ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022

Laser Surgery in Oral Surgery

Amit B Lall[1*], Akshay Bhargava[2], Mayank Singhal[3], Shweta Bali[4], Tina Chugh[5], Saumya Dimri [6]

[1]Professor & HOD, Department of Oral & Maxillofacial Surgery, Santosh Dental College & Hospital, Santosh Deemed to be University, Ghaziabad, Delhi NCR

[2] Professor & Dean, Department of Prosthodontics and Crown & Bridge, Santosh Dental College & Hospital, Santosh Deemed to be University, Ghaziabad, Delhi NCR

[3] Professor, Department of Oral & Maxillofacial Surgery, Santosh Dental College & Hospital,

[4] Professor & HOD, Department of Periodontics and Oral Implantology, Santosh Dental College & Hospital, Santosh Deemed to be University, Ghaziabad, Delhi NCR

[5] Reader, Department of Orthodontics & Dentofacial Orthopedics, Santosh Dental College & Hospital, Santosh Deemed to be University, Ghaziabad, Delhi NCR

[6] Senior Lecturer, Department of Conservative Dentistry and Endodontics, Santosh Dental College & Hospital, Santosh Deemed to be University, Ghaziabad, Delhi NCR

Email- [1] dr_abl@yahoo.com

ABSTRACT:-

A search of Medline was undertaken between the years of 2008 and 2022, and the most recent research on laser-assisted oral minor surgery will be discussed in this study. The literature on its use was assembled from the research that was found in the aforementioned search.

Keywords*:* Oral surgery, Laser, Review

INTRODUCTION: -

A laser is a light source that produces a monochromatic, collimated, coherent, and strong beam of light through stimulated emission of radiation. The categorization of lasers based on the laser active medium, such as gas, liquid, solid, and semi-conductor, which identifies and distinguishes the kind of output laser beam, is one of the parameters used to categorise lasers. In dentistry, both visible beams (such as the Argon laser at 488 or 518 nm) and invisible beams in the infrared range (such as the CO2 (Carbon Dioxide Laser), Ho:YAG (Holmium Yttrium Aluminium Garnet), Er:YAG (Erbium substituted: Yttrium Aluminium Garnet), Er-Cr: YSGG (Erbium, Chromium Doped: Yttrium Sc The type and extent of contact that may occur are determined by the characteristics of a given laser beam, specifically wavelength and the optical properties of the particular target tissue[1]. Due to its anti-inflammatory, biostimulant, and regenerative benefits, low level laser treatment (LLLT), which has therapeutic effects without producing a lot of heat, is well-established in clinical dentistry [2]. In the literature, its use has been extensively described with positive outcomes [3].This review article will examine how these aforementioned lasers have been used in surgery across the literature.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022

Oral mucosa lesions are removed

The use of the potassium-titanyl-phosphate (KTP) laser (532 nm) with a low power parameter (1 Watt - CW) to assess intraoperative and postoperative pain was documented in a clinical research. They suggested that using the KTP laser with low settings may enable effective pain management and fast wound healing during oral surgery (Fornaini).

Oral leucocytosis

An oral mucosal lesion called oral leukoplakia is a precursor to oral cancer [6].Using the CO2 laser and a cold knife to remove oral leukoplakia, a randomised clinical experiment assessed the discomfort and swelling. They came to the conclusion that CO2 laser was a minimally painful and swollen procedure, indicating that it might be utilised as an alternative to traditional surgery for patients with oral leukoplakia. The effectiveness and safety of photodynamic therapy for the treatment of oral leukoplakia using pulsed dye laser and 5-aminolevulinic acid were assessed in a nonrandomized, single-arm, Single-site phase 1/2 pilot study. Regression of oral leukoplakia may be achieved with photodynamic therapy using pulsed dye laser and 5-aminolevulinic acid. Safe and well-tolerated, the treatment. The ideal conditions in this investigation were determined to be a 1.5-hour application period, an 8 J/cm laser radiant exposure, and a 1.5-ms pulse time. The laser therapy in this study can be finished in 1 to 3 minutes because to the high-power laser employed. To enhance the response rate, more research is required to identify the ideal laser radiant exposure and drug application [7]. Cryotherapy and photodynamic therapy (PDT) were both used to treat oral leukoplakia, and their therapeutic results were evaluated. They discovered that the benefits of PDT are related to its limited, minimally intrusive nature, which spares collagenous tissue structures from destruction. As a result, normal cells will naturally repopulate these arrangements. PDT is more practical, less uncomfortable, and more esthetic for patients. Clinical healing of a leukoplakia lesion following laser surgery was assessed in a prospective trial, and it was found to be correlated with the new epithelium's normal functional condition. Pathological changes were also linked to the probability of local recurrence. They came to the conclusion that altered cell turnover may occur in 20% of cases with clinical healing of leukoplakia treated by laser surgery. In the mucosa that will eventually cover the lesion, the proliferative status marker Ki67 may serve as a prognostic indicator8. Patients who underwent laser surgery for dysplastic oral leukoplakia had their risk of recurrence examined by Yang et al. The prognostic indications for recurrence after laser surgery, according to this study, are persistent smoking after surgical therapy and broad multiple-focus lesions. The outcome of laser treatment for dysplastic oral leukoplakia could be greatly impacted by changes in oral habits [9].

Lacunar planus

Having an unknown cause, oral lichen planus (OLP) is a prevalent chronic condition. A therapeutic difficulty is treating patients with symptomatic OLP. In one study, the

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022

effectiveness of diode laser therapy (940 nm) in treating oral lichen planus was assessed. Their findings suggested that diode laser therapy can be a useful complementary therapy for treating OLP10 symptoms (Misra, 2013 #491).Treatment methods for patients with oral lichen planus were compared using low-level laser therapy and CO2 laser therapy. As a substitute or extra form of treatment, they demonstrated that low-level laser therapy produced superior outcomes than CO2 laser therapy [11].

According to a clinical investigation, the Er:YAG laser is effective at reducing oral lichen planus symptoms and lymphoplasmocytic infiltration (OLP). The settings were as follows: energy, 80–120 mJ; frequency, 6–15 Hz; non-contact hand piece; spot size diameter, 0.9 mm; pulse duration, 100–300 ms (very short pulse)–12.6–18.9 J/cm2; and air/water spray (ratio, 6–5). The usage of this wavelength has a number of benefits, such as a quick and effective healing process, minimal discomfort during and after treatment, and quick symptom relief12. An oral lichen planus that had been surgically removed using a CO2 laser was described in a case report. The lesion was removed with a CO2 laser, and an oral lichen planus diagnosis was made by histopathology. Throughout a year of patient monitoring, there were no indications of a lesion recurrence. It was discovered that using the CO2 laser to treat lichen planus was advantageous and efficient [13].

Melanin pigmentation of the gingiva

Techniques for gingival depigmentation include stripping, erbium-doped: yttrium, aluminium, and garnet laser, and carbon dioxide laser. They came to the conclusion that changes in the density and activity of the melanin pigments on the histological level cause clinical repigmentation following gingival depigmentation. Surgical stripping is still the gold standard for gingival depigmentation, but Er:YAG and CO2 lasers can be utilised successfully with some key changes.

Excision of Fordyce granules

A 19-year-old guy had surgical lip Fordyce granule excision utilising a high-power diode laser. The fantastic aesthetic outcome proved that both high- and low-intensity laser therapy were effective in removing Fordyce granules [16].

Tooth dysplasia

In patients undergoing such a surgery, a prospective research examined recurrence, residual disease malignant transformation, and overall prognosis. They proved that erythroplakias and non-homogenous leukoplakias were the most common sites for recurrence and malignant transformation. For oral dysplasia, laser resection/ablation was advised in order to avoid postoperative oral impairment brought on by other conventional modalities, as well as recurrence and malignant transformation [17].

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022

Malignant growths

A prospective study assessed the recurrence rates brought on by various CO2 laser vaporisation techniques. According to their findings, the defocused approach yielded the best outcomes when treating oral mucosal premalignant lesions with CO2 lasers. It is conceivable that other approaches with lower penetration and higher rates of recurrence were the result because the deeper-lying cells were not affected by thermal effects [18].

Oral melanomas

The most practical method of treating oral mucosal melanoma, according to a retrospective study, is laser surgery. In their trial, conservative care using a CO2 laser was sufficient to remove dental organs and curettage the alveoli in order to achieve complete surgical resection microscopically without sacrificing quality of life in patients with oral mucosal melanoma. There was disagreement over how to treat the neck. Only if a clinically positive result was discovered would they advise a selective therapeutic resection of the neck. Elective dissection did not appear to affect overall survival [19].

Benign oral lesions

Children frequently develop mucoceles, which are benign lesions of the tiny salivary glands. Lower lip and cheek mucosa are where these lesions are most frequently found. Boj et al. described the use of an erbium laser to treat a 4-mm extravasation mucocele that was on the lower lip. They demonstrated that the wound healed quickly and flawlessly without stitches. One year after the procedure, no relapse was seen. Lasers use contemporary technology and are advantageous for soft tissue surgery in paediatric dentistry since procedures are quick and wounds heal nicely without sutures. The CO2 laser and the scalpel were tested for the removal of oral mucocele. Their findings demonstrated that CO2 laser ablation of oral mucocele produced more predictable outcomes and fewer issues and recurrences than traditional scalpel resection.

Ranulas are a mucus extravasation phenomena caused by sublingual gland damage or mucus retention due to sublingual duct occlusion.

Pregnant women may experience the development of a PG in their oral cavity. A massive gingival pyogenic granuloma was treated with a CO2 laser, according to Lindenmüller et al. Based on their findings, the initial wound healing was uneventful. A 12-month follow-up showed healthy periodontal tissues and no sign of the tumour returning.

Getting rid of hyperplastic gingival lesions

All of the gingival hyperplastic lesions were removed using an 810nm Diode laser by Asnaashari et al. Their findings showed that a perfect shape was achieved after the entire tumour was removed in a single session, and no recurrence was noticed after six months.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022

Fissured epulis

The vestibular sulcus' soft tissues are covered with a pseudotumor growth called epulisfissuratum, which develops as a result of ongoing discomfort from improperly fitted dentures. Surgery with suitable prosthetic repair is the indicated course of treatment for these lesions. In a patient using antithrombotic medicine, one study suggested treating epulisfissuratum with a carbon dioxide laser. The lesions were removed using a CO2 laser, and no serious side effects like bleeding, discomfort, edoema, or infection were noted. They suggested that CO2 lasers should be used as the current gold standard for the excision of this type of lesion, particularly in patients who have hemorrhagic disease or are receiving antithrombotic therapy. Three patients with vesiculobullous diseases (VBDs) were treated for epulisfissuratum using a CO2 laser and received prosthetic rehabilitation, according to Işeri et al. A CO2 laser was used to remove fibrous tissue, and the laser-created wounds were left open to secondary epithelization. Given the low damage to surrounding tissue, they showed that the CO2 laser might be a beneficial tool in treating soft tissue diseases in VBDs patients. Complete or partial dentures had been seen as a reasonable, non-surgical, and feasible therapeutic option for people with VBDs [28].

Lymphangioma

The head, neck, and oral cavity are particularly susceptible areas for lymphphangiomas, which are hemorrhagic, uncommon, benign hamartomatous tumours of the lymphatic system. Lymphangiomas are congenital lesions that are frequently found at or shortly after birth (60%) in humans.

Hemangioma

The use of surgical lasers in the treatment of hemangiomas was reviewed by Genovese et al. They said that the use of a GaAs high-potency diode laser in the treatment of hemangiomas decreased bleeding during surgery, which led to a shortening of the surgical time, and promoted quick postoperative hemostasis. It was safe to use on large lesions, it was simple to control, and there were few postoperative issues, such as potential scarring or discomfort.

Dental cavity cancer

A retrospective study evaluated the effectiveness of the Nd:YAG laser in treating stage I lip squamous cell carcinoma. According to their findings, lip Stage I squamous cell carcinoma was treated with a Nd:YAG laser in accordance with minimally invasive and morbid surgical techniques. In a retrospective analysis, 236 patients with oral cavity cancer received postoperative (chemo) radiation, selective neck dissection, and enoral laser microsurgery. Enoral laser microsurgery is an effective therapeutic choice for the management of oral cavity cancer, the researchers determined. While morbidity and problems are usually less common, oncological and functional outcomes are equivalent to those of any other treatment plan.A clinical case examined the wound's ability to recover after the lesion was removed

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** **UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022**

using a laser diode. The use of laser diodes significantly improved the surgical management of oral cavity tumours by reducing bleeding and operating time, as well as enhancing cosmetic outcomes and avoiding scarring while the body was healing by reducing swelling and post-operative pain.

Surgical biopsy

In 60 patients with comparable fibrous hyperplasias of the buccal plane, an excisional biopsy using a CO2 laser (10.6 m) mode was studied and compared for clinical and histopathological findings. The diameters of thermal damage zones between the CW and CF groups did not significantly differ. Both the VAS scores and the analgesic consumption were low in the two groups. The two CO2 laser modes were suitable for the removal of in one study, oral soft tissue diseases were treated with a carbon dioxide (CO2) laser in comparison to traditional surgery, and the impact of collateral thermal damage on histological diagnosis was assessed. According to their findings, CO2 lasers are an efficient tool for soft tissue excisional biopsies with few intraoperative and postoperative problems and appropriate pain management. On oral soft tissues, CO2 laser applications are recommended as an alternative to traditional surgery.

Treatment for Venous Malformations of the Oral Cavity

Bleeding, discomfort, and functional impairment can result from mucosal involvement of venous malformations. Surgery, sclerotherapy, or laser therapy are available as treatments. A retrospective study examined 4 patients (5 subsites) who had underwater Nd:YAG laser treatment for venous abnormalities of the oral cavity. Their research showed that the Nd:YAG laser can be a practical choice for treating venous abnormalities of the mouth cavity. In a retrospective analysis, the effectiveness and safety of CO2 laser resurfacing in the symptomatic management of intraoral lymphatic anomalies were assessed (LM). They suggested CO2 that laser resurfacing looked to be both safe and effective in treating intraoral LM symptoms. Treatments for reoccurring symptoms were anticipated to be intermittent.

Jaw osteonecrosis brought on by bisphosphonates

Multiple myeloma, metastatic breast and lung cancer, Paget's disease, osteoporosis, hypercalcemia brought on by malignancy, and numerous other skeletal illnesses are all treated with bisphosphonates (BSPs). Bone resorption is caused by osteoclastic actions that are reduced by BSPs. A recently coined term, bisphosphonates-related osteonecrosis of jaws (BRONJ), is used to characterise the serious consequence that affects people using bisphosphonates. It is well known that BSPs have an anti-angiogenetic action that causes the hard tissue to begin necrosing. There isn't agreement yet on how to solve this problem properly. In patients receiving bisphosphonate medication, osteonecrosis of the jaws (ONJ) surgery using an Er:YAG laser was suggested by Vescovi et al (BPT). They came to the conclusion that an early, conservative surgical approach using an Er:YAG laser in

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022

conjunction with LLLT for BP-induced ONJ could be seen as more effective than conventional methods like medicinal therapy.

Complications after having the mandibular third teeth extracted

Analgesic and anti-inflammatory effects of low-level laser therapy administered to the wound that developed following the surgical removal of impacted lower third molars were examined in a prospective, randomised, and double-blind trial. They found that although no statistically significant changes were found, the control side had slightly higher edoema and trismus at the second and seventh postoperative days. After impacted lower third molars were extracted, using a low-level laser with the parameters utilised in this study did not show any reduction in discomfort, edoema, or trismus. After the extraction of mandibular third molars, Aras and Güngörmüş examined the effects of extraoral and intraoral low-level laser treatments (LLLT) on postoperative trismus and oedema. This study showed that extraoral LLLT is superior to intraoral LLLT for reducing postoperative trismus and edoema following lower third molar extraction.

Operation on the teeth

When used for apicectomy, an in vitro study compared the temperature produced by the Er:YAG laser with tungsten bur and surgical saw and three distinct pulse lengths (pulse duration 50 s, pulse duration 100 s, and pulse duration 300 s). According to their findings, of the three pulse durations, laser irradiation with a pulse duration of 50 s appears to have the lowest temperature rise and the quickest time needed for apicectomy. However, in the presence of enough water, Er:YAG laser for apicectomy in all pulse lengths might be utilised safely for resection in endodontics.

Frenectomy

Oral sagittal fibrous folds are called labial frenulums. An ND:YAG laser was used for a labial frenulectomy, according to a case study individuals received treatment, and they were thereafter under control. The gold standard treatment method seemed to be laser therapy, particularly ND:YAG59. In comparison to frenectomies carried out with the Er, Cr:YSGG laser, the upper lip frenulum reinsertion, blood, surgical time, and surgical wound healing were studied. Upper lip frenulum reinsertion at the mucogingival junction was part of the upper lip laser frenectomy, a straightforward procedure that caused little to no postoperative pain or swelling. Comparing the CO2 laser to the Er,Cr:YSGG laser, the CO2 laser provided a bloodless operating room and faster surgery times. However, the Er,Cr:YSGG laser produced quicker wound healing.

CONCLUSION:-

In one study, researchers examined the tolerability of lingual frenectomy in terms of the need for local anaesthesia and the level of postoperative discomfort felt by patients who underwent surgery using both diode and erbium: yttrium-aluminum-garnet (Er: YAG) lasers. The Er:

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022

YAG laser, which may be used for modest soft-tissue surgery while requiring just topical anaesthetic, is superior to the diode laser, according to their findings.

REFERENCE:-

1. Sulewski JG. Historical survey of laser dentistry. Dent Clin North Am 2000;44(4):717-52.
2. Asnaashari M, Mohebi S, Paymanpour P. Pain reduction using low level laser irradiation in single-visit endodontic treatment. J Lasers Med Sci 2011;2(4):139-43.
3. Asnaashari M, Moeini M. Effectiveness of Lasers in the Treatment of Dentin Hypersensitivity. J Lasers Med Sci 2013;4(1):1-7.
4. Convissar RA. Principles and practice of laser dentistry: Mosby; 2010.
5. Paghdiwala AF. Application of the erbium: YAG laser on hard dental tissues; Measurement of the temperature changes and depth of cut. Lasers Med Surg Dent 1988;64:192-201.
6. Kawczyk-Krupka A, Waskowska J, Raczkowska-Siostrzonek A, Kosciarz-Grzesiok A, Kwiatek S, Straszak D, et al. Comparison of cryotherapy and photodynamic therapy in treatment of oral leukoplakia. PhotodiagnosisPhotodynTher 2012;9(2):148-55.
7. 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.
8. Montebugnoli L, Frini F, Gissi DB, Gabusi A, Cervellati F, Foschini MP, et al. Histological and immunohistochemical evaluation of new epithelium after removal of oral leukoplakia with Nd:YAG laser treatment. Lasers Med Sci 2012;27(1):205-10.
9. Yang SW, Tsai CN, Lee YS, Chen TA. Treatment outcome of dysplastic oral leukoplakia with carbon dioxide laser-emphasis on the factors affecting recurrence. J Oral MaxillofacSurg 2011;69(6):12.
10. Misra N, Chittoria N, Umapathy D, Misra P. Efficacy of diode laser in the management of oral lichen planus. BMJ Case Rep 2013;15(10):2012-007609.
11. Agha-Hosseini F, Moslemi E, Mirzaii-Dizgah I. Comparative evaluation of low-level laser and CO2 laser in treatment of patients with oral lichen planus. Int J Oral MaxillofacSurg 2012;41(10):1265-9.
12. Fornaini C, Raybaud H, Augros C, Rocca JP. New clinical approach for use of Er:YAG laser in the surgical treatment of oral lichen planus: a report of two cases. Photomed Laser Surg 2012;30(4):234-8.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** **UGC CARE Listed (Group -I) Journal Volume 11, S Iss 4 ,2022**

13. deMagalhaes-Junior EB, Aciole GT, Santos NR, dos SantosJN, Pinheiro AL. Removal of oral lichen planus by CO2 laser. Braz Dent J 2011;22(6):522-6.

14. Hegde R, Padhye A, Sumanth S, Jain AS, Thukral N. Comparison of surgical stripping; erbium-doped:yttrium, aluminum, and garnet laser; and carbon dioxide laser techniques for gingival depigmentation: a clinical and histologic study. J Periodontol 2013;84(6):738-48.

15. Simsek Kaya G, YapiciYavuz 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.

16. Baeder FM, Pelino JE, de Almeida ER, Duarte DA, Santos MT. High-power diode laser use on Fordyce granule excision: a case report: J CosmetDermatol 2010 Dec;9(4):321-4.

17. Jerjes W, Upile T, Hamdoon Z, Al-Khawalde M, Morcos M, Mosse CA, et al. CO2 laser of oral dysplasia: clinicopathological features of recurrence and malignant transformation. Lasers Med Sci 2012;27(1):169-79.

18. 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.

19. 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.

20. Lopez-Jornet P, Camacho-Alonso F. Comparison of pain and swelling after removal of oral leukoplakia with CO2 laser and cold knife: a randomized clinical trial. Med Oral Patol Oral Cir Bucal 2013; 18(1):e38-44.