Frenectomy review: review of conventional techniques with diode laser

**Introduction**

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

- Micosal
- Gingival
- Papillary

Frenectomy is done for clinical and美观 considerations, for functional reasons, and for orthodontic purposes.

**Frenectomy review:**

- **Abnormal frenal attachment:**
  - Immediate Post-operative view.
  - Horizontal incision made.
  - Diode laser applied.
  - Haemostat in place & wound packed.
  - Sutures done with help of surgical scissors.
  - All the deeper connective tissue fibers become visible.
  - With the help of fine surgical scissors, the deeper fibers are detached from the underlying periondontium.
  - With the help of surgical blade so as to prevent the reattachment of fibers.
  - Moist surface is converted to dry surface.
  - A periodontal dressing is placed to cover the surgical area.
  - Incision is repeated on the upper surface of the hemostat blade mounted on a Bard-Parker handle no. 3, No. 15 blade with the help of mosquito hemostat.
  - The tissue is undermined so as to permit the release of 'laser plume' (vapour and cellular debris).
  - The CO2 laser is readily absorbed by water. Soft tissue consists 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.

**Neodymium:YAG laser**

The Nd:YAG laser has a wavelength of 1,064 nm and is used in the infralimb zone as the Nd laser. The Nd:YAG laser penetrates water up to 60 mm after which it is attenuated 10% of its original strength. Therefore, the Nd:YAG laser is effective in soft tissue rather than being absorbed onto the surface. The wavelength of Nd:YAG laser is not trajected to colours and as a result its scattering in heavily pigmented soft tissues like skin is almost double its absorption.

This heating effect of the Nd:YAG laser is ideal for the ablation of papillary, hamorrhagic abnormal tissue and for haemostasis of small capillaries and veins. In 1999, the FDA approved soft tissue removal by means of a pulsed Nd:YAG laser. In 1997, the FDA approved sucular derbidity by means of a pulsed Nd:YAG laser.

**Erbium:YAG laser**

The Er:YAG laser was introduced in 1974 by Zakhartov 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 greatest because its 2,940nm wavelength coincides with the large absorption band for water.

The absorption coefficient of water of the Er:YAG laser is theoretically 10,000 and 15,000–20,000 times higher than that of the CO2 and the Nd:YAG lasers, respectively. Since the Er:YAG laser is well absorbed by all biological tissues 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 treatment such as caries removal and cavity preparation in 1997, unchanged for soft tissue surgery and suicidal derbidity in 1999 and for osseous surgery in 2004.

**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:Ne laser was used as a 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 release of ‘laser plume’ (vapour and cellular debris).

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**Indications**

- The indications for frenectomy procedure include:
  - Tension on the gingival margin (frenum-pull consonant with or without gingival recession)
  - Facilitate orthodontic treatment
  - Facilitate home care. Techniques for frenectomy
  - Conventional technique
  - Using soft tissue lasers.

**Conventional technique**

- Conventional technique utilizes traditional instruments like scalpels and periodontal knives. Different procedures have been mentioned under the conventional frenectomy technique. These include Dieffenbach, Schurhardt, and Mathis. The most common being Dieffenbach V-plasty & Schurhardt Z-plasty.

**Armamentarium**

- Bard-Parker handles no. 3, No. 15 blade, mosquito haemostat, suturing material.

- Procedure

**Dieffenbach V-plasty**

Surgical steps: The area is anesthetized by giving local anes-
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 operates in continuouswave and gated-pulse modes, and it is usually optically delivered in a contact method using a flexible fiber optic delivery system. Laser light at 800–980 nm is poorly absorbed in water, but highly absorbed in hemoglobin and other pigments (ALD 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 subcular debridement.

The FDA approved oral soft tissue surgery in 1995 and subcutaneous debridement in 1998 by means of a diode laser (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 (ALD 2000). The usage is quite similar to electrosurgery. 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 study (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 (BeAl2O4) and is one of the few trichromic minerals. Rechmann & 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 clinically 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.

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. 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. Faiyaz Yaz et al. have reported that the 308 nm wavelength XeCl excimer laser could effectively ablate dental calculus without thermal damages or smear layer production.

Frenectomy procedure using diode lasers Diode laser (A.R.C. Fox®) with wavelength of 810 nm was selected for the procedure. No local anesthesia 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 anesthesia.
- 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.

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