

LASER SAFETY AND PRECAUTIONS: A REVIEW

¹Unnati Pitale, ²Gagandeep, ²Rajneesh Parimoo, ³Aman Angra, ⁴Dinesh Sharma, ⁵Aman Singla
^{1,2,4,5}Department of Periodontology, Desh Bhagat Dental College & Hospital, Mandi gobindgarh, Punjab, India.
³Angra's Dentistry, Kharar, Punjab, India

Abstract

Lasers have been suggested as an adjunctive or alternative to conventional techniques for various periodontal procedures and considered superior in respect to easy ablation, decontamination, and hemostasis along with less operative and post-operative pain. Introduction of lasers in implant therapy and newer laser technical modalities has revolutionised the periodontal treatment outcome with patient acceptance. Lasers emitting radiation in the visible and infrared regions produce effects that vary from a mild reddening to blisters and charring. These conditions are usually repairable or reversible however depigmentation, ulceration, and scarring of the skin and damage to underlying organs may occur from extremely high powered lasers. So to prevent this, we should be careful and follow all patient safety measures to prevent sufferings to patient and operator as well.

Keywords : Laser, safety, treatment, hazards

Introduction

Non-surgical therapy by mechanical instrumentation is the primary recommended approach to control periodontal infection. Because conventional therapies result in wounding of the already inflamed periodontal tissues, the consequence of such therapeutic procedures depends largely on the cellular and molecular events associated with wound healing.¹ Although surgical and non-surgical approaches, such as scaling and root planing, are still regarded as important and useful modalities, but such instrumentation appears to demand considerable clinical skills, time, and may be limited by root anatomy and often precludes the achievement of the desired biologically compatible prognosis, it is essential to improve further possibilities.²

In the last decade, applying lasers as an adjunctive or alternative to current mechanical treatment had a great run in the treatment of periodontal diseases. The commonly used high power laser CO₂ and Nd:YAG is capable of excellent soft tissue ablation and has adequate haemostatic effect.³

Patient Safety

The patient is anesthetized or sedated during the surgical procedure. Therefore, the ability of the patient to warn the surgeon of possible injury is impeded or removed. Hence, all efforts for the safety must be directed toward prevention of possible complications. This includes the use of noninflammable materials where possible. Laser resistant shielding materials are available for the surgical field and for protecting the anesthesia equipment. Certain adjustments in the anesthesia technique may also decrease the potential hazards.⁴

Personnel Safety

Personnel working in the laser environment can be at risk for injury. Similar patterns of injury from the laser occur in the workers as in the patients. However, because the operating room personnel are awake, they should be able to be aware of an injury situation that develops. Once aware, they should correct the problem and thereby prevent or minimize the injury.

Absolute rules for the safety of the personnel are as follows:

1. Post signs that lasers are being used. These signs should:
 - a. Describe the type of laser.
 - b. Indicate the risk class of the laser.
 - c. Indicate the required safety equipment for personnel.
 - d. State that if unprotected personnel enter the area, the laser is to be turned off.
2. Eye shields must be worn at all times by all personnel.
3. Safety shield must be used.
4. A bucket of sterile water should be immediately available in the operating room.
5. A laser safety officer must be stationed at the laser at all the times.
6. Safety orientation for laser use should be required of all surgeons, anesthesia personnel, and operating room staff.
7. Credentialing of surgeons for use of each type of laser and laser apparatus is needed.

Laser safety considerations in periodontology

Properly used by an experienced operator and in a re-

stricted area, the laser is a very safe instrument. The manufacturers have taken great measures to provide a wide margin of safety in the products recommended for dental use, with fail-safe default mechanisms to eliminate accidental exposure. However, certain safety measures must be strictly adhered to in the dental operator.^{5,6}



Fig.1. Types of Laser Safety Signs And Labels

When the laser is in use for any purpose, the access to the operatory should be restricted, a caution sign should be posted and all personnel involved in the treatment, including the patient, must have eye protection. For the CO₂ laser operation, regular safety glasses with clear lenses are sufficient. The patient should wear safety glasses or have the eyes covered with moist gauze if sedated. The Nd:YAG laser operation requires special dark green lenses for the safety glasses that protect in the blue-green spectrum. Caution should also be taken near reflective surfaces, since the laser beam may be reflected off dental mirrors or instruments and hit other intraoral sites. The innovations in laser equipment laser modified for dental use have significantly reduced the need for a special aiming light with the CO₂ laser, since the flexible wave guide allows a focused beam at 2-4 mm from the target tissue (Luxar Corporation, Bothell, WA). The Nd:YAG laser using the flexible quartz optical fiber in a noncontact mode is also held within a

few millimeters of the target tissue. Since the Nd:YAG laser beam is invisible, a coaxial red helium neon laser provides a visible light for the laser (American Dental Laser, Troy, MI). Additional safety standards for fire prevention become necessary when the laser is used in conjunction with general anesthesia and should be reviewed prior to use in the operating room.⁵



Fig.2. Protective Eyeglasses Used For Different Lasers Depending on the Wavelength of the Laser Beam

Laser vaporous byproducts (laser plume) are generated as smoke once the vaporization of the tissue surface occurs. The plume has been shown to contain particles with mean diameters of 0.1-0.3 μm , and within this plume of carbonized tissue, viable tumor cells and viral particles have been cultured. Animal studies have shown respiratory pathology from laser plume effects to both the CO₂ and Nd:YAG lasers. Baggish et al. have also demonstrated in vitro that human immunodeficiency virus (HIV) pro-viral DNA was present in the laser smoke and collected in the evacuation tubing in their laboratory study. Wearing a surgical mask and using high-speed evacuation is essential for infection control, but the standard dental surgical mask does not filter out particles less than 0.5 μm . A new generation of laser surgical masks are now available that will filter to 0.1- μm particles. There are also evacuation systems with filtration for submicron particles that will increase the safety of laser use for biohazardous waste. The Ad Hoc Committee for the American Society for Laser Medicine and Surgery gives the following guidelines concerning hazards of laser plume: 1) all laser personnel should consider the laser plume to be potentially hazardous both in terms of the particulate matter and infectivity, 2) evacuator suction systems with high flow volume and frequent filter changes should be used at all times to collect the plume, the suction tip should be held within 2-5 cm of the laser impact and 3) eye protection, masks, gloves and gowns should be always

worn during laser use by all personnel, ensuring that the eyewear protects from splatter, the mask should have good effective filtration and the gloves should preferably be latex.⁵

Conclusion

Laser safety should also include the protection of tooth structure adjacent to the impact site. As mentioned previously in this review, the effects of laser irradiation on enamel or root surfaces can be detrimental when the focused mode is used for soft tissue ablation. Placing a periodontal retractor between the tooth and gingiva while attempting to hit the surface at a 90° angle will afford the best protection during soft tissue removal. It will also be essential to know the appropriate energies of each kind of laser. Application comfort, the silence, anesthesia reduction and other such advantages make lasers attractive for society and professionals. To use lasers safely in a clinic, the practitioner should have precise knowledge of the characteristics and effects of each laser system and their applications as well as a full understanding of the conventional treatment procedures.⁶

References

1. Ikramuddin aukhil. Biology of wound healing, Periodontology 2000, Vol. 22
2. Badersten A. Nuveus R and Egelberg J: 4-year observations of basic periodontal therapy. J Clin Periodontol 1987; 14: 438-444.
3. Schwarz F, Aoki A, Becker J, Sculean A. Laser application in non-surgical periodontal therapy: a systematic review. J Clin Periodontol 2008; 35 (Suppl. 8): 29-44.
4. Lasers. Wikipedia. [Online] en.wikipedia.org/wiki/Laser.
5. Guy A. Catone and Charles C. Alling. Laser Applications in Oral and Maxillofacial Surgery. s.l. : W.B. Saunders, 1997.
6. Parimoo, R., & Sharma, D. (2022). Lasers a boon or myth in periodontal and implant therapy: An overview. International Journal of Health Sciences, 5(S2), 64-68.