10.5005/jp-journals-10052-0014

REVIEW ARTICLE

Lasers in Endoscopic Surgery

[1]Anil K Tomer, [2]Amteshwar Singh, [3]Anushree Gupta

ABSTRACT

Endoscopic facial cosmetic surgery is in great demand owing to the appeal of the minimally invasive technique utilized. Some clinicians have incorporated the use of a laser to aid in dissection and ablation of fibrous bands and muscular tissue of the procerus and corrugator musculature. Small incisions are used to pass minimally invasive instrumentation to the desired surgical site. In endoscopic brow-lift surgery, small incisions are made in the scalp area to dissect within a subgaleal or subperiosteal plane, or both to alter the muscular action of procerus and corrugator musculature as well as reposition of the brow soft tissue. Some clinicians advocate the use of either the carbon dioxide (CO_2) or the neodymium-doped yttrium aluminum garnet (Nd:YAG) laser for all or part of the dissection to decrease intraoperative bleeding and postoperative ecchymosis.

Keywords: Endodontic, Laser, Minimally invasive.

How to cite this article: Tomer AK, Singh A, Gupta A. Lasers in Endoscopic Surgery. Int J Prev Clin Dent Res 2016;3(1):55-57.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Endoscopic facial cosmetic surgery is in great demand owing to the appeal of the minimally invasive technique utilized. Some clinicians have incorporated the use of a laser to aid in dissection and ablation of fibrous bands and muscular tissue of the procerus and corrugator musculature. Small incisions are used to pass minimally invasive instrumentation to the desired surgical site. In endoscopic brow-lift surgery, small incisions are made in the scalp area to dissect within a subgaleal or subperiosteal plane, or both to alter the muscular action of procerus and corrugator musculature as well as reposition of the brow soft tissue. Some clinicians advocate the use of either the carbon dioxide (CO_2) or the neodymium-doped yttrium aluminum garnet (Nd:YAG) laser for all or part of the dissection to decrease intraoperative bleeding and postoperative ecchymosis.[1]

Safety in the surgical theater is of great importance during any procedure, but when lasers are used, special considerations must be kept in the mind. Each laser has its own safety issues; therefore, clearly written descriptions of safety precautions should be available in every working environment where laser is used.

Whether the laser is used in the office or operating room, the surgeon, the staff, and the patient must be aware of the special precautions that must be taken to ensure a safe treatment area for all involved. One person who works in the environment should be designated as the laser safety officer and he should be familiar with the standards of laser safety.[2]

The nominal hazard zone (NHZ) is defined as the surgical area in which the laser is used and could potentially cause injury or damage, usually related to eye exposure. This zone can vary in size, calculating this zone is very difficult and is often supplied to consumer by the laser manufacturer. Nominal hazard zone is determined by looking at the wavelength of light, the maximum power, the type of delivery system, the diameter of laser beam, and various other physical characteristics of the light produced. The greater the calculated zone, the greater is the probability of the injury. A continuous wave CO_2 laser that produces a focused beam of light is more likely to cause injury than a Nd:YAG laser with a sapphire tip that requires contact with the laser to cause tissue damage.[3] Consequently, the CO_2 laser would have a larger NHZ as compared with Nd:YAG laser. The NHZ should be plotted out around the laser and the safeguards should be put in place based on this zone to prevent injury.

The laser system is required to have certain safeguards built into its design. One of the most important safety aspects is the use of a key to turn on the laser. These keys should be kept in a standard, safe location and should be operated by authorized personnel only.[4]

Another safeguard present in all surgical laser system is a self-testing protocol that automatically activates when the laser is turned on. This system self-checks the programming, connections, and integrity of the laser system prior to use each time the laser is turned on. However, some manual tests still need to be performed. If there is an aiming beam, such as the helium–neon aiming beam of CO_2 laser, the precise direction of the aiming beam must be correlated with the invisible CO_2 beam. This can easily be tested by wetting a tongue depressor and performing several test pulses on a side label to correlate the beams.[5]

Visual inspection of the electric cords, pedal, and all exterior mechanical parts should be done regularly to

[1]Professor and Head, [2,3]Postgraduate Student

[1-3]Department of Conservative Dentistry and Endodontics DJ College of Dental Sciences and Research, Ghaziabad, Uttar Pradesh, India

Corresponding Author: Amteshwar Singh, 174 A, Shastri Nagar, Model Town, Ludhiana-141001, Punjab, India, e-mail: amteshwar55555@gmail.com

ensure the integrity of the system. In order to prevent laser exposure of the surgical team and the patient, laser-specific protective eyewear is mandatory. For each wavelength, there are specific protective glasses to prevent injury to the eye.[6] Each pair of glasses is marked with the wavelength and type of laser with which they are used. Patient should also be provided with appropriate protective eyewear or scleral shields, especially when the laser is being used on the face.

It was noted that clinicians were developing papillomatous lesions of the mouth, pharynx, and lungs owing to the plume of viral-containing particles created by the laser heat. Consequently, special surgical laser masks with protective filters are worn to prevent inhalation of infectious or toxic plume smoke. In addition, evacuation systems with high-speed suction are used to remove plume from the field.[7]

Exposure to skin can be limited by the use of noninflammable gowns that offer maximum body coverage. When preparing the patient for surgery, no alcohol-based preparation solutions should be used in order to prevent ignition and severe burns. Wet towels are used to drape the patient and they should be moistened throughout the procedure to prevent ignition of the drapes by the laser. Fire precaution like a fire extinguisher should always be readily available. An open basin of sterile water with an irrigating syringe should be available in case a fire should develop.[8]

Anesthesia safety precautions are specially important because of the dire consequences of airway fires and operating room explosions. Most inhalational anesthetics are not inflammable, but many gases, including oxygen, will support combustion if the concentration of combustible gas is high enough and laser beam is kept in contact with the gas and an ignition source such as an endotracheal tube. Oxygen concentration should generally be less than 40% and air can be added to the mixture as well.[9]

Standard endotracheal tubes can be damaged by many types of lasers. Polyvinylchloride tubes are highly inflammable and not recommended for use during laser surgery. Metal flexible tubes are sometimes used, but they lack air tightness and require higher peak pressures to ventilate the patient adequately. Red rubber tubes are available and are resistant to penetration by the beam, but these tubes burn vigorously in the presence of high concentrations of oxygen. Other commercial tubes are available with similar designs.

Finally, all surgeons using a laser should have current certification based on state, local, and hospital guidelines. Certification should be obtained for each type of laser being used and continuing education courses should be attended at regular intervals.

Because of their many advantages, lasers have become indispensable in oral and maxillofacial surgery as a modality for soft tissue surgery. Based on manufacturer estimates, approximately 10–20% of all oral and maxillofacial surgeons have one or more lasers in their offices, and most surgeons have access to lasers in the hospital. Lasers not only enhance the current surgical options for treatment, but also have expanded the scope of practice.[10]

There are many uses of lasers in oral and maxillofacial surgery, and the advent of new wavelengths will undoubtedly lead to new procedures that can be performed with them. One elusive use is in hard tissue surgery. Although the erbium YAG has been approved for hard tissue use and currently is being used in general dentistry, it is still not yet practical or proven for large volume osseous or extraction surgery, in which the greatest opportunity for innovation and clinical use exists. With future research, it is possible that the right wavelength laser will be developed for this purpose, allowing an increased base of procedures performed with lasers in oral and maxillofacial surgery.

Laser surgery continues to be an important addition to the armamentarium of surgeons within multiple specialties and is sure to be a topic of discussion by patients and clinicians for many years to come. Advances come quickly in this rapidly growing field, and clinicians must invest a great deal of time to feel comfortable with lasers in order to perform surgery in a safe and effective manner. The surgical laser is a powerful tool that adds great dimension to the oral and maxillofacial surgeon's practice, but he or she must command the knowledge and temperament to use it for the proper indications.

REFERENCES

1. Chandu A, Smith AC. The use of CO_2 laser in the treatment of oral white patches: outcomes and factors affecting recurrence. Int J Oral Maxillofac Surg 2005 Jun;34(4):396-400.
2. Barasch A, Peterson DE, Tanzer JM, D'Ambrosio JA, Nuki K, Schubert MM, Franquin JC, Clive J, Tutschka P. Helium-neon laser effects on conditioning induced oral mucositis in bone marrow transplantation patients. Cancer 1995 Dec 15; 76(12):2550-2556.
3. Lowe AS, McDowell BC, Walsh DM, Baxter GD, Allen JM. Failure to demonstrate any hypoalgesic effect of low intensity laser irradiation of Erb's point on experimental ischaemic pain in humans. Lasers Surg Med 1997;20(1):69-76.
4. Gam AN, Thorsen H, Lønnberg F. The effect of low level laser therapy on musculo-skeletal pain: a meta analysis. Pain 1993 Jan;52(1):63-66.
5. Basford JR, Hallman HO, Matsumoto JY, Moyer SK, Buss JM, Baxter GD. Effect of 830 nm continuous wave laser diode irradiation on median nerve function in normal subjects. Lasers Surg Med 1993;13(6):597-604.
6. Belkin M, Schwartz M. Photochemical effects upon the cornea, skin and other tissues: new biological phenomenon associated with laser radiation. J Health Phys 1989 May;56(5):687-690.

7. Bensadoun RJ, Franquin JC, Ciais G, Darcourt V, Schubert MM, Viot M, Dejou J, Tardieu C, Benezery K, Nguyen TD, et al. Low energy He/Ne laser in the prevention of radiation induced mucositis. Support Care Cancer 1999 Jul;7(4): 244-252.
8. Cambier DC, Vanderstraeten GG, Mussen MJ, van der Spank JT. Low power laser and healing of burns: a preliminary essay. Plast Reconstr Surg 1996 Mar;97(3):555-559.
9. Carrillo JS, Calatayud J, Manso FJ, Barberia E, Martinez JM, Donado M. A randomized double blind clinical trial on the effectiveness of helium-neon laser in the prevention of pain, swelling and trismus after removal of impacted third molars. Int Dent J 1990 Feb;40(1):31-36.
10. Goldberg DJ. Full face non-ablative dermal remodeling with a 1320 nm Nd:YAG laser. Dermatol Surg 2000 Oct;26(10): 915-918.