Lasers in Dentistry - A Review

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ABSTRACT

Lasers are making significant contributions to every step in the practice of dentistry, from diagnosis to preventive measures. A laser, an acronym lor light amplification by stimulated emission of radiation, is a device for generating a high-intensity, ostensibly parallel beam of monochromatic (single wavelength) electromagnetic radiation. Early applications of lasers in dentistry began to appear in the mid- to late 1970s. Potential advantages of surgical lasers were clear from the beginning, but the cost, unreliability, and operational complexity of the early machines greatly limited the actual use of lasers, except in the fields of ophthalmology and dermatology, until the past 15 to 18 years. In recent years improved understanding of light-tissue interactions and, of greatest importance to the dental surgeon, new technologies for delivering laser light to the tissue, has transformed lasers into versatile and valuable dental instruments.

Keywords: Laser Doppler Flowmetry, Power Bleaching, Laser Dental Material Processing, Gingival Sculpting.

INTRODUCTIONS

A laser, an acronym lor light amplification by stimulated emission of radiation, is a device for generating a high-intensity. Einstein (I9I7) stated about emission on basis of many scientists study, Maiman (1960) made first working laser. After that we saw advancement as the argon, carbon dioxide (C02), and neodymium:yttrium-aluminium- garnet (Nd:YAG) lasers, which remain the most widely used lasers in medicine. Full appreciation of the uses, limitations, benefits, and risks of dental lasers requires a basic understanding of laser physics and the biologic action of light.

WHAT IS LASER ?

Lasers are latest technique with minimum components. An active lasing medium, which can be a solid, liquid, or gas, is enclosed within a laser cavity bounded by two perfectly parallel reflectors (mirrors). High-energy radiation is pumped Into the active medium by means of a pump source. The pump source is energy produce by an intense electrical discharge. Till maximum number of atoms, ion or molecules reaches higher state of energy, the energy will be absorbed by active medium. This is a called as a population inversion in generating laser light. The two reflectors are placed parallel at the ends of the laser cavity and act to constrain the light along and within the axis of the cavity. Thus, the light is repeatedly bounced between the reflectors. This will stimulate the emission of even more photons (amplification) in that axial direction. Few amount of scattered light get absorbed by surroundings.

Different lasing media, because of their particular atomic, molecular, or ionic structure and energy levels, emit light of characteristic wavelengths.

CO? Laser

Carbon dioxide lasers employ carbon dioxide gas (in addition to other gases required for sustained stimulated emission of radiation) as a lasing or active medium. The gases are either sealed in a tube or are circulated from a tank. The CO: laser is primarily used for cutting and vaporizing tissue in open procedure.[1]

WHAT IS KTP LASERS?

Argon and frequency-doubled Nd:YAG laser also known as a KTP laser, help in the production of energy in the green site of the electromagnetic spectrums. The emission from both the argon and KTP lasers can be transmitted through flexible glass fibers optics that can carry the light to the surgical site. Protection of patient and operator is must/ while doing any surgical procedures. Glasses used for the green lasers necessarily block green light and thus tend to obscure the overall visualization of the surgical field.

Nd.YAG Laser

The neodymium.yttrium-aluminum-garnet (Nd:YAG) laser is a solid-state device that generates light in the near infrared region of the spectrum at 1064 nm. This mode is often used in ophthalmology to disrupt the posterior capsule in secondary cataracts or in shock-wave lithotripsy.[2-4]

Holmium: YAG

The holmium:YAG laser is technologically associated with the Nd:YAG laser. This solid-state laser uses holmium as its active medium doped into a matrix of yttrium, aluminium and garnet. The holmium:YAG beam can be delivered through fiber optics. However, such fibers must be made of low OH (hydroxyl radical) glass due to the high absorption of this wavelength to water.

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How to cite this article: Sharma Yesh, Trinath Tangutoori, Chouhan Bhupindra, Mathew Rose Robina, Rapsang Eliezer, Sharma Sujata. Lasers in dentistry - a review. International Journal of Contemporary Medical Research 2018;5(3):C19-C21.

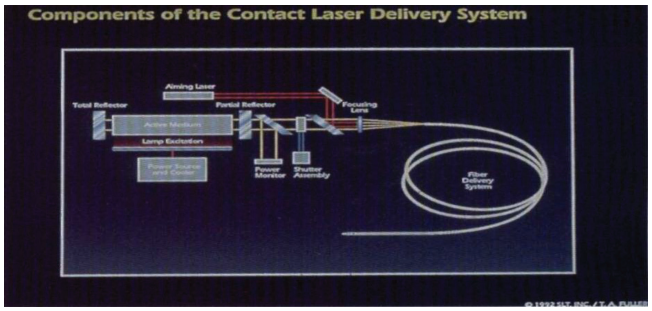

Figure-1: Basic laser components

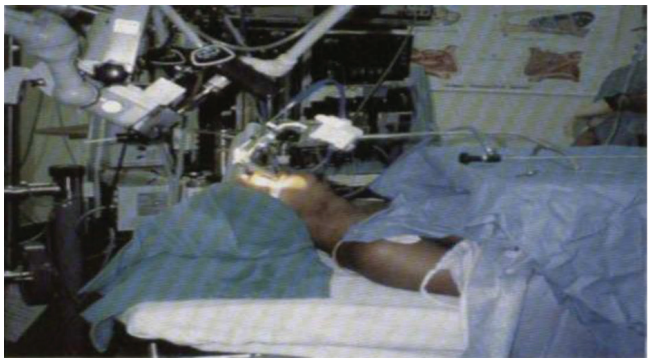

Figure-2: Showing laser treatment with the help of CO, laser tissue excision

NONCONTACT LASERS

Free-beam lasers also known as noncontact lasers. These lasers doesn't interact with surrounding tissue while doing some specific surgery on specific sites but having disadvantage of poor tactile feedback.

USES OF LASERS IN DENTISTRY

Lasers as diagnosing aids

Initially, Laser Doppler flowmetry (LDF) came for microvascular systems. It will have big impact on pulpal diseases diagnosis. LDF uses low-power settings (1-2 mW) of helium-neon (HeNe) or diode (810 nm) light sources. This technique may represent a sensitive and accurate means for pulp vitality testing because it reflects vascular rather than neural responsiveness compared with other method.[5-9]

Phototherapy with Lasers and Dyes

Laser phototherapy with dyes (activated by specific wavelengths of light) may become an attractive adjunctive modality for treatment of superficial malignancies when fluorochromes with high tumor specificity and low systemic toxicity are developed. With this easy and effective, with a potentially high effective cure rate and low morbidity. Most of these treatments can be performed as outpatient procedures thereby reducing the cost of hospitalization.[9-10]

LASER GUM BLEACHING

There are varieties of gums type and defects. The most common cause of darker pigments in the gums is genetics. Excess melanin can build up in the gums, making them look brown or black instead of pink. It is important for the operator to closely monitor the procedure so that an appropriate technique and laser settings are selected to achieve an acceptable balance between optimum ablative efficiency and a minimum degree of carbonization.

Cleaning and Disinfecting- The Root Canal System

Help in the cleaning and shaping of the canal after biomechanical preparation and help in removing smear layer.[11]

GINGIVAL SCULPTING

There is a solid-state semiconductor laser also known as diode lasers that are available in three wavelength 810nm, 940nm, 980nm.The is energy level is absorbed by pigmentation in the so the tissues and makes the diode laser an excellent hemostatic agent. It is used for so the tissue removal in a contact mode. The power output for dental use is generally around 2 to 10 watts. It can be either pulsed or continuous mode. Patient's acceptance of the procedure is always good. Gingival sculpting means reshapes and re-contour the outer surface of the gum tissue for cosmetic purposes when done with laser technology leads to no bleeding as it works on sealing the bloodvessels; restoration can proceed at the same appointment time.

The Carbon Dioxide Laser in Laryngeal Surgery

Coupling (he operating microscope with the C 0 2 laser launched a new era in the field of laryngeal microsurgery. With the development of microsurgical instrumentation and a micromanipulator laser attachment that produces a reduced spot size diameter of 0.25 mm at a 400-mm working distance, the C 0 2 laser combines surgical microprecision with capillary hemostatic capability and has become the instrument of choice for a number of laryngeal pathologies.[12-13]

POWER BLEACHING

Lasers can be very useful as an activation medium of the teeth bleaching process.The whole procedure is faster, the results are excellent and the patient feels comfortable throughout the appointment. It has better designed handpieces for bleaching and wavelength- special bleaching agents. Taking great caution in the different steps of the procedure, selecting the right wavelength and the proper parameters, is essential for the clinician in order to achieve the best results in profit of his/hers patients.

CONCLUSION

As our science is developing rapidly same way our medical problems are getting small. lasers are biggest turn in our health science field which cured many untreatable diseases within fraction of seconds. Our dentistry got benefited by lasers a lot in many treatments. major and minor surgeries are now done by lasers. lasers are bringing smiles on patients face that's what dentistry want.

REFERENCES

1. Le Goff A, Morazin-Dautel A, Guigand M, et al: An evaluation of the CO2 laser for endodontic disinfection, J Endod 1999;25:105-108.
2. Fegan SE, Steiman HR: Comparative evaluation of the antibacterial effects of intracanal Nd:YAG laser

irradiation: an in vitro study, J Endod 1995;21:415-417.
3. Kimura Y, Wilder-Smith P, Matsumoto K: Lasers in endodontics: a review, Int Endod J 2000; 33:173-185.
4. Cohen S, Liewehr F: Diagnostic procedures. In Cohen S, Burns RC, editors: Pathways of the pulp, ed 8, St Louis, 2002, Mosby, pp 3-30.
5. Nammour S, Kowaly K, Powell L, et al: External temperature during KTP-Nd:YAG laser irradiation in root canals: an in vitro study, Lasers Med Sci 2004; 19:27-32.
6. Matsumoto K: Lasers in endodontics, Dent Clin North Am 2000; 44:889-906.
7. Mesaros SV, Trope M: Revascularization of traumatized teeth assessed by laser Doppler flowmetry: case report, Endod Dent Traumatol 1997; 13:24-30.
8. Stabholz A, Zeltzser R, Sela M, et al: The use of lasers in dentistry: principles of operation and clinical applications, Compendium 2003; 24:811-824.
9. Stabholz A: The role of laser technology in modern endodontics. In Ishikawa I, Frame JW, Aoki A, editors: Lasers in dentistry: revolution of dental treatment in the new millennium, Elsevier Science, Int Congr Series 2003;1248:21-27.
10. Cozean C, Arcoria CJ, Pelagalli J, et al: Dentistry for the 21st century? Erbium:YAG laser for teeth, J Am Dent Assoc 1997;128:1080-1087.
11. Ando N, Hoshino E: Predominant obligate anaerobes invading the deep layers of root canal dentine, Int Endod J 1990; 23:20-27.
12. Freche C, Jakobowitz M, Bastian RW. The carbon dioxide laser in laryngeal surgery. Ear Nose Throat J 1988;67:436-445.
13. Crockett DM, Reynolds BN. Laryngeal laser surgery. Otolaryngol Clin North Am 1990;23:49-66.
14. Dostalova T, Jelinkova H, Housova D, et al: Endodontic treatment with application of Er:YAG laser waveguide radiation disinfection, J Clin Laser Med Surg 2002; 20:135-139.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 03-03-2018; **Accepted:** 01-04-2018; **Published:** 14-04-2018