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Laser Plays an Importance Role in Treatment of Oral Field

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Abstract

Light Amplification by the Stimulated Emission of Radiation, or LASER, is what the phrase refers to. Since Miaman used the laser for the first time in dentistry in 1960, it has been applied to both hard and soft tissues in a variety of ways. There has been a huge increase in laser application research investigations during the past 20 years. While the laser is used on hard tissue, soft tissue applications include wound healing, the removal of hyperplastic tissue to reveal impacted or partially erupted teeth, photodynamic therapy for malignancies, and photo stimulation of herpetic lesions. Hard tissue applications include caries prevention, bleaching, restorative removal and curing, cavity preparation, dentinal hypersensitivity, growth modulation, and diagnostic purposes. The laser was found to be a useful instrument for improving the dental procedure's effectiveness, specificity, simplicity, affordability, and comfort.

Keywords: Light amplification; Radiation; Wound healing; Bleaching; Herpetic lesions

Introduction

Research on the different uses of lasers in dental practise has been on-going since Miaman's introduction of the laser to dentistry in the 1960s. There are two possible outcomes: on the one hand, there are hard lasers like Carbon Dioxide (CO2), neodymium yttrium aluminium garnet, and erbium yttrium aluminium garnet, which offer both hard tissue and soft tissue applications, but have limitations due to high costs and a risk of thermal injury to tooth pulp; on the other hand, in cold or soft lasers, based on semiconductor diode devices. Lasers are appropriate for a wide range of operations in dental practise because to their simplicity, effectiveness, specificity, comfort, and cost advantage over conventional modalities. This review's objective is to highlight both the hard and soft tissue uses in dentistry.

Types of Laser

There are several ways to categorise lasers used in dentistry practise: According to the type of laser being used, such as a gas laser or a solid laser; the type of tissue to which the laser can be applied, such as a hard tissue laser or a soft tissue laser; the range of wavelengths; and, of course, the danger connected with using a laser[1,2].

Carbon dioxide Laser

Because of the CO2 laser wavelength's extremely strong affinity for water, soft tissue is quickly removed and hemostasis is achieved with only a very small depth of penetration. The CO2 laser has the highest absorbance of any laser, but its drawbacks include its relatively large size, high cost, and damaging interactions with hard tissues.

Neodymium Yttrium Aluminium Garnet Laser

The pigmented tissue strongly absorbs the Nd: YAG wavelength, making it an excellent surgical laser for coagulating and cutting oral soft tissues with exceptional hemostasis. In addition to its use in surgery, the Nd: YAG laser has also been studied for its potential in nonsurgical secular debridement and the Laser Assisted New Attachment Procedure for the treatment of periodontal disease (LANAP).

Erbium Laser

There are two unique wavelengths in the erbium "family" of lasers: Yttrium Scandium Gallium Garnet (YSGG) and Yttrium Aluminium Garnet (YAG). The erbium wavelengths have the largest water absorption of any dental laser wavelengths and a strong affinity for hydroxyapatite. As a result, it is the preferred laser for treating dental hard tissues. Erbium lasers can be utilised for soft tissue ablation in addition to hard tissue operations since dental soft tissue contains a lot of water.

Diode Laser

The diode laser's active medium, a solid state semiconductor composed of aluminium, gallium, arsenide, and sporadically indium, generates laser wavelengths that fall between 810 nm and 980 nm. The main absorbers of all diode wavelengths are haemoglobin and melanin, which are found in tissue. In contrast, the hydroxyapatite and water in the enamel have a difficult time absorbing them. Specifically, frenectomies, soft tissue crown lengthening, exposing soft tissue-impacted teeth, removing inflamed and hypertrophic tissue, aesthetic gingival re-contouring, photo stimulation of aphthous and herpetic lesions, and removal of these tissues are all treatments[3,4].

The Way a Laser Works

A single wavelength of light makes up laser light, which is monochromatic in nature. The three main components are an energy source, an active lasing medium, and two or more mirrors that come together to form an optical cavity or resonator. A pumping mechanism, such as an electrical current, an electrical coil, or a flash-lamp strobe device, provides energy to the laser system so that amplification can take place. A spontaneous emission of photons is created when this energy is injected into an active material housed inside an optical resonator. After the photons bounce off the highly reflecting surfaces of the optical resonator and through the medium a second time before leaving the cavity via the output coupler, amplification via stimulated emission occurs. A fibrotic cable, hollow waveguide, articulated arm, or another

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device is used in dental lasers to transport laser light from the laser to the target tissue. The system is finished off by cooling mechanisms, additional controls, and focusing lenses. The active medium, which can be a gas, a crystal, or a solid-state semiconductor, determines the wavelength and other characteristics of the laser primarily by its composition[5,6].

Four potential interactions between the laser-produced light energy and a target tissue are possible: reflection, transmission, scattering, and absorption. Depending on the amount of water in the tissues, when a laser is absorbed, it raises the temperature and creates photochemical effects. Ablation is the process of vaporising the tissue's water when a temperature of 100°C is attained. Proteins start to denature at temperatures over 60°C, but below 100°C, without the underlying tissue vaporising. In contrast, at temperatures exceeding 200°C, the tissue gets dried up before burning, which causes a negative side effect known as carbonization[7,8].

Chromophores, or light absorbers, are necessary for absorption because they have a special affinity for particular light wavelengths. Melanin, haemoglobin, and water are the main chromophores in the intraoral soft tissue. Water and hydroxyapatite are the main chromophores in the dental hard tissues. With regard to these fundamental tissue components, different laser wavelengths have varied absorption coefficients, which make the laser selection process dependant. Following are some categories under which lasers are used in dentistry, depending on the tissues they are applied to: application to both soft and hard tissues [9,10].

Applications of laser in oral field

All forms of minor surgery benefit greatly from lasers, but their expense and difficulty in managing side effects are significant barriers. The use of lasers in soft tissue surgery has a variety of benefits over scalpels and electro surgery.

Therefore, it needs to be underlined above all else those lasers are an alternative to traditional surgical techniques. In oral and maxillofacial surgery, CO2 and diode lasers are now the standard cutting lasers. The Nd-YAG laser was frequently utilised in surgery for homeostasis. Numerous studies have shown that benign, premalignant, or malignant tumours of the oral soft tissues can be removed with a diode laser. It is a precise method of removing the affected tissue with little discomfort to the patient, but it is no more effective than a scalpel at curing certain disorders. Clinical findings obtained by numerous authors suggest extensive recovery. The surgical care of malignant illnesses of the oral cavity and adjacent structures benefits greatly from many of the inherent qualities of lasers employed for soft tissue surgery. It is advantageous for the surgeon to be able to perform more precise surgery in a bloodless field thanks to the laser's ability to perform haemostatic surgery by sealing blood vessels with a smaller diameter than the laser beam. Additionally, by sealing the vessels, the risk of malignant cells being seeded during surgery may be reduced. Similar to this, it is favourable for reducing swelling and edoema after surgery for the laser to be able to seal the lymphatics at the time of surgery [11-13]. As a result, there may be less need for postoperative steroid administration and less need for tracheostomy surgery to treat face edoema. The risk of introducing cancerous cells into the lymphatics during surgery may be reduced if the lymphatics are sealed. Additionally, reducing postoperative discomfort is facilitated by the capacity to block nerve terminals. The observed low infection rate following laser surgery is most likely due to the laser's capacity to leave a clean, dry, sealed wound. The requirement for therapeutic and preventative antibiotics is reduced, which is useful in the management of malignant disorders[14]. According to wound contractors, formal reconstruction using primary closure, skin grafting, or local flap procedures is not necessary because wounds can be allowed to heal by secondary intention, producing a good functional result with minimal scarring and lack of movement. This indicates that laser wounds heal with low levels of discomfort and relatively little scarring. Additionally, the laser now makes it possible to do various procedures that were previously only done in hospitals on an outpatient basis. Other established applications for lasers in dental soft tissue surgery include: Examples include frenectomies, incisional and excisional biopsies, and soft tissue tubrosity reduction, soft tissue crown lengthening, vestibuloplasty, stage 2 implant recovery, etc. The use of lasers in oral and maxillofacial surgery is potentially widespread because they may effectively treat numerous lesions that develop on the surface of the mouth mucosa. The use of lasers and endoscopes in facial rejuvenation techniques has utterly transformed the field of cosmetic surgery. These innovative technologies have been included into traditional surgical procedures like brow raising, blepharoplosty, and rhytidectomy such that the patient experiences less postoperative pain and recovers more quickly while still achieving the desired cosmetic outcomes.

Conclusion

After decades of research up to the present, laser technology for hard tissue application and soft tissue surgery is at a high state of refinement, and more advancements are possible. Additional uses for laser-based photochemical processes are quite promising, especially for focusing on certain cells, pathogens, or chemicals. The use of both diagnostic and therapeutic laser treatments is anticipated to rise further in the future. In the coming ten years, it is anticipated that particular laser technologies will become indispensable parts of modern dental practise.

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Conflict of Interest

The author has no conflict of interest.

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