**Frenectomy review: review of conventional techniques with diode laser**

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**Introduction**

The word frenum is derived from the Latin word “frænum”. Frenum is a trigone-shaped folds found in the maxillary and mandibular alveolar mucosa, and acts as the barrier between the central incisors and canine premolar area. Frenum may be classified depending upon its morphology as: Long and thin, Short and broad. Depending upon the attachment level, frenum has been classified as: (Plass et al. 1974)

**Mucosal**

- Gingival
- Papillary
- Papillary penetrating.

When the insertion point of the frenum is at the gingival margin it may pose a problem (Corn 1961). This kind of abnormal insertion of the frenum may cause marginal recession of the gingival. Abnormal frenum insertion can distend and retract the marginal gingiva or pull away from the tooth when the lip is stretched. A frenum that extends on the margins of the gingiva may interfere with plaque removal, and tension on this frenum may tend to open the sulcus. This condition may be more conducive to plaque accumulation and the development of poor oral hygiene. Alloreactant frenum can be treated by frenectomy or frenotomy procedure. The term frenectomy and frenotomy signify operations that differ in degree of surgical approach. Frenectomy is a complete removal of the frenum, including its attachment to the underlying bone, and may be required for correction of abnormally diastema between maxillary central incisors (Fridman 1987). Frenotomy is the incision and relocation of the frenum attachment.

**Indications**

- The indications for frenectomy procedure include:
  - Tension on the gingival margin (frenal-pull) concomitant with or following gingival recession
  - Facilitate orthodontic treatment
  - Facilitate home care. Techniques for frenectomy
  - Conventional technique
  - Using soft tissue lasers.

**Conventional technique**

Conventional technique utilise traditional instruments like the scalps and periodontal knives. Different procedures have been mentioned under the conventional frenectomy technique. These include Dieffenbach, Schuchardt, and Mathus. The most common being Dieffenbach V-plasty & Schuchardt Z-plasty.

**Armamentarium**

Bard-Parker handles, No. 15 blade, mosquito haemostat, su- ture material.

**Procedure**

Dieffenbach V-plasty

Surgical steps: The area is anesthetized by giving local anes-
thetic injection (2 % lignocaine with 1,200,000 adrenaline). After anaesthesia is achieved, the frenum is held with mononapsa haemostat to its full depth. With the No. 15 blade mounted on a Bard-Parker handle, an incision is made along the upper surface of the haemostat till the entire depth of the frenum extended to its full width. A similar incision is repeated on the under-surface of the haemostat so that the haemostat is detached along with the frenum tissue within its breaks. Once this is achieved, a rhomboid area exposing the deeper connective tissue fibers becomes visible. With the help of fine scissors, the deeper fibers are detached from the underlying peristomeum. Periodontal scoring is done with the help of surgical blade so as to prevent the reattachment of fibers. The labial mucosa is undermined so as to permit the approximation of the edges. The bleeding is controlled by applying pressure packs.

Suturing: The diamond-shaped wound is sutured using either a 4-0 or 5-0 silk sutures in simple interrupted fashion. Proper approximation of the margins is ensured. A periodontal dressing is placed to cover the surgical area.

**Carbon dioxide laser**

The carbon dioxide lasers have a wavelength of 10,600 nm. The beam of this laser falls in the infrared range and is thus invisible. This made the use of CO2 lasers awkward. Thus later on a quartz fiber incorporating a 650 nm coaxial He-N2 laser was used as an aiming beam in the handpiece. The CO2 laser received safety clearance from FDA in 1976 for use in soft tissue surgery. With the CO2 laser there is rapid intracellular rise of temperature and pressure leading to cellular rupture and re-lease of “laser plume” (vapour and cellular debris).

The CO2 laser is readily ab-
sorbed by water. Soft tissue con-
sists of 75 % to 90 % water; 98 % of the incident energy is converted into heat and absorbed at the tissue surface with very little scatter or penetration. Thus moist surface is essential for maximal effect. With CO2 laser no contact is made with the tissue, and no tactile feedback occurs.

**Erbium:YAG laser**

The Nd:YAG laser has a wave-
length of 1,064 nm and lies in the infrared zone like the CO2 laser. The Nd:YAG laser penetrates wa-
ter up to 60 mm which after it is at-
tenuated 10 % of its original strength. This makes it suitable in soft tissue rather than being ab-
sorbed onto the surface. The wavelength of Nd:YAG laser is at-
tracted to colours and as a result its scattering in heavily pigmented soft tissues like skin is almost dou-
bled its absorption.

This heating effect of the Nd:YAG laser is ideal for the abla-
tion of papillae, haemorrhagic abnormal tissue and for haemostasis of small capillaries and veins. In 1990, the FDA ap-

**Diode laser applied.**

The Er:YAG laser was intro-
duced in 1974 by Zhitkov et al. as a solid-state laser that generates a light with a wavelength of 2,940 nm. Of all lasers emitting in the near- and mid-infrared spectral range, the absorption of the Er:YAG laser in water is the great-
est because its 2,940 nm wave-
length coincides with the large ab-
sorption band for water.

The absorption coefficient of water of the Er:YAG laser is theo-
retically 10,000 and 15,000–20,000 times higher than that of the CO2 and the Nd:YAG lasers, respec-
tively. Since the Er:YAG laser is well absorbed by all biological tis-
sues that contain water molecules, this laser is indicated not only for the treatment of soft tissues but also for ablation of hard tissues. The FDA approved the pulsed Er:YAG laser for hard tissue treat-
ment such as caries removal and cavity preparation in 1997, un-
changed for soft tissue surgery and sulcular debondment in 1999 and for osseous surgery in 2004.

**Carbon dioxide laser**

CO2 laser is ideal for the abla-
tion of soft tissue like skin as well as soft tissue in general, en-
abling a non-contact mode of application. The Nd:YAG laser is ideal for soft tissue and prevents burning.

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Diode lasers

The diode laser is a solid-state semiconductor laser that typically uses a combination of Gallium (Ga), Arsenide (As), and other elements such as Aluminum (Al) and Indium (In) to change electrical energy into light energy. The wavelength range is about 800–980 nm. The laser emits in continuouswave and gated-pulse modes, and is usually operated in a contact method using a flexible fiber optic delivery system. Laser light at 800–890 nm is poorly absorbed in water, but highly absorbed in hemoglobin and other pigments (ALLD 2000). Since the diode basically does not interact with dental hard tissues, the laser is an excellent soft tissue surgical laser (Romanos G, 1999), indicated for cutting and coagulating gingiva and oral mucosa, and for soft tissue curettage or subulcual debridement.

The FDA approved oral soft tissue surgery in 1995 and subulcual debridement in 1998 by means of a diode laser (GaAs 810 nm). 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 (ALLD 2000). The usage is quite similar to electrocauterization. Tissue penetration of a diode laser is less than that of the Nd:YAG laser, while the rate of heat generation is higher (Rastegar S 1992), resulting in deeper coagulation and more charring on the surface compared to the Nd:YAG laser. The width of the coagulation layer was reported to be in excess of 1.0 mm in an in-vitro (White JM 2002). The advantages of diode lasers are the smaller size of the units as well as the lower financial costs.

Argon laser

The argon laser uses argon ion gas as an active medium and is fiber optically delivered in continuous wave and gated pulsed modes. This laser has two wavelengths, 488 nm (blue) and 514 nm (blue-green), in the spectrum of visible light. The argon laser is poorly absorbed in water and therefore does not interact with dental hard tissues. However, it is well absorbed in pigmented tissues, including hemoglobin and melanin, and in pigmented bacteria.

The argon laser was approved by the FDA for oral soft tissue surgery and curing of composite materials in 1991 and for tooth whitening in 1995. Considering the advantages of eradication of pigmented bacteria, this laser may be useful for the treatment of periodontal pockets.

Alexandrite laser

The Alexandrite laser is a solid-state laser employing a gemstone called Alexandrite, which is chromium-doped: Beryllium-Aluminum-Oxide (chrysoberyl Cr:5; ReAl2O4) and is one of the few trichrome minerals. Reichmann & Henning first reported that the frequency-doubled Alexandrite laser (wavelength 532 nm, pulse duration 100 ns, double spikes, q-switched) could remove dental calculus in a completely selective mode without ablating the underlying enamel or cementum. The development of this laser for clinical use is widely expected due to its excellent ability for selective calculus removal from the tooth or root surface without ablating the tooth structure.

Recenly, Frentzen et al. demonstrated that the ArF excimer laser, wavelength 193 nm, could effectively remove dental calculus without causing any damage to the underlying surface. The cementum surface was clean, and only a slight roughness could be observed after irradiation, supporting the use of excimer lasers for laser scaling. Fielitz et al. have reported that the 308 nm wavelength XeCl3 excimer laser could effectively ablate dental calculus without thermal damages or smear layer production.

Excimer laser

Excimer lasers are lasers that use a noble-gas halide, which is unstable, to generate radiation, usually in the ultraviolet region of the spectrum. Excimer lasers were first reported by Henning in 1985. The argon fluoride (ArF) laser was approved by the FDA for oral soft tissue surgery in 1995 and sulcular debridement. The FDA approved oral subgulval prophylaxis unit (ALD 2000). The use of excimer lasers in periodontal pocket therapy has been considered feasible due to their high absorption in hemoglobin and other pigments (ALLD 2000).

The use of excimer lasers for laser debridement in 1998 by means of a diode laser (A.R.C. Fox 1998) with wave length of 308 nm was selected for the procedure. No local anaesthesia was given to the patient. The frenum was stretched to visualize its extent. The diode laser was applied in a contact mode with focused beam for excision of the tissue. The ablated tissue was continuously mopped using wet gauze piece. This takes care of the charred tissue and prevents excessive thermal damage to underlying soft tissue. The tissue was lasered until all the underlying muscle fibers were dissected. No sutures were placed at the end of this procedure. Patients were asked to take analgesics only if needed. Advantages of Laser over Conventional technique:

- No need of local anaesthesia.
- Hence it’s a painless procedure.
- As a result there is less patient apprehension.
- Bloodless operative field, thus better visibility.
- No need of periodontal dressing, therefore no patient discomfort.