Use of Laser in Prosthodontics

1Sankey Kumar Baidya, 2MK Singhal, 3Alok Kumar, 4Chandana Nair, 5Shipra Tripathi

ABSTRACT
Lasers were introduced into the field of clinical dentistry with the hope of overcoming some of the drawbacks posed by the conventional methods of dental procedures. A variety of studies on the potential applications of lasers in dentistry have been conducted. Many applications, like computer aided design and rapid prototyping technology, and study of occlusion in complete dentures using three-dimensional (3D) laser scanner have been developed. The applications of laser range from fixed prosthodontics to treatment of dentinal hypersensitivity to surface treatment of base metal alloys. Nowadays, it even extends to the fields of dental implantology and maxillofacial prosthodontics.

Keywords: Complete denture, Dental implants, Dentinal hypersensitivity, Laser, Maxillofacial prosthesis.

INTRODUCTION
Laser is an acronym for light amplification by stimulated emission of radiation. They are heat producing devices converting electromagnetic energy into thermal energy. The characteristic feature of a laser depends on its wavelength. The wavelength of a laser affects both the clinical applications and design of laser. The wavelength used in general medicine and dentistry generally range from 193 to 10,600 nm, representing a broad spectrum from ultraviolet to the far infrared range.

The most earlier lasers used in dentistry are the CO₂, and Nd:YAG. Since, the beam of both lasers falls in the far infrared range on the spectrum, they are not visible, therefore, these lasers often use Quartz fiber incorporating a 630 nm coaxial helium-neon laser into the device to act as an aiming beam and facilitate use.

HISTORY OF LASERS
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 dentin with a disappointing result.

The laser has been recommended for the treatment of benign oral lesions including:

- Fibromas
- Hemangiomas
- Papillomas
- Idiopathic gingival hyperplasias
- Gingival hyperplasia
- Aphthous ulcers
- Mucosal frenula
- Tongue ties (ankyloglossia)
- Oral leukoplakia
- Erythroplakia, etc.

Some reports on the use of the laser also support the possibility of treating malignant oral diseases in early stages (e.g. T1N0 carcinomas) with excisional biopsies.

TYPES OF LASER
Dental lasers are divided into two basic categories as follows:
1. Those, which work solely on noncontact mode either focused or defocused, e.g. CO₂ and erbium laser.
2. Those that work either in contact or noncontact mode, the contact mode being focused and the noncontact mode being defocused. This group includes lasers given by fiber optics, e.g. argon, Nd:YAG and Ho:YAG. Focused mode: The focused mode is when the laser beam hits the tissue at its focal point or its smallest diameter and the diameter in turn is dependent upon the lens used. Most CO₂ lasers have lens that can focus the beam to a spot size ranging from 0.1 to 0.35 mm or larger. This focused mode is also called as cut mode.
Defocused mode: The other mode is called as defocused mode in which moving the focal spot away from the tissue plane defocuses the beam, and thus the beam size that hits the tissue plane has a greater diameter thus, covering a wide area of the tissue to be vaporized.4

Based on Power

High-power Lasers (Hard, Hot)

These lasers increase tissue kinetic energy and produce heat. As a result, they leave their therapeutic effects through thermal interactions including necrosis, carbonization, vaporization, coagulation and denaturation. These lasers usually have an output power of more than 500 mW.5

Intermediate-power Lasers

These lasers leave their therapeutic effects without producing significant heat. To shorten treatment period length and to accelerate the therapeutic effect in some cases, low-power lasers are replaced by intermediate lasers with output powers ranging from 250 to 500 mW.5

Low-power Lasers (Soft, Cold)

These lasers have no thermal effect on tissues and produce a reaction in cells through light, called photobiostimulation or photobiochemical reaction. Output power of these lasers is less than 250 mW. The critical point that differentiates low-power lasers from high-power ones is photochemical reactions with or without heat. The most important factor to achieve this feature in lasers is not their power but the power density per cm². If the density is lower than 670 mW/cm², it can mimic stimulatory effect of low-power lasers without any thermal effects.6

Use of Laser in Prosthodontics

A. Fixed Prosthetics/Esthetics7

- Crown lengthening
- Soft tissue management around abutments
- Osseous crown lengthening
- Troughing
- Formation of ovate pontic sites
- Altered passive eruption management
- Bleaching
- Veneer removal
- Tooth preparation for veneers and full coverage crowns and bridges5
- Removal of carious lesion and faulty composite restorations before placement of final restorations
- Crown fractures at the gingival margins enamel and dentin etching

B. Implantology

- Second stage uncovering
- Implant site preparation
- Peri-implantitis

C. Removable Prosthetics7

- Tuberosity reduction
- Torus reduction
- Soft tissue modification
- Epulis fissurata
- Denture stomatitis
- Residual ridge modification
- Treatment of flabby ridges
- Vestibuloplasty
- Sulcus deepening
- Frenectomies
- Osseoclastomy during tooth/root extraction or ridge recontouring
- Treatment of soft tissue and hard tissue undercuts

D. Laser Applications in the Dental Laboratory2

- Laser titanium sintering
- Laser ablation of titanium surfaces
- Laser assisted hydroxyapatite coating
- Laser welding of titanium components of the prostheses

E. Lasers in Maxillofacial Rehabilitation2

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

Advantages of Laser over Other Techniques8

- It is painless, bloodless that results in clean surgical field, and fine incision with precision is possible
- There is no need for anesthesia if at all anesthesia has to be administered, then it needs to be used minimally only
- The risk of infection is reduced as a more sterilized environment is created as the laser kills bacteria
- No postoperative discomfort, minimal pain and swelling, generally does not require medication
- Superior and faster healing, offers better patient compliance.

Disadvantages of Lasers8

- Lasers cannot be used to remove defective crowns or silver fillings, or to prepare teeth for bridges
- Lasers cannot be used on teeth with filling already in place
- Lasers do not completely eliminate the need for anesthesia
Lasers treatment is more expensive as the cost of the laser equipment itself is much higher.

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 have never been the ‘magic wand’ that many people have hoped 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 and limitations of the optical energy. 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.

REFERENCES