tissue, including enamel and dentine and hence is the most popular soft and hard tissue laser today. Nowadays, diode lasers are being extensively used in the field of dentistry. The first experiment with lasers in dentistry was reported in a study about the effects of a pulsed ruby laser on human caries (Goldman *et al*, 1964). The results of that study showed that the effects varied from small 2-mm deep holes to complete disappearance of the carious tissue, with some whitening of the surrounding rim of enamel, indicating extensive destruction of carious areas along with crater formation and melting of dentine. Further work in the 1970's focused on the effects of neodymium (Nd) and carbon dioxide (CO_2) lasers on dental hard tissues. Early researchers found that CO_2 lasers produced cracking and disruption of enamel rods, incineration of dentinal tubule contents and excessive loss of tooth structure, carbonisation and fissuring and increased mineralization caused by the removal of organic contents (Gimbel, 2000). It was also reported that the use of the CO_2 laser was unfavourable because of the loss of the odontoblastic layer (Wigdor *et al*., 1993). Therefore, it was concluded that, unless heat-related structural changes and damage to dentinal tissues could be reduced, laser technology could not replace the conventional dental drill. Further advances in laser technology however, have identified acceptable biologic interactions. For example, the Er: YAG laser was tested for its ability to ablate (or vapourise) dental hard tissues (Gimbel, 2000). Enamel and dentine cavities were successfully prepared using the Er: YAG laser. Since then, this laser has been used for caries removal and cavity preparation, soft tissue minor surgery and scaling (Aoki and Watanabe *et al*., 1998)[4]. Dr Terry Myers and his brother William Myers in 1983 used Nd:YAG lasers for experiments on removal of incipient caries and this is believed to have sparked the dental laser revolution. Since then this science has progressed rapidly and has been used in wide variety of soft tissue and hard tissue procedures[5].

MECHANISM OF ACTION OF DENTAL LASERS [5,6,7]

Dental lasers function by producing waves of photons that are specific to each laser wavelength. This photonic absorption within the target tissue results in an intracellular or intercellular change to produce the desired result. Chromophore refers to the substance or quality within a specific target tissue that serves as an attractant for laser photon. This photonic absorption within a target tissue's chromophore forms the basis for a dental laser's functional dynamic process, referred to as laser tissue interaction. The following are the mechanism of action of lasers:

1. **Photo thermal ablation:** This occurs with the use of high powered lasers when used to vaporize

or coagulate tissue through absorption in a major tissue component.

2. **Photo mechanical ablation:** Disruption of the tissue due to a wide range of phenomena such as shock wave formation and cavitations.

3. **Photo chemical effects:** Using light sensitive substances to treat conditions such as cancer.

Dental professionals should always use the lowest possible power setting to achieve the intended treatment objective. Merely increasing a laser's power setting will not cut tissue faster; in fact it can cause an adverse result or even lead to treatment failure. Using too much power unnecessarily will increase the target tissue's temperature too rapidly resulting in collateral thermal damage.

LASER INTERACTION WITH BIOLOGIC TISSUES[3,7]: (Fig.1)

Light can interact with tissues in four different mechanisms:

1. Reflection

2. Scattering

3. Absorption

4. Transmission

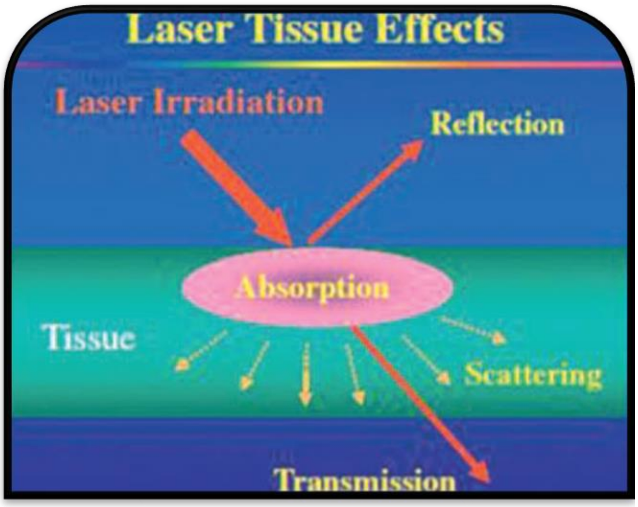

Fig1: Interactions of the laser on tissue[7]

Reflection: Reflected light bounces off the tissue surface and is directed outward. Energy dissipates after reflection, so that there is little danger of damage to other parts of mouth and it limits the amount of energy that enters the tissue.

Scattering: Occurs when the light energy bounces from molecule to molecule within the tissue. It distributes the energy over a larger volume of tissue, dissipating the thermal effects.

Absorption: occurs after a characteristic amount of scattering and is responsible for the thermal effects within the tissue. It converts light energy to heat energy. The absorption properties of tissue and cells depend on the type and amount of absorbing pigments or chromophores.

Ex:. Hemoglobin, water. Melanin, Cytochromes etc.

Transmission: Light can also travel beyond a given tissue boundary. This is called transmission. Transmission irradiates the surrounding tissue and must be quantified. Its effects should be considered before laser treatment can be justified.

TYPES OF LASERS[1,7,8,10,11,12]

Lasers used in dental practice can be classified by various methods: According to the lasing medium used, such as, gas laser and solid laser; according to tissue applicability, hard tissue and soft tissue lasers; according to the range of wavelength [Figure 1], and of course the risk associated with laser application. Anecdotally, there has evolved two groups of lasers, 'hard' and 'soft', in distinguishing their effect on tissue. ***'Hard', or surgical lasers*** are essentially high power lasers which achieve desired tissue effect through a direct interaction. This effect is primarily *photothermal*, in that incident light energy is absorbed and converted into thermal energy which causes tissue change. ***'Soft', or 'low-level' lasers*** are essentially low power lasers which achieve desired tissue effect through an indirect interaction, known collectively as *photobiostimulation*, e.g. tissue warming, increase of local blood flow and production of 'feel-good' factors, ex: endorphins.

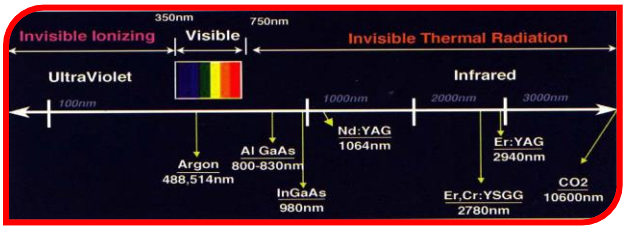

Fig 2: Various types of lasers and their corresponding wavelengths[4]

Different Types of Lasers Used In Dental Treatment[8]:

1. The Er: YAG laser possesses the potential of replacing the drill.
2. CO_2 laser can be used to perform gingivecotomy and to remove small tumours.
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 aesthetic flaws. It is used for soft tissue procedures.

INDICATIONS OF LASERS IN VARIOUS DENTAL PROCEDURES[13]:

Application	Laser system
Cavity preparation	Er:YAG
Endodontics	Nd:YAG, diode, Er:YAG
Calculus removal	Er:YAG, ErCr:YSGG
Epithelial removal	CO_2, diode, Nd:YAG, ErYAG
Drug-induced gingival overgrowth	CO_2, diode
Peri-implant gingival overgrowth	CO_2, diode
Peri-implantitis therapy	CO_2, diode, Er:YAG
Soft tissue tumors	CO_2, diode, Nd:YAG, Er:YAG
Pre-prosthetic surgery	CO_2, diode
Precancerous lesions	CO_2, Er:YAG
Bone removal	Er:YAG, Er,Cr:YSGG
Bleeding disorders	Nd:YAG, diode, CO_2
Bacterial reduction	PDT, diode
Phototherapy	soft lasers

APPLICATIONS OF LASERS IN CLINICAL DENTISTRY[10]

Fig 3: Completed crown preparation.

Fig 4: Tissue retraction completed with excellent haemostasis.

Table 1: Uses of Lasers

S.No.	Field of application	Area of application
		Detection of pulp vitality
		Doppler flowmetry
		Low level laser therapy (LLLT)
		Used in treating ulcerative oral lesions (Recurrent apthous ulcers and oral herpetic lesions (HSV-1)

1.	Diagnosis	Laser fluorescence- used for detection of caries, bacteria and dysplastic changes in the diagnosis of cancer
2.	Hard tissue applications	Caries removal and cavity preparation
		Re-contouring of bone (crown lengthening)
		Endodontics (RCT, Sterilization and apicectomy)
		Laser etching
		Caries resistance
		Treatment of dentinal hypersensitivity
3.	Laser-induced analgesia	
4.	Laser activation	Restorations(composite resin)
		Bleaching agents
5.	Periodontics	Diode & Nd: YAG lasers are invaluable in periodontics as part of the surgical phase of periodontal therapy.
6.	Oral & Maxillofacial Surgery	Widely used lasers in tumour surgery are the CO2 laser, Er:YAGlaser, Nd:YAG laser and KTM laser.
7.	Implant ology	Diode laser can be used at second stage surgery instead of scalpel, the laser cuts precisely and effects hemostasis and seems to minimize pain & swelling.
		Gingival contours seem to be stable after implant recovery procedures.
8.	Soft Tissue Applications of Lasers	Laser-assisted soft tissue curettage and peri-apical surgery.
		Gingivectomy and Gingivoplasty
		Gingival retraction for impressions
		Biopsy incision and excision
		Coagulation/Hemostasis
		Removal of granulation tissue
		Operculectomy,vestibuloplasty
		Aesthetic contouring, frenectomy
		Incision & Drainage procedures
		Treatment of recurrent aphthous ulcerations and oral lesion therapy.
		Reliable Treatment option for oral cancer as well as for precancerous lesions.

Table 2: Use Of Lasers In Prosthetic Dentistry [13,14]

A.	FIXED PROSTHETICS/ESTHETICS	a) Crown lengthening.
		b) Soft tissue management around abutments
		c) Osseous crown lengthening
		d) Troughing
		e) Formation of ovate pontic sites
		f) Altered passive eruption management
		g) Modification of soft tissue around laminates
		h) Bleaching

B.	IMPLANTOLOGY	a) Second stage uncovering
		b) Implant site preparation
		c) Peri-implantitis
C.	REMOVABLE PROSTHETICS	a) Tuberosity reduction
		b) Torus reduction
		c) Soft tissue modification
		d) Epulis fissurata
		e) Denture stomatitis
		f) Residual ridge modification

1. FIXED PROSTHESIS / 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.

B) Soft tissue management around abutments:

Argon laser energy has peak absorption in hemoglobin, thus lending itself to providing excellent haemostasis and efficient coagulation & 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 µm fiber, and a power setting of 1.0W, continuous wave delivery and the fiber is inserted into the sulcus in contact with the tissue. In a sweeping motion, the fiber is moved around the tooth. Gingivoplasty may also be done using argon laser.

Advantages of laser tooth preparation include:

- No local anaesthesia
- Reduced clinical time
- More comfortable procedure
- Heat generated is minimal
- No vibration
- No smear layer formation
- Precise, pin-point accuracy
- Conservative preparation

C) Modification of soft tissue around laminates :

The removal and re-contouring of gingival tissues around laminates can be easily accomplished with the argon laser. The laser can be used as a primary surgical instrument to remove excessive gingival tissue, whether diseased, secondary to drug therapy, or orthodontic treatment. The laser will remove tissue and provide haemostasis and tissues weld the wound.

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.

E. Formation of ovate pontic sites:

There are many causes of unsuitable pontic site. Two of the most common causes are insufficient compression of alveolar plates after an extraction and non replacement of a fractured alveolar plate. Unsuitable pontic site results in unaesthetic and non-self-cleansing pontic design. For favorable pontic 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.

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. Nd:YAG laser is used to alter the biological width of gingiva. It vaporizes the epithelium attached to the marginal finish lines, which is only a transient loss and it forms again. After laser troughing, the impression is taken and sent to the lab for prosthetic work. The most important function of marginal finish line is to maintain the biological width, it acts as the termination point of tooth reparation, helps in ease of fabrication & in taking a proper impression. Laser troughing plays an important role in brittle teeth to maintain the biological width and finish line.

2. 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.

A. Implant recovery:

Following the placement of implant and its integration into the osseous substrate, the current method of treatment is to surgically uncover the implant, wait for the tissue to heal, and then proceed with impressions and fabrication of the restoration. The reason for the delay is to facilitate the impression-taking process. Uses of lasers can greatly expedite this procedure because the implant can be uncovered and impressions can be obtained at the same appointment. All types of lasers can be used to expose dental implants. One advantage of use of lasers in implantology is that the 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. Also, there is **minimal tissue shrinkage** after laser surgery, which assures that the tissue margins will remain at the same level after healing. In addition, the use of lasers can **eliminate the trauma to the tissues** of flap reflection and suture placement.

B. 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.

C. Removal of diseased tissue around the implant:

Lasers can be used to repair ailing implants by decontaminating their surfaces with laser energy. Diode, CO_2 & Er:YAG lasers can be used for this purpose. Lasers can also be used to remove granulation tissue in case there is inflammation around an already osseointegrated implant.

3. REMOVABLE PROSTHETICS:

The successful construction of removable full and partial dentures mainly depends on the preoperative evaluation of the supporting hard and soft tissue structures and their proper preparation. Lasers may now be used to perform most preprosthetic surgeries. These procedures include hard and soft tissue tuberosity reduction, torus removal, and treatment of unsuitable residual ridges including undercut and irregularly resorbed ridges, treatment of unsupported soft tissues, and other hard and soft tissue abnormalities. Lasers also may be used to treat the problems of hyperplastic tissue and nicotinic stomatitis under the palate of a full or partial denture and ease the discomfort of epulis, denture stomatitis, and other problems associated with long term wear of ill fitting dentures. Stability, retention, function and aesthetics of removable prostheses may be enhanced by proper laser manipulation of the soft tissues and underlying osseous structure.

A. *Treatment of unsuitable alveolar ridges:*

Alveolar resorption usually is uniform in vertical and lateral dimensions. On occasion, irregular resorption occurs in one of the dimensions, producing an unsuitable ridge. As the available denture bearing area is reduced, the load on the remaining tissue increases, which leads to an ill fitting prosthesis, with discomfort that is not alleviated by soft linings to remove sharp bony projections and to smoothen the residual ridge, soft tissue laser surgery may be performed to expose the bone with any number of soft tissue wavelengths (CO2, diode, Nd:YAG). Hard tissue surgery may be performed with the erbium family of wavelengths.

a. *Treatment of undercut alveolar ridges:*

There are many causes of undercut alveolar ridges. Two of the most common causes are **dilated tooth sockets** that result from insufficient compression of the alveolar plates after an extraction and **non replacement of a fractured alveolar plate**. Naturally occurring undercuts such as those found in the lower anterior alveolus or where a prominent pre-maxilla is present may be the cause of soft tissue trauma, ulceration, and pain when prosthesis is placed on such a ridge. Soft tissue surgery may be performed with any of the soft tissue lasers. Osseous surgery may be performed with the erbium family of lasers. During mastication, the upper denture oscillates, causing disproportionate resorption in the maxilla. The soft tissues are compressed, thus causing the denture to become increasingly unstable. Unsupported maxillary alveolar soft tissues are bulkier than those in the lower jaw that tend to pro lapse in the lingual direction. Traditional surgery consists of removing wedges of soft tissue from the alveolar crest until the wound edges are closed easily. Any of the soft tissue lasers are able to perform this procedure.

b. *Treatment of enlarged tuberosity:*

The most common reason for enlarged tuberosity usually is soft tissue hyperplasia and alveolar hyperplasia accompanying the over-eruption of unopposed maxillary molar teeth. The enlarged tuberosity may prevent the posterior extension of the upper and lower dentures, thereby reducing their efficiency for mastication and their stability. The bulk of the hyperplastic tuberosity may lie toward the palate. Surplus soft tissue should be excised, allowing room for the denture bases. The soft tissue reduction may be performed with any of the soft tissue lasers. If undercuts are present, then osseus reduction may be required. Erbium laser is the laser of choice for the osseus reduction.

c. *Surgical treatment of tori and exostoses :*

Prosthetic problems may arise if maxillary tori or exostoses are large or irregular in shape. Tori and exostoses are formed mainly of compact bone. They may cause ulceration of oral mucosa. These bony protuberances also may interfere with lingual bars or flanges of mandibular prostheses. Soft tissue lasers may be used to expose the exostoses and erbium lasers may be used for the osseous reduction. A smooth, rounded, midline torus normally does not create a prosthetic problem because the palatal acrylic may be relieved or cut away to avoid the torus.

d. *Soft tissue lesions:*

Persistent trauma from a sharp denture flange or over compression of the posterior dam area may produce a fibrous tissue response. Hyperplastic fibrous tissue may be formed at the junction of the hard and soft palate as a reaction to constant trauma and irritation from the posterior dam area of the denture. The lesion may be excised with any of the soft tissue lasers and the tissue is re-epithelialized.

4. LASER APPLICATION IN DENTAL LABORATORY:

There is a range of laboratory-based laser applications. Laser holographic imaging is a well established method for storing topographic information, such as crown preparations, occlusal tables, and facial forms. The use of two laser beams allows more complex surface detail to be mapped using Interferometry, while conventional diffraction gratings and interference patterns are used to generate holograms and contour profiles. Laser scanning of casts can be linked to computerized milling equipment for fabrication of restorations from porcelain and other materials. An alternative fabrication strategy is to sinter ceramic materials, to create a solid restoration from a powder of alumina or hydroxyapatite. The same approach can be used to form complex shapes from dental wax and other materials which can be sintered, such that these can then be used in conventional 'lost wax' casting. A variation on this theme is ultraviolet (helium-cadmium) laser-initiated polymerization of liquid resin in a chamber, to create surgical templates for implant surgery and major reconstructive oral surgery. These templates can be coupled with laser-based positioning systems for complex reconstructive and orthognathic surgical procedures.

LASER SAFETY MEASURES[10]:

According to **ANCI & OSHA**, four categories of control measures have been identified:

1) ***Engineering controls which consists of:***

- Protective housing
- Interlocks
- Beam Enclosures
- Shutters
- Service panels
- Equipment labels
- Warning system

2) Personal Protective Equipment which consists of:

- Eye wear
- Clothing
- Surgical masks
- Screens & Curtains

3) Administrative & procedural control which consists of:

- Training & Education
- Thorough knowledge of laser operation
- Warnings signs
- Protective devices
- Medical surveillance
- Incident reporting
- Highly reflective instruments and those with mirrored surface should be avoided since they cause danger to non target tissue.
- Appropriate power settings and time frames are essential to prevent undesirable effect on teeth and supporting structures.

4) Environmental control which consists of:

- Use proper ventilation
- Reticulating air filtration system
- Change the filters of evacuation system regularly to maintain full airflow & to prevent the accumulation of harmful agents.

Fig 5: Safety measures in dental office during laser application.

Laser treatment area should have limited access except for operating personal, have warning signs marked on entrance & doorways, have protective laser curtains, be kept dry, have reticulating air filtration system. Shielding may be used as an effective method to avoid contact of the beam with tooth enamel when performing laser treatment on soft tissues. The foot control should be covered with a metallic hood to prevent accidental activation of the laser beam. Most of the laser accidents and injuries can be prevented if appropriate measures are recognized and implemented.

CONCLUSION

Lasers have shown rapid strides in technological advances since its inception in 1960's. The emergence of lasers with variable wavelengths and its wide application in the management of oral lesions may influence the outcome of treatment and treatment planning of patients. Laser has become a ray of hope in dentistry. When used efficaciously and ethically, lasers are an exceptional modality of treatment for many clinical conditions that dentists treat on daily basis. Yet another issue that needs to be addressed when considering the use of lasers is the cost factor. This remains important particularly in developing countries where the per capita income of individuals remains low. Thus, even if the dentist bears the expenses of the laser units, the patients may not opt for such pricey treatments. Such a problem can be negotiated only with further scientific research focusing not only on technological advancements, but also on economics and affordability of the newer technologies. 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. From operative dentistry to periodontics, pediatrics' and prosthetics to cosmetics and implant ology, lasers have made a tremendous impact on the delivery of dental care in the 21st century and will continue to do so as the technology continues to improve and evolve. In the future, it is likely that continued improvements in laser technology will bring about revolutionary change in the approach towards managing oral lesions.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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