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Review of lasers in dentistry and safety measures.

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Abstract –Characteristics of laser made them appropriate into the field of clinical dentistry to overcome the drawbacks of clinical conventional dental procedures. Since it's introduced in 1960s thereafter its application has increased rapidly in the last couple of decade. This review describes different types of lasers in dental procedures. Lasers have wide applications ranging from cavity preparation, caries removal, restoration removal, etching, and treatment of dental sensitivity, caries prevention and bleaching. Laser safety is matter on concern while opting for any clinical laser procedures. Though it is better tool than conventional methods, Safety norms must followed.

Key Words: Lasers in dentistry, Diode Laser, laser Safety,

1. INTRODUCTION

Laser is proven beneficial and more suitable tool in treating a wide range of dental conditions. It is used therapeutic tool in tissue management. It is more of a standard of care than just some cool new tool. The number of dentists and dental hygienists utilizing laser technology in their private practices has doubled since 2008.Major categories of laser application are as follows.

DECAY Tooth decay can be removed by Laser, Further surrounding enamel is prepared filling.

Gum disease Bacteria can be removed during root canal procedures. It also helps in reshaping gums.

Biopsy or lesion removal. For examination of cancer small piece of tissue has to be removed from mouth (called a biopsy).Laser is promising tool for this purpose. Lesions in the mouth which is pain of canker sores can be removed by laser.

Teeth whitening. Tooth whitening is also used as routine clinical process in which Lasers are used to speed up in-office teeth whitening procedures. In this process a peroxide bleaching solution, applied to the tooth surface, is ''activated" by laser energy, to fasten the process

Review of types of laser

Lasers are classified Based on the active medium

• Gas lasers—Argon, carbon dioxide lasers

• Solid state lasers—Nd:YAG, Er:YAG, Ho: YAG

• Semiconductors—Diode lasers.

1.1 CO2 Laser

Medicine began integrating lasers in the mid 1970's for soft tissue procedures.**[1]** CO2 Lasers have been available in medicine since the early 1970's and have been used in dentistry for more than 25 years. They are a 10,600 nm infrared wavelength, which is highly absorbed by water. Carbon dioxide (CO2) laser was introduced into practice by oral surgeons for removal of oral lesions in the 1980s.[**2,3]**

CO2 lasers are excellent tools for incising tissue for multiple purposes. Incisional and excisional biopsies, frenectomy, gingivectomy, pre prosthetic procedures, and the like are all achieved with excellent hemostasis. Sutures are rarely needed and the controlled thermal effects and sealing of nerve endings often makes for a very comfortable post-operative experience for the patient. This wavelength is also very effective for ablation and vaporization of leukoplakia and dysplasia. **[4]**

1.2 Nd:YAG lasers

Neodymium-yttrium-aluminum-garnet (Nd:YAG) laser, developed in 1987 and approved by the Food and Drug Administration in 1990 was the first laser specifically for dental use [1,4]

Nd:YAG lasers were the first types of true pulsed lasers to be marketed exclusively for dental use in 1990.They are a near infrared wavelength of 1064 nm. This wavelength is absorbed by pigment in the tissue, primarily haemoglobin and melanin.Photothermal interaction predominates and the laser energy here can penetrate deeply into tissues. Contact and non-contact mode are both utilized depending on the procedure being performed.Nd:YAG also have excellent biostimulative properties. Nd:YAG lasers have the unique capacity to stimulate fibrin formation.This effect is maximized when the pulse duration is set at 650 microseconds. Nd:YAG lasers can also be used for multiple soft tissue procedures such as gingivectomy, frenectomy, impression troughing, and biopsy. The deep penetration and the near infrared wavelength of these lasers also make them ideal for photobiomodulation procedure.**[5]** The most commonly used laser by dental hygienists is the diode laser. It is more cost effective than most other lasers on the market. It does the job you need it to do and is user friendly. Thermal effects of diodes, Diode laser is one of laser systems in which photons are produced by electric current with wavelengths of 810, 940 and 980nm. The application of diode laser in soft tissue oral surgery has been evaluated from a safety point of view, for facial pigmentation and vascular lesions and in oral surgery excision; for example frenectomy, epulis fissuratum and fibroma.Advantages of laser treatments are relatively bloodless surgical and post-surgical courses with minimal swelling and scarring.

1.3 Diode lasers

The diode laser can be used as effectively for oral soft tissue surgery. Semiconductor diode lasers are classified depending on semi conducting material as (Gallium arsenide (GaAs), gallium-aluminum-arsenide (GaAlAs). It is new area of research in dentistry being portable compact surgical unit. It gives efficient and reliable benefits. During clinical use it is observed that it offer reduced costs in comparison to other modern hard laser devices and proved as economic and ergonomic consideration **[6]**

1.4 Penetration based Lasers

Lasers used in dentistry are termed as cold lasers and hot lasers.

- Cold laser: that use photobiostimulation to produce an effect without generating heat.
- Hot laser: that use photo thermal reaction, which generate heat in target tissue to produce an effect.

As shown in **Fig.1 l**aser has applications based on penetration. Erbium lasers pulsed technology, shallow penetration, and water absorption produces a minimal thermal effect and minor procedures can sometimes be achieved with no anesthetic at all. The nearly “cold cutting” effect of erbium tissue interaction creates a remarkable post-operative course.

Diode and Nd:YAG lasers exhibit much deeper tissue penetration and thermal effects than the erbium lasers and the potential for tissue damage is greater. Considering all the effects we want our laser to be able to produce, we should realize that laser closest to doing everything is ERBIUM: YAG “the laser for all purpose.”**[7]**

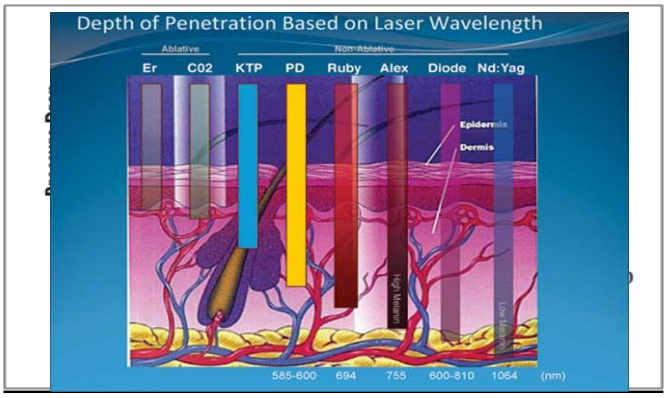

Fig -1: Penetration based Lasers

Each laser has its advantages and disadvantages. According to have the ability to effectively ablate, incise and excise biological tissue

2. HAZARS AND SAFTY

Laser devices should be handled with care and given safety measures. Laser hazards may be listed as optical, non-target oral tissue, skin, chemical, fire etc. The laser divergence and other parameters are specified but in practice some value may vary. Maximum permissible exposure value can be decided depending on wavelength, power output, beam diameter, possible focusing of the beam and the target and non-target tissue of structures.**[8,9**]

While using lasers safety measures and procedural standards must be maintained. Most laser standards focus on the theoretical basis for safety, and include a mathematical approach. Laser users should have a working knowledge of the technical material, including exposure limits, nominal ocular hazard area, optical density levels, maximum permissible exposure, classifications, etc. Therefore, everyone who may work within a laser treatment room, must have that knowledge, including doctors, staff, assistants, students, and observers. Safety is only ensured, when everyone has appropriate training, responsibility, and understanding of what occurs when a laser is applied to a patient. And since not all lasers have the same hazards, this understanding must be specific to the user's equipment and the intended clinical application.**[10]**

3. CONCLUSIONS

This paper reviews various types of lasers along with its strengths and weaknesses. It highlights how conventional methods are replaced by modern tool as laser effectively. It shows revolution in dentistry from co2 laser to now a day's diode laser emerging technology for soft tissues. Along with its use one has to take care of safety and hazard. For this purpose routine audit, troubleshooting, training and wearing safety essentials is required.

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