Case Report

Use of DENLASE Diode Laser (980 nm/7 W) in Labial Frenectomy for a child of 11 years old

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ABSTRACT

Labial frenum is the fold of mucosa that attaches specific area of inner surface of upper lip to the specific area of alveolar mucosa. The adverse effects of a low-attaching frenum are: midline diastema, poor aesthetics and gingival recession. It can be treated either by conventional surgery (by scalpel, scissors and other surgical instruments) or, recently, by use of laser technology.

11 years old Egyptian child complained of a midline diastema due to low attachment of upper labial frenum. Diode laser (980 nm) was used for frenectomy, pain during and postoperatively, bleeding and swelling were assessed. The actual procedure takes 4-6 minutes, no pain during and after operation, also no bleeding. The child felt soreness at the operation site for 3 days and uneventful healing with new tissues is evident within 12 days.

Key words: Labial frenum, laser frenectomy, diode lasers.

Frenum or frenulum in the oral cavity is mucosal fold in the labial buccal and lingual surfaces of alveolar mucosa. The frenum which attaching the tongue to the base of the mouth is the lingual frenum while the labial frenum is the tight mucosal fold that attaches the upper lip to the gums. The **labial frenum** should be attached at least 4 mm above the gum crest of the front teeth and should not limit the lip movements. The general consequences of a low-attaching frenum, especially in children are: midline diastema (spacing between two central incisors with orthodontic and aesthetic problem), periodontal inflammation and consequently gingival recession and the tight folds limits lip's function and prevents it from adapting with the lower lip, or forming lip seal, leads to open mouth.

In such a case surgery for its removal is indicated. The conventional way is the use of scalpel with different surgical techniques while the new technology is laser[2].

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The role of laser surgery in the oral cavity is well established. The benefits of laser are relatively bloodless field, reduction of post-operative pain and minimal swelling and scarring[1].

Lasers emit a precise beam of concentrated light energy. This light is unique in that it is composed of a single wavelength. The wavelength generated is based on the active medium present in the laser device and can be a solid like (diode) or gas like CO_2 and Argon. The diode laser is considered a solid, with a semiconductor chip embedded with crystals, making the device smaller and lighter. The active medium determines the wavelength, varying by the makeup of the crystals. The wavelengths divided into visible and invisible wavelengths from 532 nm in visible area to 1550 nm, the laser used in this case of wavelength near infrared spectrum, typically 980 nm. The wavelength determines the absorption characteristic in biologic tissues.

Absorption of laser light by biologic tissue determines efficiency of surgical removal. The various components of the biologic tissue determine whether laser light will be absorbed. Diode lasers are well-absorbed by hemoglobin and pigmented tissue. Different wavelengths are absorbed by soft tissue at varying rates, depending on the type of soft

tissue. Keratinized tissues, containing less blood, require the use of lasers with higher wavelengths or the use of more power in general.

Interaction of this laser with tissue is a photo-thermal, in which laser light is transformed into heat. When the laser beam penetrates tissue and is absorbed, a designated amount of energy is removed per unit of time, with a resultant temperature rise. Coagulation begins at over 50°C, with protein denaturation at 60°C. At temperatures 100°C, vaporization of water occurs. At 150 C carbonization of tissue and 300 C melting of tissues occur. Laser surgery is achieved by the process of ablation, removing this tissue by converting it to a gaseous state or plume. The plume is considered to be a biohazard and should be removed with high-volume evacuation[3].

The power output utilized by the soft-tissue diode laser is typically between 1 and 10 watts or joules per second, in a continuous output or a pulsed power. Diode lasers use optical fibers to deliver the laser beam. A pencil-size hand-piece glides over the fiber and locks into place. Most treatment uses direct contact with the tissue and allows the operator to experience tactile feedback similar to a scalpel or mechanical instrument. Several researchers refer to the clinical uses for lasers with the aim of bringing the laser to the dental practitioner to improve dental care. Currently, soft tissue applications have constituted the primary area for the clinical use of lasers in dentistry. The aim of this case treatment was to verify the reliability and efficacy of one of these compact portable diode instruments, emitting a maximum power density of 7W/cm^2 not requiring pre-warming or controlling, and delivering a wavelength of 980 nm[4].

CASE PRESENTATION:

The 11 years old Egyptian male child with low labial frenum attachment complained of midline diastema with speech interference especially in words contain “S “letter.

Neither the extra-oral examination nor the intraoral one shows any abnormalities, except for the low attachment of upper labial fremum with spacing between two upper central incisors as shown in figure 1.

Figure 1: the low attach of labial frenum.

Laser device used, diode laser 980 nm - 7 W(DENLASE-980/7)as shown in figure 2, with delivery hand piece through fiber glass of 0.8 mm.

Figure 2: diode laser 980 nm - 7 W(Model:DENLASE-980/7) with delivery hand piece.

Safety measures were taken by wearing protective goggles and specific operative field precaution were taken, like gauze sponges used for charred tissues debridement saturated with water, not alcohol to prevent any risk of fire.

Figure3: immediately post-operative bloodless field.

The actual procedure takes 4-6 minutes, no bleeding during the operation and

postoperatively as shown in figure 3. Four days later fibrin tissues formation was seen as sign of healing as shown in figure 4 and full healing with new tissues is evident within 12 days.

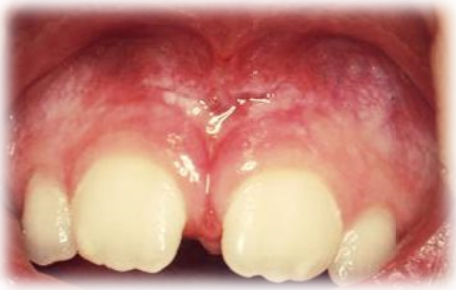

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Figure 4: four days after Laser Frenectomy with fibrin tissues formation

At the 4-week follow-up the case had completely healed without scarring as shown in figure 5. The patient was satisfied with the treatment and the results obtained.

Figure 5: the attachment of labial frenum after 12 days.

DISCUSSION:

Laser technology is developing very quickly. It is an instrument that achieves maximum oral health in a minimally invasive fashion. New Lasers with a wide range of characteristics are available today and are being used in the various fields of medicine and dentistry. The search for new devices and technologies for dental procedures was always challenging and in the last two decades much experience and knowledge has been gained. Applications now are being developed for a broader range of wavelengths that will offer useful, predictable, and comfortable therapy for management of dental patients. Particularly, the use of a diode laser seems to be promising, in patients, who need to be treated with a technique where the operative and post-operative blood loss and post-operative discomfort are reduced.

Diode lasers contribute significantly to the field of oral surgery providing an invaluable resource for clinicians who perform treatment of soft tissue issues. Diode laser provides benefit to dental patients and professionals and also is very useful in surgical dental procedures because operative and post-operative blood loss and discomfort are reduced. . Also pain perception is an important issue in creating guidelines for surgical procedures[5].

If a clinician decides to use a laser for a dental procedure, so needs to fully understand the character of the wavelength being used, and the thermal implications and limitations of the optical energy.

In the case described above, the use of diode laser was preferred. Diode laser used,980 nm/7 W for labial frenectomy. As it is known laser transmits energy to the cells causing warming, welding, coagulation, protein denaturation, drying, vaporization and carbonization.

The new frenum attachment should be at least 5-6 mm higher up to gum crest level to take into account that relapse occurrence will be within 1-2 mm.

The use of diode laser was preferred in order to avoid any painful needle injection even if the clinician needs more time to complete the surgery procedure. The whole procedure was performed without pain.

However, homeostasis was optimum immediately after the removal of the frenal attachment. Also no sutures are required and the risk of a post-operative infection is limited[6].

For 3 days, the child felt soreness at the operation site. The eating function after that returns normal.

In general, the advantages of lasers include a relatively bloodless field with minimally swelling and scarring. Coagulation and cutting is minimal or no need for suturing. Reduction in surgical time occurred when infiltrated anesthesia was used. No pain during and after surgery.

DENLASE diode lasers have several advantages when compared to monopolar electrosurgery units for frenectomies. The benefits of a laser frenectomy using DENLASE 7W as compared to techniques by AMD Picasso1.4 W, Er:YAG lasers, Ora-laser Jet-20 and CO_2 lasers have been studied[7].The diodes cause less lateral thermal damage, which may result in faster healing with less postoperative pain[8].

Comparing my frenectomy case by other surgeon cases which were performed also in children revealed the followings:

The frenectomy which was performed by AMD Picasso laser with1.4 W, the result was similar but the healing period will be more than 14 days with more time operation than DENLASE[10].

The frenectomy which was performed by Er:YAG lasers may ablate frenums faster, and can be used in non-contact mode, but the drawback compared to diode lasers is an increased risk of bleeding[7].

The laser device used in the next compared study to perform frenectomy was the Ora-laser Jet-20. It is (Ga AI As) diode laser emitting 810nm with Maximum out-put power was 20 watt.

This laser machine with 20 watt and 10.000 Hz pulsation gives different energy values, like 6.6 Joules/sec. has the best cutting momentum, and 3.3 Joule/sec and 2.5 Joule/sec were similar but 1.8 Joule/sec showed slight slower speed but high output at fiber tip which helps cutting efficiency.

For the treated case the surgeon used energy of 1.83J/second that gave best dry field (no bleeding) with good cutting efficiency and decreased post-operative complications. Patient reported of no or minimal postoperative pain or discomfort, one experienced pain after the first day and pain and swelling. After three days wounds had fibrin layers. Case showed redness in the periphery of the wound. At one week follow up they found good wound healing with faster epithelisation rate. After four weeks the excision sight could not be distinguished. Scaring was not visible[11].

The laser device used in the next study was the CO_2, although CO_2 laser has been performed for frenectomy in previous clinical studies, limited reports exist in the literature comparing to the use of different lasers in this respect. In one comparative study, CO_2 laser showed better intra-operative bleeding control and shorter surgical time (9 minutes) but longer healing time (15-20 days) than diode laser performed by DENLASE diode laser. In addition to that, cautions should be taken during the use of CO_2 laser because it may damage unprotected enamel surface and even cause pulpal injury as little as 0.5 W for 2 seconds, so a tinfoil protective shield has been suggested to cover the tooth surface to prevent it from injury[9, 12].

CONCLUSION:

As a result of my study, I recommend using of diode laser of 980 nm/ 7 W to treat the low attachment of frenum. This minimally invasive laser-assisted frenectomy was accomplished with minimal anesthesia, minimal discomfort, no sutures, no antibiotics, and great patient satisfaction with short healing time comparing to another types of lasers.

Consent: Written informed consent was obtained from the patient's parents for publication of this case report, and any accompanying images.

ACKNOWLEDGEMENT:

The author thanked the reviewer Dr. Elhadi Mohiedin Awooda for his great efforts and comments to improve the quality of this manuscript.

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