Laser in Oral Lesions

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Abstract

Lasers in dentistry began to gain popularity in the 1990s. Lasers in dentistry are used as a treatment tool or as an adjunct tool. By using the laser in the field of dentistry, the main goal is to overcome the disadvantages, which are currently being experienced in conventional dental treatment procedures. Many specialties in dentistry including oral surgery, implants, oral medicine, periodontics, pediatrics, and operative use the current new laser technology. The ability of lasers to provide minimally invasive procedures with less discomfort to the patient has been useful in the patient delivery system in dental practice. This article describes in brief on the uses of lasers in oral lesions.

Introduction

In today's world, modern science and technology have undergone rapid changes over the past decade than in the previous 100 years combined. It has helped us in achieving pleasing appearances with the advent of newer treatment options, better materials, and innovative procedures. The newer treatment procedures are conservative, painless and more reliable, and contribute towards better outcomes. Lasers in dentistry have allowed dentists to give state the art treatment to their patients. Speed, comfort, and ease of approach are some of the advantages of these techniques. Thus, the clinician should learn the use of lasers in dentistry, which has been evolving at a rapid rate, leading to a significant expansion of the worldwide base of knowledge. In turn, resulting in the rapid development of new ones for the betterment of society. Dental lasers were introduced and recognized as a tool for better patient compliance in the early 1980s. In the ensuing years, clinicians have found that practicing cosmetic dentistry can be more exciting and rewarding by laser technology for accomplishing general and cosmetic tasks. Clinicians, in this specialized area, seek to provide the highest caliber of care, while enhancing the aesthetics of the smile.1 A laser, an acronym for light amplification by stimulated emission of radiation, is a device for generating a high-intensity, ostensibly parallel beam of monochromatic (single wavelength) electromagnetic radiation. There is a complex physics behind the generation of various forms of LASER radiant energy1, 2. Lasers have been used in areas such as removal of oral leukoplakia, discrete oral mucosal lesions, pre-prosthetic surgery, and TMJ arthroscopy including open joint procedures, cosmetic surgery, and laser facial resurfacing. Lasers by no means can replace the traditional surgical procedures but can be used in combination with conventional surgical technique as with all technologies, there are significant advantages and disadvantages in their application1, 3

Classification of Lasers

Laser classifications are based chiefly on the potential of the primary laser beam or the reflected beam to cause biologic damage to the eye or skin. According to ANSI (American national standard institute) and OSHA (Occupational Safety & Health Administration) standardization, There are four general classes of lasers; the higher the classification number, the greater the potential hazard. The classes are differentiated by a combination of the out power of continuous emission of laser or energy per pulse for pulsed laser and the amount of the time that the beam is viewed4.

Class I

Laser in this category working under normal operating conditions do not pose a health hazard. These devices are enclosed, and the beam does not exit the housing. A CD player would be an example. The output power of class 1 laser is measured in tenths of mill watts.

Class II

Lasers in this category emit only visible light with low`` power output and do not normally pose a hazard because of the normal human blinking and aversion reactions. A supermarket bar code scanner and some small laser pointers demonstrate this class. The maximum allowable power of this device is 1 mW. There are two subclasses:

Class II a: It is hazardous when directly viewed for longer than 1000 seconds;

Class II b: It has a dangerous viewing time of one- fourth of a second, which is the length of time of an ordinary blinking reflex.

Class III: Lasers in dentistry can emit any wavelength and have output power less than 0.5 w of visible light or approximately 0.1 to 0.2 w in the other portions of the electromagnetic spectrum. In this class, when the laser light is viewed only momentarily, it will not harm the unprotected eye. These lasers have a caution label on them.

Class IV:

The category of laser is hazardous from direct viewing and may produce hazardous diffuse reflections. Any output power greater than 0.5W measured in either continuous wave or pulsed emission constitutes class IV lasers. This device also produces fire and skin hazards. The laser presently used in dentistry is class III or Class IV.

TYPES OF LASER – There are several different types of laser available as mentioned 5.

Laser type	Laser	Wavelength	Color
Excimer lasers	Argon Fluoride (ArF) Xenon Chloride (XeCl)	193 nm 308 nm	Ultraviolet Ultraviolet
Gas lasers	Argon	488 nm 514 nm	Blue Blue-green
	Helium -Neon (HeNe) Carbon Dioxide (CO2)	637 nm 10,600 nm	Red Infrared
Diode lasers	Indium Gallium Arsenide Phosphorus (InGaAsP) Gallium Aluminum Arsenide (GaAlAs) Gallium Arsenide (GaAs) Indium Gallium Arsenide (InGaAs)	655 nm 670–830 nm 840 nm 980 nm	Red Red infrared infrared

Uses of Laser in Oral Medicine: - The development of laser energy as a modality of therapy in the management of oral lesions is an ongoing and exciting discipline. The myriad interactions that make various laser wavelengths useful as therapeutic tools are just beginning to be explored. The number of different wavelengths used for soft tissue procedures is growing rapidly as a better understanding of the interactions of the coherent light energy with the oral target tissues is developed.

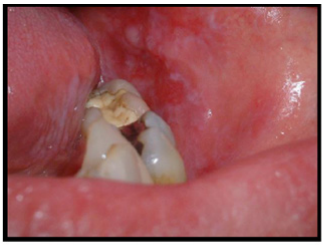
Leukoplakia:

Following administration of local anesthetic, the lesion is outlined and vaporized with the laser in continuous mode at 4 to 6 W, creating a series of continuous, defocused, no overlapping, inverted ‘‘U’’s. A second pass is performed to achieve the desired depth of ablation 1.

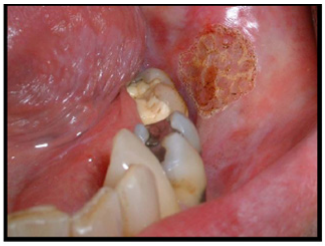
Vaporization of Leukoplakia of ventral tongue

Oral lichen planus:

Following administration of local anesthetic, the lesion is outlined and vaporized with the laser in continuous mode at 4 to 6 W, creating a series of continuous, defocused, nonoverlapping, inverted ‘‘U’’s. A second pass is performed to achieve the desired depth of ablation.6



Oral lichen planus of the left cheek

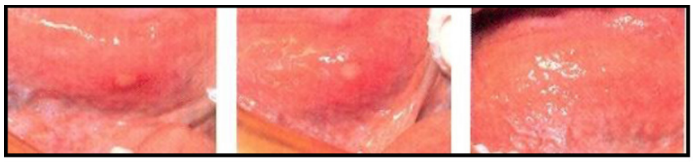


CO2 laser evaporation of oral lichen planus

Three months after CO2 laser evaporation of oral lichen planus

Aphthous ulcer

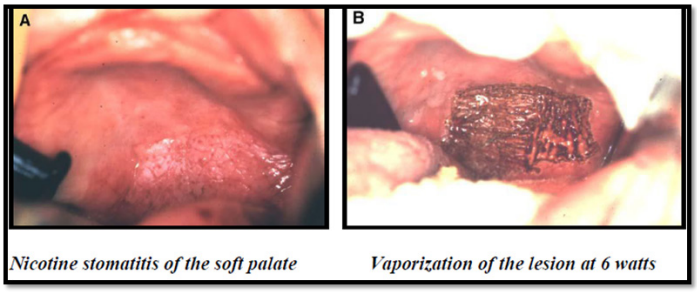
This type of traumatic ulcer may be palliated by lasing in continuous mode at 2W with slight defocusing. Laser treatment of aphthous ulcers is an alternative to temporary palliative pharmacologic therapy. The laser provides relief of pain and inflammation, with normal wound healing of this uncomfortable and potentially recurrent oral lesion.[1,6]



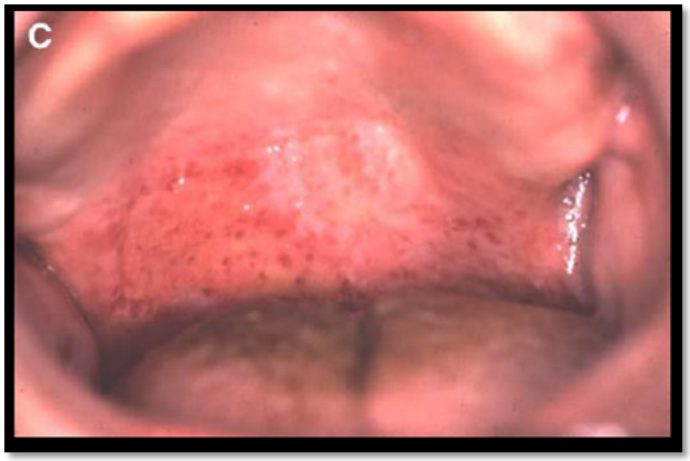
Apthous ulcer on tongue *Immediate post op.* *Complete healing after 5 days*

Nicotine stomatitis:

Given the function of the soft palate, the laser is ideal due to its minimal amount of scarring and ease of access. Local anesthesia is administered, and the affected area is vaporized with the laser in defocused, continuous mode at 6 W. With this technique, the amount of swelling is negligible; minimizing the risk of airway compromise, and the patient may be discharged to home immediately postoperatively.1, 6



Nicotine stomatitis of the soft palate *Vaporization of the lesion at 6 watts*



Ten - day postoperative appearance demonstrating excellent healing.

Epulis fissuratum:

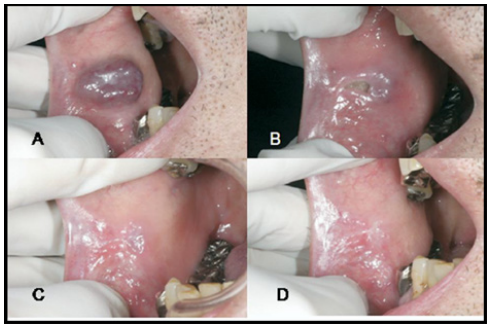
Epulis fissuratum, which consists of hyperplastic mucogingival folds from fibroepithelial proliferation secondary to ill-fitting dentures, prevents proper denture seating on a stable base. It responds well to laser excision with minimal postoperative discomfort and swelling focused beam at 5 to 10 W CW is used to aid hemostasis and promote a dry field. Alternatively, a pulsed waveform at 20 W, PRR = 50-200 pps at 2.0 to 3.0-mm spot size may be used. The existing denture is relined with soft denture liner. The wound re-epithelializes in about 3 weeks with little loss or no loss of sulcus depth.[1]

Epulis Fissuratum on Maxillary Ant. Ridge *After Vaporization with Laser*

Healing after 1 Week

Hemangioma:

Although this type of lesion may be coagulated by using a hemoglobin-specific laser, it also may be excised in toto by sealing of the peripheral feeding vasculature. This technique is performed exactly as any other excisional technique by first outlining the margin of excision in interrupted mode and then incising and undermining the lesion in continuous, focused mode.7



A: hemangioma at the corner of mouth B: 1 - week after coagulation

C: 6 months post - op. D: 1 - year post - op.

Leiomyoma

The area was anesthetized using topical anaesthesia and the periphery of the lesion was marked 1mm beyond the lesion (safety margin) using an initiated surgical tip at 0.8Watts power in a continuous mode in slow and controlled fashion using 940nm diode laser (Ezlase, Biolase Technology Inc, USA). The lesion was excised intact with 1W continuous mode and the area was scaled with ultrasonic scaler followed by laser curettage.[8]

Pre –OP Marked outline of the lesion 1mm beyond

Total excision of the lesion Follow up after 10days follow up after 1year

Lasers in temporomandibular joint disorders

Temporomandibular disorder (TMD) is a collective term, characterized by symptoms involving muscles of mastication, TMJ, and orofacial structures resulting from a dysfunction of the stomatognatic system. This is defined as a functional unit consisting of structures associated with chewing, speaking and swallowing.

The Laser is one of the most recent treatment modalities in the field of physiotherapy. Low-level laser therapy (LLLT) is suggested to have bio stimulating and analgesic effects through direct irradiation without causing the thermal response. It has been studied in several musculoskeletal pain syndromes and contradictory results were reported in two major meta-analyses. Few studies have investigated the efficacy of laser therapy in TMD[7].

HAZARDS OF LASER SURGERY

Laser light is absorbed by body tissue. If the beam is powerful enough, the absorbed energy can cause injury. The skin and eyes are the most sensitive tissue to laser light. The amount of light absorbed depends on the wavelength of the beam. The more light absorbed, the greater the injury. In lasers, we are concerned with the optical spectrum region of the EM spectrum. The wavelength range is 100nm-10000nm. Again, the optical spectrum includes, ultraviolet, visible, and infrared light1,

LASER SAFETY

Precautions for dental staff and patients are essential during laser procedures to protect non-target tissues – particularly the eyes – from stray beams. Reflective surfaces such as instruments, mirrors, and polished restorations have the potential to redirect laser energy. Metal instruments are advisable, as are protective eyeglasses for patients and staff1, 9.

Green safety glasses are required for use with Nd :YAG lasers and amber -colored glasses for use with the argon laser. For CO2 laser procedures, clear glasses are indicated. Also besides, the patient's eyes should be covered with moist 2 x 2 gauze pads.

Protective eye wear

Each institution that uses lasers clinically should appoint a laser safety officer (LSO) to observe and ensure the safe use of lasers in its facility. The LSO should attend a laser safety course to assist in the proper performance of their duties. He/she should evaluate all laser usage related policies and procedures and should identify laser-related potential hazards.

Once approved by the laser committee, this information should be disseminated to the operating room staff and to all the laser surgeons, dentists, physicians etc. All lasers must have their keys removed when not in use and, should be kept in a locked room to maintain equipment safety and security. Only LSO approved personnel should have access to operate laser equipment.

Laser safety warning signs should be placed on the door of any operating room. These signs should include the type and power of the laser being used. All operating room windows should be covered with an opaque material while laser is in used so that no laser light can escape and harm any unsuspecting bystander. This is not necessary during CO2 laser procedures because its emission is absorbed by plastic and glass. A pair of laser goggles should be placed on the door handles of the operating room for adequate eye protection of the operating personnel. All clinical lasers should be examined weekly and their power output should be monitored regularly with a power meter. This data should be recorded for the LSO's monthly quality assurance report and medical/legal record-keeping.

Remember foot pedal safety [9]

When the laser is not in use, the clinician's foot should be removed from the pedal. If the laser is not being used for a substantial period time, the laser should be placed in the standby mode with the approval of the clinician. The covered design of the foot pedal helps prevents accidental activation of the laser (fig). A basin of saline should be available to be utilized in the event of fire for each laser procedure.

Foot pedal covered with hood to prevent accidental Pressing

Remember

In case of fire, use the laser fire safety protocol and act quickly. Do not use water to extinguish fires on electrical equipment.

All operating room personnel should know where and how to use the fire extinguishers located near the operating room. Remember: P.A.S.S. - pull, aim, squeeze, and sweep10, 11.

CONCLUSION

Lasers have become a ray of hope in dentistry. When used efficaciously and ethically, lasers are an exceptional modality of treatment for many clinical conditions that dentist treat on a daily basis. Lasers have quickly become indispensable in the treatment of oral mucosal lesions as a modality for the treatment of soft tissue surgery. AS lasers technology has advanced, so too has their use. Lasers not only allow dentists to enhance current surgical options for treatment but also have contributed to the evolution of a variety of new procedures that are now commonplace in the treatment of oral mucosal lesions. Many new laser systems are now available in the market today, each with the wavelength and features which make them unique. Although these new systems make some procedures easier. it has become essential for the laser surgeon to relay on the basic principles of laser physics to use then in a safe and efficient manner. The incorporation of lasers into the practice of treatment of oral mucosal lesions has led to exciting advances in surgical therapy and improved patient care. Advances in laser technology undoubtedly will yield new procedures and have a major role in the future of minimally invasive treatments. But laser has never been the "magic wand" that many people have hoped for. However, the future of dental laser is bright with some of the newest ongoing researches

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