

Laser in Oral Mucosal Lesions - An innovative tool

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Abstract

Laser is a special light source that has a higher power and better quality of beam compared to the other light sources. The word 'LASER' is not a new term for science and technology. The introduction of lasers to the biomedical field has truly given a technological boost to the way clinicians perform a number of procedures. Soft tissue lasers are becoming popular among the clinicians due to their potential value in surgical procedures providing surface sterilization, dry surgical field and increased patient acceptance. Oral premalignant lesions of the oral cavity such as leukoplakia and erythroplakia remain a diagnostic and treatment challenge. They have a potential for malignant transformation. Management of such lesions includes observation, excision, ablation, or topical medical therapies. The gold standard for management of the clinically evident high-grade premalignant disease is excision or laser ablation. Laser treatment has been a well-established modality for management of premalignant lesions and has potential advantages over surgical excision.

Keywords: Argon Lasers, Co2 Lasers, Premalignant Lesions.

Introduction

Laser play a valuable role in field of dentistry. This acronym describes the lasing principle.⁽¹⁾ It has been harnessed for practical use in wide range of industries, ranking among the most significant laser applications are those in medicine and dentistry. Dental procedures performed today with the laser are so effective.⁽²⁾ Laser use in dentistry has centered on the possibility to encourage patient uptake through the avoidance of pre and post-operative pain and discomfort. Laser procedures offer high quality, state-of-the-art dentistry because of new treatment modality and enhancement to traditional treatments, with reduced need of anesthesia during treatment and a great reduction or lack of post-treatment pain, making the patient experience somewhat easier.^(3,4) The dental lasers offer the dentist not only a window, but a door into this high-tech, rewarding and potentially profitable areas. Recent advances in laser technology and research into its potential have set the stage for a revolution in dental practice.^(5,6)

Laser Application in Oral Mucosal Lesions

A host of intraoral lesion can be treated with lasers. The importance of using laser for biopsy and vaporization of extensive, diffuse mucosal lesions lie in the incomparable speed, efficacy and overall tolerability as compared to other surgical modalities. The mucosa of entire oral cavity can be vaporized without significant patient morbidity and major problem in feeding and hydration when patient is discharged from hospitalized CO₂ laser for excision of premalignant and malignant lesion. The various applications of different types of lasers are given in Table 1. Apfelberg used argon laser to remove vascular

lesions such as hemangiomas and nevus flammeus from maxillofacial region.^(5,6)

Table-1. Different types of Lasers with their Application:^{24,25,26,27,28}

Lasers	Applications
Carbon Dioxide Lasers	Superficial lesions, resurfacing of the skin and removal of sialoliths. <ul style="list-style-type: none"> • Premalignant lesions like leukoplakia, sublingual keratosis. • Aphthous ulcers • Herpetic lesions • Coagulation of bleeding areas • Removal of granulation tissues • Excision of epulis • Inflammatory hyperplasias • Mucocoeles and ranulas • Pigmented lesions
Nd:YAG Lasers	Pigmented lesions. Sialoliths, verrucous carcinoma
Ho:YAG Lasers	Excisional biopsy
Er:YAG Lasers	Hard tissues and skin resurfacing
Argon Lasers	Vascular anomalies
Diode Lasers	oral soft tissue lesions
He-Ne laser	Radiation Mucositis
Low level laser	<i>Herpes lesions, aphthous</i>

		<i>ulcers and denture sores</i>
Helium Lasers	Cadmium	Fluorescence examination.

In Aphthous Ulcers

Aphthous ulcers are painful and often recurrent. 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. Lasers when used in defocused mode removes exposed nerve endings. The lesion can be rendered insensitive at low wattage within 4 minutes or less. Healing time is reduced markedly.^(7,8)

Recurrent aphthous ulcers are also known as canker sores. It is the most common oral ulcerative lesion. The exact cause of these ulcers is unknown. They can various possible etiologic factors like trauma, stress, lack of sleep, vitamin B12 deficiency, iron deficiency or immune reactions. These lesions are usually found on the lips, buccal mucosa, tongue, soft palate and floor of the mouth. Clinically they appear as a yellowish white pseudo membrane surrounded by erythematous halo. The ulcer is painful on palpation. Recently Low Level Laser Therapy (LLLT) has been used. It helps in immediate pain relief and accelerates wound healing. According to De Souza et al, 75% of the patients reported that there is a significant pain relief in the same session after laser treatment and the lesion is totally regressed in 4 days. When steroids are used, it takes 5-7 days for regression, Bladowski et al also found that diode laser used at low levels reduces the wound healing period to half compared to pharmaceutical method.^(9,10)

It is best to treat aphthous ulcers within the first 48 hours. 400 micron tip is used for small lesions. The laser defocused mode 5-6mm away from the lesion and advanced towards the periphery 2mm away. Continual movement from the periphery to the centre is done. 15-20 seconds period is given between the laser allowing the tissue to cool. The area, a wet gloved finger to determine if there is reduced pain felt. 2nd and 3rd pass need to be done to completely reduce the pain. After every application of laser, the area should be palpated to check for reduced pain.^(11,12)

In Herpes Labialis and Herpetic Gingivostomatitis

Soft tissue lasers is successful in diminishing the effects of herpes virus infections. The infusion of laser disrupts the activity of virus, arresting the lesion progress. Herpes labialis have been treated successfully with Nd:YAG lasers.^(13,14)

Premalignant Lesions and Conditions

The low morbidity and minimal pain generally associated with laser ablation makes it a valuable tool in the management of premalignant mucosal lesions. PJ

Thomson et al conducted a study to determine the efficacy of interventional CO₂ laser surgery in histopathologically proven oral pre-cancer management in 57 patients. Laser surgery successfully excised 55 precancerous lesions 11 of which exhibited more severe dysplasia or neoplasia compared with initial biopsy. Postoperative scarring and morbidity were minimal. It was thus concluded that interventional laser surgery is advisable as compared conservative management of oral pre-cancers to facilitate efficacious, low-morbidity treatment and to establish definitive histological diagnosis.⁽¹⁵⁾

In Leukoplakia

Leukoplakia is the most common potentially malignant lesion of the oral mucosa. There are different kinds of treatment for this lesion including scalpel excision, electro cautery, cryosurgery, laser surgery and medications. The lesions removed with laser and heal by new healthy epithelium. Small lesions can be treated by carbon dioxide laser with a margin of 3 mm.⁽¹⁶⁾ Fausto Chiesa et al (1986) treated 92 leukoplakias by CO₂ laser surgery.

Felix WK Chu et al (1988) used CO₂ laser to treat 29 leukoplakia patients and follow up was done for 3-10 years. The results supported CO₂ laser over conventional modes of treatment in relation to precision of tissue removal, minimal damage to adjacent tissue, immediate hemostatic effect, excellent wound healing and effective destruction of abnormal mucosal tissue minimizing recurrences.⁽¹⁷⁾

Gooris et al (1999) conducted a retrospective study to evaluate the treatment results of CO₂ laser evaporation for 27 cases of leukoplakia of the lip. It was concluded that selective removal of affected epithelium with minimal damage to surrounding structures is possible using CO₂ laser evaporation, followed by excellent wound healing and good functional result. Treatment can be performed under local anaesthesia on an outpatient basis and the recurrence rate is low compared with the recurrence rate after surgical excision.⁽¹⁷⁾

In Oral lichen planus

Oral lichen planus is a common mucocutaneous disease. It was first described by Wilson in 1869. It can be bilateral white striations, papules or plaques on the buccal mucosa, tongue and gingivae.

Vander Hem et al (2008) treated 21 oral lichen planus patients with CO₂ laser evaporation in the period of 1973-2003. During follow up of 1-18 years (mean 8 years) 85% patients were found to be free of pain while 15% experienced painful recurrence after treatment. They thus concluded that in patients whose condition is unresponsive to topical corticosteroids, CO₂ laser evaporation can cause long-term remission of symptoms and may even be the treatment of first

choice in patients suffering from painful oral lichen planus.⁽¹⁸⁾

In Oral Submucous fibrosis

Jawahar R et al - used diode laser to treat trismus in oral submucous fibrosis patients. They concluded that Diode laser is a less expensive and alternative method in group III and group IVA cases in whom bilateral temporalis myotomy and coronoidectomy are considered to be the only solution. Also this technique had less morbidity and was suitable for Asian population as it required less hospital stay and less follow up as compared to other surgical methods.⁽¹⁹⁾

Nayak DR et al used KTP-532 laser to treat 9 oral submucous fibrosis patients. Their study indicated that adequate release of oral submucous fibrosis can be achieved by using a KTP-532 laser release procedure, with minimal morbidity and satisfactory results.⁽¹⁹⁾

Mohan Kameshwaran et al treated 15 patients by lysis of the fibrotic bands with a soft tissue laser and adjunctive treatment. Excellent results over a 12 month follow up.⁽²⁰⁾

In Erythroplakia

Erythroplakia can be managed by surgical excision and CO₂ laser. It is important to excise the lesion widely rather than deeply due to superficial nature of dysplastic and in situ lesions.⁽²¹⁾

In Actinic cheilitis

Robert J Stanley, Randall K. Roenik (1988) treated three cases of actinic cheilitis using CO₂ laser. They concluded that CO₂ laser vaporization was an effective office procedure for treatment of actinic cheilitis that yielded excellent cosmetic and functional results especially when compared to standard vermilionectomy. Also, morbidity was minimal and the cost, when done on outpatient setting was favorable in comparison with vermilionectomy.⁽²²⁾

In Frictional keratosis

Frictional keratosis, as the term suggests results from chronic low-grade friction derived mechanically either from cheek biting, ill-fitting denture or sharp cusps of the teeth. The lesion is characterized by white in colour appearance of patch. The lesion is non scrap able. These lesions can be treated with soft laser therapy. Small questionable lesions can be excised by using carbon dioxide laser with a 0.2mm spot size. It is applied perpendicular to the elliptical outline around the lesion.^(22,23)

In Nicotinic Stomatitis

Nicotinic Stomatitis caused by pipe smoking or cigar smoking. The lesion appears as a red dots surrounded by a halo of white keratin. These lesions are usually asymptomatic. If the patient complains of pain, laser treatment done to as a treatment. The lesions are

vaporized after multiple punch biopsies. Carbon dioxide laser is used in this case, continuous mode perpendicular to the tissue surface along the long axis of the lesion.⁽²³⁾

In Smokeless tobacco induced white lesions

These lesions are induced by the chronic usage of smokeless tobacco. These lesion are treated by carbon dioxide lasers.^(22,23)

In Verrucous Carcinoma

Verrucous carcinoma is also a malignant lesion. Treated by carbon dioxide and Nd:YAG contact laser using excisional technique including the base of lesion with wide margins.⁽¹⁶⁾

In Oral Papillomatosis

It can be treated with a carbon dioxide laser or an Nd:YAG.⁽²⁴⁾

Salivary Gland Pathologies

Sialolithiasis is the disease of the salivary glands. Most of the sialoliths are found in the submandibular gland. Various types of lasers have been employed to treat sialolithiasis, including carbon dioxide, diode, and Nd:YAG lasers.⁽¹⁶⁾

In Radiation Mucositis

Radiation mucositis remains a common complication of high-dose chemoradiotherapy regimens, with potentially serious complications due to the immunosuppression. Soft tissue laser therapy has been found to be effective in reducing the oral mucositis lesions and the time of wound healing.

In Mucocele

The majority of patients with this type of lesion middle age and older. The lower lip is the most common site of involvement. It appears as a dome shaped mucosal swelling.⁽²²⁾ Laser treatment can be done to remove mucoceles. The mucocele treated with the gland tissue using Laser HF.⁽²³⁾ This laser uses high frequency technology which helps in precision cutting and reduces the risk of necrosis. Re-epithelialization takes about 2-3 weeks.⁽²⁵⁾

Pain Relief and Anti-Inflammatory Action

Soft tissue laser therapy are said to relieve pain due to various etiologies and have anti-inflammatory role. The soft tissue laser therapy depends on the fact that laser light penetrates tissues and tissue fluids. The energy may be absorbed where the concentration of fluid is highest and thus, absorbed more easily by inflamed and edematous tissue. It has been claimed that this energy can stimulate several biologic reactions involved in the healing process.^(13,14)

Wound Healing

Wound healing is a complex process with local and systemic responses and involves several types of cells, enzymes, growth factors and other substances. In studies of fibroblast responses to lasers, increased cell division and increased collagen production have been reported. However, it is possible that low level laser therapy effects on wound healing depend not only on the total dose of irradiation but also on the irradiation time and the irradiation mode.^(13,14)

Conclusion

The use of the lasers in the management of oral premalignant lesions has got many advantages over other treatment modalities. The ability to perform less invasive procedures with greater patient comfort makes laser dentistry something the modern practitioner. The other advantages of lasers are-healing faster, no pain, no bleeding and easy to use or perform.

References

- JY Kim, A Hosoya, S Kwak, SW Cho, YJ Kim, HS Jung et al - Analysis Of Gene Expression In Root Region of Developing Tooth Using Laser Capture Microdissection. *European Cells and Materials* 2007;Vol:14:2.
- Nora Raffetto et al - Lasers in initial periodontal therapy. *Dental Clinics of North America* 2004;48(4):751-1160.
- Husein et al - Applications of Lasers in Dentistry: A Review, *Archives of Orofacial Sciences* 2006;1:1-4.
- David Hornbrook. et al- Lasers in Dentistry. *Hoya Con Bio Rev.*2006;34:56-59.
- M .Thomas George et al - Ashima Valiathan, et al. Laser in dentistry. *Current Science*, 25 February 1993;64: 4.
- Donald J. Coluzzi. et al -An Overview of Lasers in Dentistry. *Academy of Laser Dentistry* 2008;6:89-91.
- Dae-Hyun Lee.et al- Application of Laser in Periodontics 10 October 2007;2:7.
- Lawrence A. Kotlow.et al- Lasers in Pediatric dentistry. *Dental Clinics of North America* 2004;5:131-132.
- De Souza To, Martins MA, Bussadori SK, Fernandes KP, Tanji EY, Mesquita-Ferrari RA, Martins MD. et al. Clinical evaluation of low level laser treatment for recurring aphthous stomatitis. *Phtomed laser Surg* 2010;28:85-87.
- Bladowski M, Konarska-Choroszuca H, Choroszuca T. et al- Com- parison of treatment results of recurrent aphthous stomatitis (RAS) with low-and high-power laser irradiation vs. pharmaceutical method (5-year study). *J Oral Laser Applic* 2004;4:191-209.
- Walsh LJ. et al- The current status of low level laser therapy in dentistry. Part 1 Soft tissue applications. *Australian Dent. J.* 1997;42(4):247-54.
- Walsh LJ. et al- The current status of low level laser therapy in dentistry. Part 2 Hard tissue applications. *Australian Dent. J.* 1997;42(5):302-06.
- Grace Sun, Jan Tuner. Low-Level Laser therapy in dentistry. *Dental Clinics of North America* 2004Oct;48(4):1061-76.
- Jan Tunér, Grängesberg et al. Low level lasers in dentistry. 2004;6:8-9.
- Francina Lozada-Nur. A treatment for oral precancerous lesions. *Oral Medicine and Pathology. Med Oral Patol Oral Cir Bucal.* 2009 Apr 1;14(4):E159-62.
- Reshma j Abrahametal et al- Laser management of intraoral soft tissue lesions –A review of literature, *IOSR-JDMS* 2014;13:59-64.
- F. Wong. et al. - Treatment of Oral Leukoplakia With Topical Bleomycin. A Pilot Study. *Oral CANCER* 1989;64:142.
- Farzane Aghahosseini, Fateme Arbabi-Kalati et al. Methylene Blue-Mediated Photodynamic Therapy: A Possible Alternative Treatment for Oral Lichen Planus. *Lasers in Surgery and Medicine* 2006;38(1):33-8.
- D. R. Lai, H. R. Chen, L. M. Lin, et al. Clinical evaluation of different treatment methods for oral submucous fibrosis. A 10-year experience with 150 cases. *J Oral Pathol Med* 1995. Oct;24(9):402-6.
- LJ Walsh. et al - The current status of laser applications in dentistry. *Australian Dental Journal* 2003.
- George Romanos, Georg-Hubertus.et al. Diode Laser (980nm) in Oral & Maxillofacial Surgical Procedures: Clinical Observation based on Clinical application. *Journal of clinical laser medicine & surgery.*1999;17:193-7.
- Neville B.W, Damm D.D, Allen C.M, Bouquot et al. J. Oral and Maxillofacial Pathology:third edition.2012;10:390-454.
- Catone GA, Alling CC et al- Laser Applications in Oral and maxillofacial surgery. *J. Oral Surg* 1969;17:36-40.
- Luis Silvae et al –Laser treatment of oral vascular malformations.2014;9:89-90.
- K S Manjunath, Amal Raj et al. Lasers in the Management of Oral Pre-Malignant Lesions. *International Journal of Scientific Study.* August 2015;3:183-186.
- Rajat Bhandari, Kartesh Singla et al. Soft tissue applications of lasers: A review. *International Journal of Dental Research* 2014;2(1):16-19.
- Sunil R. Panat et al - Lasers in oral medicine: An update. *Journal of dental sciences and oral rehabilitation,* October-December 2014;5(4):200;204.
- Chaya M David, Pankaj Gupta et al. Lasers in Dentistry: A Review. *International Journal of Advanced Health Sciences.*2015;2:8.