

Lasers: A Minimal Invasive Approach in Maxillofacial Surgery

Dr. Seema S Pendharkar¹

Department of oral and maxillofacial surgery, CSMSS dental college and hospital, Aurangabad, Maharashtra, India.

Corresponding Author: Dr. Seema S Pendharkar, Department of oral and maxillofacial surgery, CSMSS dental college and hospital, Aurangabad, Maharashtra, India.

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Lasers have revolutionarised the approach and treatment of oral lesions. With its minimal invasive micro surgery property it has increased the scope of treatment of various lesions. Lasers used in dentistry include visible beam laser and invisible beam lasers but since decades CO₂ remains the laser of choice. Lasers have advantage of excellent tissue cutting, better intraoperative control on bleeding, less post operative complications, and less surgical time required over conventional methods. Future research is must to include laser in the dental armamentarium. This review gives a revelation about lasers and its application in oral surgery.

Keywords: Carbon dioxide laser , Laser, Lesion, Minimally invasive surgery.

Introduction

Laser is a collimated, coherent, monochromatic intense beam of light formed by radiations emitted from a light source. Clinical uses of lasers has been increased recently, due to the rapid advances in laser technology and also due to the better understanding and interpretation of the biologic interactions of different laser systems.[1] Based on their active medium, lasers are classified as Gaseous, Liquid, Solid and Semiconductor. Lasers used in dentistry are: Visible beams which include argon laser at 488 or 518nm and Invisible beams such as carbon dioxide (CO₂)

laser, Holmium Yttrium Aluminium Garnet (Ho:YAG) laser, Neodymium- Doped Yttrium Aluminium Garnet (Nd:YAG) laser, Erbium Chromium Doped Yttrium Scandium Gallium Garnet (Er-Cr:YSGG) and Gallium Arsenide (Diode). [2] Application of lasers in dentistry and specially in the field of oral surgery is improving rapidly. Specific advantages of using lasers in oral surgery include:- Incision of soft tissue, Intraoperative coagulation and Post operative benefits. Galium Arsenic, Galium Aluminium Arsenic, are semiconductor diode lasers which are portable and compact surgical units with reliable and efficient results.[3] Lasers commonly used in oral and maxillofacial surgery include CO₂ laser, Er family, Diode and Nd:YAG laser. In dental practice CO₂ laser was the 1st laser to be used (since 1980s) and is still a desirable choice.[4] Er:YAG (2940nm) and Er Cr:YSGG (2790nm) are used for cavity preparation, Nd:YAG laser can be used in periodontal procedures, Diode laser (810-1064nm) due to their low cost, small size, fiber optic property and ease of use has become popular in dentistry in minor surgical procedures of oral soft tissues.[5]

Components of Laser include:

- 1) An active medium
- 2) An external source of energy
- 3) An optical resonator

Applications of laser in oral surgery

- 1) Frenectomy: Frenectomy is the process of removal of frenulum. In a comparative study by Junior RM et al on labial frenum treated with conventional surgical method and with Nd:YAG laser it was reported that laser frenectomies reduces the trans-operative bleeding, avoids the need of post operative suturing and also reduces the surgical time of operation as compared to the conventional method. [6]
- 2) Apicectomy: It was evaluated in an invitro study done by Bodrumlu E et al, that the laser irradiation with pulse duration 50 micro seconds proved to have the lowest rise in temperature and the time required for apicectomy was less compared to the conventional tungsten bur and surgical saw.[7]
- 3) Therapeutic application of laser after removal of impacted 3rd molar: In a study by Paschoal MA et al, it was evaluated that when low level laser therapy was applied to the wound after surgical removal of impacted third molar, analgesic and anti-inflammatory effect was seen. They concluded that use of therapeutic laser in postoperative management decreases post operative pain, swelling and trismus.[8]
- 4) Excisional Biopsy: A study by Tuncer I et al, compared the carbondioxide laser and conventional method in the oral soft tissue pathologies for excisional biopsy. They reported that CO₂ laser is an effective instrument in soft tissues biopsy. The reson include minimal inta and post operative bleeding with precise excision of tissue. CO₂ lasers are suggested as a good alternative method to conventional method in biopsy of oral soft tissues.[9]
- 5) Ranula: Ranula is a mucus extravasation cyst involving sub lingual gland and is a type of mucocele found on the floor of mouth. In a case series reported by Lai et al, it was reported that excision of ranula using CO₂ laser was safe method with minimal or no recurrence. [10]
- 6) Mucocele: Oro mucocele resection with CO₂ laser and scalpel was compared in a study by Garcia J et al, the result showed that ablation of mucocele with CO₂ laser offered predictable result with minimal complications and low rate of recurrence than scalpel method.[11]
- 7) Epulis Fissuratum: It is a benign hyperplasia of fibrous connective tissue which develops as a reactive leasion. Surgical removal of the hyperplastic tissue is the treatment of choice in such cases. A study showed carbon dioxide laser as a gold standard in excision of epulis fissuratum, especially in patient under antithrombotic therapy.[12]
- 8) Lymphangioma: It is a benign, hamartomatous tumor of lymphatic system with marked predilection for head, neck and oral cavity region. Treatment of lymphangioma with carbon dioxide laser has been reported with the conclusion that carbon dioxide laser can be an alternative method in the treatment of lymphangioma with less recurrence rate compared to conventional procedure.[13]
- 9) Hemangioma: In a review by Genovese WJ et al it was stated that use of GaAs high potency diode laser in the treatment of hemangioma has helped reduce the intra-operative bleeding and promoted rapid post operative healing and hemostasis. [14]
- 10) Removal of Gingival Hyperplastic lesion: 810nm diode laser was used to remove the hyperplastic lesion on gingival by Asnaashari et al. Perfect shaping after removal of whole lesion was observed with no recurrence of the lesion.[15]
- 11) Oral leukoplakia: It is a white plaque like patch that cannot be rubbed off and cannot be characterized as any other condition both clinically and histologically.

In a study by Kawczyk-Krupka A et al, the curative effects of treatment of oral leukoplakia by cryotherapy and photodynamic therapy were compared. It was found that photodynamic therapy was advantageous as it was minimally invasive treatment with no damage to collagenous tissue structures, as a result the normal cells repopulate. Hence photodynamic therapy proved to be more convenient, minimal invasive and less painful treatment modality.[16]

- 12) Oral Lichen Planus: It is a chronic inflammatory disease that affect the mucus membrane of oral cavity. CO₂ laser in the treatment of lichen planus was found to be useful in a case reported. The lesion was removed by CO₂ laser and patient was followed up for one year with no sign of recurrence.[17] Also low level laser and CO₂ laser were compared in the treatment of oral lichen planus, low level laser came out to give better result than CO₂ laser.[18]
- 13) Fordyce Granule: Excellent esthetic result was seen when high power diode laser was used to excise the lip Fordyce granule in a nineteen year old male.[19]
- 14) Oral Dysplasia: To prevent the recurrence, post operative oral dysfunction caused by the conventional treatment procedures and to prevent the malignant transformation of lesion laser resection of the lesion is recommended by Jerjes W et al in their study.[20]
- 15) Lasers in cancer of oral cavity: Oral cavity cancer is the most common form of malignancies hence various treatment methods has to be evaluated to obtain the best result in order to eradicate the lesion/ disease completely. In a retrospective study done by Canis M et al, 232 patients suffering from cancer of oral cavity were treated by enoral laser microsurgery, selective neck dissection and post operative chemo therapy or radio therapy. They reported that enoral laser microsurgery is an effective and efficient therapeutic

option in the treatment of oral cavity cancer.[21] A clinical case evaluated the healing of the site after removal of lesion and concluded that laser diodes have significant contribution in improving the surgical management of tumor of oral cavity in terms of decreasing the postoperative bleeding, reducing the surgical time, decreasing the postoperative pain and swelling.[22]

- 16) Other applications of laser include: Scar correction, Cyst enucleation, Preprosthetic surgery, removal of granulation tissue, Gingivectomy, Removal of melanin pigmentation, Osseous recontouring, Subgingival debridement, Abscess drainage, Operculectomy, Extraction site hemostasis, Aphthous ulcer excision, Removal of salivary gland pathologies. [23]

Precaution to be taken with clinical use of laser include [24]:

- 1) Preventing inadvertent radiation
- 2) Using wet guaze pack in order to avoid reflection from shiny metal surface
- 3) Eye protection using glasses for the operator, assistant and patient
- 4) Ensuring high speed evacuation in order to capture the laser plume
- 5)

Conclusion

Lasers have developed a lot since its implication. Due to their different types and their variable wavelength laser have found a wide range of application in the treatment of various lesion. Lasers in oral cavity lesion have proved to be more superior, and effective modality compared to the conventional surgical methods. In past many lesions were left untreated due to anticipation of negative results after treatment but with advancement in laser it has influenced the treatment plan and the outcoime of treatment. In future

more research and improvement in the field of laser microsurgery is required to bring about a revolutionary change in approach towards the treatment of any lesion.

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