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LASERS: ACUMEN IN PROSTHODONTIC TREATMENTS - A REVIEW

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ABSTRACT

The laser is an acronym, stands for Light Amplification by Stimulated Emission of radiation being used in many fields. The first synthetic laser system was introduced by the scientist Theodore Miamian in 1960. Dental lasers were found to be a newer sign and technology in modern dentistry and considered as the hope of overcoming the conventional procedures. The lasers were broadly classified, based on their physical construction as solid, liquid, gas, based on the application over the tissues as soft and hard tissue lasers. Most commonly used lasers in prosthodontic treatments are CO_2, neodymium-doped yttrium aluminium garnet (Nd: YAG),

diode etc. The role of lasers in prosthodontics helps in providing removable, fixed partial dentures, implant placement, treatment of unsupported soft tissue, for the removal of tori, tooth bleaching, etc. The four main aspects of biological tissue interaction of lasers includes the reflection, scattering, absorption and transmission. The lasers now being used provide a precise clinical control with dry operative field and less chair-side time during the dental procedures. The dentists must have proper knowledge on different types of lasers being used, their wavelength and tissue interaction on oral cavity. A review with valuable information about the role of lasers and its applications in prosthodontic treatments were collected using the recent articles searched from pubmed, google scholar, core, cochrane, etc. The present review highlights the role of lasers which acts as a better acumen in prosthodontic treatments.

Keywords: Lasers, Nd: YAG, applications, prosthodontic treatments

INTRODUCTION

The laser is an acronym, stands for Light Amplification by Stimulated Emission of radiation being used in many fields. The first synthetic laser system was introduced by the scientist Theodore Miamian in 1960 **[1]**. Dental lasers were found to be a newer sign and technology in modern dentistry and considered as the hope of overcoming the conventional procedures. The lasers were broadly classified, based on their physical construction as solid, liquid, gas and based on its application over the tissues as soft and hard tissue lasers. The soft tissue lasers are used for incision, excision, ablation and for the impaction of teeth; whereas hard tissue lasers are employed for the diagnostic purposes to prevent caries and for the removal of restorations etc **[2, 3]**. The role of lasers in prosthodontics helps in providing removable, fixed partial dentures, implant placement, removal of unsupported soft tissue, torus, for tooth bleaching, etc. Most commonly used type of lasers in prosthodontic treatments are CO2, neodymium-doped yttrium aluminium garnet (Nd: YAG), diode, etc. Stability, retention, function of esthetics are the three main aspects of prosthesis which enhances the quality of treatment given for the patients. The major development in dental lasers found that being a mechanical cutting device, it offers the patient comfort and painless during the dental procedures **[4, 5]**. The other main aspects of tissue interaction of lasers includes the reflection, scattering, absorption and transmission **[6, 7]**. The dental lasers being used, provide us a precise clinical control with a dry operative field and less

chair-side time during the dental procedures. The characteristic feature of lasers includes, the patients will have minimal postoperative symptoms, with improved wound healing and reduce the risk of infection to the underlying tissues. The dentists must have proper knowledge on different types of lasers being used, their wavelength and tissue interaction on oral cavity, so that they can provide an accurate treatment for patients. A previous case report study stated that effective use of laser phototherapy can reduce the gingival inflammation in prosthodontic treatments. The findings of this study has been reported that low power lasers offer many benefits while doing the direct, indirect treatments such as, tooth preparation, crown fabrication, etc. Thus an effective use of these lasers provides a painless treatment with improved tissue healing in the patients **[8, 9]**. The present review highlights the role of lasers and its applications in prosthodontic treatments.

ROLE OF LASERS IN PROSTHODONTIC TREATMENTS

The prosthodontic treatment involves the replacement of missing teeth, placement of veneer crowns, removable, fixed and complete partial dentures. Dental lasers play a significant role in all these prosthetic placements.

Role of LASERS In Removable Prosthesis:

The success of the prosthetic placement depends upon the tooth vitality and tissue interaction. Any change in the tissue resorption or extraction of teeth with improper oral hygiene results in the development of uneven alveolar ridges. So, laser therapy is now being used to treat such abnormal residual ridges and malformations under the deep undercuts. Patients with severe undercut or exostosis may experience denture dislodgement, which results in palatal coverage of maxillary prosthesis. Er :YAG (erbium:yttrium-aluminium-garnet) found to be the best choice of laser used to excise such bony protuberances. The tuberosity in the maxilla, which aids in the retention and stability of denture in an edentulous patient can be corrected using the effective lasers. A clinical study reported that patients with an unopposed maxillary molar teeth, having an enlarged tuberosity over hard palate, have been removed using the hard tissue lasers such as CO2, diode, Nd: YAG lasers **[10]**.

Role of LASERS In Fixed Prosthesis

In fixed prosthesis placement, the lasers provide an accurate treatment with minimal energy and tissue interaction. The procedures involved in fixed prosthesis are crown lengthening, laser troughing, veneer removal,

for the management of soft tissues around the abutment, etc. A previous study on coronal elongation has reported that lasers can be used to treat subgingival cavity lesion or a fracture of the crown with disordered gingival architecture. A recent clinical study done by our team has evaluated the fit of non original abutments to titanium implants at the micro gap junction of the tooth **[11, 12]**.

LASER Troughing

It is the procedure by which a small groove created by the lasers around the tooth structure provides us with the ease of fabricating the impression for the prosthesis. This treatment, which involves the diode lasers, offers the increased speed with 30-60 seconds without interfering with electrical components present in the lasers. Diode laser crown troughing also has the added benefit of killing bacteria in the tooth cavities. Other than the diode lasers, argon lasers are also known to provide excellent hemostasis in oral tissues, that can be used for the soft tissue management around the abutments **[13]**.

Removal of veneer

Advanced LASER beams are now being used to remove the restoration in the veneers without causing any trauma to the underlying tissues. Erbium lasers are the most commonly used to remove the porcelain veneers, which requires only less time and energy to remove the restorations from the tooth surface. The benefit of using these dental lasers reported that the wavelengths of these lasers are well absorbed in water and hydroxyapatite crystals present in tooth structures. Few studies have been reported that composite restoration can also be removed using the advanced laser beams. A recent study has proved that high energy lasers, when passed through the porcelain glass, get occupied by the water molecules present in the adhesive restorations. Apart from the veneer removal, it is also found that Er:YAG lasers have been used effectively for bone ablation and soft tissue management around the abutments **[14, 15]**.

Osseous crown lengthening

Recently, dental lasers have been utilized extensively in the provision of esthetic dentistry for the soft and hard tissue crown lengthening. A previous study has evaluated that in the method of bone ablation in which water content and hydroxyapatite present in the alveolar bone can be easily removed using the high water absorbent Er: YAG lasers **[16, 17]**. In addition to this, Nd YAG lasers were also used for hard tissue cutting, which prevents the coagulation and provides a good hemostatic capability to the soft tissues **[18, 19]**. The recent study has

reported that diode lasers are one of the soft tissue surgical lasers, and can be used effectively for cutting and coagulating gingival mucosa in the procedure involving the soft tissue curettage **[20]**.

Advantages of LASERS

The advanced laser techniques used in dentistry offer an effective and excellent treatment for soft and hard tissue complications. Dental hypersensitivity is one of the common clinical conditions associated with exposed tooth dentinal surfaces. This can be effectively reduced by the Nd: YAG lasers which induces thermal effect and minimise the pulpal damage to the tissues. The tori or hyperplastic soft tissue growth present in the oral cavity can be easily excised using soft tissue lasers such as Nd: YAG, CO_2, diode lasers. These types of lasers are found to enhance the re-epithelization of gingival mucosa in the patients **[21, 22]**. The current trend in laser therapy involves the portable, cordless and cost effective procedures which provide an accurate treatment. Previous clinical studies have demonstrated that diode lasers are considered to be safe and effective with an excellent tissue healing response in the oral cavity. It was also found to enhance the restorative impressions and also patients were reported to have minimal postoperative symptoms, with improved wound healing of the surgical wounds which can minimize the risk of infection. Recently, a study has been discovered that Er: YAG lasers are helpful in the removal of subgingival calculus from the surface of titanium implants. These lasers prevent overheating, decontamination of surgical areas and reduce the production of a smear layer which interrupts the healing process **[23, 24]**. The effective use of these dental lasers provides us precise control during surgery and enhances gingival outline in the tooth structure. It also creates a dry surgical field with better visualization and reduces the bacterial growth in the oral cavity. The main advantage of lasers includes, better patient comfort without any application of sutures or anaesthesia which results in a faster wound healing capacity.

RECENT ADVANCES

Digital dentistry is now being popular in the field of medicine and technology, incorporating computer controlled systems to provide a better quality of dental procedures. One of the most prime areas of digital dentistry, includes CAD CAM system. The clinical application of CAD CAM involves, the caries diagnosis, digital fabrication of restorations etc. This technology allows the delivery of well-fitting aesthetic, and provides durable prostheses for the patient. It

also improves the quality of prosthesis in dentistry and increases the standardised production process **[25, 26]**. In complete denture prosthesis, CAD-CAM prototyping and analysing which provides an improved accuracy of impression can be done using the advanced laser scanners. The clinical record of the patient can be included in the digital impression requires only less time, and it is cost effective. The advanced laser scanner has a 3D digitiser in it, gives the precise clinical data of all the patients, so that an accurate prosthesis can be obtained **[27, 28]**.

[27, 28] is an advanced dentistry, employs highly precise dental lasers for the implant recovery, site preparation and for the removal of diseased tissue around the implants. Lasers are also used for the placement of mini-implants, especially in patients with bleeding problems, as it can minimise the bleeding of gums and provide rapid bone healing. The most commonly used lasers in implant treatments include diode, CO2 & Er: YAG lasers. These lasers found to minimise the tissue shrinkage around the implant placement and tooth **[29]**. In maxillofacial rehabilitations, laser technology has been used for designing the shape and position of the prosthesis. It also provides an accurate three-dimensional view of extra oral defects that persist in the oral cavity. This treatment now being used in the dentistry, replaces the conventional impression techniques and other radiographic methods like CT, MRI reconstruction of jaws **[30, 31]**. Esthetics and smile are the two main aspects of the patient's profile. In esthetic dentistry, Digital Smile Design (DSD) is a multitool source assists the dentists in improving and understanding the aesthetic concerns and it provides the detailed examination of patients with extraoral and intraoral defects. Tooth bleaching, being a part of esthetic dentistry, which employs the argon and diode lasers. It has been found that in office bleaching technique, these lasers effectively induce less sensitivity and it provides a rapid complexion to the tooth surface due to its photolytic activity **[32, 33]**. A previous study has reported that advanced lasers now being used for the pre-prosthetic surgery improves the condition of oral tissues with marked protuberances and undercuts for the better placement of a removable prosthesis in an old patient **[34, 35]**.

CONCLUSION

Dental Lasers have now become a ray of hope in modern dentistry, which incorporates the use of advanced laser systems for the benefit of patients. The effective prosthodontic treatment involves the replacement of missing teeth, placement of

crowns, in providing fixed and complete partial dentures, etc. Soft and hard tissue lasers play a significant role in all these prosthetic placement. It helps to restore the form, function and esthetic of a patient. The future scope of this study to understand the advances in the wide range of lasers used in dentistry. The present review, thus highlights the applications and role of lasers which acts as a better acumen in prosthodontic treatments.

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