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Soft tissue diode laser in orthodontics

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Abstract
An increased focus on personal aesthetics in orthodontics has taken hold. Laser technology has risen to forefront of adjunct care. Laser technology has created the opportunity for the most aesthetic result possible in conjunction with orthodontic treatment. Several soft tissue laser procedures along with their indications and methods will be addressed in this review article.

Keywords: operculum; frenectomy; diode laser

Introduction
In recent years, use of laser technology in many aspects of general dentistry has become popular. The need of the day has given rise to greater access to laser education. The number of orthodontists has increased who use laser technology to facilitate treatment outcomes. Unaesthetic gingival margins along with gingival hyperplasia can now be managed in coordination with incisal recontouring to produce most aesthetic treatment outcome.

Soft tissue procedures and orthodontist can consider using a laser
Orthodontists want the best aesthetic treatment results for their patients. They are constantly striving to find methods to reduce treatment time. Clinical instances where the use of soft tissue laser would benefit the patient include gingival recontouring, removal of hypertrophic tissue, apthous ulcer management, facilitation of tooth eruption, operculum removal and frenectomies [1-4].

Gingival recontouring
Gingival reshaping can improve a gummy smile. It can greatly enhance the aesthetic treatment outcome. The removal of excess gingival tissue by laser can permit the orthodontist to bond the bracket to the tooth in the desired appropriate position in a timely manner [3]. (Fig 1, 2).

Fig 1: Excessive gingival tissue inhibiting proper bracket placement.

Fig 2: Delayed passive eruption

Management of aphthous ulcer

Aphthous ulcers are often painful for the patient. Laser is used to lace the aphthous ulcer. The laser wound that replaces the aphthous ulcer allows the patient to have a faster and more comfortable recovery [3].

Tooth exposure

Soft tissues sometimes impede the eruption of the tooth into the arch. Laser can be used to remove the overlying tissue. Unerupted teeth should be visualized and located by radiographic images to determine if laser uncovering is warranted. (Fig 3, 4)

Fig 3: Archwire traction placed on delayed cuspids.

Fig 4: Cuspid seating into occlusion

Removal of operculum

Sometimes bonding of second molar becomes difficult if operculum is present. The diode laser can remove the operculum allowing immediate bonding on the desired tooth to keep teeth on track for timely eruption [4].

Frenectomies

Low frenum often contributes to excessive spacing. Such patients with a low frenum have a large central diastema. The soft tissue laser makes frenectomy procedures easier to manage than a traditional scalpel approach. Laser procedure is more homeostatic.

Types of lasers used in orthodontics

Four main types of lasers are used in dentistry:

1. CO_2 laser
2. Nd: YAG laser
3. Erbium laser
4. Diode laser

CO_2 laser is difficult to use due to technique sensitivity. The tip does not directly contact the surgical site. Its tip is used at a slight distance. A delay is present from the time the incision is made to when the incision can be seen [2]. Diode laser is ideal for use in orthodontics. Its advantages include:

- Its manageable size for portability.
- Its specificity to cut only soft tissues.
- It is relatively low cost.
- Procedures typically require only a topical anaesthetic for pain management [2].

Mechanism of action of a diode laser:

Laser is made up of 3 main components:

1. An energy source
2. An active medium
3. A resonator

The composition of active medium determines the wavelength of the laser. In diode laser, active medium makes use of aluminium, gallium, arsenide, or indium. It has a wavelength of roughly 810 nm to 980 nm. This range of wavelength is readily absorbed by haemoglobin and poorly absorbed by metal. This makes diode lasers ideal for soft tissue surgeries.

The energy supply to a diode laser works by an electrical current. The current is supplied to laser system and moved through active medium contained in an optical resonator. The resonator amplifies the photons. The photons are delivered to target tissue by way of fibre optic cable. The cable has a protective outer coating. The outer coating must be removed prior to the use of laser for tissue ablation. The tissue is cut through ablation. The energy absorbed in the target cells is immediately subjected to heating, welding, coagulation, protein denaturation, drying vaporization and carbonization [2]. Pulsed mode laser delivery allows intermittent cooling, less tissue damage and less discomfort [2].

Maximum procedures can be performed at a setting of 1 to 1.2 watts. Power settings can be increased to 2 watts in areas of dense tissue. It is recommended to use lowest power setting that can effectively remove the tissue. This prevents collateral thermal damage of adjacent tissue.

Technique for soft tissue laser surgery for gingival recontouring

The principles of cosmetic dentistry must be incorporated into orthodontic treatment. This optimizes the aesthetic results. The smile arc, and tooth and gingival proportions are routinely evaluated by the orthodontists. Understanding of the aesthetic concepts of the tooth contacts, embrasures and gingival characteristics before using laser surgery for gingival removal is imperative for the orthodontist. The maxillary central incisor should be approximately 60% to 80% wide compared with its height [1]. The gingival shape of the maxillary canines is elliptical with a gingival zenith that is

distal to the longitudinal axis.

Gingival recontouring can be used on numerous occasions to improve treatment results. When initially evaluating a patient for orthodontic care, it is important for the orthodontist to carefully evaluate the patient to determine ideal bracket placement. Most commonly used reference for the bracket placement height is the use of incisal edge of the teeth. Sometimes it is impossible to place a bracket in an ideal location because of delayed passive eruption. Especially in such instances it is very helpful for the orthodontist to be able to remove any excess gingival tissue in order to place the brackets in an ideal position rather than referring the patient to the periodontist to have the teeth uncovered [3, 4].

Another indication of gingival recontouring is in patients with poor oral hygiene. Such patients with poor oral hygiene have inflammation that causes pseudo pocket formation of their gingiva. These pseudo pockets exacerbate inflammatory process by impeding patient's ability to thoroughly floss around gums [3, 4]. Gingival recontouring can allow the patient to access more areas to keep the gingivitis under control. Closure of large extraction spaces can cause redundant tissue to appear in conjunction with poor oral hygiene [3]. Removal of this tissue allows more effective space closure.

For finishing a case to a best aesthetic outcome, gingival recontouring plays an active role. Patients may have gingival inflammation or poor crown height-to-width ratios that result in less than optimal treatment results. The soft tissue laser allows orthodontists to improve gingival shape and contour in accordance to smile line of the individual patint [1, 2, 4].

During the procedure of gingivectomy, apply topical anaesthetic and use a probe to mark height guides. Make sure to leave 1 mm of sulcus when finished to preserve the biologic width. Laser points can be used to mark the new gingival contour. Set the laser power at 1.2 watts. Hold the laser perpendicular to the tissue at the gingival margin. In a smooth, continuous fashion clearly remove excess gum tissue. Clean the area with a microbrush or cotton roll with 3% hydrogen peroxide after the ideal contours are achieved [5]. (Fig 5, 6, 7)

Fig 5: Uneven gingival architecture detracts from finished orthodontic case. Diode laser used to sculpt proper architecture. Enhanced aesthetic result after diode laser recontouring and healing.

Fig 6: a) Low, rolled gingival tissue in anterior. b-d) Immediately post tissue removal with diode laser. e) Aesthetic crown-to-height ratio after healing.

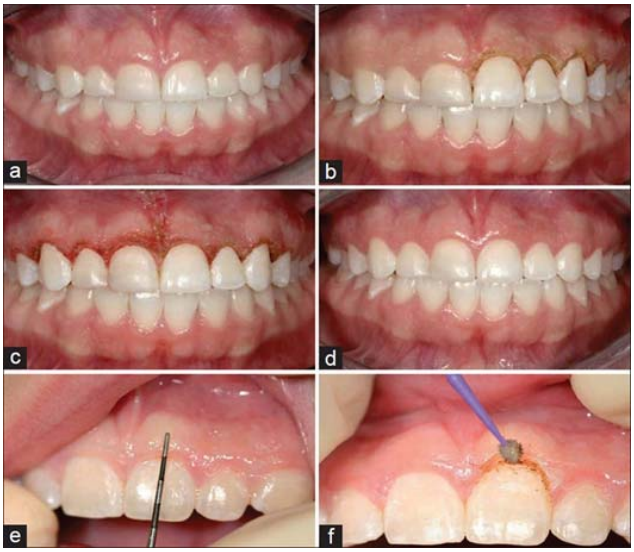

Fig 7: a) Uneven gingival architecture. b, c) Immediately after diode laser therapy. d, f) Enhanced symmetry after healing.

Technique for soft tissue laser surgery for a frenectomy:

Patients with large diastema often have a low frenum attachment. It contributes to excessive spacing. Orthodontic treatment protocol for diastema includes closing the space and then stabilizing it with removable retention in addition to a frenectomy. Performing the frenectomy becomes more comfortable for the patient when done by the soft tissue laser. No sutures or dressing is needed and bleeding is highly controlled.

Frenectomy technique includes first placing topical anaesthetic at the surgical site. Lightly pull the upper lip forward until frenum is taut. Set the laser at 1.0 watts. Lase the frenum horizontally approximately 3mm away from the frenum base. Use light, continuous strokes until lip is released from tension. In the end a V-shaped wound is left which is approximately 1cm wide. It is better to continue to lase any deeper fibrous attachments to prevent reattachment. Then smooth the remaining tissue at the base of the frenum. Clean

the surgical site with 3% hydrogen peroxide on a cotton tipped applicator [5]. Another technique is called the diamond release frenectomy. It involves pulling the upper lip taut, lasing the site of V-shaped frenum and then lasing the base of the frenum. It creates a diamond shaped surgical site, hence the name. (Fig 8)

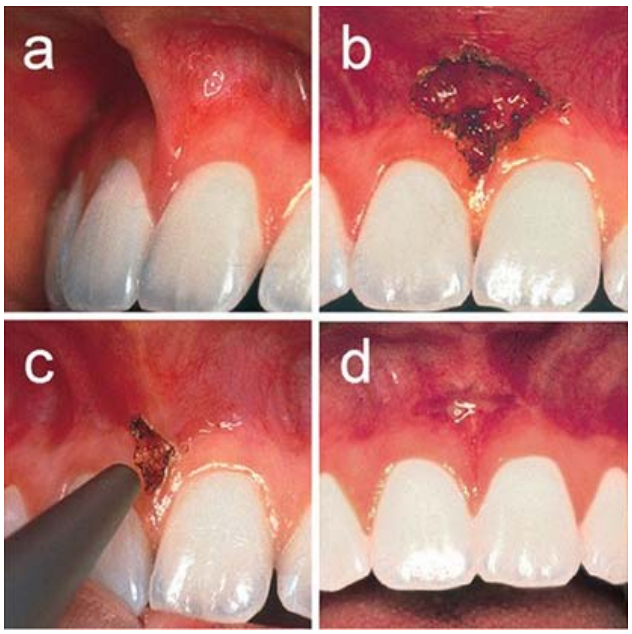

Fig 8: a) Strong frenum full and gingival hyperplasia. b,c) Immediately after excess tissue removal and release of frenal tension. d) Gingival tissues healed and no excessive pull from frenum.

Procedure used with a soft tissue laser to uncover impacted teeth

Waiting on a soft tissue impacted tooth to erupt dramatically increases the duration of orthodontic treatment. Traditionally, patients would be referred to a periodontist for the tooth to be exposed and a bond and chain could be placed for orthodontic traction, however thick tissue covering the tooth can still impede the tooth from finally erupting into the arch. This is especially common in the palatal tissue. The soft tissue laser can be used to remove the thick tissue so that the tooth can continue to be moved into the arch without hindrance. Sometimes the impacted is nearly erupted in the mouth with just a thin layer of tissue still covering its surface [3]. In these cases the laser can be used to remove the overlying tissue so that the orthodontist can bond an attachment to the tooth and begin moving it into the arch immediately [3].

Conclusion

The use of soft tissue lasers offers many advantages such as improved oral hygiene, practice efficiencies, and aesthetic finishing. When lasing tissue overlying a tooth, the operator must adjust the power as needed according to their tissue thickness. A bond can be placed immediately after tissue removal. Clinicians interested in incorporating soft tissue lasers into their practice should obtain proficiency certification, attend continuing education courses, and recognize the inherent risks associated with laser surgery. As an orthodontist committed to providing the best possible service, adjunctive procedures such as soft tissue surgery can dramatically enhance the overall treatment experience in your office.

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