REVIEW ARTICLE

Therapeutic Uses of Laser in Pedodontics

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Abstract

Historically, oral soft tissue surgery on infants and young children was completed in the operating room under a general anesthetic agent. Traditional methods of oral surgery using scalpels or electro surgery produced postoperative discomfort and prolonged healing. Lasers provide a simple and safe in-office alternative for children while at the same time reducing the chances of infection, swelling, discomfort, and scaring. In a pediatric practice, there are a variety of surgical and restorative laser wavelengths, such as diode and Erbium, and other photo bio stimulation or therapeutic lasers which are effective at powers well below those of the surgical lasers.


Key words: Occupational Exposure to HBV and HIV + Dental Practice

Introduction

Laser represents a quantum leap forward in the treatment of Dental patient’s especially pediatric patients. A wide range of procedures can be treated with laser. Three types of laser are useful in the area of pediatric dentistry, Photobiostimulation or cold laser, diode, Nd:YAG primarily for soft tissue and Erbium laser used for both hard and soft tissue\(^1\). When treating children, it is important to make dental experiences as comfortable as possible without compromising care. This goal becomes more challenging as dentist proceed from educating parents and patient about their health and care towards prevention, repair or the correction of dental procedure through needles, numbing and suturing. In addition, high speed drill when utilized produce noise and vibration. Traumatic injury results in devitalization or tooth loss, bleeding and discomfort. Acute illness like herpes and or gagging may interrupt the treatment. Thus laser are extremely versatile and can be used with great success.

Photobiostimulation Laser Treatments

Most of the Laser treatments in pediatric dentistry are performed with the Q1000 Photo bio stimulation unit or the Accupoint laser. Photobiostimulation\(^3\) is also known as therapeutic laser therapy and low level laser therapy. The 2 primary diodes used for this therapy are; The (indium/gallium/aluminium/phosphide) at 660 nm, creating energy of 50 mW and The GaAlAs
(gallium, aluminium, arsenides) at 808 nm creating energy up to 500 mW.

**Pulpal Analgesia**

Pulpal analgesia can be achieved by using the InGaAIP 660-nm laser probe. The laser probe is placed on the occlusal or buccal surface of primary teeth for 1 to 2 minutes to achieve successful analgesia which may allow dentist to use a high speed drill to prepare cavity without the need for any local anesthesia. Laser interferes with sodium pump mechanism which changes cell membrane permeability which temporarily alters the endings of the sensory neurons and blocks the depolarization of C and A fibers of nerve. Success in primary molars varies from 50% to 75%. The analgesic effect may be compromised by pigmentation of the patient’s gingival tissue because the diode may react with the pigment in the tissue rather than be absorbed by the pulpal tissue. In permanent teeth, placing 808-nm laser probe on gingiva for 1 minute helps to achieve successful analgesia.

**Pulpal Trauma**

In young patients with anterior primary teeth trauma, placing 808-nm probe over the root may prevent the tooth from devitalization. Laser along with analgesic effect controls hemorrhage and provide sterilization by destroying oral pathogens at the site of trauma thus preventing the tooth’s vitality. A tooth or teeth which have been displaced may respond positively if treatment begins within few hours of trauma. Treatment consists of placing the laser probe over the injured tooth for a period of 1 minute on the facial as well as lingual or palatal root area. Anterior permanent teeth which have been displaced or traumatized may also be treated successfully. An additional treatment in 24 to 36 hours may improve the chance of successfully healing the tooth. In case of Soft Tissue Trauma, facial lacerations and swelling, can be benefitted by placing 660-or 808-nm laser/light-emitting diode (LED) unit over the area for approximately 3 minutes and placing the probe over the most injured area for 1 to 2 minutes. Additional treatment 24 to 36 hours later may be needed to reduce the discomfort and improve healing.

**Controlling Gag Reflex**

During an intraoral examination or intraoral radiograph, some patients may gag and in extreme cases vomit. Using the 3 J to 4 J of energy with the 660-nm probe placed over the P-6 acupuncture point on each wrist may prevent the gag from occurring. This point is located approximately 1 inch above the wrist crease. The probe is placed on each wrist for 1 to 2 minutes.

**Herpes Labialis and Recurrent Aphthous Ulcers**

Two of the most debilitating oral lesions children may experience are recurrent herpes labialis or aphthous ulcers. The Er:YAG or the Diode laser can bring instant relieve to the aphthous ulcer lesion and often abort or shorten the duration of the herpes labialis lesion. Treatment of the aphthous ulcer using the Er:YAG laser involves settings of 15 Hz and 35 mJ in a noncontact mode. Extend the treatment area about 1 mm beyond the lesion’s boundaries. Water is not required. Place the laser tip above the lesion until small white areas are seen on the tissue. Allow the laser to remain over the lesion for 15 seconds, moving the tip in a circular area over the entire lesion. Repeat the process 2 to 3 times until the child indicates that the lesion no longer feels uncomfortable. Large lesions may need a second treatment in 24 hours. Herpes labialis is treated similarly; however, the tip should slowly be passed over the entire portion of the lip that is affected just short of observing the white change in tissue color. The process takes 1 to 2 minutes. The diode settings are 0.500 mw, 400 u fiber for approximately 1 minute for aphthous ulcers and 2 minutes for herpes labialis lesions. The nature of the diode laser allows for deeper penetration of the laser energy and may be more effective than the Er:YAG laser when treating herpes labialis lesions. No local anesthesia is required for either laser during treatment.
Orthodontic and Temporomandibular Joint Discomfort

Patients having orthodontic adjustments or having temporomandibular joint discomfort may experience relief using the laser/LED unit\textsuperscript{12, 13} over the area for 3 minutes using mode 3. More than 1 treatment over a 24-to 48-hour period may be needed to reduce the discomfort.

Pretreatment of Surgical Sites

Pre treating a surgical site may reduce postoperative hemorrhage and discomfort. Treatment involves placing the 660-nm laser over the surgical area for 1 minute before lasing the soft tissue.

Photothermal Laser Treatments (Erbium: Yag, Erbium:Cr; YSGG, and Diode)

Soft tissue surgical procedures are completed using the Erbium: YAG laser 2940 nm or Erbium:Cr; YSGG at 2780 nm\textsuperscript{27}. They are useful in treating most of soft tissue lesions where absolute hemostasis is not required. Diodes in the 810 to 980-nm range are excellent lasers for treatment where hemostasis is an absolute necessity. There is one major difference in these 2 groups of wavelengths: first, the Erbium family of lasers is relatively shallow in laser energy penetration; therefore, what you see is exactly what you are doing. Second, when using a diode, the result of treatment may initially be unobserved because of deeper penetration of the laser energy. This may result in more collateral damage and more postoperative discomfort. Thus in Erbium laser you can observe the direct effect of the laser on the tissue; however, when using the diode, the tissue must heat up first and the laser penetrates deeper into the tissue. If you increase the laser energy to increase the speed of the treatment, more collateral damage and postoperative discomfort may result.

Frenum Revision

Lingual Frenum

Abnormal lingual frenum attachment is one of most common developmental anomalies of the oral cavity\textsuperscript{15, 16, 17}. A short lingual frenum in newborns makes nursing difficult. Mothers may find nursing too painful and difficult to continue. Gagging may occur when infants are beginning to eat solid foods because of the inability of the restricted tongue to clear food from the palate\textsuperscript{18, 22, 24, 26}. A short frenum may also contribute to speech or periodontal problems as children mature. Normal frenum attachment was determined to be more than 16 mm of distance from the tip of the tongue to the insertion of the frenum\textsuperscript{19, 20}. When the frenum insertion is less than 8 mm, it should be revised. If it is thin fibrous attachment, no local anesthesia is needed but if the tissue is thick and fibrous, local anesthesia may be required, the frenum is anesthetized and then stretched using grooved tongue positioner. The laser is placed 2 to 3 mm away from the tissue to ablate the frenum. The recommended settings for an Er:YAG laser is 30 Hz and 55 mJ for 15 to 30 seconds to complete. No water is required for the treatment. To prevent reattachment, a single gut suture is placed at the end of the lased area and the child is instructed to exercise the tongue and to stretch the area daily. Follow-up is scheduled in 6 to 7 days.

When using the diode 810-nm laser, the laser tip is first initiated using a piece of articulating paper to prevent it from becoming a hot tip, which would heat the tissue above the desired temperature. Unlike the Erbium laser, the diode tip is used in direct contact with tissue at a power of 1.0 W CW using a 400 u fiber. The procedure usually takes more time and requires the use of a local anesthetic.

Maxillary Frenum

Maxillary frenum may extend into the palatal area or into the interproximal area between the upper central incisors. This degree of frenum attachment may contribute to nursing difficulties, development of facial caries on the upper anterior teeth, bleeding gingival tissue between the incisors, preventing healing of trauma to the frenum area, and causing a diastema to form between the 2 central incisors\textsuperscript{21, 23}. Treatment in infants and in the primary dentition involves placing a topical anesthetic over the area, and then lasing the area to get the desired detachment and repositioning of the frenum. The recommended settings when using the Erbium laser are 30 to 45 Hz and 55 mJ and the chisel tip. Water is not required unless the process includes cutting away interproximal bone.
In permanent dentition, if bone removal is required interproximally, water should be turned on when lasing the bone. Settings remain the same. Bleeding is usually controlled, but since the area being highly vascular continues to seep blood. When this occurs, pressure for 1 to 2 minutes usually resolves the problem. If bleeding remains uncontrolled, hematinics are used. The diode laser will usually prevent any bleeding, because it is a better laser for hemostasis. When using a diode, the settings are 1.0W, CW using a 400 u fiber. Healing using the diode usually takes longer with the potential of more post operative discomfort than when using the Erbium laser. When the frenum is not corrected in children before 3 years of age, the next best time to revise the frenum occurs when the maxillary permanent central incisors begin to erupt. Revising the frenum when a large gap appears or when the central incisors appear to be erupting distally can prevent diastema formation or periodontal problems in the frenum area. A diastema as wide as 4 to 5 mm may close without orthodontic intervention. No scar tissue has been observed interproximally when the frenum is revised. The frenum should be revised before the beginning of any orthodontic care.

Biopsies

Fibrotic lesions, gingival growths, mucoceles, and other non hemangioma type lesions can be quickly and safely removed using the Erbium laser. Lesions usually require a local anesthetic, but in some instances, a topical anesthetic may be adequate. Erbium setting range of the diode is from 15 to 45 Hz and 55 mJ either with or without water. Tips may include the chisel tip or any one of the hard tissue tips. A diode laser setting uses the 400 u fibers which are 1.0 to 1.5W CW. The diode is useful if the lesion contains a vascular area which could result in post treatment hemorrhage. Fibrotic lesions or lesions which do not contain any pigment may be more effectively removed using the Erbium laser.

Pulpotomy

It involves removal of only coronal part of pulp Lasers followed by placement of suitable medicament. Laser eliminates placing of chemicals such as formoacresol into the tooth chamber to complete the Pulpotomy. The Erbium laser is the laser of choice for this treatment. Treatment consists placing the laser tip into the coronal portion of the tooth at settings of 30 HZ, 55 mJ with water or without water for approximately 15 seconds or until adequate hemostasis is achieved, this may require 2 to 3 treatment intervals. The pulpotomy is completed by placing zinc oxide and eugenol into the chamber. Local anesthetic is usually not used because of analgesic effect of Laser on Pulp tissue.

Gingival Recontouring

Children undergoing orthodontic treatment or taking medications for epilepsy or immune suppression etc may develop gingival hyperplasia. This may be a contributing cause for facial or buccal dental caries formation or enamel decalcification within the deep gingival pocket. This overgrowth of tissue can be reshaped or removed using either the Erbium or diode laser. Post-orthodontic treatment may result in the desire to improve aesthetics by exposing more available tooth enamel to eliminate the short tooth appearance of anterior teeth. This gingival recontouring is painless in most instances. Using either the Erbium or the diode laser, the tissue can often be reshaped without the need for local anesthesia. The Erbium laser settings are 30 to 45 Hz and 55 mJ. Diode laser uses 400 u at 1 to 1.5W, depending on the density and amount of pigment in the tissue. No water is usually needed. In some patients, a local anesthetic may be required.

Surgical Treatment of Patients with Bleeding Disorders

Patients with bleeding disorders have tendency to bleed profusely. In soft tissue surgeries hemostasis is a vital requirement. It can be treated by diode laser. These lasers use wavelengths that target blood and pigment to provide excellent hemostasis. Patients with hemophilia or von Willebrand’s diseases can often be treated without medical intervention. This saves the patient from complications and the cost of medications to control bleeding. Patients on blood thinners for reasons such as organ transplants or cardiac valve
replacements can also be effectively treated with the diode laser and not have to have their blood thinner medications altered.

**Venous Lake Lesions**

A venous lake or pool often appears at the site of an injury to the lower lip. It presents as a bluish soft, discrete, painless nodule beneath the epithelium of the lower lip. The source of this lesion is a feeder vessel that has extended an appendage into the epithelium of the lip. The laser diode can ablate and seal the extension of the feeder vessel without damaging the lip or causing collateral damage to the adjoining tissues. Scarring at the site of the lesion is also not seen. Topical anesthetic is placed over the site, and then an 810 nm diode with a 400 µm initiated fiber at 0.6W is used to impart laser for 60 seconds and then it is taken out of contact to cool down for an additional 30 seconds. The procedure is repeated 4 to 5 times till results are oriented.

**Discussion**

Thus laser treatment provides both safe and effective treatment modality for children and is a continuous evolving part of dental care. Lasers are an exciting new technology which provides pediatric patients with optimal care without many of the “fear factors” found in conventional dental care.

**References**


