LASERS IN PERIODONTAL THERAPY – A REVIEW

Dr . B.M. Bhusari., Dr. Ridhima .V. Mahajan., Dr. Namrata . J. Suthar& Dr. Shubhangi .R. Rajbhoj*

*Department of Periodontics, Y.M.T Dental college, Kharghar, Navi Mumbai, Maharashtra

Email ID- rajchetanabhoj@gmail.com

(Received on Date: **29th March 2015** Date of Acceptance : **22nd May 2015**)

ABSTRACT

Light has been used as a therapeutic agent for many centuries. Laser means "Light Amplification by Stimulated Emission of Radiation". The use of lasers for treatment has become a common phenomenon in the medical field. Dental patients are still afraid of the noise and vibration produced by the mechanical action of the air turbine or ultrasonic scalers. Lasers offer the ability to negotiate curves and folds in the oral cavity, and depending on power settings and mode of delivery they vaporize, coagulate, or cut tissue. From the end of the 20th century until now, there has been a continuous upsurge in the development of laser-based dental devices. Laser fluorescence is an effective method for detecting and quantifying incipient occlusal and cervical carious lesions, and with further refinement could be used in the same manner for proximal lesions. Photoactivated dye techniques have been developed which use low power lasers to elicit a photochemical reaction. Photoactivated dye techniques can be used to disinfect root canals, periodontal pockets, cavity preparations and sites of peri-implantitis. Using similar principles, more powerful lasers can be used for photodynamic therapy in the treatment of malignancies of the oral mucosa.

Keywords: *Laser fluorescence, Photoactivated dye, Periodontal pockets, Peri-implantitis.*

No. of Tables: *2* ***No. of References:12***

INTRODUCTION

Dentistry has changed tremendously over the past decade to the benefit of both the clinician and the patient. One technology that has become increasingly utilized in clinical dentistry is that of the laser. Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Laser is a device that utilizes the natural oscillations of atoms or molecules between energy levels for generating coherent electromagnetic radiation usually in the ultraviolet, visible, or infrared regions of the spectrum. It is a device that produces high intensity of a single wavelength and can be focused into a small spot.

History In 1917 Einstein published ideas on stimulated emission radiation. Based on Albert Einstein's theory of spontaneous and stimulated emission of radiation, Maiman developed the first laser prototype in 1960 using a crystal of ruby as a medium that emitted a coherent radiation light, when stimulated by energy. The first dental lasers approved by the US Food and Drug Administration, namely the CO2, the Nd:YAG and the diode lasers were accepted for use only for oral soft tissue procedures in periodontics. In 1997, the Food and Drug Administration cleared the first Er:YAG laser system, then in use for preparing dental cavities, for incisions, excisions, vaporization, ablation and hemostasis of soft and hard tissues in the oral cavity.

Table 1: *Classification based on light spectrum*

UV Light	100 nm – 400 nm	Not Used in Dentistry
Visible Light	400 nm – 750 nm	Most commonly used in dentistry (Argon &Diagnodent Laser)
Infrared light	750 nm – 10000nm	Most Dental Lasers are in this spectrum

Table 2: *Classification According to material used*

Gas	**Liquid**	**Solid**
Carbon Dioxide	Not so far in	clinical useDiodes, Nd:YAG,Er:YAG,Er:Cr:YSGG,Ho:YAG

Types of lasersOn the basis of output energy :

Low output, soft or therapeutic ,eg. Low-outputdiodes; High output, hard, or surgical eg.CO2,Nd:YAG,Er:YAG

On basis of state of gain medium :

Solid state-eg.Nd:YAG, Er:YAG, Er,Cr: YAG;Gas- eg.HeNe, Argon,CO2;Excimer-eg. ArF, KrCl;Diode- eg. GaAIAs

On the basis of oscillation mode:
Continuous wave eg. CO_2, Diodes; Pulsed wave eg. Nd:YAG, Er:YAG

Mechanism of action of lasers:
Laser light is a man-made single photon wavelength. The process of lasing occurs when an excited atom is stimulated to emit a photon before the process occurs spontaneously. Spontaneous emission of a photon by one atom stimulates the release of a subsequent photon and soon. This stimulated emission generates a very coherent (synchronous waves), monochromatic (a single wavelength), and collimated form (parallel rays) of light that is found nowhere else in nature.[3]Laser is a type of electromagnetic wave generator. Lasers are heat producing devices converting electromagnetic energy into thermal energy. The emitted laser has three characteristic features. Monochromatic: in which all waves have the same frequency and energy; Coherent: all waves are in a certain phase and are related to each other, both in speed and time; collimated: all the emitted waves are nearly parallel and the beam divergence is very low.

Advantages of lasers
Non – Invasive; Bactericidal effect;Very small / precise incision; Less bleeding /"bloodless surgery," and less swelling; Less time consuming procedure; Reduce post-operative pain.

Disadvantages of lasers
Cost; Eye hazards; imprecisely aimed lasers can burn or destroy healthy tissue; Needs special training / arrangement

Precautions and Risks Associated with Clinical use of Lasers:
Precautions before and during Irradiation; Use glasses for eye protection (patient, operator, and assistants).;Prevent inadvertent irradiation (action in non-contact mode).; Protect the patient's eyes, throat, and oral tissues outside the target site.; Use wet gauze packs to avoid reflection from shiny metal surfaces.; Ensure adequate high speed evacuation to capture the laser plume.

Potential risks
Excessive tissue destruction by direct ablation and thermal side effects; Destruction of the attachment apparatus at the bottom of pockets; Excessive ablation of root surface and gingival tissue within periodontal pockets; Thermal injury to the root surface, gingival tissue, pulp, and bone tissue.

Applications of Lasers in Periodontal Treatment
Scaling and Root Planning Erbium lasers show the greatest potential for effective root debridement (SRP). The Er:YAG laser has been shown, in vitro, to remove calculus[5]and to negate endotoxin. There is the potential for root surface damage during the process of in vivo calculus removal since the Er:YAG is a hard tissue laser and the operator would not be able to visualize what is being lased. Clinical data on attachment level changes when compared to SRP alone are conflicting, with some studies showing a slight benefit while others show no benefit. Further study is needed to determine if laser-assisted SRP has a beneficial effect.

Reduction of Subgingival Bacterial Levels

Current evidence shows lasers, as a group, to be unpredictable and inconsistent in their ability to reduce subgingival microbial loads beyond that achieved by SRP alone. Further, this conclusion also appears to apply to the use of photodynamic therapy (PDT),either as a monotherapy or adjunctive to SRP.[8]Atbest, the evidence is lacking or conflicting. For example, of the 10 published clinical trials, only two showed PDT to be effective in reducing subgingival microbial loads, four reported no difference, and four did not measure reductions in microbes.

Laser-Mediated Sulcular And/Or Pocket Debridement

If one considers the clinical parameters of reductions in probing depth or gains in clinical attachment level, the dental literature indicates that when used as an adjunct to SRP, mechanical, chemical, or laser curettage has little to no benefit beyond SRP alone. The available evidence consistently shows that therapies intended to arrest and control periodontitis depend primarily on effective debridement of the root surface and not removal of the lining of the pocket soft tissue wall, i.e., curettage. Currently, there is minimal evidence to support use of a laser for the purpose of sub gingival debridement, either as a monotherapy or adjunctive to SRP.

Application of lasers for the treatment of peri-implantitis

Lasers may be used for decontamination of implant surface and treatment of peri-implantitis without damaging the implant surface. Diode lasers basically do not interact with titanium or the coated material. Regarding Er:YAG lasers, the power output must be controlled so as to avoid damage of implant surfaces.

Dental Laser Safety

Laser Hazard Classification according to ANSI (American National Standard Institute) and OSHA (Occupational Safety and Health Administration) Standards:

Class I Lasers in this category working under normal operating conditions do not pose a health hazard. These devices usually are totally enclosed, and the beam does not exit the housing. The output power of a class I laser is measured in tenths of milli-watts.

Class IIa Low powered visible lasers that are hazards only when viewed directly for longer than 1000 sec.

Class IIb Low powered visible lasers that are hazardous when viewed for longer than 0.25 sec.

Class IIIa Medium powered lasers or systems that are normally not hazardous if viewed for less than 0.25 sec without magnifying optics.

Class IIIb Medium powered lasers (0.5w max) that can be hazardous if viewed directly.

Class IV High powered lasers (>0.5W) that produce ocular, skin and fire hazards.

The types of hazards can be grouped as follows:

Ocular Injury Damage can be manifested as injury to sclera, cornea, retina and aqueous humorand also as cataract formation; Tissue Hazards – Laser induced damage to skin and other non target tissues can result from the thermal interaction of radiant energy with tissue proteins.

Environmental hazards This involves potential inhalation of airborne bio-hazardous materials which results from surgical application of lasers.

Combustion hazards Flammable solids, liquids and gases used within the clinical setting can be easily ignited if exposed to the laser beam; Flammable materials found in dental treatment areas.

Electrical hazards This is due to the very high currents and high voltage required to use, the present dental lasers.

Post-operative instructions Safety measures; Manufacturing process, Proper operation, Personal protection; Everyone in the room must wear protective glasses—dark green tinted for Argon and YAG lasers, and clear for CO2 lasers; Wet gauze pads must be placed in the patient's mouth surrounding the treated area; Reflective surfaces, such as instruments and mirrors, should be covered so that stray light beams cannot ricochet around the room; It is very important that all anaesthetic gases be removed from the room. They are explosive, and could be ignited by a laser beam; The dentist must also suction off vaporized soft tissue, and the smoke, or laser "plume," emitted during procedures.

REFERENCES

Aoki A, Sasaki KM, Watanabe H, Ishikawa I. Lasers in nonsurgical periodontal therapy. Periodontol 2000: 2004: 36: 59–97.

Azarpazhooh A, Shah PS, Tenebaum HC, Goldberg MB. The effect of photodynamic therapy for periodontitis: A systematic review and meta-analysis. J Periodontol 2010;81:4-14.

Cobb CM, Low SB, Coluzzi DJ. Lasers in the treatment of periodontitis. Dent Clin N Am 2010;54(1):35-53.

Cobb CM. Clinical significance of non-surgical periodontal therapy: An evidencebased perspective of scaling and root planing. J ClinlPeriodontol 2002;29(Suppl 2):6-16.

Cobb CM. Lasers in periodontics: a review of the literature. J Periodontol 2006: 77: 545–564.

Coleton S. Lasers in surgical periodontics and oral medicine. Dent Clin N Am 48 (2004) 937-962

Isao Ishikawa. Application of laser in periodontics : true innovation or myth? Periodontology 2000, vol 50,2009,90-126.

Kreisler M, Al Haj H, d'Hoedt B. Temperature changes at the implant-bone interface during simulated surface decontamination with an Er:YAG laser. Int J Prosthodont 2002: 15: 582–587.

Loe J. Miserendino Laser in dentistry.Miserendino Leo J / Pick Robert M. Lasers in dentistry, Quintessence publications, 1995.

N Raffetto, T Gutierrez.Lasers in periodontal therapy, a five-year retrospective. J Calif Dent Hyg Assoc, 2001.

Pamela J Piccione. Dent. Clin. North Am.DentClin North Am 2004 Oct;48(4):795-807.

Raffetto N. Lasers for initial periodontal therapy. Dent Clin N Am 48 (2004) 923-936.