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Abstract

Contemporary orthodontics continues to merge with modern-day technology and the growing focus on dental esthetics in todayâ€™s culture. Laser technology got in these years a more and more important role in modern dentistry and, recently, also in orthodontics the utilization of laser devices was proposed. In the last two decades, there was an explosion of research studies in laser application. All diode wavelengths are absorbed primarily by tissue pigment (melanin) and hemoglobin. Conversely, they are poorly absorbed by the hydroxyapatite and water present in the enamel. Specific procedures include aesthetic gingival re-contouring, soft tissue crown lengthening, exposure of soft tissue impacted teeth, removal of inflamed and hypertrophic tissue, frenectomies, and apthous ulcers.

Introduction

In previous years, orthodontists have been limited in what they could do to improve treatment outcomes by the lack of technology and knowledge.

In recent years, the advent of the soft-tissue diode laser had made several soft-tissue procedures easily accessible and doable for orthodontists.

Laser is an acronym for â€˜light amplification by stimulated emission of radiationâ€™. Fundamentally, a laser beam is a focused source of electromagnetic radiation, or light energy.

Three main types of lasers are used in dentistry: the CO_2, erbium, and diode laser. Diode lasers are almost exclusively used for soft tissue surgery[1].

Diode lasers convert electrical energy into light energy. Diode lasers are known as semiconductors, as they use a media of gallium and arsenide, and occasionally indium and aluminum, whose ability to conduct electricity is between that of conductors and insulators. By doping the laser medium with impurities (dopants), stimulated emission occurs. The wavelengths produced by diode lasers range between 810nm and 980nm. Light energy at these wavelengths is easily absorbed by melanin (soft tissue pigmentation) and hemoglobin, and poorly absorbed by enamel. Therefore, diode lasers are highly effective in soft tissue ablation, hemostasis, and sealing lymphatics, with low risk of damaging teeth and bone, making them ideal for soft tissue laser surgery[2]. Compared with other laser types, diode lasers are compact, reliable, and have a long operatory lifetime, and are packaged in portable units typically weighing less than 4.5 kg. Connecting to the main unit is a thin, pencil-sized hand-piece containing a 200â€“400Âµm fiberoptic tip. Newer models have handpieces that receive single-use, twist-on laser fiberoptic tips, providing a higher potential standard of cleanliness and eliminating time-consuming stripping and cleaving of the fiberoptic tip.

The energy absorbed in the target cells is immediately subjected to heating, welding, coagulation, protein denaturation, drying vaporization and carbonization [3]. Pulsed mode laser delivery allows intermittent cooling, less tissue damage and less discomfort [3]. 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[4].

Therefore, the diode laser controls bleeding exceptionally at the surgical site. The laser tip gently contacts the surgical site, allowing the operator to have tactile feedback. [3]

Other advantages of the diode include low costs and the fact that these procedures typically require only a topical anesthetic. The laser cauterizes the surgical site, while cutting so that a periodontal dressing is not necessary for healing.

Instead, the CO_2 laser can be difficult to use because the tip does not directly contact the surgical site; instead, it must be used at a slight distance and a delay is present from when the incision is made to when it can be seen[3,5,6].

The erbium laser has a very high wavelenght and is effective in soft tissue removal; however, it does not control bleeding well [3,5,7].

Advantages of the diode laser are useful for orthodontists to enhance treatment results for example in cases of slowly erupting teeth and gingival

overgrowth, unaesthetic gingival contours and margins, aphtosus ulcer management, frenectomy and removal of operculae.[8]

Methods

Â One of the main treatment goals of orthodontics has been the ability to produce an esthetic smile in a timely manner. The Diode laser allows to finish cases much more efficiently and to a higher esthetic standard. Several soft-tissue procedures along with their indications and methods will be addressed in this systematic review. We have used PubMed and Scopus. 37 articles were analyzed. Keywords are: esthetic orthodontics, diode laser, gingival recontouring, aphthous ulcer manager, frenectomy, impacted teeth.Â

Review

The majority (84%) of orthodontists and general dentists regarded the use of a soft tissueÂ laserÂ by orthodontists as appropriate.[9]

As an adjunctive procedure, laser surgery has helped many orthodontists to enhance the design of a patientâ€™s smile and improve treatment efficacy. Before incorporating soft-tissue lasers into clinical practice, the clinician must fully understand the basic science, safety protocol, and risks associated with them.[10]

The soft-tissue laser allows orthodontists to improve tooth proportionality and gingival shape and contour and this is very useful in finishing a case to a better esthetic in accordance to the smile line and smile arch of patient.[3,11,12]

About the esthetic concepts of tooth proportionality, the ideal maxillary central incisor should be approximately 66% to 80% width compared with height. It is important to assess if a tooth disproportion is due to a short clinical crown height, gingival overgrowth, or delayed passive eruption. In these cases gingival recontouring or dental restoration may be optimal solution.[11]

About the esthetic concepts of placement contactâ€™s point and embrasure, we need to remember that from the midline to posterior contactâ€™s point becomes apical and embrasure larger.[11]

About the gingival shape, maxillary lateral incisors have a shape like symmetrical half-oval; therefore their gingival zenith should be located within their longitudinal axis. Instead, the gingival shape of the maxillary centrals and canines is elliptical and gingival zenith is located distal respect of axis.[11]

If there is an excess gingival tissue, gingival recontouring allows place the brackets in an ideal position quickly.[12,13]

In addition gingival recontouring can help to reduce inflammation due to poor oral hygiene, allowing the patients to access more areas to brush and to keep gingivitis under control. There is excess tissue for example when large extraction spaces are closed and the patient has poor oral hygiene.[12,13]

Kravitz and Budi [14] described gingivectomy with laser. When applying topical anesthetic, dry the mucosa with gauze; apply 0.2 mL (equivalent to 1 cotton swab head) of topical anesthetic to the mucosa for no longer than 5 to 7 minutes, because prolonged application can cause tissue irritation; confirm anesthesia with a perio probe and use a probe to mark height guides. Hold the laser tip perpendicular to the tissue at the gingival margin and use a continuous wave stroke to remove the tissue surface one layer at a time. Traditionally, a minimum of 1 mm sulcular depth of attached tissue was considered critical for maintenance of periodontal health and prevention of gingival recession. These opinions were based largely on the study by Lang and LÃ¶e[15] on the significance of keratinized gingiva. However, more recent longitudinal studies have shown that, in the absence of gingival inflammation, the incidence of recession around teeth without attached gingiva was not greater than that observed in areas with attached gingiva.[16-20] Experimental studies have even shown that gingivectomies extending into alveolar mucosa can regenerate as much as 50% with the formation of new attached marginal gingiva.[21,22] Therefore, although the preservation of attached tissue is preferred, a certain quantity of attached gingiva might not be essential for maintenance of periodontal health.[23,24] Immediately after the procedure, the patient should rinse with mouthwash and gently massage the surgical area with a soft-bristle toothbrush. If tissue discoloration persists, hydrogen peroxide can be applied with a cotton swab or cotton roll. Bleeding and discomfort are minimal. Chlorhexidine and analgesics are rarely prescribed. Complete tissue healing takes place in 1 week. The patient should be seen for a postoperative follow-up after 2 weeks. Frenectomy with laser is indicated when patients with a large diastema often have a low frenum that can contribute to the excessive spacing.[31,32,33] Orthodontists will treat the diastema by closing the space and stabilizing with fixed or removable retention in addition to a frenectomy. The process is less painful,

no sutures are needed and bleeding is controlled. As the frenum is in the new position, the scar tissue can help to maintain the space closure. The technique for a frenectomy is to hold the upper lip until the frenum is taut and lase the frenum horizontally 3 mm from the frenum base, using continuous waves until the lip is released, creating a V-shaped crater. Continue to lase deep enough to prevent reattachment. Clean the surgical site with hydrogen peroxide on a cotton ball.

Soft tissues can sometimes cover a tooth and impede its eruption into the arch. Sometimes the impacted tooth is nearly erupted into the mouth and the soft tissue laser can be used to remove overlying tissue so that the orthodontist can bond a bracket and begin moving the tooth immediately[12,13].Â After applying topical anesthetic, probe the surgical site to locate the tooth and mark, then with carefully remove the tissue with light, continuous waves until the underlying tooth is exposed. After exposure wipe the area with 3% hydrogen peroxide with a microbrush or cotton roll. A bond can be placed immediately after exposition of tooth.[13]

Apthous ulcers can occur in single or multiple numbers and affect the non-keratinised mucosa [34]. Clinically, present as one or several rounds of ulcerated lesions, surrounded by erythema, covered by a whitish pseudomembrane with variable symptoms and history of recurrences.[35] The ulcers occur in three clinical forms: minor, major and herpetiform.[34] Several therapies have been advocated to manage these lesions such as topical corticosteroids (triamcinolone acetonide, hydrocortisone acetate and clobetasol propionate), chlorhexidine mouth rinses, tetracycline oral rinses, thalidomide, fluocinonide, colchicines and the immune boosting agent levamosile, vitamin therapy and topical interferon Î±-2a. Laser therapy is used as an alternative method in treatment. The exact underlying etiology and pathogenesis of RAS is not completely understood. Many etiological, predisposing and precipitating factors such as genetic factors, immunological problems, hypersensitivity to foods, deficits of folic acid, iron, zinc, vitamin B_1, vitamin B_2, vitamin B_6Â or vitamin B_{12}, BehÃ§et's syndrome, gastrointestinal disorders such as Crohn's disease, coeliac disease or ulcerative recto colitis, immunodeficiencies such as HIV infection and others, stress, trauma, cessation of smoking, the luteal phase of the menstrual cycle and oral healthcare products containing sodium lauryl sulfate have been identified to play a role in the etiology .[36]The orthodontist has the ability to lase them and ulcers can heal within 1 day after treatment. The laser is activated for 30 seconds at a very low wattage and kept at a distance of 1 to 2 mm away from the lesion. The laser is nonpainful and allows the patients to have a faster recovery. [12,13,34,37]

Conclusions

The diode laser is a useful instrument with a greater advantage over conventional surgery in the management of soft tissue procedures. Dental laser research has emerged to maturity and presages a substantial contribution to the future of clinical dental practice. Orthodontists and other dentists can now benefit from several different advantages that lasers provide and can finish cases much more efficiently and with higher esthetic standard.

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