

LASERS IN ORAL AND MAXILLOFACIAL SURGERY - REVIEW ARTICLE

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Abstract: *Since the onset of LASER in dentistry, it has been first priority in treating oral and maxillofacial surgery. Because of its efficacy and portability, LASERS are more common among dental practitioners. Over the decades, lasers are used in all fields of treatment in dentistry. The purpose of this article is to improve technology and further study of lasers and its wavelength in order to reduce complications. This article provides the introspection towards the wide application of LASERS in oral and maxillofacial surgery.*

Keywords : *Lasers, applications, oral and maxillofacial surgery*

1. INTRODUCTION

“Light Amplification by Stimulated Emission of Radiation” is an acronym of “LASER”. Laser is a device used to convert light or electrical energy into a pointed or focused high energy beam. LASER was first invented by Theodor Maiman in the year 1960 [1]. Then it was introduced into dentistry for the first time by Goldman et al in the year 1965. Laser is different from other sources of light where Lasers have a characteristic in emission of intense light beam which is ‘coherent’. Other features include collimation, monochromatic and efficiency [2]. Laser is a dental office-based treatment. It is small, compact and easily transferred from one place to another. Hence, laser procedures are common among dental professionals [3]. Traditionally, lasers are vastly used in oral and maxillofacial surgery for excision of benign lesions, malignant lesions, pre-prosthetic surgery and in the removal of vascular lesions. In 1970, malignant and premalignant lesions are excised using carbon dioxide lasers by Strong et al [4] whereas benign tumors and superficial oral cancers are removed using argon lasers by Kaplan [5].

CLASSIFICATION OF LASER

1) SOFT LASERS:

- Helium-Neon
- Gallium-arsenide

2) HARD LASERS:

- Argon lasers
- Carbon dioxide lasers
- Nd: YAG lasers
- HO: YAG lasers [6].

BASED ON GAIN MEDIUM:

a) GAS MEDIUM

o Helium Neon o
Argon

o Carbon dioxide

b) SOLID MEDIUM

o Neodymium YAG (Nd: YAG) o
Semiconductor

o Ruby

o Er: YAG

c) LIQUID MEDIUM Dye
lasers

d) MOLECULAR MEDIUM Excimer
(example: ArF, KrCl)

e) FREE ELECTRON LASERS [7]

LASERS IN ORAL AND MAXILLO-FACIAL SURGERY

According to different frequencies, different cases, coagulopathic patient lasers can be used in Oral and Maxillo-facial surgery. Petron et al reveals that diode lasers are commonly accepted by patient because of fast and bloodless procedure. Whereas, carbon dioxide lasers have high rate of absorption towards moisturized surface. [3]

LASER TYPES	DATA APPLICATIONS
Excimer Laser	Calculus removal hard tissue depletion
Gas laser	Tooth Whitening Intra oral soft tissue surgery Treating dentin hypersensitivity Subgingival curettage
Diode laser	Diagnosis of caries Pulpotomy - Sulcular debridement Treating gingival melanin pigmentation
Solid State Laser	Selective depletion of plaque & calculus Soft tissue surgery Sulcular debridement Pulpotomy & Root canal treatment Apthous ulcer treatment Osseous surgery

Tab:1 [6]

APPLICATIONS OF LASERS IN ORAL AND MAXILLO-FACIAL SURGERY

1) REMOVAL OF ORAL MUCOSAL LESIONS

³/₄ ORAL LEUKOPLAKIA

Oral leukoplakia is a pre-malignant lesion of the oral mucosa [8]. A random clinical trial is conducted to compare the pain, swelling and post-operative complications after excision of oral leukoplakia using carbon dioxide laser and cold knife. After the trial, they concluded that carbon dioxide lasers showed minimum pain and swelling compared to cold knife excision. Thus, it shows another conventional surgical procedure to remove oral leukoplakia [9].

Photodynamic therapy (PDT) is an advanced laser technique used in excision of oral leukoplakia which shows no damage to collagenous tissue structures. PDT is most economical, shows minimum pain and maximum aesthetics [8].

$\frac{3}{4}$ LICHEN PLANUS

Oral lichen planus is a common chronic inflammatory disorder. In symptomatic patients diode laser (940nm) shows effective treatment towards relieving oral lichen planus [10]. Other study shows carbon dioxide laser was used in excising the lesion which confirms the histopathological diagnosis. Follow up sessions of the patient for about 1-year results drastic improvement and healthy oral mucosa [11].

$\frac{3}{4}$ GINGIVAL MELANIN PIGMENTATION

Simsek et al compared the procedures using diode and Er: YAG laser in treating gingival melanin pigmentation (GMP) regarding comfortness, effectiveness, post-operative pain, requirement and time taken for the procedure. Their results showed diode lasers are way effective in consuming time than Er: YAG [12].

$\frac{3}{4}$ FORDYCE GRANULA

Excising fordyce granule using high power diode laser shows great aesthetic result in post-operative procedure. Both low and high intensity diode laser is effective towards fordyce granule [13].

$\frac{3}{4}$ PRECANCEROUS LESIONS

Carbon dioxide lasers can be helpful in treating precancerous lesions using different method of vaporization. But the best result comes up with using defocused technique. Whereas, other methods show less penetration of deeper-lying cells which results higher recurrence rate [14].

$\frac{3}{4}$ ORAL MELANOMA

$\frac{3}{4}$ Oral melanomas can be treated using carbon dioxide lasers along with removal of surrounding dental organs and curettage of the alveoli in order to achieve complete excision and shows better quality of life for the patient [15].

2) ORAL BENIGN LESIONS

a) MUCOCELE

Mucocele is a lesion involving minor salivary glands commonly seen in lower lip and buccal mucosa. A study was done to compare the excision of mucosa using scalpel and carbon dioxide laser. It resulted that carbon dioxide laser showed much better results and quick wound healing than traditional scalpel excision [16].

b) RANULA

Ranula are formation of the mucous after trauma to the sublingual gland from the arrest of sublingual ducts. Lai et al reported treating ranula with carbon dioxide laser shows less or no recurrent rate [17].

c) PYOGENIC GRANULOMA

Pyogenic granuloma is commonly developed in pregnant women. Linden muller et al reviewed using carbon dioxide laser procedure in excising of pyogenic granuloma. It showed monotonous surface during initial treatment. After 1 year of follow-up sessions it resulted with no recurrence and normal periodontal tissues [18].

d) GINGIVAL HYPERPLASIC LESION

Asnaashari et al used diode laser (810nm) in order to remove all gingival hyperplastic lesions. This resulted normal structure after removal of whole lesion in a single visit and no recurrence is seen for about 6 months after the procedure [19].

e) EPULIS FISSURATUM Epulis fissuratum is a pseudo tumor commonly seen in patients using ill fitting dentures. A study reveals that using carbon dioxide lasers in patient under anti-thrombotic therapy shows no post-operative complications [20].

f) LYPHANGIOMA

Lymphangioma is a congenital lesion. In a case report, it was stated that it can be treated using carbon dioxide laser with the parameters of 3 watt (W), continuous wave with 90-degree angulation of the tip. This resulted with no recurrence for about 2 years on follow-up sessions [21].

g) HEMANGIOMA

Genovese et al described using Gallium arsenide high potential diode laser which resulted in drastic minimization of bleeding and maximization of post-operative hemostasis while treating hemangioma [22].

3) FRENECTOMY

Labial frenum is a fold of oral mucosal membrane which extends from lips to alveolar gingival mucosa. A study described that labial frenectomy procedure was done using conventional surgical technique and Nd: YAG laser. It resulted that Nd: YAG laser showed suture less with minimized trans-operative bleeding and surgical time than conventional surgical technique [23].

4) ANKYLOGLOSSIA (TONGUE TIE)

A study was done to compare between Er: YAG and diode lasers in order to review the discomforts in the patients with treating ankyloglossia. It resulted that Er: YAG laser was very efficient than diode laser because it performs by applying as topical anesthesia [24].

5) HEMOSTASIS Major property of the laser is it gives bloodless procedures thus increasing the visibility and clear operating field. The principle behind this property of laser is by contracting the vascular collagen wall leading to constriction of the vessel opening, resulting in hemostasis [3].

6) DENTAL IMPLANTOLOGY

Carbon dioxide and Er: YAG laser can be used only at low power. Using laser in second stage of implant surgery results minimum trauma and post-operative pain.

Major advantage of using laser in second stage of implant surgery is that impressions can be made immediately due to its hemostatic effects. Also, shrinkage of the tissue is less so that the margins will remain the same [25].

ADVANTAGES

- ¾ Helps in hemostasis which provides clear operating field.
- ¾ Reduces post-operative pain and swelling.
- ¾ Increased accuracy in surgical procedures.
- ¾ Suture less procedures.
- ¾ Aggravates faster wound healing.

DRAWBACKS

- 9 Scattered and reflected laser beams possess a massive health hazard.
- 9 Laser is quite expensive.
- 9 Technique sensitive.

2. CONCLUSION

Lasers in oral and maxillo-facial surgery shows tremendous growth in recent years. Because of its minimum bleeding and less post-operative pain, professionals are giving priorities for using LASERS. A dental professional should acknowledge a complete view and concepts in order to practice LASER surgeries. Outcome of the treatment is purely based on the different wavelength and techniques used during the procedure. In the following decades, LASERS show revolutionary improvement towards surgical procedures.

REFERENCE

1. Gaspar L. 1994. The use of high-power lasers in oral surgery. *J Clin Laser Med Surg.*, 12: 281–5.(Google Scholar)
2. Goldman L. 1966. *Laser cancer research*. Berlin: Springer; .
Kamami YV. 1990. Laser CO2 for results. *Acta Otorhinolaryngol Belg.*.(Google Scholar)
3. Robert A Strauss, Steven D Fallon. Lasers in contemporary oral and maxillofacial surgery. *Dent clin N Am* 48 (2004) 861-888.(Google Scholar)
4. Strong MS, Jako G, Polanyi T, Wallace R. 1972. Laser surgery of the aerodigestive tract. *Am J Surg.*, 2;126:529–33.
White J, Goodis H, Rose C. 1991. Use of the pulsed Nd:YAG laser for intra oral soft tissue surgery. *Lasers Surg Med.*, 11:455–61.(Google Scholar)
5. KaplanI, Gassner S, Shindei Y. 1974. Carbondioxide in laser in head and neck surgery. *Am J Surg* ;128:563–7.(Google Scholar)
- 6.

3. Strauss, R. A. Lasers in Oral and Maxillofacial Surgery. *Dental Clinics of North America* 2000; 44(4), 851-873.(Google Scholar)
4. Kawczyk-Krupka A, Waskowska J, Raczowska-Siostrzonek A, Kosciarz-Grzesiok A, Kwiatek S, Straszak D. et al. Comparison of cryo therapy and photodynamic therapy in treatment of oral leukoplakia. *Photodiagnosis Photodyn Ther.* 2012;9(2):148–55.(Google Scholar)
5. Shafirstein G, Friedman A, Siegel E, Moreno M, Baumler W, Fan CY. et al. Using 5-aminolevulinic acid and pulsed dye laser for photodynamic treatment of oral leukoplakia. *Arch Otolaryngol Head Neck Surg.* 2011;137(11):1117–23.(Google Scholar)
6. Misra N, Chittoria N, Umopathy D, Misra P. Efficacy of diode laser in the management of oral lichen planus. *BMJ Case Rep.* 2013;15(10):2012–007609.(Google Scholar)
7. de Magalhaes-Junior EB, Aciole GT, Santos NR, dos Santos JN, Pinheiro AL. Removal of oral lichen planus by CO2 laser . *Braz Dent J.* 2011;22(6):522–6.(Google Scholar)
8. Simsek Kaya G, Yapici Yavuz G, Sumbullu MA, Dayi E. A comparison of diode laser and Er:YAG lasers in the treatment of gingival melanin pigmentation. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2012;113(3):293–9.(Google Scholar)
9. Baeder FM, Pelino JE, de Almeida ER, Duarte DA, Santos MT. High-power diode laser use on Fordyce granule excision: a case report. *J Cosmet Dermatol .* 2010 Dec;9(4):321–4.(Google Scholar)
10. Deppe H, Mucke T, Hohlweg-Majert B, Hauck W, Wagenpfeil S, Holzle F. Different CO2 laser vaporization protocols for the therapy of oral pre cancerous lesions and precancerous conditions: a 10-year follow-up .
11. *Lasers Med Sci.* 2012;27(1):59–63.(Google Scholar)
12. Deppe H, Mucke T, Hohlweg-Majert B, Hauck W, Wagenpfeil S, Holzle F. Different CO2 laser vaporization protocols for the therapy of oral precancerous lesions and precancerous conditions: a 10-year follow-up . *Lasers Med Sci.* 2012;27(1):59–63.(Google Scholar)
13. Luna-Ortiz K, Campos-Ramos E, Pasche P, Mosqueda-Taylor A. Oral mucosal melanoma: conservative treatment including laser surgery. *Med Oral Patol Oral Cir Bucal.* 2011;16(3):e381–5.(Google Scholar)
14. Yague-Garcia J, Espana-Tost AJ, Berini-Ayres L, Gay-Escoda C. Treatment of oral mucocele-scalpel versus CO2 laser . *Med Oral Patol Oral Cir Bucal.* 2009;14(9):e469–74.(Google Scholar)

15. Lai JB, Poon CY. Treatment of ranula using carbon dioxide laser--case series report. *Int J Oral Maxillofac Surg.* 2009;38(10):1107–11 (Google Scholar)
16. Lindenmuller IH, Noll P, Mameghani T, Walter C. CO2 laser-assisted treatment of a giant pyogenic granuloma of the gingiva . *Int J Dent Hyg.* 2010;8(3):249–52.(Google Scholar)
17. Asnaashari M, Azari-Marhabi S, Alirezaei S, Asnaashari N. Clinical Application of 810nm Diode Laser to Remove Gingival Hyperplastic Lesion. *J Lasers Med Sci.* 2013;4(2):96–8.(Google Scholar)
18. Monteiro LS, Mouzinho J, Azevedo A, Camara MI, Martins MA, La Fuente JM. Treatment of epulis fissuratum with carbon dioxide laser in a patient with antithrombotic medication. *Braz Dent J.* 2012;23(1):77–81. (Google Scholar)
19. Arslan A, Gursoy H, Cologlu S. Treatment of lymphangioma with CO2 laser in the mandibular alveolar mucosa . *J Contemp D Pract.*2011;12(6): 493–6.(Google Scholar)
Genovese WJ, dos Santos MT, Faloppa F, de Souza Merli LA. The use of surgical diode laser in oral hemangioma: a case report. *Photomed Laser Surg.* 2010;28(1):147–51.(Google Scholar)
20. Junior RM, Gueiros LA, Silva IH, de Albuquerque Carvalho A, Leao JC. Labial frenectomy with Nd:YAG laser and conventional surgery: a comparative study. *Lasers Med Sci.* 2013;22:22.(Google Scholar)
21. Aras MH, Goregen M, Gungormus M, Akgul HM. Comparison of diode laser and Er:YAG lasers in the treatment of ankyloglossia. *Photomed Laser Surg.* 2010;28(2):173–7.(Google Scholar)
22. Arnabat-Dominguez J, Espana-Tost AJ, Berini-Aytes L, GayEscoda C. 2003. Erbium: YA Glaser application in the second phase of implant surgery: a pilot study in 20 patients. *Int J Oral Maxillofac Implants.*, 18:104–12
23. (Google Scholar)