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Using of Diode Laser (940 nm) in Orofacial Region

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ABSTRACT

Many specialties in medicine and surgery are interested in the progress of the biomedical applications of the laser. Lasers are now becoming the treatment of choice by both clinicians and patients, and in some cases, the standard of care. The aim of this clinical study was to apply and assess the usefulness of diode laser 980nm in orofacial region. This clinical study was carried out at our private clinic using diode laser (940nm) in many orofacial clinical applications. A total of 35 patients including 20 (≈57%) male and 10 (≈42%) female with age range from (3 to 58) years old. Overall satisfaction was observed in all clinical applications and proved to be of beneficial effect for daily practice and considered practical, effective, easy to used, offers a safe, acceptable, and impressive alternative for conventional surgical techniques. Diode laser (940 nm) can be used in oral and facial soft tissue surgery because of easy application, better coagulation, no need for suturing, less swelling and pain, as well as for its capability for treatment of physiologic gingival pigmentation.

Key words: Laser surgery, laser application, epic, diode laser, orofacial.

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INTRODUCTION

Laser is a monochromatic, collimated, coherent, and intense beam of light produced by stimulated emission of radiation of a light source. Lasers are classified according to different factors among which is the classification based on laser active medium such as gas, liquid, solid and semi-conductor, which identifies and distinguishes the type of emitted laser beam 1. From the first trials by Maiman (1960), a plenty of investigations was conducted in by clinicians in field of maxillofacial region [1, 2]. Laser systems and their application in dentistry especially oral surgery are rapidly improving today. The specific advantages of lasers are incision of tissues, coagulation during operation and postoperative benefits. Semiconductor diode lasers are portable compact surgical units with efficient and reliable benefits [3].

Lasers have been flicked an integrative role in practicing of maxillofacial surgery much more than other specialty in dentistry in turn become a standard tool for care providing in orofacial region offering advantages of precision, hemostasis, less edema, elimination of bacteremia, minimum postoperative pain, improved infection control, excellent scope visibility, avoidance of tissue shrinkage & mechanical tissue trauma, reduced scarring, less instrument & tools at operation site and tumor seeding prevention [2, 4] .

Laser is an effective and appraised device in all branches of dentistry including periodontics, endodontics, pedodontics, prosthetics, cosmetic

dentistry, oral implant, conservative dentistry, oral pathology, oral surgery and maxillofacial surgery. Diode lasers are emitting light in spectrum of visible red region to near infrared region and they are quite differ from other kinds of lasers in both pumping mechanism and operating performance. Hence; have advantages of simplicity, efficiency, compactness, need a scanty of auxiliary equipment and thus can be linked readily to optical fibers [5, 6]. The aim of current clinical trial is to use and evaluate Epic X 940nm diode laser in orofacial region.

MATERIAL AND METHODS

This clinical trial was conducted our private clinic using BIOLASE epic X 940nm in many orofacial clinical applications. 35 patients; about 10 (≈42%) female & 20 (≈57%) male and the age was range from (3 to 58) years old. The questionnaire sheet & written instructions were discussed and construed to both patients (and / or parent); informed consent was also signed. Patients were clinically evaluated and prepared for surgical procedures. Demographic information regarding patient's age, sex, occupation, clinical presentation, dental & medical history and address were obtained & recorded and viral screen (HBsAg, HCV, HIV) was requested.

The surgical procedures were carried out under topical anesthesia (Xylocaine Spray 10%, AstraZeneca AB, Sweden) and in certain few cases (Lignospan special 2% lidocaine injection, Septodent-France) was used. At end of surgery, verbal instructions were given that including; parrying citrus, spicy, hot and vigorous foods for a few days as well as following instructions of soft diet & meticulous oral hygiene practice. Oral analgesics were prescribed on need during the postoperative period. All patients were followed up at 3 days, 1 wk, 2 wk, 3wk and 4 wk after surgery to evaluate and reveal opinion about bleeding, edema, pain, functions and total satisfaction (Fig 1- 7).

RESULTS

The results of this study were shown in table 1; Facial Nevus was treated in 2(5.78%), Melanin depigmentation in 2(5.7%), Gingivalfibromatosis in 5(14%), Fibroma in 4(11.5%), Tongue tie in 5(14.3%), Lower lip Fibroliboma 1(2.9%), Implant insertion & Exposure in 6(17.1%), Gingivectomy in 2(5.7%), Teeth whitening in 2(5.7%) , and Teeth trooghing in 6(17.1%). Treatement mode was varied from CP0 to CP2 with pulse duration from 10 microsecond to 1 millisecond and average power range from 0.9 W to 2.5 W and 7.0 W (for teeth whitening).

All patients were undergone laser surgery under topical anesthesia spray and local anasethesia solution injection was used if needed; hence; no pain was experienced throughout the surgical operation with only 2(5.7%) patients revealed mild pain throughout the first three postoperative days. Because there is no bleeding at the intraoperative field; so there is no need for using sutures that provide a clear surgical field. The wound was left open (to be healed by second intention) covered with the coagulative layer that formed on the surface irradiated tissue will effectively eliminate soreness & bleeding after the laser operation and healed the wound by secondary intention without secondary infection or complications. A mild edema (I/O and /or E/O) was observed during first three postoperative days after surgery that gradually subsided without any limitation in functional abilities throughout the next weeks postoperatively. All patients were convenient with no pain (intra-operatively or post-operatively)and functional complications and revealed marked excellent total satisfaction during one week, two weeks and four weeks postoperatively.

Table 1: Clinical presentation

No.	Lesion or condition	N (%)	Power	Mode(CP = Comfort Pulse)	Pulse duration
1	Facial Nevus	2(5.7%)	0.9 W	CP1	100 milliseconds
2	Melanin depigmentation	2(5.7%)	0.9 W	CP2	1 millisecond
3	Gingivalfibromatosis	5(14.3%)	1.7 W	CP0	10 microsecond
4	Fibroma	4(11.5%)	1.7 W	CP2	1 millisecond
5	Tongue tie	5(14.3%)	2.5 W	CP1	100 milliseconds
6	Fibroliopma of lower lip	1(2.9%)	0.9 W	CP1	100 milliseconds
7	Implant Insertion & Exposure	6(17.1%)	0.9 W	CP2	1 millisecond
8	Gingivectomy	2(5.7%)	1.7 W	CP0	10 microsecond
9	Teeth whitening	2(5.7%)	7.0 W	-----	30 seconds
10	Teeth trooghing	6(17.1%)	1.0 W	CP2	1 millisecond
	Total			35(100%)	

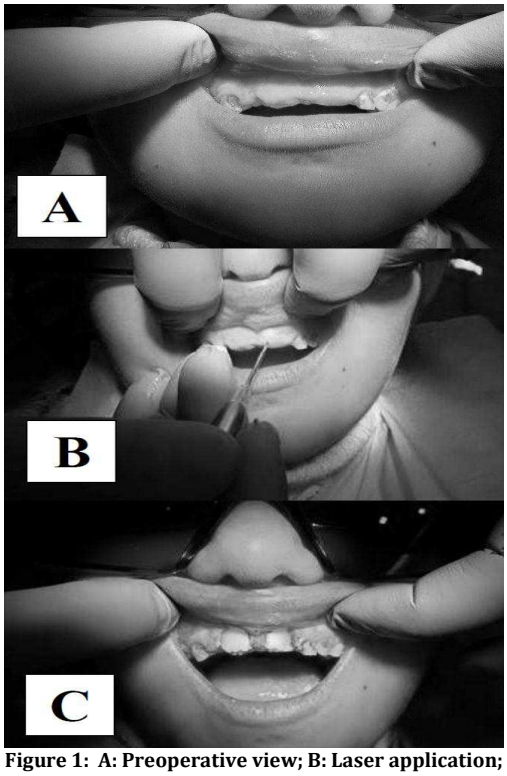

Figure 1: A: Preoperative view; B: Laser application; C: Tooth eruption

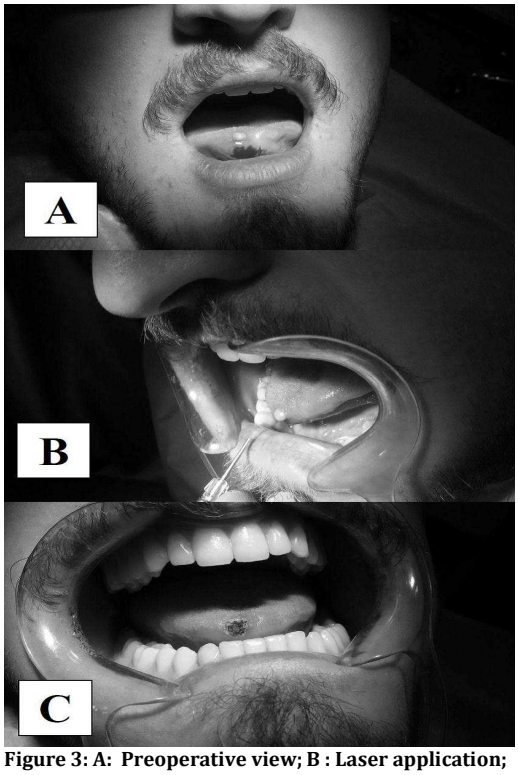

Figure 3: A: Preoperative view; B : Laser application; C: Excision of fibroma of tongue

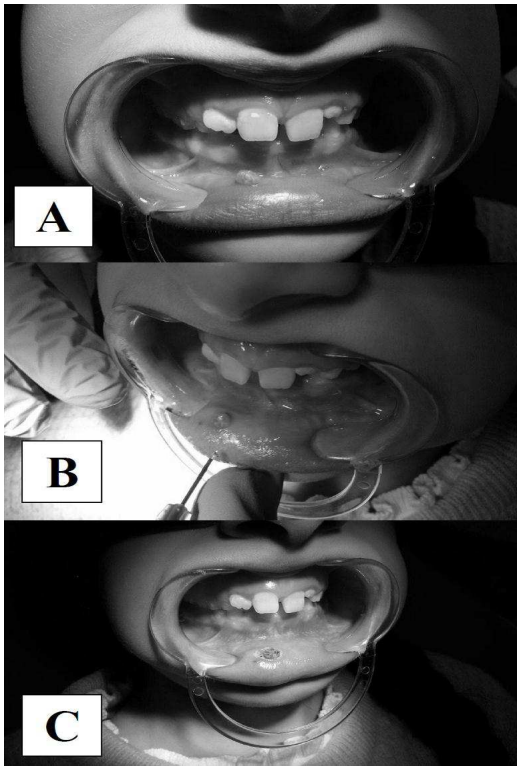

Figure 2: A : Preoperative view; B : Laser application; C: Excision of fibroma of lip

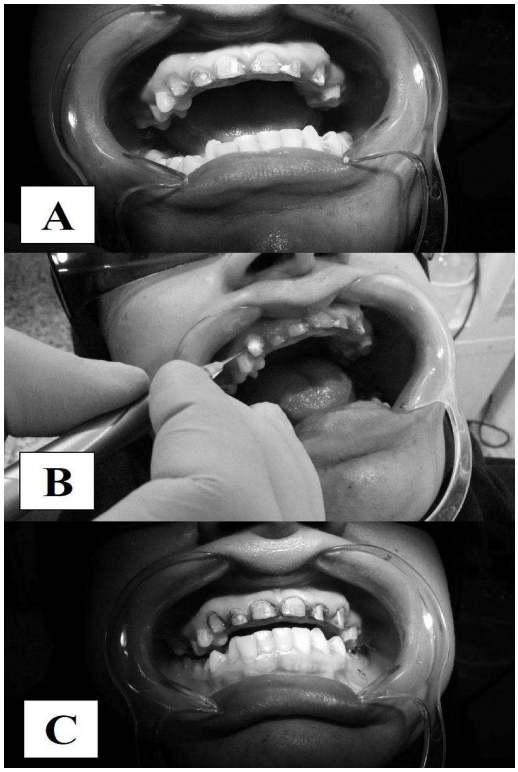

Figure 4: A : Preoperative view ;B: Laser application; C: Trooghing completed

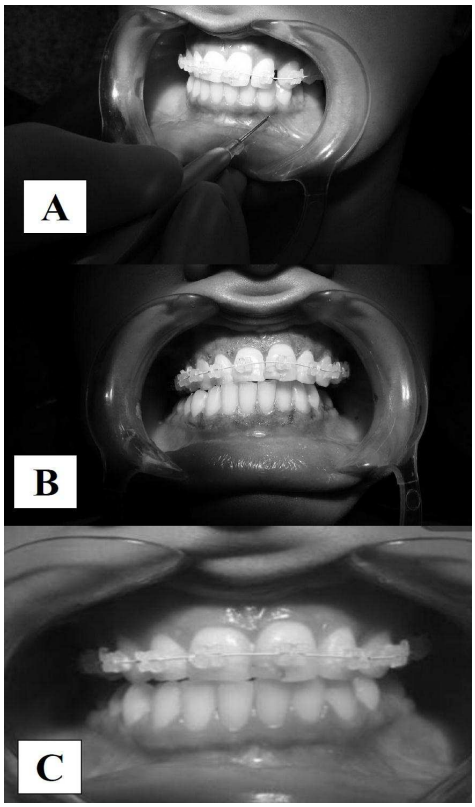

Figure 5: A : Preoperative view; B : End of laser surgery; C: Complete melanin depigmentation

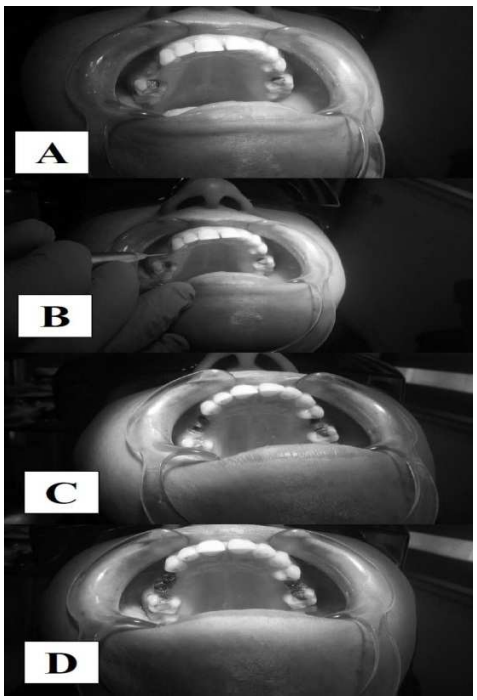

Figure 6: a : Preoperative view; B : Laser application; C: Implant recovery; D: Insertion of gingival former

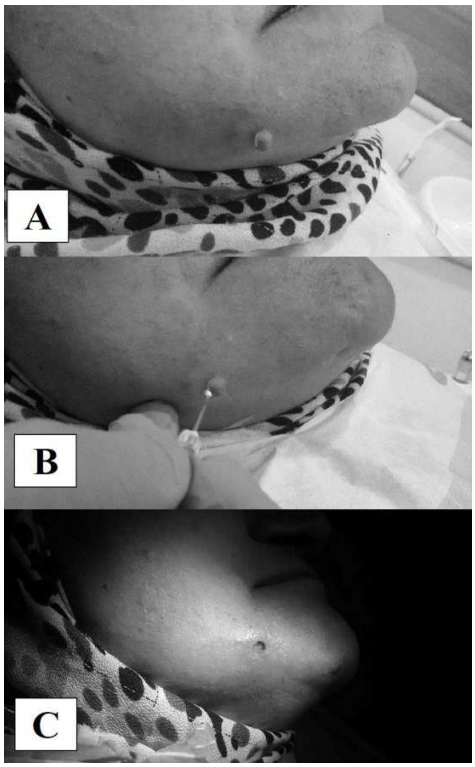

Figure 7: A : Preoperative view; B : Laser application; C: Complete ablation of facial nevus

DISCUSSION

This 940nm wavelength has affinity and attraction toward melanin and is markedly absorbed by the hemoglobin that contributed to their laser effect. Therefore, this laser works more efficiently when the energy applied in the presence of pigments. This was the reason that homeostasis occurs with this wavelength. Through the heating of elements, and by direct sealing of small blood vessels, by desiccation and contraction of the vessel wall [2, 3, 7].

For therapeutic purposes, the laser-tissue interaction mechanisms are mainly determined by two parameters, namely the laser exposure time on the tissue and the effective power density taking into account the tissue-specific absorption. It can be concluded that with proper selection of the wavelength, exposure time and intensity of the laser, the biologic effect on the target tissue can be optimized and undesirable collateral effects on adjacent tissues can be minimized. By selecting the appropriate wavelength and pulse width, and properly delivering the applied energy, one can achieve a selective effect on the target tissue [3].

The basic concept & apprehensible effect of diode laser with tissue was photothermal interaction. In this process, laser light was absorbed by the target tissue converted & transformed to heat energy changing the structure of tissue. Laser able to perform haemostatic surgery by sealing blood vessels result in a clean, dry, and sealed wound. Laser also able to decrease the rate of infection following surgery, in addition laser seal the lymphatic vessels at the time of surgery which decrease the swelling and edema [5, 6]. Another advantage at using laser is the possibility of cauterizing and sealing neural path ways which reduces postoperative discomfort such as pain sensation.

Laser-tissue interaction was patent when laser light appropriately applied; it was transformed to thermal energy which producing reactions ranged from incision, coagulation to vaporization. In current clinical study, the conducted surgical procedure was good endured & tolerated by patients and they were very cooperative during laser treatment. The hemostasis was achieved by effect of coagulation on small vessels and sealed the endings of sensory nerve that provide a good anesthesia which was consequential for control of pain for patient dental physical and well-being, as well as for the effectiveness of laser therapy [8, 9] .

The use of laser offer accuracy and surgical precision thus decreases collateral tissue damages without bleeding by sealing lymphatic and blood vessels resulting in better surgical field visualization, needless for postoperative sutures and in turn reducing operation time [4, 7, 10, 11]. In respect to patient perceptions; all patients revealed total satisfaction & well acceptance with laser surgical procedures as minimally invasive surgery. Indeed; all patients return to practice their usual daily activities.

The tissue injury is minimized leading to less or no post-surgical edema as a result of laser-induced hemostasis & mild induced inflammation that was attributed by a precised laser surgical procedures without any damages on surrounding normal tissue as well as laser capability for sealing the lymphatic, blood vessels and nerve endings reducing inflammatory response and leading to fibrin clot formation over the surgical wound for protection from external flustering & irritation. Consequently; causing less pain experience, minimum prescription of analgesic drugs with no wound contraction and mucosal scarring postoperatively [12-14].

In almost all clinical researches and trials; the scientists declared the unique specialties of lasers and particularly diode lasers such as; sharp and definite cutting edge, hemostasis and coagulation after surgery in addition to small size and better maneuver during application, which makes this laser very effective and a useful alternative device in soft tissue surgery in the oral and maxillofacial field.

BIOLASE epic X diode laser (940 nm) can be used in oral and facial soft tissue surgery because of easy application, better coagulation, no need for suturing, less swelling and pain, as well as for its capability for treatment of physiologic gingival pigmentation from an esthetic point of view and in turn it can be considered as a first choice despite periodontal surgery due to; faster action, better de-epithelialization, no bleeding and better repair.

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