

Versatility of Diode Laser in Dentistry & Oral Rehabilitation

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Abstract:

With the rapid advances and changes in everyday technology, lasers are gaining their place to improve the overall experience of the patient. Diode Lasers are a versatile combination of aluminium, gallium, and arsenide operating at 450-1064 nm wavelength. This combination makes them highly absorbable by the pigmented tissue containing haemoglobin, melanin, and water. This article casts light on the versatility of diode soft tissue laser that can be used to perform a variety of dental soft tissue procedures like incision, blood coagulation, haemostasis, and curettage.

Keywords: Diode Laser, Neuralgia, LLLT, Photobiomodulation, Orofacial pain

Introduction

Over a very short period, technology has become more productive and has brought many improvements in dentistry. Lasers have been introduced just a few decades and they have already made a major place in our dental offices and hospitals. Diode soft tissue lasers are a combination of Gallium arsenide (GaAs), gallium-aluminum-arsenide (GaAlAs). They are simple, compact units which are economic as well as productive. Their mechanism of action is attributed to the fact that all diode wavelengths are absorbed primarily by tissue pigment (melanin) and hemoglobin but poorly absorbed by the hydroxyapatite and water present in the enamel. With wavelengths ranging from 450 to 1064 nm in a continuous or pulsed mode, they have been used in every branch of dental specialty for soft tissue treatments.

Applications of Diode Lasers

The advantages of laser application are that it provides relatively bloodless surgical and post surgical courses with minimal swelling and scarring. The application of diode laser in ranges from the treatment of oral mucosal lesions, orofacial pain, salivary gland pathologies, TMJ disorders and biopsies to soft tissue oral surgery for facial pigmentation and vascular lesions and in oral surgery excision; for example, frenectomy, epulis, pyogenic granuloma, and fibroma.

According to Eckerdal and Bastin¹, low-level laser of 830 nm wavelength was efficient in the treatment of 81% of patients, with 42% of them having no pain after a year.

Shirani et al² evaluated the efficacy of a LLLT producing 660 and 890 nm wavelengths and concluded LLLT was an effective treatment for pain reduction in MPDS patients.

It has been demonstrated that photo stimulation of aphthous ulcers and recurrent herpetic lesions³, with low levels of laser energy (HeNe) can provide pain relief and accelerate healing. In the case of recurrent herpes simplex labialis lesions, photo stimulation during the prodromal (tingling) stage seems to arrest the lesions before painful vesicles form, accelerate the overall healing time, and decrease the frequency of recurrence.^{4,5}

Owing to the smaller penetration in blood rich tissues diode laser is accepted to be safe in the adjacent tissues. The cut is precise and does not affect the muscle layer, causes minimal hemorrhage and almost no acute inflammatory reaction.⁶

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Walsh LJ⁷ has done a tremendous amount of research on the proposed mechanisms of the action of LLLT on both hard and soft tissues and has proposed that cold lasers (LLLT lasers) accelerate wound healing and reduce pain by perhaps 'stimulating oxidative phosphorylation in mitochondria and modulating inflammatory responses.

Laser Fluorescence at a wavelength of 655 nm (red light) can be used for detecting occlusal caries. Its high reliability, reproducibility and predictability makes it a valuable adjunct for disclosing occlusal caries in primary and permanent teeth.⁸

Enamel demineralization with white spot formation on the buccal surfaces of the teeth are very common especially with fixed appliance therapy. Diode lasers help in the remineralization of those spots as well and help in restoring back the esthetics and health of the teeth.⁹

In Endodontics, diode lasers have been used for root canal sterilization and removal of pulp polyps which previously hampered a clinician from performing the procedure on the same day.

In surgical procedures whether macro or micro-gingival surgery, diode lasers have proved their mettle to restore the teeth with traumatic injuries. Various surgical procedures like frenectomies, ankyloglossia, operculec - tomies or rendering surgical incision for the enhancement of eruption of unerupted teeth can be easily performed with lasers. Oral submucous fibrosis (OSMF) is a chronic precancerous condition characterized by progressive fibrosis of the submucosal tissues resulting in marked inability to open the mouth and rigidity. The use of laser to release fibrotic bands leads to healing with minimal scarring, thereby decreasing the probability of procedure induced trismus. Its cutting depth is less than 0.01 mm, thus controlled cutting is possible without damaging deeper structure. It seals smaller blood and lymphatic vessels, allowing excellent visibility and minimizes the chances of post-operative bleeding and edema. Laser induced coagulum covers the surface, therefore eliminating the need for grafts. Tissue coagulation acts as dressing, decreases pain and risk of infection. Therefore, wound healing delayed because of secondary epithelization, takes around 3 to 4 weeks. But fortunately, that provides more time for active mouth opening exercise to prevent contracture during healing.

The advantages of laser application are relatively bloodless surgery, minimal swelling, scarring and coagulation, no need for suturing, reduction in surgical time and less or no post surgical pain. Also, the laser instantly disinfects the surgical wound as well as allowing a noncontact type of operative procedure and therefore no mechanical trauma to the tissue.¹⁰

Lasers are especially helpful in geriatric patients as the technology makes the procedure more tolerable and can help over-come some of the barriers to providing dental care including severe dental complexity, multiple medical conditions, and diminished functional status. In short, lasers can enable the dentist to render better-quality dentistry.¹¹

Use of diode lasers in dentistry has grown in popularity over the years. When used by a properly trained and licensed dental professional and proper protocols are observed, efficacy of diode laser use for many procedures is possible. It is important that specific protocols be followed when using the diode laser to ensure the safety of both patients and providers.

Conclusion:

In only a few short decades, diode lasers have made it possible for many clinicians to provide minimum invasive dentistry to the patients. Many advantages have been documented and rest are still making their way provided the dental surgeon is aware of correct laser tissue interaction, selection and application of diode lasers wavelength. Proper training to choose appropriate parameters during diode laser use is still one of the main concerns as that will refine the way we treat our patients in day-to-day dental practice.

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