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CO_2 Laser Treatment of Oral Leukoplakia: A Review of Clinical Outcome

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Abstract: Oral leukoplakia is a common potentially malignant oral disorder characterized by predominantly white plaques that cannot be identified as any other definable disease.[1] Management of oral leukoplakia can be challenging due to recurrence and potential for malignant transformation.[1,2]CO_2 laser surgery has been applied for oral leukoplakia to precisely excise or ablate the affected tissue with adequate haemostasis.[2,3] This article reviews clinical application of CO_2 laser therapy, highlighting potential postoperative advantages and limitations of laser treatment for oral leukoplakia.[2,3] Research studies demonstrated favourable postoperative outcomes, such as minimal intraoperative bleeding and reduced postoperative pain and swelling when compared to other surgical modalities.[2,4] However, recurrence following laser surgery may still occur and the effect of laser treatment on malignant transformation is inconclusive.[2,5] Histopathologic interpretation can also be difficult if the lesion is vaporized instead of allowing for surgical excision due to thermal changes at the site.[3,6] Treatment should therefore be determined on the clinical presentation, histopathologic findings, lesion characteristics and suitable follow-up.[1,7] CO_2laser treatment may serve as one option when deciding on an appropriate treatment modality, but should not take the place of histopathologic diagnosis or delay long-term follow-up.[7]

Keywords: *Oral Leukoplakia; Carbon Dioxide Laser; Laser Surgery; Potentially Malignant Oral Disorders; Recurrence.*

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I. INTRODUCTION

Oral leukoplakia is among the more significant potentially malignant oral disorders due to the potential for recurrence and malignant transformation. Management should take these factors into consideration, though the risk for either will vary based on the clinical and histopathological features of the lesions.[1,5] Risk factors for malignant transformation should be evaluated when a patient presents for examination, such as tobacco use, areca nut chewing, or other pertinent exposures.[1]Treatment options vary based on the clinical presentation of the lesion and can range from cessation of risk factors, clinical monitoring, biopsy, excision or selected ablation.[7] Laser surgery using carbon dioxide (CO_2) has been utilized in the fields of oral medicine and oral surgery to remove soft tissue due to its ability to deliver concentrated energy to a localized area.[2,3]The laser energy is absorbed by tissue which causes thermal reactions that can ablate or cut through tissue.[3] Thermal effect also aids in achieving hemostasis by sealing small blood vessels.[3,4] Due to this ability, surgical treatment with lasers may offer the advantage of minimal bleeding, allowing for improved visibility during the procedure. However, treating oral leukoplakia with laser does not eliminate risk for malignant transformation.[2,5] This literature review will cover the clinical benefits and limitations of CO_2 laser treatment for oral leukoplakia as well as implications for recurrence.

II. CLASSIFICATION AND PROPERTIES OF LASER SURGERY

The most common method of classifying lasers is based on their active medium which includes gas lasers, solid-state lasers, liquid lasers (dye lasers), and semiconductor lasers.[8] This includes familiar lasers such as the CO_2 laser, neodymium-doped yttrium aluminium garnet (Nd:YAG) laser, erbium lasers and diode lasers.[8] Another category of lasers includes excimer lasers.[8]CO_2 lasers emit infrared light that is well absorbed by water.[3,8] Because human tissue is comprised of a large amount of water, this allows the CO_2 laser to vaporize tissue in a controlled manner or to cut through tissue using high amounts of energy. The CO_2 laser also allows for hemostasis due to the thermal effect it has on small vessels.[3,4]As with any laser, various factors will affect the clinical outcome when using a laser. Clinical Use and Results CO_2 laser surgery can be applied in oral leukoplakia for tissue removal and haemostasis.[2,3] Laser surgery may afford a clearer view during surgery and decreased bleeding compared with scalpel surgery.[3,4] There are studies comparing lasers and scalpel excision that suggest decreased postoperative pain, swelling and scarring with laser

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treatment. However, these findings may depend on size of the lesion being treated, the surgical technique being used, and length of follow-up.[4]In regard to CO_2 lasers specifically, Mogedas- Vegara et al. completed a systematic review on the application of this laser in treatment of oral leukoplakia.[2] Clinical studies comparing postoperative results after laser versus scalpel excision have also been conducted.[4]One important distinction with laser treatment is that successful surgery does not equate to prevention of cancer. Studies have looked at both recurrence and malignant transformation after laser treatment, but the two are not interchangeable.[2],[5] Recurrence is when the lesion returns after treatment. Malignant transformation is when cancer develops.[5] Just because postoperative recovery may be better does not mean that one of these outcomes cannot occur.[2],[5] Another factor to consider is whether the laser was used to excise or vaporize the leukoplakic tissue.With vaporization, there may be no specimen left to examine. Excision can provide a specimen for histopathologic analysis.[6] If you need a histopathologic diagnosis or need to evaluate for dysplasia, then you must obtain an adequate biopsy or excision specimen.[7] Specimens obtained with laser should be carefully evaluated for thermal artifact.[3],

III. CLINICAL IMPLICATIONS

Treatment of leukoplakia should be tailored on a lesion-by-lesion basis according to histopathologic features, risk factors, and clinical discretion.[7] Simple measures such as riskfactor modification, biopsy when appropriate, treatment if warranted, and long-term follow-up are the mainstay of therapy.[7]Carbon dioxide laser surgery may be helpful in certain instances where its ability to provide excellent hemostasis and remove soft tissue with great precision may benefit the patient.[2,3]However, CO_2 laser removal should be thought of as one form of treatment rather than a means of assured prevention of either recurrence or malignant transformation.[2,5] Patients should be counseled about the necessity for follow-up even if the lesion is successfully treated.[7]

IV. CONCLUSION

Carbon dioxide laser treatment is an effective treatment modality for surgical removal of oral Leukoplakia in select cases.[2] While advantages include haemostasis and precise ablation of soft tissue, with some studies demonstrating favorable postoperative outcomes when compared to traditional scalpel surgery,[3,4] lesions may recur, and biological effects of laser heating are still not completely understood.[2,5,6] As with any treatment modality, proper histopathologic evaluation, tailored treatment recommendations, and long-term monitoring are critical.[7] More research using prospective study designs with uniform treatment protocols and long-term follow-up is necessary to further elucidate the role of CO_2 laser therapy in the management of leukoplakia.[2]

REFERENCES

[1]. Warnakulasuriya S, Johnson NW, van der Waal I. Nomenclature and classification of potentially Malignant disorders of the oral mucosa. J Oral Pathol Med. 2007;36(10):575–580. Doi:10.1111/j.1600-0714.2007.00582.x.

[2]. Mogedas-Vegara A, Hueto-Madrid JA, Chimenos-Küstner E, Bescós-Atín C. Oral leukoplakia treatment with the carbon dioxide laser: a systematic review of the literature. J Craniomaxillofac Surg. 2016;44(4):331–336. Doi:10.1016/j.jcms.2016.01.026.

[3]. Wilder-Smith P, Arrastia AM, Liaw LH, Berns M. Incision properties and thermal effects of three CO_2 lasers in soft tissue. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1995;79(6):685–691.Doi:10.1016/S1079-2104(05)80300-2.

[4]. López-Jornet P, Camacho-Alonso F. Comparison of pain and swelling after removal of oral Leukoplakia with CO_2 laser and cold knife: a randomized clinical trial. Med Oral Patol Oral Cir Bucal. 2013;18:e38–e44.

[5]. Brouns EREA, Baart JA, Karagozoglu KH, Aartman IHA, Bloemena E, van der Waal I. Treatment Results of CO_2 laser vaporisation in a cohort of 35 patients with oral leukoplakia. Oral Dis.2013;19(2):212–216.Doi:10.1111/odi.12007.

[6]. Deppe H, Mücke T, Hohlweg-Majert B, Hauck W, Wagenpfeil S, Hölzle F. Different CO_2 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. Doi:10.1007/s10103-011-0910-5.

[7]. Lingen MW, Abt E, Agrawal N, et al. Evidence-based clinical practice guideline for the evaluation of potentially malignant disorders in the oral cavity: a report of the American Dental Association. J Am Dent Assoc. 2017;148(10):712–727.e10. doi:10.1016/j.adaj.2017.07.032.

[8]. Korkmaz M, et al. Evaluation of the effectiveness of the carbon dioxide (CO_2) laser in minor Oral surgery: a systematic review. J Lasers Med Sci. 2023. Doi:10.34172/jlms.2023.44.