

## CASE REPORT

# The Light Touch—Application of Soft Tissue Diode LASER in Periodontics: A Report of Three Cases

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## ABSTRACT

The word 'LASER' is an acronym for light amplification by stimulated emission of radiation. Different types of lasers used in dentistry are Argon, CO<sub>2</sub>, Nd:YAG (Neodimium:Yttrium-Aluminum-Garnet), Diode and Er:YAG (Erbium: Yttrium-Aluminum-Garnet). Various uses of soft tissue diode lasers in periodontics are depigmentation, soft tissue crown lengthening procedure, soft tissue recontouring, hemostasis, soft tissue ablation, removal of large masses of tissue, bactericidal effects in the pockets, curettage, frenectomy and operculectomy.

The present article reports three cases of the application of soft tissue diode LASER (Fotona XD-2)<sup>®</sup> in Periodontics - one being gingival depigmentation and the other two of maxillary labial frenectomy. The patient of gingival depigmentation showed mild patchy repigmentation after 1 year follow-up whereas the patients of frenectomy had stable frenal attachment 6 months postoperatively.

**Keywords:** Laser, Depigmentation, Frenectomy.

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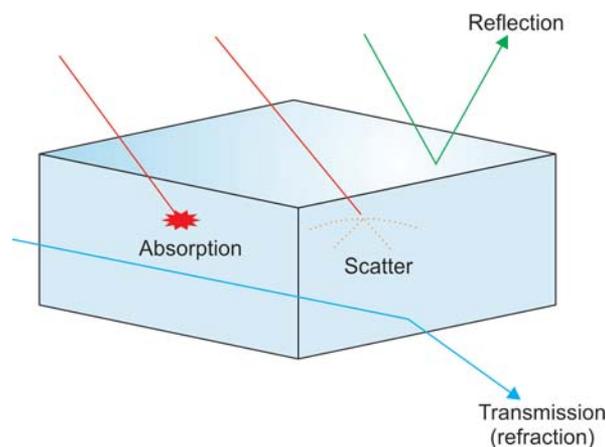
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## INTRODUCTION

LASER is an acronym for light amplification by stimulated emission of radiation, which is based on theories and principles first put forth by Einstein in the early 1900s. The first actual laser system was introduced by Maiman in 1960.<sup>1</sup> Laser light is a man-made single-photon wavelength. The process of lasing occurs when an excited atom is stimulated to emit a photon before it occurs spontaneously; spontaneous emission of light results in unorganized light waves similar to light emitted by a light bulb. Stimulated emission of photons generates a very coherent, collimated, monochromatic ray of light that is found nowhere else in nature.<sup>2</sup> Because laser light is so concentrated and focused, it can have a decided effect on target tissue at a much lower energy level than natural light. The effect of laser light on target tissue is dependent on its wavelength, which is determined by the lasing medium inside the laser device. When laser light comes into contact with the tissue, it can reflect, scatter, be absorbed, or be transmitted to the surrounding tissues.

The breakthrough for lasers in the field of the dentistry came in the mid 1990s, with various laser types, like Nd:YAG, Er,Cr:YSGG, Er:YAG, CO<sub>2</sub>, with corresponding



Possible laser light-tissue interactions<sup>3</sup>

wavelengths of 1,064, 2,780, 2,940, 10,600 nm to address the needs for hard and soft tissue procedures. Soft tissue lasers are characterized by high absorption in chromophores found in the soft tissue, e.g. hemoglobin, resulting in excellent soft tissue incision, ablation and coagulation as well as antimicrobial effectiveness, due to relatively deep, highly localized tissue heating.<sup>3</sup>

Diode lasers are predominantly used for soft tissue procedures, soft tissue surgery, periodontal pocket therapy and peri-implantitis. They can also be used for certain applications involving hard tissue (teeth), i.e. endodontics—root canal disinfection and laser-assisted tooth whitening.<sup>3</sup>

## CASE REPORTS

The three patients who reported to Government Dental College and Hospital, Nagpur were in good health, with no contraindications to periodontal surgery. The surgical procedure was thoroughly explained to them and informed consent was taken. Patients were given oral hygiene instructions and underwent scaling, polishing and routine hematological investigations. Procedures were performed under topical anesthesia. In compliance with the food and drug administration (FDA) rules, the patient and staff used special eye glasses for protection. Caution was taken near-reflective surfaces. In all the cases, (Fotona XD-2)<sup>®</sup> diode laser was used.

### Case 1

A 23-year-old female reported with the complaint of black gums. A diagnosis of gingival melanin hyperpigmentation was made (Fig. 1). Depigmentation procedure was

performed in the anterior region of the maxillary and mandibular arch. Diode laser of wavelength 810 nm and power of 5 W in non-contact mode was used in sweeping motion in the pigmented areas (Fig. 2). Every 5 minutes, the operation area was wiped with sterile gauze soaked in normal saline solution to remove the charred tissue. The



Fig. 1: Preoperative view showing melanin hyperpigmentation



Fig. 2: Diode laser being used



Fig. 3: Immediate postoperative view



Fig. 4: One year postoperative view

depigmentation procedure continued until no pigmentation remained. After wiping the operation field for the last time, there was slight bleeding (Fig. 3). No periodontal dressing was applied nor was any analgesic prescribed. Healing was satisfactory 1 week postoperatively. When the patient returned after 1 year for follow-up, mild patchy pigmentation reappeared (Fig. 4).

### Case 2

A 12-year-old female patient was referred from the Department of Orthodontics with high maxillary labial frenal attachment (class II)<sup>4</sup> which resulted in midline diastema (Fig. 5). Diode laser of wavelength 810 nm and power of 2 W in contact mode was used which consisted of a simple incision which extended from the attached gingiva to the vestibule separating the fibers (Fig. 6). The incision was extended laterally to excise the fibrous tissue on the lateral aspect as well. Since, the laser seals both nerve endings and capillaries, postoperative discomfort and bleeding were almost nonexistent, and the need for postoperative suturing was eliminated (Fig. 7). Neither periodontal dressing was



Fig. 5: Preoperative view showing high maxillary labial frenum attachment

applied nor was analgesic prescribed. After 6 months, the frenal attachment was stable (Fig. 8).



**Fig. 6:** Diode laser being used



**Fig. 7:** Immediate postoperative view



**Fig. 8:** Six months postoperative view

### Case 3

A 15-year-old male patient referred from the department of orthodontics with high maxillary labial frenal attachment (class II)<sup>4</sup> was treated with similar surgical procedure as

described in case 2. No postoperative complication was noted. The frenal attachment was stable 6 months postoperatively.

### DISCUSSION

The breakthrough for dental laser systems came in the mid 1990's. Among the various laser types, diode laser systems have established themselves as compact, competitively priced and versatile additions to the dentist's repertoire, predominantly for performing soft tissue applications. Research has shown that the diode laser wavelength (800-980 nm) is ideally suited for numerous soft tissue procedures due to their high absorption in hemoglobin. This fact gives diode laser the ability to precisely and efficiently cut, coagulate, ablate or vaporize the target tissue. The added advantage of laser performed surgical procedures is the sealing of small blood and lymphatic vessels, resulting in hemostasis, reduced postoperative edema, disinfection of target tissue due to local heating and production of eschar layer and decreased amount of scarring due to decreased postoperative tissue shrinkage.<sup>3</sup> When using a laser, local anesthesia may not be required for pain control and sutures/periodontal packs may also not be required. This is a distinct advantage for all patients, including pediatric patients.<sup>5</sup> Hence, it was readily accepted by our patients as well. The diode laser has obtained FDA safety clearance. It is a solid state semiconductor laser that typically uses combination of gallium, arsenide, aluminum, and indium to change electrical energy into light energy. It can be delivered through a flexible quartz fiber optic handpiece. It is used in a contact mode for soft tissue removal and during procedures like depigmentation. The power output for dental use is generally around 2 to 10 W and can be either pulsed or continuous mode.<sup>6</sup>

Brown or dark pigmentation and discoloration of gingival tissue can be caused by a variety of local and systemic factors.<sup>7</sup> Systemic conditions, such as endocrine disturbance, Albright's syndrome, malignant melanoma, antimalarial therapy, Peutz-Jeghers syndrome, trauma, hemochromatosis, chronic pulmonary disease, and racial pigmentation are known causes of oral melanin pigmentation.<sup>8</sup> Clinical melanin pigmentation of the gingiva does not present a medical problem, however, complaints of 'black gums' may cause esthetic problems and embarrassment, particularly, if the pigmentations are visible during speech and smiling.<sup>9</sup> The patient treated in present case was systemically healthy and hence, racial pigmentation could be the only probable cause of melanin hyperpigmentation.

Melanin is produced by specialized pigment cells in gingiva called melanocytes. They are located in the basal

layer of epithelium and epidermis. Hence, it is necessary to remove a part of the epidermis. The wound healing takes place by proliferation of cells present along the periphery of the wound. These cells migrate and help in re-epithelialization of the wound.<sup>10</sup> Oral repigmentation refers to clinical reappearance of melanin pigment after a period of clinical depigmentation of the oral mucosa.<sup>11</sup> In this case, the pigmentation started to reappear after 3 months and during the 6 months follow-up period, the patchy pigmentation started to appear. The patchy pigmentation could be a result of the ongoing process of repigmentation. Similarly, Kon et al. study was consistent with our findings; who demonstrated that permanent results cannot be offered when gingival depigmentation procedures are performed for cosmetic reasons.<sup>12</sup>

Frenectomy involves apical repositioning of the frenum with denudation of alveolar bone, destruction of the transseptal fibers, and gingivoplasty or recontouring of the labial or palatal gingival papilla in cases of excessive tissue accumulation.<sup>13</sup> In the present case reports, we used (Fotona XD-2)<sup>®</sup> diode laser to treat class II frenal attachments and obtained satisfactory results postoperatively.

Soft-tissue procedures can be performed using lasers, electrosurgery units and scalpels. Scalpel technique has good tactile sensation, readily available and inexpensive but control and visibility can be awkward depending on the clinical site and amount of bleeding. In addition, local (and topical) anesthesia, sutures or a periodontal pack are required. Postoperative pain and inflammation is reported to be less using a laser, as compared to using a scalpel.<sup>5</sup>

Comparing electrosurgery units and a laser, in electrosurgery units, the cutting is done using the sides as well as the tip of the electrode, depending on the access and site, thus, inadvertently damage to adjacent tissues may occur.<sup>5</sup>

When scalpels, electrosurgery units and diode lasers are compared, soft-tissue procedures can be achieved in less time with lower patient discomfort with laser. Also, when diode laser is compared with other soft tissue lasers, precise tissue removal without impacting neighboring tissues can be achieved at low power levels of diode laser.<sup>5</sup>

The main limitation of diode laser is its lack of ability to perform hard tissue procedures (e.g. cavity preparation, bone cutting).<sup>3</sup> In case of lasers, it is important to wear protective glasses when laser units are in use to safeguard the eye health of the patient and operatory staff. Failure to do so has been reported to be one of the most common factors in injuries associated with laser use.<sup>5</sup>

## CONCLUSION

The advent of new diode laser technology provides periodontists with an instrument that allows minimally invasive, more comfortable treatment to the patients when compared with traditional techniques. The relative lack of pain, ease of use and site specificity of the diode laser makes it an ideal addition to the periodontists armamentarium. Applications are being developed for a broader range of wavelengths that will offer useful, predictable and comfortable therapy for managing the periodontal patient.

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