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Research Article

LASERS: STEPPING INTO CONTEMPORARY PERIODONTICS

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ABSTRACT
With advances in dentistry over the years, lasers have been talked about a lot. The use of lasers in periodontics is a little more complicated because of the presence of dental hard and soft tissue. However, the availability of a number of laser systems ranging from erbium hard tissue lasers to diode, CO_2, Nd:YAG soft tissue lasers have managed to find their place not only in periodontal practice but also in restorative, esthetic and surgical treatments. The use of lasers in periondontal procedures has long been discussed and scrutinized and this article presents a few case reports of periodontal procedures done using a diode laser.

Keywords: *Diode Laser, Gingivectomy, Vestibuloplasty, Frenotomy, Depigmentation*

INTRODUCTION
"LASER- Light Amplification by Stimulated Emission of Radiation". A laser is a powerful beam of light that can produce intense heat when focused at a close range. Lasers have been classified traditionally based on the active medium e.g., gas, liquid, solid state, or semiconductor diode. Whereas, clinically lasers can be classified into two types: soft and hard lasers. The soft tissue lasers available are carbon dioxide lasers, Nd: YAG lasers, argon lasers, Er: YAG lasers, Er, Cr: YSGG lasers and diode lasers. The first laser diode was demonstrated by Robert N. Hall in 1962 (Shcherbakov, 2007). The diode laser basically does not interact with dental hard tissues; this makes it an excellent soft tissue surgical laser, indicated for cutting and coagulating gingiva and oral mucosa, and for soft tissue curettage or sulcular debridement (Mani, 2009). Tissues can interact 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 (Mani, 2009). 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. Tissue penetration of a diode laser is less while the rate of heat generation is higher than that of the Nd: YAG laser. Since, the diode laser causes minimal damage to the periosteum and bone under the gingiva being treated as well as exhibits the unique property of being able to remove a thin layer of epithelium cleanly (Prabhuji *et al.*, 2011), it can be used for a variety of soft tissue procedures without impacting the neighboring tissues. Diode lasers can be used for a multitude of dental procedures which are predominantly soft tissue procedures and include soft tissue surgery, periodontal pocket therapy, peri-implantitis, but can also be used for certain applications involving hard tissue (teeth), i.e. endodontics - root canal disinfection and laser-assisted tooth whitening. The advantages of diode lasers over the other lasers are the smaller size of the units as well as the lower financial costs (Prabhuji *et al.*, 2011). Regarding advantages of lasers over surgical procedures these include- dry and bloodless surgery, instant sterilization of the surgical site, reduced bacteremia, reduced mechanical trauma, minimal postoperative swelling and scarring and minimal postoperative pain.
The case reports described below show a few of the various soft tissue procedures that were performed with Picassa® 810 nm Diode laser.

CASES
Case 1(Frenotomy)
A 32 year old male patient reported to the Department of Periodontics, Ahmedabad Dental College & Hospital, Ahmedabad, with the chief complaint of receded gums in the lower front tooth region (Figure

1). The patient reported no significant medical history. Presence of a high mandibular frenal attachment was identified as the cause of recession in the lower anterior**.** Therefore the patient had to be treated and a frenectomy procedure with diode laser to excise the aberrant frenum was planned. The problem was explained to the patient and a written consent was signed. The frenum was excised with a diode laser in a continuous mode at a setting of 2.5 watt. The procedure was completed within 10 minutes and caused no discomfort to the patient. The surgical field was clear and dry without bleeding and caused no pain to the patient. No local anaesthesia or suturing was required for the patient. The postoperative area was left to heal by secondary intention. Healing was uneventful and no scarring was seen at 2 weeks.

Case 2 (Depigmentation)

A 28 year old male patient reported to the Department of Periodontics, Ahmedabad Dental College & Hospital, Ahmedabad with a chief complaint of unaesthetic brownish color of gums. On intra oral examination score-4 gingival pigmentation (Dummett-Gupta Oral Pigmentation Index scoring criteria given by Dummett C.O. in 1964) of the maxillary and mandibular gingiva was observed (Figure 2). The patient was provided with various gingival depigmentation treatment options including conventional scalpel blade, electrocautery and laser. The patient gave consent in written for laser depigmentation. Diode laser in a pulsed mode at 2.5 watt was used to treat maxillary gingival hyperpigmentation and 2 weeks later mandibular gingival hyperpigmentation. There was no bleeding, discomfort and the patient was fully satisfied with the results. Even after 1 years of follow-up there were no signs of repigmentation.

Case 3 (Gingevectomy)

A 19 year old female patient reported to the Department of Periodontics, Ahmedabad Dental College & Hospital, Ahmedabad with a chief complaint of gum enlargement in the upper front region (Figure 3). The patient was undergoing orthodontic treatment since 6 months. The patient reported no medical history and was not under any medication. On intra oral examination gingival enlargement covering half of the crown of the mandibular anterior teeth was observed. Oral prophylaxis was performed, but the enlargement failed to resolve. Therefore a gingivectomy with laser was planned. An informed consent in written was taken from the patient. Diode laser in a pulsed mode at 2.5 watt was used. The surgical field was with minimal bleeding. Minimal local anesthesia was injected, and the patient complained of no discomfort or postoperative pain. Healing was uneventful and the gingival contour and size achieved was remarkable.

Case 4 (Vestibuloplasty)

An 18 year old male patient was referred from Department of Orthodontics with a shallow vestibule in the lower front region. Neither did the patient have any past medical history nor was he under any medication and therefore a vestibuloplasty was planned (Figure 4). Diode laser in a pulsed mode at 2.5 watt was used and the treatment was completed successfully with minimal local anesthesia and no post operative pain or swelling.

DISCUSSION

For many intraoral soft tissue surgical procedures, the laser is a viable alternative to the conventional techniques. The commercially available dental instruments have emission wavelengths ranging from 488 nm to 10,600 nm and are all non-ionizing radiation. Different wavelengths have different absorption coefficients based on the varied composition of human tissue. Laser light can have four different interactions with target tissue hyperthermia (37-50°C), coagulation (60-70°C), welding (70-80°C), vaporization (100-150°C), and carbonization (>200°C) (Coluzzi, 2004).

Lasers allow the clinician to reduce pathogens in the surgical field and achieve good hemostasis with the reduced to no need for sutures. The purported advantages of lasers versus conventional surgery include increased coagulation that yields a dry surgical field and better visualization (Romanos *et al.,* 1999).

Diode is a solid active medium laser manufactured from semiconductor crystals using some combination of aluminium or indium gallium and arsenic. Diode lasers (810-980 nm range) emit laser light in the near infra-red spectrum of the electromagnetic radiation which are highly absorbed in hemoglobin and other

pigments. Diode lasers have been proven to be successful for soft tissue procedures. Therefore, diode laser surgery can be performed safely in close proximity to dental hard tissue.

All these above mentioned advantages were evidently experienced in the above cases. During procedure there was no bleeding encountered and postoperatively no pain or swelling or any other signs of infection was noticed. Any other alternative procedures would have to have been accompanied by administration of antibiotics and analgesics to minimize postoperative infection and pain.

Figure 1: Case 1 Frenotomy: A. Pre-operative; B. Intra-operative; C. 2 weeks follow up

Figure 2: Case 2 Depigmentation: A. Pre-operative; B. Intra-operative; C. 2 weeks follow up

In the gingival enlargement case reported above, as the patient was wearing fixed orthodontic braces and wires, electrocautery was avoided and surgery with scalpel would have been cumbersome. The soft tissue procedures described in the current article validate the advantages associated with diode laser. The risk of using lasers is minimal but has to be considered. Protective goggles must be used for the patient and the clinician. The laser plume that is the resulting smoke of laser surgery contains toxic substances like formaldehyde, hydrogen cyanide hydrocarbons that can be minimized by use of high volume laser smoke evacuation that filters smoke particles or by keeping the suction wand within 4 cm of the surgical site to

remove as much of plume possible is recommended (American National Standard for Safe Use of Lasers, ANSI Z136. 1-2000). The future of diode lasers as soft tissue lasers is promising and can be successfully integrated into the everyday dental practice.

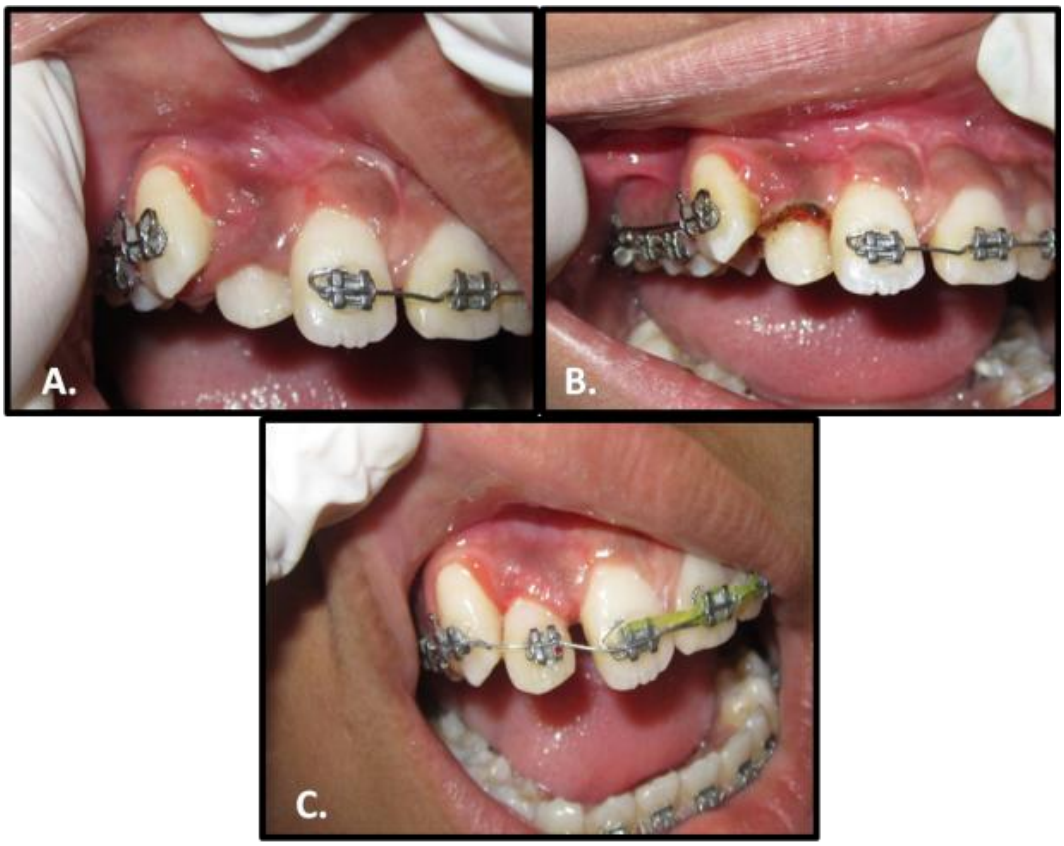

Figure 3: Case 3 Gingivectomy: A. Pre-operative; B. Intra-operative; C. 1 month follow up

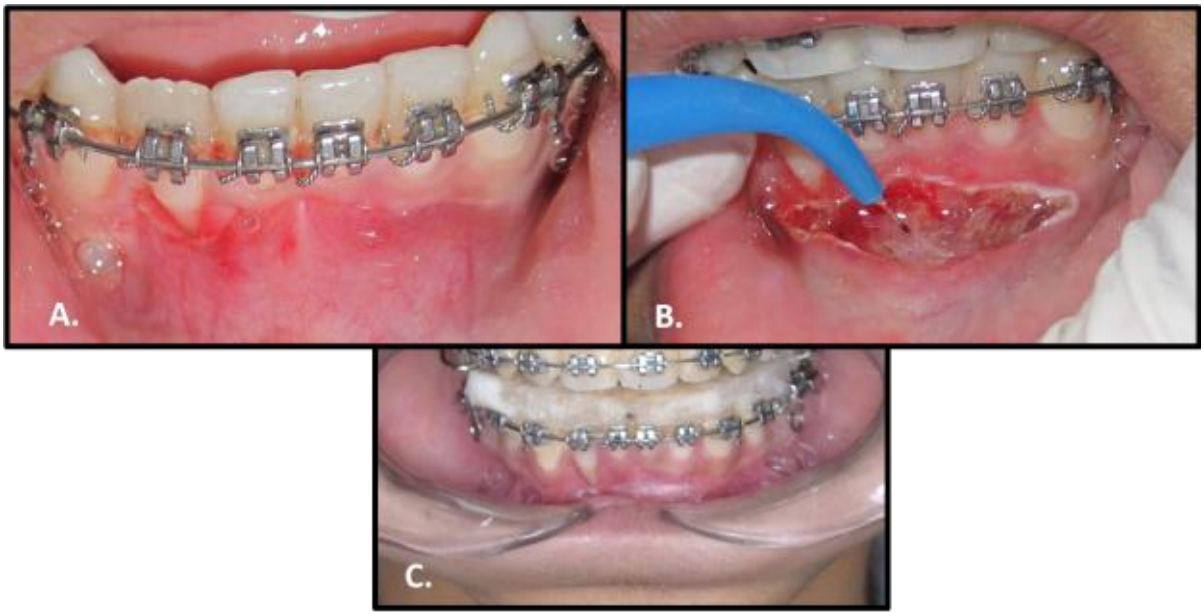

Figure 4: A. Pre-operative; B. Intra-operative; C. 4 months Post-operative

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