



LASERS IN PERIODONTAL THERAPY.

Dental Science

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ABSTRACT

Lasers were introduced into the field of dentistry as they are a precise and effective way to perform many dental procedures. Treatment with lasers provides a hope of overcoming the disadvantages of conventional dental procedures. As the applications for dental lasers expand, greater numbers of dentists will use the technology to provide patients with precision treatment that may minimize pain and recovery time. Every discipline of dentistry has been positively affected with the use of laser technology including oral medicine, oral surgery, pediatric and operative dentistry, periodontics and implantology, prosthetic dentistry. The ability of the lasers to perform less invasive procedures without any discomfort to the patients had made a tremendous impact on the delivery of dental care. This will continue as this technology will continue to improve and evolve.

KEYWORDS

Neodymium- doped:yttrium aluminum garnet, Peri- implantitis, Curettage.

INTRODUCTION :

The word "laser" is an acronym for "light amplification by stimulated emission of radiation." It refers to a device that emits light that is spatially coherent and collimated; a laser beam can remain narrow over a long distance, and it can be tightly focused. When directed at tissues, different interactions result. The absorption, reflection, transmission, and scattering of the laser light vary depending on the wavelength of the laser and the characteristics of the tissue⁽¹⁾. Lasers have various periodontal applications including calculus removal (Er: YAG, Er, Cr: YSGG lasers); soft tissue excision, incision and ablation; decontamination of root and implant surfaces; biostimulation; bacteria reduction; and last but not least bone removal (osseous surgery). Certain laser wavelengths (i.e. Er: YAG, Er, Cr: YSGG) are highly absorbed by hydroxyapatite and can be used for bone removal more efficiently than others. In contrast, diode and Nd: YAG lasers are more highly absorbed by hemoglobin and thus should be used when coagulation is desirable. In addition, due to the effect that these wavelengths (diode and Nd: YAG lasers) have on pigmented tissues, they can be used by periodontists for removal of gingival pigmentation and/or reduction of periodontopathogenic black-pigmented bacteria.

Application of Laser for Periodontal Treatment

Different lasers penetrate to different tissue depths, depending on their wavelength and the type of tissue at which they are directed. Lasers in periodontal therapy have been demonstrated to be beneficial for control of bacteremia, better removal of the pocket epithelium in the pockets, bacteria reduction, efficient subgingival calculus removal (using Er: YAG lasers) and improvement of periodontal regeneration in animals and humans without damaging the surrounding bone and pulp tissues.

Removal of the pocket epithelium

Lasers are also used for soft tissue periodontal applications. The Nd: YAG was the first laser wavelength to be compared to the scalpel for treating periodontal pockets and controlling bacteremia and gingival bleeding.⁽²⁾ The probing pocket depth and bleeding index scores were reduced using the pulsed Nd: YAG laser. Furthermore, clinical evaluation of soft tissue biopsies taken from human subjects using the Nd: YAG laser versus a curette presented a complete removal of the epithelium of the pocket after use of the pulsed Nd: YAG laser compared to the curette.⁽³⁾

The use of CO₂ lasers to decontaminate root surfaces has been investigated, providing more information about the exact power settings and parameters required to avoid root damage. Barone *et al.*⁽⁴⁾ showed that a defocused, pulsed CO₂ laser is able to create smooth and clean root surfaces compared to a focused, continuous wave; the latter leads to melting and root surface damage. Later studies using the same parameters for CO₂ lasers reported root conditioning with a better fibroblastic activity, cellular proliferation, and greater fibroblast attachment. Different clinical case reports have demonstrated these advantages of CO₂ laser de-epithelialization.⁽⁵⁾

Bacterial reduction

A laser application that has been especially promoted in the past is for

the reduction of bacteria in pockets, due to the high absorption of specific laser wavelengths by the chromophores. Initially, the use of an Nd: YAG laser was shown to reduce the load of *Porphyromonas gingivalis* and *Prevotella intermedia*.⁽⁶⁾

Laser applications in implant dentistry

There are applications for lasers in implant dentistry, including for second stage surgery, removal of peri-implant soft tissues, and decontamination of failing implants.⁽⁷⁾ Serious concerns about the implant overheating followed by melting of the implant surface have been raised.

CO₂ laser decontamination of the surface of implants placed in dogs allowed new bone to grow and be in contact with the implant surface (re-osseointegration). *In vitro* studies of osteoblasts have confirmed these effects for CO₂ and Er, Cr: YSGG lasers.⁽⁸⁾

Advantages of laser use in dentistry

1. Less pain
2. NO need for anesthetics
3. No risk of bacteremia
4. Excellent wound healing.
5. Bleeding control, no need for sutures
6. Ability to remove both hard and soft tissues

Disadvantages of lasers use in dentistry

1. Relatively high cost of the devices.
2. Need to use safety measures i.e. goggles.

Future Developments:

There is a great potential for laser systems to be developed further to include additional features and functions. The Alexandrite laser is a solid-state laser, which could remove dental calculus selectively. Mechanism of selective ablation has not been clarified yet. The development of this laser for clinical use is widely expected due to its excellent ability for selective calculus removal from the tooth structure.

CONCLUSION :

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. Finally, in order to have a successful periodontal treatment in long term, patients need to be motivated. It is not so much the technology but the motivation and psychology that matter when it comes to practice of oral hygiene before, during and after the periodontal treatment to maintain a good and stable periodontal condition.

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