Using photobiostimulating lasers in the practice of pediatric dentistry

author_Lawrence A. Kotlow, USA

Fig. 1

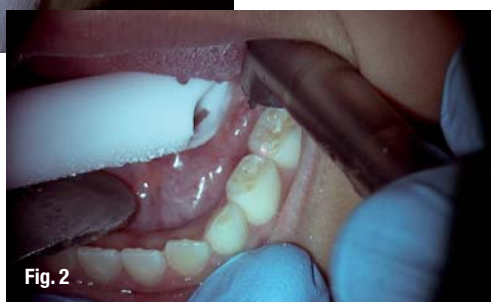
Fig. 2

Fig. 1_ PBS laser desensitizing tooth.
Fig. 2_ Erbium:YAG laser desensitizing tooth.

_Discussion

There are many peer reviewed articles in the dental literature that have examined the of benefits of hard and soft tissue lasers.[1] The use of the Erbium:YAG laser, diodes[2] of various wavelengths, carbon[3] dioxide lasers as well as lasers used in the past such as the Argon[4] and holmium are well accepted through out the world.[5, 6] Photobiostimulating lasers which are, non-surgical, non-invasive and use energy levels below .500 w. PBS lasers do not require tissue temperature elevation in the target tissue (photothermal effects), but rather create a photo-bio-stimulation (PBS) or modulation effect on the target tissue. PBS laser's benefits and usage are beginning to gain acceptance within the dental community, especially in the United States. These non-photo-thermal producing lasers are known by many different names, among the most common names are; cold lasers, healing lasers as well as low level lasers (LLLT) and produce their effects by a photobiological or photochemical effect on the target tissue. Low level lasers produce energy in a range of 50–500 mws. PBS lasers effects occur by producing both stimulation and or suppression of biological processes and allow the body to create an intracellular or biological response. The present understanding of PBS indicates one of its major effects is created within the cell mitochondria and results in an increase in ATP, the cell's fuel for energy and repair. PBS lasers are semiconductor diode lasers consisting of InGaAlP (Indium-Gallium-Aluminum-Phosphide) in the range of 630–700 nm. GaAlAs (Gallium-Aluminum-Arsenide) in the invisible therapeutic light range of 800–830 nm. Depending on the specific wavelength of each laser, PBS lasers are capable of penetrating soft tissue up to depths of approximately 2–3 cm. PBS lasers affect damaged cells and do not produce harmful or negative effects on healthy cells. In the United States, the Federal Drug Administration (FDA) recognizes and defines Photobiostimulating lasers *as NSR or posing no significant risk and are considered safe*. Outside of dentistry, the FDA has given approval for such procedures as pain control and carpel tunnel syndrome treatment. At this time, in the United States, all dental applications should be considered *off label* usage. The only suggested contraindications for use of PBS lasers are: Pregnancy, malignancies, use near the eye or in some cases over the thyroid gland. The effects of photobiostimulating laser therapy can be divided into three areas; primary, secondary or tertiary and are postulated to be effective locally and systemically, that is, producing bene-

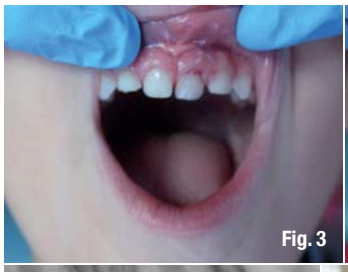
Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

ficial effects in areas of the body not being directly radiated. In the United States, per reviewed articles acceptable to the scientific community are few[7,8], due to the inability to produce good double blind studies determining whether the effects demonstrated are due to a therapeutic effect or a placebo effect, however, over 2,500 articles have been written and accepted world wide outside of the United States. PBS effects are not limited to cold lasers. Hard and soft tissue lasers also appear to produce PBS effects when used in a noncontact, defocused mode in tissue beyond the photo-thermal effected areas and therefore do not produce heat build up within the radiated tissue. Examples of PBS effects, which maybe attributed to the nonthermal effect of hard and soft tissue lasers, would be the reduction of post surgical discomfort, reduction of pain and swelling due to trauma, improved healing over conventional surgical techniques such as electro-surgery and maintaining vitality of injured teeth. PBS lasers used in this report consist of either in a (a,b) cluster containing LEDs and (c,d) Diodes or as a probe containing a single wavelength such as 660, 808, or 831 nm. Typically the cluster used for treatment provides between 4–12 mj externally and intraoral probes between 2–8 mj per minute.

_Suggested treatments

Dental analgesia[9,10]

PBS lasers reduce the need for a local anesthetic during restorative dental procedures by producing an analgesic effect. The tooth or teeth being treated are not numb, however, the ability of the body to recognize or feel pain appears to be significantly reduced.[9] Teeth exposed to laser therapy have lower levels of pain as compared to those with the placebo treatment. A Photobiostimulating effect can be accomplished by using (PBS) lasers that are limited to low level energy (a 660 nm probe) or by using a hard tissue laser (an Erbium:YAG laser 2,940 nm) in a defocused mode. The technique of achieving this effect is to place the tip of the (PBS) laser in a defocused mode (non-contact 1–3 mm off of the tooth surface) over the crown and roots of a tooth for one to two minutes using the 660 nm probe or when using the Er:YAG by keeping the laser tip defocused and in motion in order to prevent production of any thermal effects within a tooth. Using this technique, it is often possible to complete the tooth cavity preparations with the Erbium:YAG (2,940 nm) hard tissue laser. In many instances, when preparing primary teeth and many

Case 1

Fig. 3-4_ Trauma to upper centrals treated using laser.

Fig. 5-6_ 24 months post treatment.

Fig. 7_radiograph of extruded tooth # 9.

Fig. 8_repositioned tooth # 9 using a composite ribbon for stabilization.

Fig. 9_tooth # 9 , 23 months after treatment asymptomatic and vital.

Fig. 10_example of patient requiring PBS to reduce swelling.

Figs. 11a,b_(a) PBS probe using Q1000 660 nm probe intraorallly to treat TMJ discomfort.
(b) Q1000 led,laser cluster in mode 1 to treat TMJ discomfort externally.

Fig. 10

Fig. 11a

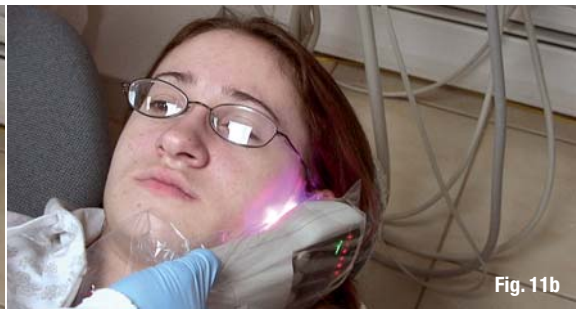
Fig. 11b

permanent teeth, it is possible to use a highspeed dental handpiece to complete the cavity preparation without causing the patient discomfort. (If the patient has not been previously introduced to the high speed or vibrations of the low speed there is no preconceived fear factor.) Whether you place a composite or an alloy, the patient is able to leave your office without the discomfort of a numb lip, tongue or cheek. In children, this eliminates the potential for developing a traumatic tongue or lip injury due to the child biting one of these areas. (Fig. 1 & 2)

Treatment of traumatized anterior teeth[11,12]

Trauma to maxillary or mandibular anterior primary teeth may result in pulpal death, tooth discoloration and possibly future infection or developmental damage to a developing permanent tooth. This usually develops within 2–6 weeks after a child has sustained an injury to the upper incisor teeth. Infants and toddlers, ranging from 7 months to 5 years of age, whom have had a traumatic dental injury, have had the involved tooth or teeth remained vital after treatment with a 660 nm laser probe. Cases where the front teeth were slightly mobile, partially avulsed or displaced and were treated within 24-48 hours after an injury, demonstrated through clinical evaluations, as long as 36 months post trauma, to be both clinically and radiographicly normal in color, vitality and asymptomatic. The treatment consists of placing a 660 nm PBS probe on the facial and palatal area of a traumatized tooth for one minute. In some instances it is advantageous to retreat the effected tooth or teeth similarly at 3- and 5-day intervals after the accident. Primary tooth trauma: Patient[1] seen immediately after upper front teeth received trauma and a second patient[2] who received trauma to the lower anterior teeth (Fig. 3 to 6).

Permanent tooth trauma (Fig. 7 to 9)

A 10 year old female child presented with tooth #9 partially avulsed. The tooth extruded out of the alveolus approximately 5 mm. The tooth was gently repositioned into the correct position, splinted and treated with the 660 probe for one minute facially and one minute palatally. This was repeated at three days and 7 days post trauma. At the end of 23 months the tooth remains vital and asymptomatic.

Treatment of Cellulitis and muscle trismis (Fig. 10)

Patients with oral infections may have a limited ability to open his or her mouth to allow an accurate examination of the oral cavity due to an abscessed tooth. This can limit the ability of a clinician to properly examine and diagnose an infected tooth and allow for drainage and relief of pain. Placing a PBS laser cluster containing both diodes and LEDs over the affected side of the upper or lower jaw for three minutes on mode 1 (approx 3 joules, Q1000) will often gave a patient enough relief of muscle trismis to allow for adequate opening and allow drainage of the infected tooth.

Treatment of Temporomandibular joint discomfort (TMJ)[13]

A 13-Year-old female presented with a history of ringing in the ears, jaw pain upon chewing and limited ability to open her mouth fully. The patient was treated using a combination laser LED cluster for five visits, on alternate days, extraorally and the 660 nm(2.2 joules) intra-orally probe for one minute on each TMJ area. The patient indicated she felt relieve immediately and after three days was essentially pain free (Figs. 11a, b).

Reducing the gag reflex[14,15,16]

An Acupuncture point on the inside area of the wrists, know as the P6 meridian, has the potential to reduce the nausea and gagging. Applying laser energy using the 660 (4 joules), or 830 nm wavelength using 4 joules to the P6 acupuncture can provide sufficient energy to alleviate the gag reflex. The P6 point is located on the undersurface of the wrist approximately 1 inch from the wrist crease; this is approximately the width of the distal thumb phalanx. Patients who in the past had gag reflexes strong enough to prevent taking of intra-oral radiographs, placement of rubber dam or and visualization and treatment of the most distally located molars can be successfully treated when the PBS laser placed on the P6 acupuncture point for one minute (Figs. 12 to 13).

Treatment of surgical procedures and injuries[17,18,19]

Patients undergoing surgical procedures benefit from pretreatment of the surgical site prior to

Fig. 12_Placement of laser.
Fig. 13_Two minutes of laser.

Fig. 12

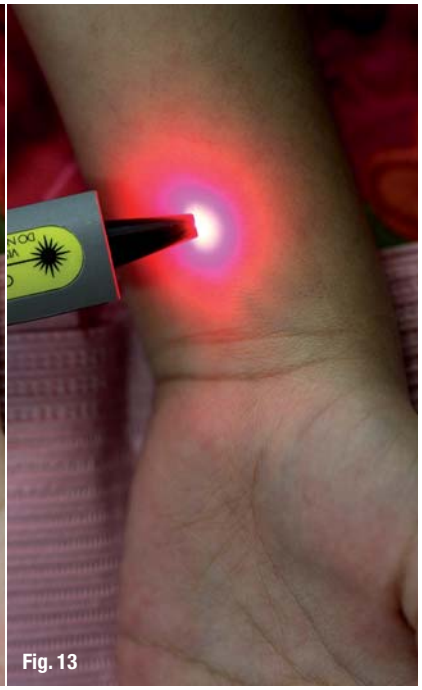
Fig. 13

Fig. 14

Fig. 15

Fig. 16

Fig. 17

treatment. This is effective in reducing post surgical pain and inflammation. Photobiostimulating lasers result in enhanced healing when measured by wound contraction. These effects are the result of laser action of (photons) light on both the cell membrane components within the nucleus of the cell. Stimulating healing in soft tissues, to resolve inflammation, give pain relief, improve the tensile strength of the wound, increase the speed at which it heals and stimulate the immune system to resolve infection. Rochkind et al. (1989) also found that the effect of irradiating one area was gleaned elsewhere on other wounds of the body, suggesting the systemic effects of LLLT. This appears to be a significant reason why it is difficult to create a study using the left and right side of the same patient. The systemic effects prevent the examiner from determining if there is a difference between a placebo effect and the laser's effect.

Facial injury: four year old child who received an injury to her upper teeth and soft tissue when falling against a table while playing at home (Q1000 mode 1, three minutes) (Figs. 14 to 17).

Fig. 18

Fig. 19

Treatment of intraoral primary herpes[20, 21, 22, 23, 24, 25] *(Fig. 18 & 19)*

A ten year old patient presented with multiple lesions intra orally and significant discomfort. Laser globe was placed extra orally for three minutes. Patient returned four days later with history of no discomfort and most lesions no longer present (Q1000 mode 1, three minutes).

_Conclusion

Photobiostimulating lasers are able to provide patients with many benefits among them are; reduced pain and duration of traumatic injuries, reduction of gag reflex and nausea, reduced healing durations, relief of muscle discomfort, The mechanism of these benefits is still undergoing investigation and needs more scientific studies to allow for proper understanding._

Photobiostimulating lasers

a: Aculaser: Laserex Technologies
PO Box 177, Unley, SA 5061, Australia
2 mm probe 660 nm 2.2 joules /minute

b: Q1000: 2035, inc., 520 Kansas City Street,
Ste 100 Rapid City, SD 57701
phone 605-342-5669

c: MEDX home unit distributed in the US by
lasers4technology

d: DIOBEAM 830 distributed in Canada by laser light
of Canada.

The Literature list can be requested from the editorial office.

Fig. 14_Facial trauma day 1.
Fig. 15_Day 2.5 after laser treatment.
Fig. 16 and 17_Day 6 after laser treatment externally and intraorally.
Fig. 18_treatment of patient who presented with multiple herpes like lesions.
Fig. 19_4 days post treatment.

_contact laser

Lawrence Kotlow DDS
Private practice, 340 Fuller Road,
Albany, NY 12203, USA
Board Certified Pediatric Dentistry
Advanced Proficiency Erbium: YAG lasers, ALD
Standard Proficiency Nd: YAG & Diode lasers, ALD
Mastership in the Academy of Laser Dentistry
Recognized Standard Course Provider, ADL
Web site:www.kiddsteeth.com