

Application of Laser in Prosthetic Dentistry: A Review

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ABSTRACT

A number of lasers is now available for use in dentistry. Over the last decade, there have been tremendous advances in the use of laser for soft tissue surgery and preparation of cavities. Used in conjunction with or as a replacement for conventional methods, it is expected that sophisticated laser technologies will become a vital component of current dental practice in the near future. This paper reviews the current emerging applications of lasers in the management of patients requiring prosthodontics treatments.

KEYWORDS: Ruby lasers, implantology, prosthetics, YAG lasers.

INTRODUCTION

“Light Amplification by Stimulated Emission of Radiation” or LASER has been added to the armamentarium of the dental surgeons as a convenient tool for the treatment of a variety of dental problems since the 1960s. Laser produces a radiant energy reaction with biological tissues – this is the hallmark of laser treatment in dentistry.¹ Conventional treatment methods for the drilling of teeth are gradually getting replaced by the more advanced and less traumatising Ruby lasers.

LASERS IN PROSTHETIC DENTISTRY

Since the advent of laser applications in dentistry, traditional dental equipment has taken a back seat. The common laser tools are dental turbines and angle pieces, high speed multi-edged tools and fine diamond grinding pieces; these have conveniently removed tissues without much damage to the adjacent tissues. Keller and Hibst demonstrated the use of pulsed erbium YAG (2.940 nm) laser in effectively cutting enamel, dentin and bone.² The

introduction of the er:YAG and er,cr: YSGS lasers around the year 1987 has made the use of laser possible on hard dental tissues. This has the advantage of lessening the heat production thus creating an accurate area of the selection zone.³

Different forms of lasers are used in myriad other procedures in the practice of prosthetic dentistry:

A) FIXED PROSTHETICS/ESTHETICS

In fixed prosthodontics, accuracy of the component treatment stages can be achieved with the help of laser. By the use of minimal laser energy of the correct wavelength, it confers very little collateral damage.⁴

Crown lengthening: Dental treatment avenues where crown lengthening procedures are indicated within esthetic zone require special consideration to achieve predictable esthetic results. Crown lengthening procedures are indicated in the following: Conditions: a) Caries at gingival margin b) Cuspal fracture extending apical to the gingival

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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) Unesthetic gingival architecture h) Cosmetic enhancements.

Lasers makes extreme precision and operator control possible; and is of great value in defining fine tracing lines and sculpting the required margin of the gingival outline.

Modification of soft tissue around laminates: The argon laser makes removal and recontouring of gingival tissues around laminates much easier. By providing excellent haemostasis, the remaining tissues weld faster.⁴

Management of soft tissue around abutments: Argon laser energy is thoroughly absorbed in haemoglobin and thus provides 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. Gingivoplasty may also be done using argon laser.⁴

Osseus crown lengthening: Mineralized bone matrix, like teeth, is composed mostly of hydroxyapatite. The water content and hydroxyapatite will cause high absorption of the Er:YAG laser light in the bone. Er:YAG laser has very encouraging potential for bone ablation.⁴

Altered passive eruption management: To manage passive eruption problems in patients with 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 by using laser without the need for blade incisions, flap reflection, or suturing.⁴

Formation of ovate pontic sites: Recontouring of soft and bony tissue are required for a favourable pontic design. Soft tissue surgery can be performed with one of the soft tissue lasers; and osseous surgery may be performed with erbium lasers.

Laser troughing: A trough can be created around a tooth using a laser before taking impression. Laser can entirely replace the need for retraction cord, electrocautery, and the use of hemostatic agents. Nd:YAG laser minimizes impingement of epithelial attachment, causes less bleeding during the subsequent impression by reducing postoperative problems, and lessen chairtime.⁴

Bleaching: Esthetics and smile are important issues in our modern society. Bleaching of teeth can now be performed in the Dental OPD. Diode lasers are used to bleach teeth effectively without causing much tooth sensitivity and alteration of the complexion of the tooth.

Removal of veneer: Restoration can be dislodged without cutting with the help of laser beams. The laser energy passes through porcelain glass unaffected and is absorbed by the water molecules present in the adhesive. Debonding takes place at the junction of the silane and the resin without causing any trauma to the underlying tooth.

B) IMPLANTOLOGY

Dental lasers are used for a variety of procedures in implantology.

Implant recovery: Currently the implants are uncovered surgically after waiting for a considerable period of time to allow for full integration of the implant into the bony tissue. Laser can facilitate the process of impression taking, and implants can be uncovered and impressions taken in the same sitting. All types of lasers can be used to expose dental implants. In addition, the use of laser can eliminate the trauma to the tissues of flap reflection and suture placement.⁵

Implant site preparation: Patients with bleeding diathesis have inherent problems in the fixation of implants. However, laser can provide more or less a bloodless insertion of the mini-implants.⁵

Removal of diseased tissue around the implant: Lasers can be used to repair ailing implants by decontaminating their surfaces with laser energy. Diode, CO₂ & 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 Osseo integrated implant.^{5,6}

Sinus lift procedure: Lasers can also be used in the sinus lift procedure. The procedure can be done by making the lateral osteotomy with a decreased incidence of sinus membrane perforation. The yttrium-scandium-gallium-garnet (YSGG) laser is the optimal choice for not cutting the sinus membrane. The YSGG laser can also be used to make the osteotomy for a ramal or symphyseal block graft. Bone grafts done with lasers have been demonstrated to decrease the amount of bone necrosis from the donor site and the osteotomy cuts are narrower, resulting in less postoperative pain and edema.⁷

C) REMOVABLE PROSTHETICS

Treatment of unsuitable alveolar ridges: Alveolar resorption usually is uniform in vertical and lateral dimensions. To smooth the residual ridge soft tissue lasers surgery to expose the bone may be performed with any number of soft tissue wavelengths (CO₂, diode, Nd:YAG,) Hard tissue surgery may be performed with the erbium family of wavelengths.

Treatment of enlarged tuberosity: The most common reason for enlarged tuberosities usually is soft tissue hyperplasia and alveolar hyperplasia accompanying the over-eruption of unopposed maxillary molar teeth. The excision of the surplus soft tissue may be performed with any of the soft tissue lasers. Cutting of the bony tissue may be done with Erbium laser.

Surgical treatment of tori and exostoses: Large or irregular maxillary tori or exostoses create prosthetic problems. Soft tissue lasers may be used to expose the exostoses and erbium lasers may be used for the osseous reduction. A midline torus does not interfere with the prosthetic technique as adequate space can be made available by trimming the palatal acrylic.

Treatment of undercut alveolar ridges: There are many causes of undercut alveolar ridges. 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.⁸

Soft tissue lesions: Continuous injuries due to a sharp denture flange or pressure over the posterior dam area produce a fibrous tissue response. Hyperplastic fibrous tissue forms at the junction of the hard and soft palate following the constant trauma and irritation from the posterior dam area of the denture. The lesion can be excised with any of the soft tissue lasers and the tissue allowed to regenerate.⁸

CONCLUSION

Laser finds its place in all aspects of dental care and treatment for clinical, aesthetic, and psychological reasons. It also obviates the need for anaesthesia to a large extent. Laser is a boon to patients with history of allergies to anaesthetic drugs, history of cardiac decompensation and a fright for the needles. A multitude of dental procedures can be performed with the use of laser keeping in mind the larger interest of the patients who love comfort and a pain-free dental care. Besides being a 'state-of-the-art' gadget, laser is an extremely useful and patient friendly piece of equipment for the dental surgeons.

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