International Journal Of

Recent Scientific Research

ISSN: 0976-3031
Volume: 7(1) January -2016

APPLICATIONS OF LASERS IN PERIODONTICS- REVIEW

Ramesh Babu Mutthineni., Kiran Kumar Nagubandi., Chandra Mohan Pabolu., Druva Kumar. Gani., Srikanth Chintala., Ramanarayana Boyapati and Shyam Sunder S

THE OFFICIAL PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)
http://www.recentscientific.com/ recentscientific@gmail.com

ISSN: 0976-3031

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

International Journal of Recent Scientific Research
Vol. 7, Issue, 1, pp. 8175-8179, January, 2016

International Journal of Recent Scientific Research

REVIEW ARTICLE

APPLICATIONS OF LASERS IN PERIODONTICS- REVIEW

Ramesh Babu Mutthineni[1*]., Kiran Kumar Nagubandi[2]., Chandra Mohan Pabolu[3]., Druva Kumar. Gani[4]., Srikanth Chintala[5]., Ramanarayana Boyapati[6] and Shyam Sunder S[7]

[1,2,3,4,5,6,7]Department of Periodontics Mamata Dental College Khammam Telangana India

ARTICLE INFO

Article History:

Received 15th September, 2015
Received in revised form 21st November, 2015
Accepted 06th December, 2015
Published online 28st January, 2016

Key words:

Organic liquid manures, PGPR, plant growth, chlorophyll content and yield.

ABSTRACT

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 b/w energy levels for generating coherent electromagnetic radiation in the U.V/V/I.R regions of the spectrum.It is a device that produces high intensity of a single wavelength and can be focused into a small spot.Device that converts electrical/chemical energy into light energy.

INTRODUCTION

Classification

Based on light Spectrum

- U.V.Light-100nm-400nm-Not used in dentistry
- Visible -400nm-750nm-Most commonly used (Argon and Diode)
- Infrared Light- 750nm-10000nm-Most Dental lasers are in his spectrum

Based on material used

- Gas: Carbon Dioxide
- Liquid: Not so far in clinical use
- Solid: Diodes, Nd: YAG, Er: YAG, Er:Cr: YSGG, Ho: YAG

Soft Lasers

- Helium-Neon at 632.8nm- red visible light
- Gallium-Arsinide at 830nm –Infrared invisible

Hard Lasers (Surgical)

- Argon at 488 to 514nm
- Co2 at 10600nm
- Nd:YAG at 1064nm
- Ho: YAG at 2100nm
- Er:Cr:YSGG at 2780nm

On the basis of output energy

- Low output/soft/therapeutic- Diodes
- High output/hard/surgical- Co2,Nd:YAG,Er:YAG

On the basis of state of gain medium

- Solid state-Nd: YAG, Er: YAG, Er: Cr: YAG
- Gas- HeNe, Ar, Co2
- Excimer-ArF, KrCl
- Diode-GaAlAs

On the basis of oscillation mode

- Continuous wave- CO2, Diodes
- Pulsed wave –Nd:YAG, Er:YAG

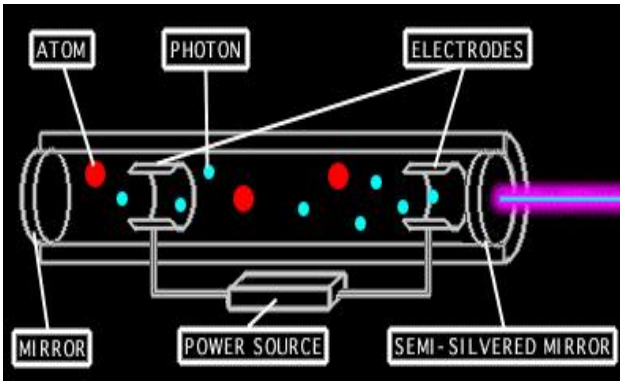
Corresponding author:* **Ramesh Babu Mutthineni
Department of Periodontics Mamata Dental College Khammam Telangana India

Mechanism of action of Lasers[2]

Laser is a type of electromagnetic wave generator. Lasers are heat producing devices converting electromagnetic energy into thermal energy. This emitted laser has three chrecteristic features:

1. ***Monochromatic:*** all waves have the same frequency and energy
2. ***Coherent:*** all waves are in a certain phase and are related to each other, both in speed and time
3. ***Collimated:*** all the emitted waves are nearly parallel and divergence is very low.

Lasers can interact with their target material by either being absorbed, reflected, transmitted, or scattered. Aboserbed light energy gets converted to heat and can lead to warming, coagulation or excision and incision of the target tissue. Although the wavelength of the laser is the primary determinant of how much energy is absorbed by the target tissue. optical properties of the tissue,- such as pigmentation, water content, and mineral content can also influence the extent of energy absorbed.



- Process of supplying energy for amplification-pumping

Emission Modes[3]

Continuous wave:- beam emitted at one power level continuously as long devise is active.

Gated pulse mode:- periodic alteration of laser energy being on or off, similar to blinking of eye. Mode achieved by opening closing of shutter in front of beam path.

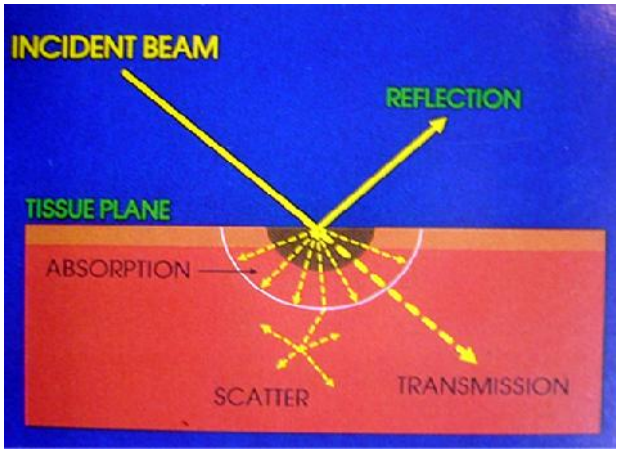
Free running pulsed mode (True pulsed):- large peak energy of laser light are emitted for short time (microsecond) followed by long time when laser is off.

Laser interaction with biologic tissues Four different interaction

Laser effects on tissue

The light energy from a laser can have four different interactions with the target tissue, and these interactions depend on the optical properties of that tissue and wave length

Reflection
Scatter
Absorption
Transmission



Reflection

- Laser beam become more divergent as distance from handpiece increases. Can be dangerous

Absorption: This effect is the usual desirable effect, and the amount of energy that is absorbed by the tissue depends on the tissue characteristics such as pigmentation and water content, and on the laser wavelength and emission mode. Short wave lengths, from about 500-1000nm are absorbed readily in pigmented tissue. Argon has high affinity for melanin and hemoglobin.. Diode and Nd: YAG have a high affinity for melanin and less interaction with hemoglobin. Longer wavelength are more interactive with water & hydroxyapatite – Erbium, carbon dioxide laser.

Transmission: Transmission of laser energy directly through the tissue, with no effect on target tissue. Water is relatively transparent to Nd: YAG whereas tissue fluids readily absorb carbon di-oxide.

Scattering: Scattering of the laser light causes weakening the energy and possibly producing no useful biologic effect. May cause heat transfer to tissue adjacent to the surgical site and unwanted thermal damage can occur.

Advantages[4]***:*** Greater hemostasis, bactericidal effect, and minimal wound conraction. Compared with the use of conventional scalpal, lasers can cut, ablate and reshape the oral soft tissues more easily, with no or minimal bleeding and little pain as well as no or only a few sutures. Dry surgical field and better visualization. -Tissue surface sterilization and reduction in bacteria. -Decreased swelling, edema and scarring. -Decreased pain. - Faster healing response. -Increased patient acceptance. -Minimal mechanical trauma.-Negotiates folds in tissues.

Disadvantages: Inadvertent irradiation-laser beams may reach the patients eyes and other tissues surrounding the target in the oral cavity. Laser beams can be reflected by shiny surfaces of metal dental instruments, causing irradiation to other tissues. Expensive. - Require specialized training. -Dental instruments mainly used are both side and end cutting thus; a modification of clinical technique is required. -No single wavelength will optimally treat all dental disease. -There is inability to remove

metallic and cast-porcelain defective restorations. -Harmful to eyes and skin.

Precautions before and during irradiation: 1.use glasses for eye protection(pt, operaor, and assistant),2.prevent inadvertent irradiation (action in non-contact mode),3.protect the pt's eyes, throat, and oral tissues outside the target site,4.use wet gauze packs to avoid reflection from shiny metal surfaces,5.ensure adequate high speed evacuation to capture the Laser plume.

Current and Potential applications of Lasers in Dentisry[5]:

Excimer Lasers(ArF,XeCl): -Hard tissue ablation, -Dental calculus removal *Gas Lasers(Ar, He-Ne, Co2):*Ar-Curing of composite materials, tooth whitening, intraoral soft tissue surgery, sulcular debridement, He-Ne-Analgesia, treament of dentin hypersensitivity, apthous ulcer treatment., Co2- Intra oral soft tissue surgery, apthous ulcer treatment, removal of gingival melanin pigmentation, treatment of dentine hypersensitivity, analgesia

*Diode Lasers(InGaAsP, GaAlAs, GaAs):*Caries and calculus detection, intra oral general and implant soft tissue surgery, sulcular debridement, analgesia, dentine hypersensitivity, pulpotomy, root canal disinfection, apthous ulcer treatment, gingival depigmenation

Solid state Lasers (Nd:YAG,Er:YAG,Er:Cr:YAGG):Selective ablation of dental plaque and calculus, caries removal and cavity preparation, modificaion of enamel and dentine surfaces, root planing, osseous surgery

Applications of Lasers in Periodontics

Used in non-surgical and surgical periodontal

Initial Periodontal therapy/SRP

-Soft tissue lasers-bacterial reduction and coagulation.-erbium lasers-bactericidal effect against Pg and Aa. Reduction of Interleukins and Pocket DeptInitial 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. Soft tissue lasers are used as an adjunct or an alternative in periodontal therapy to reduce the soft tissue inflammation. It reduces the bacterial populations photothermally and in addition eliminates the antimicrobial's problems like resistance, allergy and side effects, thus can be used even in children and pregenant women. For bacterial reduction and coagulation, soft tissue lasers as Argon(488-514nm), Diode lasers(800-980nm) and Nd: YAG(1064nm)are a good choice for periodntally diseased dark inflammed tissues and pigmented bacteria

Soft tissue application[7]

Gingival depigmentation-laser ablation-effective, pleasant and reliable technique, Anterior crown lengthening-Erbium laser-new dimension in smile design.

The ***beneficial properties of Lasers over conventional scalpel*** includes

1.relative ease of ablation of soft tissues,2.hemostasis,3.instant sterilization, 4.reduced bacterimia, 5.little wound contraction, 6.reduced edema, 7.minimal scarring,8.reduced mechanical trauma, 9.less operative and post operative pain,10.Faster healing,11.increased patient acceptance,12.no or few sutures,13.requiring no or topical anesthesia

Soft tissue lasers viz Co2,Nd:YAG,Diode,Er:YAG and Er:Cr:YSGG are being widely used as a tool ***for gingival soft tissue procedures*** [6]such as

1.gingivectomy, 2.frenectomy, 3.gingivoplasty, 4.epulis or benign tumor removal, 5.gingival depigmentation, 6.second stage exposure of dental implants, 7.irradiation of apthous ulcers, 8.coagulation of free gingival graft donar sites, 9. soft tissue crown lengthening, 10. operculectomy, 11.deepithelization of reflected periodontal flap, 12.Subgingival debridement and curettage, 13. Removal of granulation tissue.

Gingivectomy

Lasers offer the potential of increased operator control and minimal damage in the removal of gingival tissue for restorative purposes and for the treatment of gingival hyperplasia. Diode lasers specifically, operate at a wavelength that is easily absorbed by the gingival tissues, while posing little risk of damaging the tooth structure. Performance of laser differs depending on their penetration depth and hence may possibly damage the underlying tissues by thermal effects.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 surface.

Management of Chronic Generalised Periodontitis- using Diode Laser

using diode laser 940 nm the area was anesthetized using Xylocaine spray. Pocket was disinfected using a diode laser with a noninitiated tip of 300 µm. The settings were 1.5 W with a pulse interval of 1.00 ms and pulse length of 1.00 ms. The tip was moved from apical to the coronal direction and was not kept stationary for more than 5 s. Pocket disinfection was followed by ultrasonic scaling and thorough root planning with Gracey Curettes. The pocket was rinsed with normal saline to

eliminate blood clots. Target tissue was inflamed epithelial lining of the pocket, which was debrided using a sinusoidal movement of the tip. The fiber was moved both horizontally and vertically, "painting" the tissue on the wall of the sulcus with laser energy from the calibrated depth to gingival margin .The fiber was inspected often; any accumulated debris was wiped off with dry gauze to avoid any inefficiency. The setting used were 3.5 W pulsed mode, pulse length 0.50 ms, and pulse interval of 0.20 ms. The pocket was again rinsed with normal saline to eliminate the debris followed by denuding and plasty of the outer surface epithelium to recontour the gingiva. No postoperative dressing was applied.

Root surface modifications

Better fibroblast adherence after suitable Er:YAG laser irradiation of diseased surfaces than mechanical scaling alone. In contrast to focused mode, root conditioning effects with defocused mode CO2 laser prepare the root surface for favourable fibroblast attachment. Nd:YAG laser irradiation results in irreversible root surface changes that includes surface pitting, crater formation, melting, charring and carbonization, along with unfavourable fibroblast attachment.

LANAP(Laser Assisted New Attachment Procedure)

Associated with cementum-mediated new connective tissue attachment and apparent periodontal regeneration of diseased root surface in humans.

Osseous Surgery

The use of Er-YAG or Er:Cr:YAG laser –ability to recontour osseous tissue without the discomfort, Surgical precision, Reduced collateral damage of soft tissue, Reduced noise And eliminating vibrations with conventional instruments less healing time. Er:YAG laser without water coolant and CO2 laser irradiation shows formation of toxic by-products on bone surfaces which delays healing. Er:YAG laser in bone surgery (Strubinger S 2007) –lower cutting efficiency as compared to conventional instruments, And lack of depth control are its limitation.

Implant therapy

Er: YAG Lasers- removal of gingival hyperplasia as well as treatment of peri-implantitis. Due to its bactericidal, degranulation and decontamination effect, and without heat generation it can be used in the maintenance of implants. Also to prepare fixture holes in the bone tissue in order to achieve faster osseointegration of the placed implants, Also second stage exposure of dental implants, During first stage implant therapy-Er:YAG lasers used to prepare fixture holes in bone due to its ability to produce effective bone tissue ablation. In second stage implant therapy-prior to placement of healing abutment, lasers used for uncovering the submerged implant with advantages of 1.improved hemostasis 2.fine cutting surface3.less postoperative discomfort 4. and favourable healing .Because of difficult and time consuming mechanical debridement, emergence of bacterial resistance to antibiotics – being proposed for treating peri-implantitis. Nd:YAG laser is contraindicated- it produces morphological changes on implant surfaces,Co2 lasers- shown the associated risk with high temperature, influence the attachment rate of osteoblasts.

Low level laser therapy (LLLT)[8]

Is ***defined*** as laser treatment in which the energy output is low enough to produce nonthermal and biostimulatory effects.

The mechanisms: due to the stabilization of depolarising potential of nerve fibres or effects on the cellular and biochemical processes of the inflammatory responses. *used in* pain during orthodontic therapy, acceleration of healing process in wound, reduction of bacterial load.

Healing after Laser treatment[9]

In spite of ostensible advantages of lasers based on clinical observatin and patient acceptance, claims of faster healing response or decreased scarring, which itself appear to be wavelength specific and highly sensitive to energy density, do not find much data to support it.Co2 laser induced wounds in oral and oropharyngeal mucosa healed significantly faster than those created by Nd:YAG laser.(Lippert -2003) ,Overall, Initial periodontal wound healing with laser application has been shown to be delayed and decreased tendency toward scar contraction compared to conventional scalpel surgeries.Recent studies(Schwarz-2009) of low –level laser therapy(LLLT) using GaAl As radiation within milliwatt range have been shown positively influence proliferation of gingival or periodontal ligament fibroblasts, thus support periodontal and peri-implant wound healing.

Recent advances[10]

Waterlase-uses laser energized water to cut or ablate soft and hard tissue. {and provide periodontists with the opportunity to perform more procedures in fewer appointments with less need for anaesthesia, scalpels and drills.}

Periowave-photodynamic disinfection system utilizes nontoxic dye (photosensitizer) in combination with low intensity lasers enabling singlet oxygen molecules to destroy bacteria. (Suppression of anaerobic perio-pathogens).

Future developments:

There is a great potential for laser system to be developed further to include additional fetures and funcions. He ***Alexandrite*** (Cr: Berylium-Aluminium-Oxidechrysoberyl) laser for clinical use is widely accepted due to its excellent ability to remove dental calculus in a selective mode without ablating the underlying enamel or cementum from the tooth surface.

CONCLUSIONS

Laser treatment is expected to serve as an alternative or adjunctive to conventional mechanical periodontal treatment. Currently, Er: YAG and Er: Cr: YSGG lasers are best suitable for periodontal procedures due to its dual ability to ablate soft

and hard tissues with minimal damage. Lasers have been suggested as an adjunctive or alternative to conventional techniques for various periodontal procedures and considered superior in respect to easy ablation, decontimination, and he most as is along with less operative and post-operative pain. Introduction of lasers in implant therapy and newer laser technical modalities has revolutionised the periodontal treatment outcome with patient acceptance. However patient risk and procedural cost must always be considered and fully understood before its application.

References

1. Fay Goldstep: Diode lasers for periodontal treatment; journal of oral health,dec-2009;44-46
2. Laurence J Walsh: Softtissue applications: *Australian Dental Journal*:42(4):1997:247-254.
3. Mehmet Saglam *et al*: clinical and biochemical effects of diode laser as an adjunct to nonsurgical treatment of chronic periodontitis: a randomized, controlled clinical trial: *journal of lasers medical science* 29:2014:37-46.
4. Fabrizio Sgolastra *et al* ,effectiveness of diode laser as adjunctive therapy to scaling root planning in the treatment of chronic periodonttis: a meta –analysis: *journal of lasers medical science* 28:2013:1393-1402.
5. Munqith S Dawood *et al*, low level laser accelerates wound healing: *journal of lasers and medical science*: 28:2013:941-945.
6. Prasad SSV *et al*, Lasers in periodontics- a review: *Indian journal of stomatolgy* 2(3):2011:179-182.
7. Vivek K Bains *et al*: Lasers in periodontics: an overview: *journal of oral health and community dentistry*: 4(spl)2010:29-34.
8. Aashima B Dang, Role of lasers in periodontology: a review: *Journal of annals of dental speciality* 1(1)2013:8-10.
9. Isao Ishikawa *et al*, Application of lasers in periodontics: true innovation or myth?: *journal of periodontology* 2000:50:2009:90-126.
10. Donald J Coluzzi *et al*, J of Dental clinics of north America: 48:2004:751-770.

****

How to cite this article:

Ramesh Babu Mutthineni *et al*.2016, Applications of Lasers in Periodontics- Review. *Int J Recent Sci Res.* 7(1), pp. 8175-8179.

TSSN 0976-3031