CASE STUDY

PERIODONTAL APPLICATIONS OF SOFT TISSUE DIODELASERS

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ABSTRACT

Lasers, which were first used in dentistry in 1960, are now an integral part of the dental practice. They are used in cavity preparation, surgical procedures and various other procedures. They can be used not only as adjunct but also as an alternative to conventional techniques. Soft tissue lasers can be put to use for a number of treatment options in periodontics. Here are case series reviewing the periodontal applications of soft tissue diode lasers.

INTRODUCTION

Laser stands for light amplification by stimulated emission of radiation. It is a device which generates a high intensity, monochromatic parallel beam of electromagnetic radiation. Lasers have been used in medicine and dentistry since 1960’s. In 1960, Maiman et al developed the first laser prototype using ruby crystals as an active medium based on the Einstein’s principle of stimulated emission theory (1917) (Husein, 2006). To study the effectiveness of a pulsed ruby laser on human caries, lasers in dentistry were experimented (Husein, 2006). The diode, ruby, Ho: YAG, Er: YAG, Nd: YAG, dye lasers for photodynamic therapy and various other laser systems have been used for treating diseases (Werner et al., 2009). The wide range of laser wavelengths and delivery systems are used to perform periodontal, restorative and surgical treatment procedures (Lee, 2007). This article aims to review the periodontal applications of a soft tissue diode laser and presents a case series in this regard.

Soft Tissue Diode Lasers

A combination of Aluminum, Gallium and Arsenide is used to change electrical energy into light energy in diode laser which is a solid state semiconductor (Naik et al., 2010). The diode laser is ideal for using in periodontal surgery, bleaching, photodynamic therapy, soft laser therapy and other procedures as it uses a wavelength of 635 – 980 nm (Naik et al., 2010; Olivi et al., 2009).

Naik et al. (2010) and Mahajan et al. (2011) summarized the advantages of lasers in dental practice:

- Tissue surface sterilization and reduction in bacteremia
- Dry surgical field and better visualization
- Decreased pain
- Decreased swelling, edema and scarring
- Increased patient acceptance
- Faster healing response
- Minimal mechanical trauma

Coluzzi et al discussed the soft tissue interactions of lasers that can be seen based on the different wavelengths available (Coluzzi, 2004):

- Reflection: No interaction occurs as the beam reflects off the surface
- Transmission: No interaction occurs as the beam passes directly through the tissue

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Scattering: An interaction as the beam disperses in a non-uniform manner throughout the tissue
Absorption: Light radiation is absorbed by specific tissue elements.

Absorption and scattering are the interactions amongst these which occur inside the oral cavity (Gillis and Stron, 1983). The factors influencing tissue interactions are (Naik et al., 2010):

- Duration and rate of pulse
- Unfocussed beam versus focused beam
- Dissipation and conduction of heat
- Vascularisy

The clinician has control over these through the following factors (Naik et al., 2010):

- Energy density
- Power density
- Duration and repetition of pulse
- Manner and mode of delivery

Applications of Diode Laser in Periodontal treatment:

Diode lasers are a viable alternative to scalpel for various procedures in periodontal treatment.

Gingivectomy/Gingivoplasty:

To gain access to perform restorative treatment in areas located below the gingival margin, gingivectomy or gingivoplasty are performed. Gingival hyperplasia can also be treated using soft tissue diode laser.

Crown Lengthening:

Soft tissue diode laser is also used for clinical crown lengthening without gingival flap elevation as is the requirement of esthetic and prosthetic purposes (Roshna and Nandakumar, 2005).

Frenectomy:

Clinicians can use diode lasers for performing frenectomy procedure. Kafas P et al found satisfactory results while performing diode laser frenectomy, even without local anaesthesia for paediatric patient (Kafas et al., 2009).

Depigmentation:

For the purpose of reduction of tissue pigmentation, diode lasers are preferred over scalpel (Gillis and Stron, 1983).

Low Level Laser Therapy:

To produce biostimulatory effects and analgesia at a nonthermal level, low level laser therapy is used as it keeps energy output at a lower level (Bhandari et al., 2014). As put forward by Hong-Meng et al., it can be used to reduce pain and accelerate wound healing effectively during orthodontic treatment, and bacterial load in ulcerative conditions and infections is also reduced (Hong-Meng et al., 1995).

Photodynamic Therapy:

A photosensitive dye is used in photodynamic theory which binds to the target cells. This dye is then activated using light of appropriate wavelength. The free radicals which are formed during activation, is found to be toxic to bacteria, hence making it useful for treatment of localized microbial infections (Polansky et al., 2009).

Dentinal Hypersensitivity:

At low powers, diode lasers can be used to block the depolarization of peripheral C-fibre afferent and inhibits sensitivity and pain, sealing the dentinal tubules (Naik et al., 2010). Sicilia et al enhanced the inhibition of hypersensitivity by combining with fluoride gel (Sicilia et al., 2009).

Surgical Pocket Therapy:

In accessible deep surgical pockets such as furcation areas and deep intrabony defects can be debrided using lasers, but it may also lead to carbonization of the bone and root surface (Naik et al., 2010).

Important Considerations when using soft tissue lasers:

During use of soft tissue lasers, the temperature rise of the soft tissue of ≥100 °C can cause breakdown of protein-based elements to hydrocarbon and carbon residues. Charring and carbonization of the tissues occur due to this at temperatures ≥200 °C, which has to be avoided (Miserendino et al., 1995).

The following guidelines, put forward by Pang et al are to be followed during treatment with lasers (Pang et al., 2010):

- While directing the laser beam, the delivery system must be kept in motion
- Using water moistened gauze, built up char should be regularly removed.
- Tissue cooling should be allowed, which can be done by adjusting the pulse repetition rate, interrupting the energy delivery, using high volume suction, utilizing the water spray or applying ice near the site of treatment.
- To avoid complications, the practitioner should understand the characteristics and limitations of the laser device before proceeding to use on the patient.

Case Report I: Gingivectomy:

A 37 year old female patient was referred for the management of clinically short crown in relation to 47. After examination, it was planned to use laser for gingivectomy for increasing the crown length. Satisfactory healing was revealed in postoperative healing after 2 weeks.

Case Report I: Picture 1: Preoperative view 47
Case Report I: Picture 2: Gingivectomy done using laser
two weeks, postoperative review revealed a satisfactory esthetic result.

Case Report II: Picture 1: Preoperative view

Case Report II: Picture 2: Postoperative view of upper arch after depigmentation

Case Report II: Picture 3: Postoperative view of lower arch after depigmentation

Case Report II: Depigmentation

A 24 year old male patient was referred for management of gingival hyper pigmentation in upper and lower anterior region. Depigmentation was carried out using laser, and after

Case Report III: Surgical Pocket Therapy

A 32 year old female patient was referred for management of bleeding gums. On examination, she was found to have deep pockets of 6mm in posterior molar region on all quadrants. A surgical pocket therapy was planned using laser, after successful non- surgical preparation. Postoperative review revealed an uneventful healing and reduced pocket depths.
Case Report III: Picture 1: Preoperative view

Case Report III: Picture 2: Sulcular debridement done using laser

Case Report III: Postoperative view buccal arch

A 52 year old male patient was referred for management of clinically short crowns in relation to all teeth. On examination, he was diagnosed with bruxism and severe attrition of all the teeth. A full mouth rehabilitation treatment was planned. Following initial crown preparation, crown lengthening was done using laser. After three weeks, satisfactory healing was seen and after complete healing of tissues, restoration and rehabilitation was completed.

Case Report IV: Picture 1: Preoperative view:

Case Report IV: Picture 2: Crown Preparation done

Case Report IV: Picture 3: Crown lengthening done in upper arch

Case Report IV: Crown Lengthening

Case Report IV: Picture 4: Crown lengthening done in lower arch
Case Report IV: Picture 5: Immediate postoperative view of upper arch

Case Report IV: Picture 6: Immediate postoperative view of lower arch

Case Report IV: Picture 7: Postoperative view after restoration

Case Report V: Frenectomy

A 23 year old male patient was referred for management of ankyloglossia. Lingual frenectomy was planned using laser. Following the procedure and review appointments, patient had satisfactory healing and tongue protrusion.

Case Report V: Picture 1: Preoperative view high lingual frenum attachment

Case Report V: Picture 2: Tongue protrusion affected by high lingual frenum attachment
Case Report V: Picture 3: Postoperative view after lingual frenectomy done using laser

Conclusion

Viable alternative to scalpel and adjunct for periodontal therapy are soft tissue diode lasers. To avoid complications, practitioner should practice the technique. To avoid complications, the practitioner should follow the technique strictly.

REFERENCES


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