ORIGINAL RESEARCH

Recent Advances in Laser- as an Adjunctive Periodontal Therapy-Review Article

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ABSTRACT

High sources of light, or more specifically non-ionizing electromagnetic radiation, include lasers. The wavelengths of laser radiation are well-defined and predictable, and indeed the radiation seems to be more powerful at these wavelengths than can be produced by traditional light sources. Sutures are rarely indicated, there is very little possibility of mechanical trauma, and there is little scarring caused by lasers. The high proportion of patient acceptance of laser dentistry is one of its great advantages. Today's patients are aware of lasers' benefits. Today's dental lasers are portable, lightweight, compact, and becoming ever more accessible. Considering lasers used in dentistry, the prognosis seems optimistic. Practitioners can benefit from this new technology through knowing further about lasers and this form of light's attributes. This review article discusses about recent advancements of laser and its implications in periodontology.

Key words: Laser, Periodontal therapy, Periowave, Periodontal waterlase, Waterlase

Introduction

Laser acronym stands for "Light Amplification by Stimulated Emission of Radiation"1,2. When focused at a short distance, a laser converts light of various frequencies into chromatic radiation in visible, infrared, and ultraviolet wavelengths, with all waves in phase, capable of generating massive amounts of heat and power. A laser is a device that converts light of various frequencies into chromatic radiation in the visible, infrared, and ultraviolet ranges, with all waves in phase and capable of mobilising enormous heat and power when focused at close range3. Stern and Sognnaes, as well as Goldman et al., were the first to describe the effects of a laser on dental tissue in 1964, describing the effects of a ruby laser on enamel and dentine. The primary effect of laser energy is photothermal, and its effect on tissue is determined by the degree of temperature rise and the corresponding reaction of interstitial and intracellular water4. Soft lasers are said to help with healing by reducing inflammation and pain. However, there are few rigorous studies to back up their use. Surgical hard lasers can cut both hard and soft tissues, and newer models can send their energy through flexible fiberoptic cables. Many procedures can be performed without the use of local anaesthesia, and lasers sterilise as they cut. The laser is used in hard tissue applications such as in caries prevention, bleaching, restorative removal and curing, cavity preparation, dentinal hypersensitivity, growth modulation, and diagnostics, whereas soft tissue applications include wound healing, removal of hyperplastic tissue to uncover the impacted or partially erupted teeth, photodynamic therapy for malignancies, and photostimulation of herpetic lesions. The use of lasers has proven to be an effective tool for increasing the efficiency, specificity, ease, cost, and comfort of dental treatment4.Over the last decade, dentistry has advanced to the benefit of both clinicians and patients. The laser is one technology that is increasingly being used in clinical research. There are few recent advances like Periowave, Periodontal waterlase and Waterlase which will be explained in this review article.

- HISTORY OF LASER
- 1917, Stimulated emission: Albert Einstein
- 1959, Principle of MASER: Schalow and Townes
- 1960, Synthetic ruby laser: Theodore Maimam
- 1961, The first gas laser and first continuously operating laser: Javan et al.
- 1964, Treatment of caries: Goldman
- 1968, CO2 laser: Patel et al.
- 1971, Tissue reactionsto laser light and wound healing: Hall and Jako et al.
- 1974, Nd:YAG laser: Geusic et al.
- 1977, Ar laser: Kiefhaber
- 1988, Er:YAG laser: Hibst and Paghdiwala
- 1989, Nd:YAG laser, soft tissue surgery: Midda et al
- 2006,Waterlase : Cobb et al
- 2015,Periowave: Nay Aung 5

PRINCIPLE OF LASERS

Dental lasers use energy generated by atomic electron shifts to generate coherent monochromatic electromagnetic radiation

between the ultraviolet and far infrared sections of the electromagnetic spectrum, resulting in both visible and invisible lights with specific wavelength and colour that act on the desired tissue site. The quantum nature of light and stimulated emission is the fundamental principles underlying laser action. Lasers produce heat, converting electromagnetic energy into thermal energy. The emitted laser has three distinct properties: it is monochromatic, coherent, and collimated5.

PERIODONTAL WATERLASE MD™

Implants and periodontal therapy are among the procedures targeted by Periodontal Waterlase MDTM. The Waterlase MD laser, according to a study by Kelbauskiene S. et al., uses Er,Cr:YSGG minimally invasive surgical periodontal laser therapy, which significantly reduces bleeding on probing and increases probing depth. This therapy also appears to be more effective than scaling and root planning alone at restoring attachment levels.6.(Figure -1)

Figure 1
SOURCE:
https://bestdentalmedicalshop.com/product/biolase-waterlase-mdx-all-tissue-laser/

WATERLASE C100

The Waterlase system is a revolutionary dental tool that enables periodontists to complete more treatments in fewer visits while using less anaesthesia, scalpels, and drills. It uses laser-activated water to cut or ablate soft and hard tissues. Waterlase C100 is intended for use in early periodontal treatment. It is used in full thickness, partial thickness, and split thickness flaps. Soft tissue curettage with a laser, Removal of diseased, infected, inflamed, and necrosed soft tissue from the periodontal pocket with a laser, Removing highly inflamed edematous tissue caused by bacterial penetration of the pocket lining and junctional epithelium, as well as removing granulation tissue from bony defects To improve clinical indices such as gingival bleeding indices, probing depth, attachment loss, tooth mobilit. It can also be used in sulcular debridement, osteoplasty,osseous recontouring, Ostectomy and Osseous crown lengthening7. (Figure-2)

FIGURE: 2
SOURCE: http://bestdentalmedicalshop.com/product/biolase-waterlase-c100-all-tissue-dental-laser/

PeriowaveTM is a photodynamic disinfection device that kills bacteria by using a harmless dye (photosensitizer) and low-intensity lasers, allowing singlet oxygen molecules to destroy the bacterium. It uses a photo disinfection response to kill the bacteria and toxins left behind after scaling and root planning; a small amount of blue-colored photosensitizer solution is applied topically on the gums during the treatment. It binds to the bacteria that are present. After administering a light-sensitive medication (photosensitizer), a low-intensity laser is focused on the area treated with the drug, causing phototoxic responses. Although photosensitizers have been proposed to completely suppress anaerobic perio-pathogens, this is not the case for facultative anaerobes. Following that, a low-intensity laser is used to target the drug treated area, causing phototoxic reactions that destroy bacteria beneath the gingival line. Each treatment site requires only 60 seconds of laser activation, making the procedure quick and painless. When used in conjunction with scaling and root planning, it is extremely effective 8,9. (Figure-3)

FIGURE: 3
SOURCE: https://www.wcdental.ca/periowave-laser/

BIOLASE WATERLASE

The Er,Cr:YSGG laser is useful for debridement of a titanium implant surface in order to facilitate subsequent regenerative treatment. The findings indicate the value of BIOLASE's Waterlase technology for dentists looking for periodontal treatment devices. Data suggests that as many as 56% of people with dental implants may have peri-implantitis, said John Beaver, CEO of BIOLASE. "Unfortunately, peri-implantitis treatment can be painful, expensive, ineffective, and unpredictable. These recent studies' findings confirm that Waterlase laser technology can be a more viable treatment option than other methods. These minimally invasive

treatment options that benefit their patients through advanced laser technology.

LIGHT TOUCH Er:YAG LASER

Periodontitis can be effectively treated with the LiteTouchTM Er:YAG Dental Laser. It is capable of removing gingival and subgingival calculus, disinfecting periodontal pockets, and removing granulation tissue while causing no harm to the periodontal ligament, cementum, or surrounding tissues. The LiteTouchTM Er:YAG Dental Laser has no thermal effect on the treated tissue vascularization, and its disinfecting properties destabilise the microbial biofilm, decontaminating the treated area for quick recovery and long-term results.

WATERLASE IPLUS 2.0

WaterLase iPlus 2.0 is a minimally invasive dental laser with expanded and enhanced capabilities to help you provide the best possible experience for the patients. YSGG Delivery System, the gold standard in ergonomics and clinical precision, is included in WaterLase iPlus 2.0. Furthermore, the highly effective REPaiR periodontal protocol is available as an app from the award-winning touch-screen user interface. It can be used for outer pocket de-epithelialization, gingivectomy, de- epithelialization and retraction, scaling and root planning, sulcular debridement, bone decortication and final sulcular debridement,

LASER SAFETY MEASURES

The nature of laser effect on tissue includes wavelength, exposure time, spot size, and tissue physical and chemical composition variables. Precautionary measures must be taken to ensure the safe and effective operation of dental lasers. Lasers are not recommended for pacemaker patients, pregnant women, epileptic patients, or arrhythmic patients, and should be avoided in glands, tumours, or lupus lesions10.

1. Engineering control measures
   - o Laser barriers and protective curtains
   - o Protective housing
   - o Master switch control
   - o Optical viewing system safety
   - o Beam stop or attenuator
   - o Interlock requirements
   - o Laser activation warning system.

2. Administration control
   - o Appointing laser safety officer
   - o Safe working procedures
   - o Trained and experienced personnel
   - o Hazard signs using color, dimension, and location of symbol (sunburst pattern)
   - o Eye and skin examinations
   - o Test firing.

3. Personal protective equipment
   - o Eye protection using safety goggles
   - o Laser filtration masks to prevent airborne contamination
   - o Evacuation of laser plume using high-volume suction
   - o Protective clothing, surgical gloves, and footwear to be worn by operator.

CONCLUSION

Laser treatment is used in conjunction with traditional mechanical periodontal therapy. Unlike antibiotics, provide their bactericidal qualities without the usual adverse effects of medication interactions, bacterial resistance, or gastrointestinal issues. Furthermore, its bactericidal effect with lipopolysaccharide elimination, ability to remove bacterial plaque and calculus, irradiation effect limited to an ultra-thin layer of tissue, and faster bone and soft tissue repair make it a promising tool for periodontal treatment, such as scaling and root surface debridement.

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