Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 8, Issue, 8, pp. 19244-19248, August, 2017

ISSN: 0976-3031

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

LASERS- A NEW ERA IN PERIODONTOLOGY

Arati B Bagal*., Rohini Mali., Amita Mali., Vishakha Patil and Amit Chaudari

Department of Periodontology, Bharati Viyapeeth Dental College and Hospital, Pune

DOI: http://dx.doi.org/10.24327/ijrsr.2017.0808.0654

ARTICLE INFO

Article History:

Received 17th May, 2017
Received in revised form 21st June, 2017
Accepted 05th July, 2017
Published online 28th August, 2017

Key Words:

Laser, Tissue, Light, Emission, Implants

ABSTRACT

Lasers have become popular for their use and ease of application in various fields. Since the development of ruby lasers, they have been widely used in the field of medicine. Lasers were introduced in the field of clinical dentistry with the hope of overcoming some drawbacks posed by the conventional methods. Lasers are utilized in both soft and hard tissue application. Lasers have various periodontal applications including calculus removal, soft tissue excision, incision and ablation; decontamination of root and implant surfaces; bio-stimulation; bacteria reduction; and osseous surgery. This paper reviews some of the major uses of lasers in periodontal and implant therapy. The literature relating to the use of lasers for removal of the pocket epithelium, root conditioning, bacterial reduction and decontamination of infected implant surfaces is discussed. Advantages and disadvantages of using lasers for periodontal treatment are provided.

INTRODUCTION

The word LASER is an abbreviation of Light Amplification by Stimulated Emission of Radiation. Based on Albert Einstein's theory of spontaneous and stimulated emission of radiation, Maiman developed the first laser prototype in 1960 (Maiman 1960). Maiman's device used a crystal medium of ruby that emitted a coherent radiant light from the crystal when stimulated by energy. Thus, the ruby laser was created. Shortly thereafter, in 1961, Snitzer published the prototype for the Nd:YAG laser. The first application of laser in dentistry was reported by Goldmann *et al*, in 1964.However, the current relationship of dentistry with the laser takes its origins from an article published in 1985 by Myers and Myers describing the in vivo removal of dental caries using a modified ophthalmic Nd:YAG laser. Four years later, it was suggested that the Nd:YAG laser could be used for oral soft tissue surgery, which ultimately lead to the present relationship between lasers and clinical periodontics. Myers (1989) published the first article on the pulsed Nd: YAG laser in periodontal surgery. It was later found that the lasers used for the soft tissue were not applicable for hard tissues.

Mechanism of Action

Laser is a monochromatic light in visible or invisible range with three primary characteristics of collimation, coherency and efficiency. Wave photon produced can be defined by measurement of its velocity, amplitude and wavelength. Amplification occurs in optical cavity present at the center of the laser device, having two parallel mirrors one at each end, and core of this cavity is comprised of chemical elements, compounds or molecules, in gaseous, crystal or solid state semiconductor form known as active medium, which gave the laser its generic name. Excitation source, either a flash lamp strobe device or an electrical coil surrounds the optical cavity which provides the energy into the active medium. Other mechanical components include cooling system, focusing lenses, and other controls. Based on the quantum theory of physics given by Max Plank (1971) and atomic architecture by Niels Bohr (Bohr, 1922) spontaneous emission can be defined as the process by which a light source such as an atom, molecule, nanocrystal or nucleus in an excited state undergoes a transition to the ground state and emits a photon. In a laser, atoms are kept in an excited state by "pumping'' the laser, and some photons are inserted that causes some atoms to undergo stimulated emission, and the resulting photons cause other atoms to undergo stimulated emission, leading to a chain reaction, that produces an intense, coherent, and easily focused light (Coluzzi, 2008).

Radiation refers to light waves produced by the laser as a specific form of electromagnetic energy. All available dental laser devices have emission wavelengths of approximately 500 nm to 10600 nm and are within visible or invisible infrared non-ionizing portion of electromagnetic spectrum that emit thermal radiation. Lasers commonly used in dentistry are CO_2 , Nd:YAG, Ho:YAG, Er: YAG, Er,Cr:YSGG, Nd:YAP, GaAs (diode) and argon (Cobb, 2006).

Corresponding author:* **Arati B Bagal
Department of Periodontology, Bharati Viyapeeth Dental College and Hospital, Pune

Beam of laser can be delivered by a flexible hollow waveguide or tube that has an interior mirror finish or glass fiber optic cable, in three different emission modes:

1. Continuous wave
2. Gated pulse mode
3. Free-running pulsed mode or true pulsed

The principle effect of laser energy is photo thermal; this effect on tissue depends on the degree of temperature rise and corresponding reaction of the interstitial and intracellular water (Coluzzi, 2008). Optical properties of periodontium for example pigmentation, water content, mineral content, heat capacity and latent heats of transformation can also dictate the clinical application beside specific wavelength, heat conduction and dissipation, degree of tissue inflammation and vascularity and the availability of progenitor cells for healing (Cobb, 2006).

Laser-Tissue Interaction

Laser light has four types of interactions with the target tissue which depends on the optical properties of that tissue: Absorption, transmission of laser energy, reflection, scattering of the laser light.

Absorption

When the laser is applied to the tissue, there is the absorption of laser energy in the target tissue. Different laser wavelengths have different absorption coefficients with the dental tissue components such as water, pigment, blood contents and mineral. Laser energy can be absorbed or transmitted based on the composition of target tissue. Those primary components are termed chromophores, which can absorb the laser light of specific wavelength. In general, the longer wavelengths, such as erbium laser has a greater affinity with water and hydroxyapatite. CO_2 laser having wavelength of 10,600 nm is well absorbed by water and penetrates only to a few microns of the target tissue's surface. (Coluzzi, 2002) The shorter wavelengths ranging from 500 to 1000 nm are readily absorbed by the pigmented tissue and blood elements. For e.g., The pigment hemoglobin has greater affinity for argon laser while melanin absorbs diode and Nd:YAG laser. The primary determinant, which decides the depth of penetration and absorption of laser light in the target tissue, is the wavelength of the laser used. Depending on the wavelength used, some lasers are able to penetrate the tissue deeper than others. In contrast, other lasers have a limited penetration and have effect only on the tissue surface. For example, the Nd:YAG which is indicated for bone and hard tissue applications, penetrates 2-5 mm into tissue while CO_2 laser has a limited penetration up to 0.03 to 0.1 mm in the tissue, thus indicated for soft tissue applications. This wavelength provides enough depth to seal the damaged blood, lymphatic vessels and nerve endings resulting in good hemostasis and minimal post-operative morbidity.(Coluzzi, 2002)

Transmission

This property depends on the wavelength of laser light used. There is the transmission of the laser energy directly through the tissue without producing any effect on the target tissue. Nd:YAG, Argon and diode laser light gets transmitted through water, whereas tissue fluids readily absorb the erbium family and CO_2 at the outer surface so there is little energy transmitted to adjacent tissues.(Coluzzi, 2002)

Reflection

This property of laser causes laser light to redirect itself off the surface, having no effect on the target tissue. This reflected light could be dangerous when redirected to an unintended target such as eyes. However, a caries detecting laser device uses the reflected light to measure the degree of sound tooth structure.

Scattering of the Laser Light

There is also scattering of the laser light with correspondence decrease of that energy and possibly producing no useful biologic effect. This property can cause unwanted damage as there is heat transfer to the tissue adjacent to the surgical site. However, a beam deflected in different directions facilitates the curing of the composite resin or when treating an aphthous ulcer. The clinician must be aware of certain factors before applications of lasers such as appropriate laser wavelength, beam diameter, focused or defocused mode, pulse energy or power output, spot size, and tissue cooling. The result of using the smaller spot greatly increases the heat transfer from the laser to the tissue and a corresponding increased heat absorption in that smaller area. If the laser beam is allowed to diverge from the target tissue, this would result in the increase of the beam diameter and thus lessen the energy density of the laser beam. If a laser beam is allowed to strike the target tissue for a longer time, it will cause the tissue temperature to rise.

Table No 1 Type and wavelength of lasers

Laser Type	Wavelength (nm)	Colour
Excimer Lasers		
Argon Fluoride (ArF)	193	Ultraviolet
Xenon Chloride (XeCl)	308	Ultraviolet
Gas Lasers	488	Blue
Argon	514	Blue-Green
Helium neon (HeNe)	637	Red
Carbon dioxide (CO_2)	10600	Infrared
Diode Lasers		
Indium gallium arsenide phosphorus (InGaAsP)	655	Red
Gallium aluminium arsenide (GaAlAs)	670-830	Red-Infrared
Gallium Arsenide	840	Infrared
Indium gallium arsenide (InGaAs)	980	Infrared
Solid State lasers		
Frequency-doubled alexandrite	337	Ultraviolet
Potassium titanyl phosphate (KTP)	532	Green
Neodymium: YAG (Nd:YAG)	1064	Infrared
Holmium:YAG (Ho:YAG)	2100	Infrared
Erbium,Chromium :YSGG (Er,Cr:YSGG)	2780	Infrared
Erbium:YSGG(Er:YSGG)	2790	Infrared
Erbium:YAG (Er:YAG)	2940	Infrared

This time can be regulated by the repetition rate of the pulsed laser emission mode as well.(Coluzzi, 2002)

The characteristic of a laser depends on its wave-length (WL), and wave-length affects both the clinical applications and design of laser. Different wave lengths can be classified into three:

1. The UV range (ultra-spectrum approximately 400- 700 nm).

2. The VIS range (visible spectrum approximately 400- 700 nm).
3. The IR range (infra-red spectrum which is approximately 700 nm) to the microwave spectrum.

Advantages and Disadvantages

Advantages of laser treatment are greater hemostasis, bactericidal effect, and minimal wound contraction (Cobb, 2006; Coluzzi, 2008; Raffetto, 2004). Compared with the use of a conventional scalpel, lasers can cut, ablate and reshape the oral soft tissue more easily, with no or minimal bleeding and little pain as well as no or only a few sutures. The use of lasers also has disadvantages that require precautions to be taken during clinical application (Ramfjord *et al*, 1987). Laser irradiation can interact with tissues even in the noncontact mode, which means that laser beams may reach the patients eyes and other tissues surrounding the target in the oral cavity. Clinicians should be careful to prevent inadvertent irradiation to these tissues, especially to the eyes. Protective eyewear specific for the wavelength of the laser in use must be worn by the patient, operator, and assistant. Laser beams can be reflected by shiny surfaces of metal dental instruments, causing irradiation to other tissues, which should be avoided by using wet gauze packs over the area surrounding the target. However, previous laser systems have strong thermal side effects, leading to melting, cracking, and carbonization of hard tissues.

Clinical Applications
Initial periodontal therap
Clinical Applications
Initial periodontal therap

Clinical Application of Lasers in Periodontology

Initial periodontal therapy includes nonsurgical debridement of tooth structure, local drug delivery, host modulation and reduction of sulcular bacteria with laser coagulation of the treatment site (Rafetto, 2004; Coluzzi 2008).

Soft tissue lasers are used as an adjunct or an alternate in periodontal therapy to reduce the soft tissue inflammation (Ramfjord *et al*, 1987). It reduces the bacterial populations photothermally and in addition elimnates the antimicrobial's problems like resistance, allergy and side effects, thus can be used even in children and pregnant women (Coluzzi, 2002; Aoki *et al*, 2004). For bacterial reduction and coagulation, soft tissue lasers as argon (Finkbiener, 1995) (488 nm, 514 nm), diode laser (Moritz, 1998) (800-830 nm, 980 nm) and Nd:YAG (1064 nm) are a good choice for periodontally diseased dark inflammed tissues and pigmented bacteria. Laser energy is delivered with a thin, flexible fiber optic system and is well absorbed by melanin and hemoglobin and other chormophores but transmitted through water and poorly absorbed in hydroxyapatite .

Although well absorbed by hydroxyapatite and water, Er,Cr:YSGG (2790 nm), may also be applicable for soft tissue therapy when used carefully by keeping the fiber in contact with target tissue and in vitro study had shown significant bactericidal effect on P. gingivalis and A. actinomycetemcomitans (Aando *et al*, 1996). Laser pocket thermolysis uses the argon laser in conjunction with scaling and root planing for reducing the pathogens within the pocket.

Unlike CO2 and Nd:YAG laser, Er:YAG (Schwarz *et al*, 2003) and Er,Cr:YSGG (Ting *et al*, 2007) lasers are capable of providing selective subgingival calculus removal to a level equivalent to that provided by scaling and root planing (Ishikawa *et al*, 2009). Er:YAG had been shown to remove subgingival calculus without a thermal change of the root surface similar to ultrasonic scaler with cementum ablation of 15-30 µm (Aoki , 2004).

Soft tissue applications

With the beneficial properties over conventional scalpel that includes relative ease of ablation of soft tissue, hemostasis (Ishikawa *et al*, 2009), instant sterlization, reduced bacteraemia, little wound contraction, reduced edema, minimal scarring, reduced mechanical trauma, less operative and post-operative pain (Cobb, 2006; Wigdor *et al*, 1995; Luomanen *et al*, 1987), faster healing, increased patient acceptance , no or few sutures, and requiring no or topical anaesthesia, soft tissue lasers viz CO2, Nd:YAG, diode, Er:YAG and Er,Cr:YSGG are being widely used as a tool for ginigival soft tissue procedures such as gingivectomy, frenectomy, gingivoplasty, epulis or benign tumors removal (Ishikawa *et al*, 2009), gingival depigmentation, second stage exposure of dental implants, irradiation of apthous ulcers, coagulaton of free gingival graft donor sites and soft tissue crown lengthening (Ishikawa *et al*, 2009). Performance of lasers differs depending on their penetration depth and hence may possibly damage the underlying tissues by thermal effects. In CO2, Er:YAG, and Er,Cr:YSGG lasers, laser light is absorbed in superficial layers and hence is advantageous, with rapid and simple vaporisation of soft tissues. However, deeply penetrating Nd:YAG and diode lasers having greater thermal effects, leave a thicker coagulation area on treated suface and hence used similar to electrosurgical procedures. Finkbeiner (1995) has suggested the usefulness of argon laser in soft tissue welding and soldering compared to conventional tissue closure method. Epithelial exclusion using CO2 laser had been suggested to retard its downward growth, and studies have shown effective removal of epithelium from gingiva tissues without damaging the underlying connective tissues.

Root Surface Modifications

Root surface modification using CO2, Nd:YAG, Er:YAG and diode laser had been studied with conflicting results and shown to be related to the energy density and selection wavelength of laser. It is seen that carbonated hydroxyapatite of root surface. has intense absorption bands in mid-infrared region, hence Er:YAG laser is amongst the lasers of choice. In vitro studies have shown better fibroblasts adherence after suitable Er:YAG laser irradiation of diseased surfaces than mechanical scaling alone (Belal *et al*, 2007; Fiest *et al*, 2003). In contrast to focused mode, root conditioning effects with defocused mode CO2 laser prepare the root surface for favorable fibroblast attachment (Crespi *et al*, 2002). Nd:YAG laser irradiation results in reversible (Thomas *et al*, 1994) root surface changes that includes surface pitting, crater formation, melting, charring and carbonization (Mortiz *et al*, 1998), along with unfavorable fibroblast attachment (Trilovich *et al*, 1992).

Osseous Surgery

Since laser-biologic tissue interactions are photo-thermal (Cobb 1992), hence, inspite of having added advantages of surgical precision, reduced collateral damage of soft tissue, reduced noise and eliminating vibrations with conventional instruments (Ishikawa *et al,*, 2009), effect of most dental lasers on bone is detrimental for osseous surgery with the exception of Er:YAG and Er,Cr:YAG (Cobb, 1992). Fourier Transformation Infrared Spectra of bone surfaces has shown formation of toxic by-products that delays healing (Goldman *et al,* 1964) after 'Er:YAG laser without water coolant (Sasaki *et al,* 2002), and CO2 laser irradiation (Ishikawa *et al,* 2009; Sasaki *et al,* 2002). Recent clinical applicatons for Er:YAG laser in bone surgery have been reported (Abu-Serriah *et al,* 2004; Strubinger *et al,* 2007) however, lower cutting efficiency as compared to conventional instruments and lack of depth control are its limitations (Ishikawa *et al,* 2009).

Implant Therapy

Er:YAG laser have been suggested to prepare fixture holes in bone due to its ability to produce effective bone tissue ablation during first stage implant therapy (Ishikawa *et al,* 2009). Prior to placement of the healing abutment, various lasers have been used in second stage implant therapy for uncovering the submerged implant, with advantages of improved hemostasis, fine cutting surface, less postoperative discomfort, and favourable healing (Ishikawa *et al,* 2009; Arnabat *et al,* 2003).

Because of difficult and time consuming mechanical debridement, emergence of bacterial resistance to antibiotics, lasers are now being proposed for treating peri-implantitis. Nd:YAG laser is contraindicated because of morphological changes it produces on implant surface (Kreisler *et al,* 2002; Romanos *et al,* 2000) and previous studies with CO2 lasers have shown the associated risk with high temperature (Oyster *et al,*, 1995). Amongst dental lasers, Er:YAG laser at appropriate settings possess the best property for degranulation and implant surface decontamination, without causing titanium surface changes (Schwartz *et al,* 2003) and like CO2 laser it does not influence the attachment rate of osteoblasts (Ivanenko *et al,*1998).

CONCLUSION

As technology advances into dentistry, whether it is laser or another exciting venue, the options available to clinicians will continue to increase. Although the use of lasers in dentistry is relatively new, the future looks very bright. In summary, laser treatment is expected to serve as an alternative or adjunctive to conventional mechanical periodontal treatment. Currently, among the different types of lasers available, Er:YAG and Er,Cr:YSGG laser possess characteristics suitable for dental treatment, due to its dual ability to ablate soft and hard tissues with minimal damage. In addition, its bactericidal effect with elimination of lipopolysaccharide, ability to remove bacterial plaque and calculus, irradiation effect limited to an ultra-thin layer of tissue, faster bone and soft tissue repair, make it a promising tool for periodontal treatment including scaling and root surface debridement. The decision to use a laser should be based on the proven benefits of hemostasis, a dry field, reduced surgical time and the general experience of less postoperative swelling.

With ease of use of lasers comes a greater need of safety also. There are many hazards regarding the lasers. The ocular hazard being the most prominent has to be well taken care of. Several structures of the eye may be injured as a result of laser emissions. The site of injury is directly dependent on the preferential absorption of various wavelengths by specific structures of the eye. The primary ocular injury that may result from a laser accident is a retinal or corneal burn. All people within the dental treatment room must wear adequate eye protection, including the patient. Laser induced damage to the skin and other non-target tissue (oral tissue) can result from thermal interaction of radiant energy with tissue proteins. Hence proper knowledge regarding the laser before any procedure is a necessity.

References

1. Maiman TH. Stimulated optical radiation in ruby (1960). Nature, 187: 493-494.
2. Goldman L, Gray JA, Goldman B, Meyer R (1965). Effects of laser: impact on teeth. *J Am Dent Assoc*, 70:601-606
3. Myers TD, Myers WD (1985). In vivo caries removal utilising the YAG laser. *J Mich Dent Assoc*, 67:66-69
4. Myers TD, Myers ED, Stone RM (1989). First soft tissue study utilising a pulsed Nd: YAG dental laser. *Northwest Dent*, 68:14-17.
5. Dictionary of scientific biography (1971). New York: Charles Scribner's son. (1971)
6. Bohr N. The theory of specta and atomic constitution. 2nd edition. Cambridge: Cambridge University Press (1922)
7. Coluzzi DJ (2008). Fundamentals of dental lasers: science and instruments. *Dent Clin N Am*, 48:751-770.
8. Cobb CM (2006). Lasers in periodontics: a review of literature. *J Periodontol*, 77:545-564.
9. Coluzzi DJ (2002). Lasers and soft tissue curettage: an update. *Compend Cont Ed Dent*, 23:1104-1111.
10. Raffetto N (2004). Lasers for initial periodontal therapy. *Dent Clin N Am*, 48:923-936.
11. Ramfjord SP, Caffesse RG, Morrison EC (1987). Four modalities of periodontal treatment compared over five years. *J Clin Periodontol*, 14:445-452
12. Aoki A, Sasaki KM, Watanabe H, Ishikawa I (2004). Lasers in nonsurgical periodontal therapy. *Periodontol,* 36:59-97.
13. Finkbeiner RL (1995). The results of 1328 periodontal pockets treated with the argon laser: selective pocket thermolysis. *J Clin Laser Med Surg* , 13:237-281.
14. Moritz A, Schoop U, Goharkhay K, Schauer P, Doertbudak O, Wernisch J (1998). Treatment of periodontal pockets with a diode laser. *Lasers Surg Med*, 22:302-311
15. Aando A, Aoki A (1996). Bacterial effect of erbium YAG laser on periopathic bacteria. *Lasers Surg Med*, 19:190-200.
16. Schwarz F, Sculean A, Berakdar M, Szathmari L, Georg T, Becker J (2003). In vivo and in vitro effects of an Er:YAG laser, a GaAlAs diode laser, and scaling and root planing on periodontally diseased root surfaces: a comparative histologic study. *Laser Surg Med*, 32: 359-366.

17. Ting CC, Fukuda M, Watanabe T, Akoi T, Sanaoka A, Noguchi T (2007). Effects of Er,Cr:YSGG laser irradiation on the root surface: morphologic analysis and efficiency of calculus removal. *J Periodontol*, 78:2156-2164
18. Ishikawa I, Aoki A, Takasaki AA, Mizutani K, Sasaki KM, Izumi Y (2009). Application of lasers in periodontics: true innovation or myth? *Periodontol*, 50:90-126.
19. Wigdor H, Walsh J, Featherstone JDB, Virsuri S, *et al* (1995). Lasers in dentistry. *Lasers Surg Med*, 16:103-133.
20. Luomanen M, Meurman JH, Lehto VP (1987). Extracellular matrix in healing CO2 laser incision wound. *J Oral Pathol*, 16:322-331.
21. Belal MH, Watanabe H, Ichinose S, Ishikawa I (2007). Effect of Er:YAG laser combined with rhPDGF-BB on attachment of cultured fibroblasts to periodontally involved root surfaces. *J Periodontol*, 78:1329-1341
22. Feist IS, De Micheli G, Carneiro SR, Eduardo CP, Miyagi S, Marques MM (2003). Adhesion and growth of cultured human gingival fibrblasts on periodontally involved root surfaces treated by Er:YAG laser. *J Priodontol,* 74:1368-1375.
23. Crespi R, Barone A, Covani U, Ciaglia RN, Romanos GE (2002). Effects of CO2 laser treatment on fibroblast attachment to root surfaces. A scanning electron microscopy analysis. *J Periodontol*, 73: 1308-1312
24. Thomas D, Rapley J, Cobb C, Spencer P, Killoy W (1994). Effects of Nd:YAG laser and combined treatments on in vitro fibroblast attachment to root surfaces. *J Clin Periodontol*, 21:38-44.
25. Mortiz A, Schoop U, Goharkhay K, Schauer P, Doertbudak O, Wernisch J, *et al* (1998). Treatment of periodontal packs with a diode laser. *Lasers Surg Med*, 22:302-311.
26. Trylovich DJ, Cobb CM, Pippin DJ, Spener P, Killoy WJ (1992). The effects of the Nd:YAG laser on in vitro fibroblast attachment to edotoxintreated root surfaces. *J Periodontol,* 63:626-632.
27. Goldman L, Hornby P, Meyer R, Goldman B (1964). Impact of the laser on dental caries. Nature 203:417
28. Sasaki KM, Aoki A, Masuno H, Ichinose S, Yamada S, Ishikawa I (2002). Compositional analysis of root cementum and dentine compared with CO2 lased and intact roots using Fourier transformed infrared spectroscopy. *J Periodontal Res*, 37:50-59.
29. Abu-Serriah M, Critchlow H, Whitters CJ, Ayoub A (2004). Removal of partially erupted third molars using an Erbium (Er): YAG laser: a randomised controlled clinical trial. *Br J Oral Maxillofacial Surg*, 42:203-208.
30. Strubinger S, Landes C, Seitz O, Sader R (2007) Er: YAG laser osteotomy for intraoral bone grafting procedures: a case series with a fiberoptic delivery system. *J Periodontol*, 78:2389-2394.
31. Arnabat-Dominguez J, Espana-Tost AJ, Berini-Aytes L, GayEscoda C (2003). Erbium: YAG laser application in the second phase of implant surgery: a pilot study in 20 patients. *Int J Oral Maxillofacial Implants*, 18:104-112
32. Kreisler M, Gotz H, Duschner H. Effect of Nd:YAG, Ho:YAG, Er:YAG, CO2 and GaAlAs laser irradiation on surface properties of endosseous dental implants (2002). *Int J Oral Maxillofac Implants*,17: 202-211
33. Romanos G, Everts H, Nentwig GH (2000). Effects of diode and Nd:YAG laser irradiation on titanium discs: a scanning elctron micrscope examination. *J Periodontol*, 71:810-815.

How to cite this article:

Arati B Bagal *et al*.2017, Lasers- A New Era In Periodontology. *Int J Recent Sci Res.* 8(8), pp. 19244-19248.
DOI: http://dx.doi.org/10.24327/ijrsr.2017.0808.0654

****