

DIODE LASERS IN DENTISTRY- THE ONE TOOL TO CURE THEM ALL - CASE SERIES

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ABSTRACT

The breakthrough for dental laser systems came in the mid 1990's. Among the various laser types with corresponding wavelengths, diode laser systems quickly began establishing themselves as compact, competitively priced and versatile additions to the dentist's repertoire, predominantly for performing soft tissue applications. The advantages of laser use include a relatively bloodless operating field, sterilization of the wound site, minimal swelling and scarring, reduction of surgical time and less postoperative pain to the patient. It should appeal to dental professionals seeking to optimize the procedures they currently perform and expand the number of services they offer.

Key words: Diode Laser 940nm; Depigmentation, Operculectomy, Tissue Excision, Healing

INTRODUCTION

A laser is a device that emits light (electromagnetic radiation) through a process of optical amplification based on the stimulated emission of photons.¹ Laser is a relatively new and modern technology developed by Maiman in 1960.² The diode laser is a solid-state semiconductor laser that typically uses a combination of Gallium (Ga), Arsenide (Ar), and other elements, such as Aluminum (Al) and Indium (In) to change electrical energy into light energy.³ Laser energy is emitted at a very specific wavelength.⁴ The diode laser is well absorbed by melanin, haemoglobin and other chromophores that are present in periodontal disease.⁵ The diode basically do not interact with dental hard tissues; this makes it an excellent soft tissue surgical laser. When used correctly, laser energy will act primarily as a means of incision, excision or ablation.⁶ Tissues can respond to laser light in four different ways: scatter, transmit, reflect, and absorb. Absorption is the most desired laser/tissue interaction in dental use which in turn depends on

three factors i.e. wavelength, tissue composition and tissue's water content. The diode laser exhibits thermal effects using the "hot-tip" effect caused by heat accumulation at the end of the fiber, and produces a relatively thick coagulation layer on the treated surface.¹ The diode laser has become an important tool in the dental armamentarium because of its exceptional ease of use and affordability. These case reports describe few of the various soft tissue procedures that were performed with 940 nm Diode laser.

CASE SERIES

Case Report I

A 21 year old male patient reported with the chief complaint of recurrent painful ulcers in the oral cavity. On intraoral examination, small round ulcer with erythematous halo was seen on right retromolar area. Patient gave a history of recurrence of these extremely painful ulcers since 9 months (Figure 1A). The diagnosis of recurrent aphthous ulcer was made on the basis of history and clinical features. After obtaining a written informed consent, the patient was treated

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Figure 1A: Recurrent aphthous ulcer



Figure 1C: After 4 days of treatment

with 940 nm diode laser. The laser was started using fiber optic tip in a defocused mode 5- 8 mm from the lesion and advanced slowly toward the area ending up 2- 3 mm away from the lesion, moving continuously from the periphery of the lesion to the center, “painting” the entire area, and moving away from the lesion if the patient felt warmth. The setting was initially put at 0.6 W at continuous mode for 30- 45 seconds. A refractory period of 15- 20 seconds between laser “passes” was given to allow the tissue to cool down. The area was rubbed with a wet gloved finger to determine if a decrease in pain was felt by the patient. A second (at 0.7 W) and third pass (at 0.8 W) both for 30- 45 seconds with the laser was further applied to decrease the pain of the area on palpation (Figure 1B). Only a single sitting treatment was given. Healing was uneventful and patient experienced spontaneous reduction in pain immediately after treatment. The lesion healed completely within 3- 4 days (Figure 1C).

Case Report 2

50 year old male patient reported with a complaint of painless swelling in the gums in right upper back region since 4-5 years which had gradually increased in size. Extra oral examination revealed diffuse swelling on right side of the cheek region that extended anteriorly from line joining the ala of the nose posteriorly up to tragus of ear. Superiorly it extended 1cm from line joining the outer canthus of eye up to right commissure of lip. The colour of the swelling was same as of surrounding skin. Intra-oral examination revealed a pale pink, solitary pedunculated, well defined dome shaped gingival growth ranging 2 x 2 cms in size in relation to 15, 16 and 17 extending from the distal aspect of 15 to mesial aspect of 17. 15, 16 and 17 were grade I mobile and 16 was almost completely covered by the growth. It had a smooth surface and appeared to arise from the underlying soft tissue. The growth was firm in consistency and non compressible



Figure 1B:Laser application



Figure 2A: Peripheral ossifying fibroma

and non tender in nature. The oral hygiene status of the patient was very poor with no associated habits. Patient was also suffering from chronic periodontitis (Figure 2A). Radiographic picture revealed no significant findings relating to the lesion but there was vertical bone loss in relation to 13, 14, 15 and 16 (Figure 2B).



Figure 2B: Radiographic view

Based on the above clinical findings a differential diagnosis of irritation fibroma, peripheral giant cell granuloma or a peripheral ossifying fibroma was considered. After a routine blood examination, a thorough oral prophylaxis was done. An informed consent was taken from the patient. The excisional biopsy was done using 940 nm diode laser under topical anaesthesia. Laser parameters were 1 W at continuous mode. The procedure was done in contact mode. Surgical assistant grasped the gingival growth with tissue pliers and retracted with minimum tension. The fiberoptic tip was placed at the periphery and gradually moving around the lesion, continuously firing the laser to dissect out the fibroma completely. There was no bleeding and the patient was comfortable. The excised tissue was sent for histopathological examination (Figure 2C). The recovery was uneventful (Figure 2D).



Figure 2C: Excised tissue



Figure 2D: After a week of treatment

Case Report 3

A 35 year-old male patient on oral examination showed erythematous and desquamative areas on right upper buccal gingival mucosa. The lesion was slightly symptomatic and followed the gingival outline without involvement of the gingival margin. There was poor dental plaque control and gingival alterations were not directly associated with dental restorations or any evident systemic disease, drugs, smoking or genetic predisposition. The diagnosis was gingival erosive lichen planus according to both clinical and histopathological patterns (Figure 3A).



Figure 3A: Gingival erosive lichen planus

The site of the lesion was subjected to topical anesthesia. The Diode laser was calibrated and measured to the desired power. The irradiated leisional area was selected by the aid of aiming pilot laser beam then was irradiated by 2 W in continuous mode. The lesion was irradiated until the area changed to white color i.e. photocoagulation was completed. A progressive, regular and successful healing of the treated tissues was observed. Moreover, the pain symptoms subsided remarkably just a few hours after surgical treatment, and remained negative during the first postoperative day. The clinical examination after 1 week of the application showed healing of the treated areas with no local or regional complications. The

lesion had shrunk and the treated areas had no signs of hyperkeratosis (Figure 3B).



Figure 3B: After a week of treatment

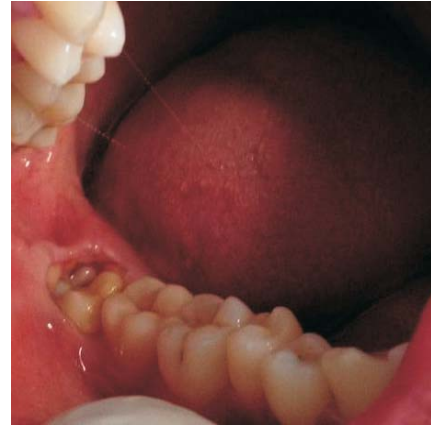


Figure 4B: After treatment

Case Report 4

A 25 years old female reported in the department with a chief complaint of localized pain and swelling in right lower back tooth region since 15 days. On examination at that time her lower right third molar was found to be partially erupted and swelling involving the pericoronal tissues and absence of regional and systemic symptoms (Figure 4A).



Figure 4A: Pericoronitis with respect to 48

Local measures were carried out to decrease the inflammation that is debridement of plaque and food debris, drainage of pus, irrigation with sterile saline and elimination of occlusal trauma. After 2 weeks patient was recalled for the treatment of pericoronitis with diode laser. The inflammation was subsided on the day of treatment. The site was subjected to field block infiltration of local anesthesia. The laser was used with 2W power and in continuous mode in contact with the pericoronal flap. After operculectomy the healing was uneventful (Figure 4B).

Case Report 5

An 18- year old male reported with a chief complaint of black colored gingiva. Since he was very conscious about his esthetic appearance, he wanted to get it corrected. Intraoral examination revealed deeply pigmented gingiva from 7th molar to 7th molar in both maxillary and mandibular arches (Figure 5A). The



Figure 5A: Pigmented gingiva

pigmentation was esthetically displeasing and hence, gingival depigmentation procedure was planned only in maxillary arch, since the mandibular region was not visible during talking and smiling, etc. For maxillary arch use of 940 nm diode laser was planned. Procedure started with the application of topical anesthesia. Laser parameters were 1W at continuous mode. The procedure was done in contact mode. Depigmentation was performed with short light paint brush strokes in a horizontal direction to remove the epithelial lining; neither bleeding nor pain was experienced by the patient during the procedure. Following the procedure, analgesics were administered. Patient was asked to take analgesics if there was pain. Patient was reviewed after one week, when progressive healing of the surgical site was seen. Healing was uneventful.

Gingiva appeared pink and firm with normal appearance (Figure 5B).



Figure 5B: After a week of treatment

DISCUSSION

For many intraoral soft tissue surgical procedures, the laser is a viable alternative to the conventional techniques. When laser cutting is in progress, small blood and lymphatic vessels are sealed due to the generated heat, thereby reducing or eliminating bleeding and edema.¹ Traditional method of oral surgery like using scalpels may produce a lot of bleeding and even after electrosurgery discomfort is there and may require sutures and prolonged healing.⁷ Recurrent aphthous ulcer is one of the most painful oral mucosal inflammatory ulcerative conditions causing pain on eating, swallowing, and speaking. Various treatment modalities are being tried time to time like steroids, mouthwashes, etc., have numerous side effects and late healing period.⁸ On the contrary, diode laser when used in this case not only provided instant pain relief but fast healing. The time required for complete healing of lesions was 3-4 days, which is significantly quicker as compared to the longer healing periods with other methods. Khademi H et al (2009) and Bladowski et al in 2010⁹ also reported similar results.

Using soft tissue lasers is not only beneficial for the patient but offers clinical advantages (especially for soft tissues), including hemostasis (the sealing of local vasculature), the ability to seal nerve endings and lymphatic vessels, reduced bacterial counts, and a minimized need for sutures in most surgical procedures.¹⁰ In above reported case of peripheral ossifying fibroma, patient was satisfied with laser surgery since it was a painless procedure. During and after surgery there was no bleeding. Healing was uneventful.

The laser technique is very easy, fast, and safe. It could be done in outpatient clinic with local anesthesia. This modality satisfied the patients who suffered psychologically from the long treatment by corticosteroids and the fear and suffering from their side effects as in case of gingival erosive lichen planus. Diode laser 940nm provides an alternative technique for treatment of gingival erosive lichen planus with marked clinical improvement as well as high degree of patient acceptance for this new modality of treatment.¹¹ These results are also supported by Maiorana C et al. in 2002.¹² In the case with lichen planus only mild pain was reported by the patient and there was no post operative oedema. Five months after the surgery no reoccurrence was seen.

The soft tissue diode laser demonstrate a high cutting ability with coagulation and thermal necrosis of the surrounding tissues with minimal post operative pain as seen in operculectomy.

Esthetic treatment has become a significant aspect of dentistry. The color of the gingiva plays an important role in overall esthetics, and yet the principles and techniques used to manage gingival melanin pigmentation remain unestablished.¹³ Growing cosmetic demand necessitates removal of gingival pigmentation for esthetic purposes.^{14,15} Treatment of gingival hyperpigmentation using 940nm diode laser radiation was a very effective procedure. The postoperative results in terms of esthetics and patient comfort were impressive.

The soft tissue procedures described in the current article validate the advantages associated with diode laser. The future of diode lasers as soft tissue lasers is promising and can be successfully integrated into the everyday dental practice.

CONCLUSION

Research has proven that the 940 nm is the premier wavelength available in today's dental diode laser systems when considering the versatility of the system. It can be used for a variety of procedures which are routinely carried out in a modern dental practice, including a multitude of soft tissue procedures, such as soft tissue surgery and periodontal therapy.

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