Lasor Vaporization of mouth lesions

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Abstract- The term laser is an acronym for "Light Amplification by the stimulated Emission of Radiation".As it's first Application in dentistry by Miaman in 1960 the laser has been various hard and soft tissue applications. Use of laser proved to be an effective tool to increase efficiency, specificity , ease ,cost and comfort of the dental treatment.
We aimed to give a brief review of the application on hard and soft tissues of oral cavity.
Application of laser vaporization in soft tissue includes wound healing , photodynamic therapy, photostimulation. In hard tissue laser vaporization is used in caries prevention and bleaching.

Key Words- Dental Application, Lasers, photostimulation, photodynamic therapy, CO2 Lasers, recurrence, malignant transformation

INTRODUCTION:

Introduction of laser in dentistry , in the 1960s by Miaman , lead to a continuous research in the various applications of lasers in dental practice.(1) Laser vaporization offers a precise means of treating mouth lesions that reduces the potential for pain and scarring. Oral lesions treated with laser surgery include aphthous ulcers, lymphangiomas, haemangiomas, and verrucous carcinomas.(2)
A laser consists, in essence, of a medium (solid, liquid, or gas) that, when excited with a source of energy, releases particles in the free state. These are then reexcited and exponentially increase in intensity, emitting the excess energy .(2)
Laser vaporization used in Oral potentially malignant disorders (OMPDs) are lesions of the oral mucosa that are predisposed to malignant transformation. The main treatment of OMPDs treatment around the world is now the carbon dioxide (CO2) laser but the reported recurrence and malignant transformation rates very high.
There are 2 types ie Hard and Soft tissue lasers , on the one hand there are hard lasers ,such as Carbon dioxide, Neodymium Yttrium Aluminium ,Garnet (Nd: YAG) ,and Er : YAG , which offers both hard tissue and soft tissue applications, but have limitations due to high cost and potential for thermal injury to tooth pulp.(3,4)
Common lasers used in oral surgery are CO2 Er Family, Diode and Nd:YAG. Also low level lasers are used in assisting the procedures of disinfection and healing.
CO2 was the first laser introduced to dental practitioner s in the mid 1980s because of its outstanding cutting abilities and after more than 25 years it still remains the desirable choice in facial coetic surgeries.(4)
Diode lasers (810 to 1064 nm) has become very popular in general Dentistry because of their small size , low cost ,Fibre optic delivery and ease of use for minor surgery of oral soft tissue. Diode lasers are used for non invasive athermal laser therapy is popular in European Countries.(4)
Laser dentistry is very good for kids who are afraid and anxious about Dental treatments. It's Advancement in dentistry and medicine play a vital role in patients well being and care.
Laser Vaporization give a brief review of the application of lasers on hard and soft tissues of oral cavity.

HISTORY OF LASER VAPORIZATION OF MOUTH LESIONS :

In 1917 Albert Einstein laid the foundation for invention of laser and predecessor, the 'Maser,' by therising that photoelectric amplification could emit a single frequency, or stimulated emission. Lasers first Application in dentistry by Miaman in 1960 the laser has various hard and soft tissue applications . In 1962, the argon laser was developed, whereas the Ruby laser become the first medical laser to coagulate retinal lesions, when it was used in 1963.(5.6)

METHODOLOGY :

The literature was searched online on the topic of Laser Vaporization of mouth lesions. The literature published only in the English language has been selected in this review, Keywords used are Dental Application, lasers, CO2 Lasers, recurrence, malignant transformation. A complete literature search was conducted utilizing electronic databases such as Google scholar,IOSR journal of dental and medical sciences, National Library of medicine, National Institute of health Sciences, PUBMED, Medscape on this topic.

MECHANISM OF ACTION OF LASER VAPORIZATION OF MOUTH LESIONS :

All lasers work by delivering energy in the form of light. When used for surgical and dental procedures, the laser acts as a cutting instrument or a vaporizer of tissue that it comes in contact with.(7)
It consists of three principal parts: An energy source, an active lasing medium, and two or more mirrors that form an optical cavity or resonator. For amplification to occur, energy is supplied to the laser system by a pumping mechanism, such as, a flash-lamp strobe device, an electrical current, or an electrical coil. This energy is pumped into an active medium contained within an optical resonator, producing a spontaneous emission of photons. (8)

APPLICATION:

Laser light interacts with tissue to cause thermal, chemical, or mechanical effects.

- The thermal effects of laser cutting, coagulation, and vaporization are made use of in the majority of laser applications at settings of 25 to 100 watts.Coagulation depend on wavelength of laser used and has a clinical usage on sealing blood vessels at wound margins.Vaporization is where the water inside the cells evaporates , with vacule formation , cratering and tissue shrinkage.(9)
- The chemical uses of laser are seen in photodynamic therapy in which a photosensitizer drug concentrates in neoplastic tissue and is then activated with laser light to release free oxygen radicals that destroy the abnormal tissue. Photodynamic therapy, or phototherapy, can be administered topically or parenterally.It is used in photodynamic therapy, where a photosensitiser is injected into the body and activated after laser irradication. (9?
- The mechanical effects of laser are utilized in the removal of tattoos and in lithotripsy procedures (eg, the removal of salivary stones).Laser drilling can be done on delicate or heat sensitive material, including tooth enamel.(9)

HARD TISSUE LESIONS

Cavity Preparation , Caries And Restorative Removal - The use of Er: YAG, since 1988, for removing caries in the enamel and dentine by ablation, without the detrimental effect of rise in temperature on the pulp, even without water-cooling, with low '*fluences*' laser (LLLT).The Er: YAG laser is capable of removing cement, composite resin, and glass ionomer. **(9)**

Etching - Laser etching has been evaluated as an alternative to acid etching of enamel and dentine. Enamel and dentine surfaces etched with (Er, Cr: YSGG) lasers show micro-irregularities and no smear layer.(10)

Dentinal Hypersensitivity - Desensitizing of hypersensitive dentine with an Er: YAG laser is effective, and maintenance of a positive result is more prolonged than with other agents.(10)

SOFT TISSUE LESIONS

Apthous Ulcer - It has been demonstrated that photostimulation of aphthous ulcers with low levels of laser energy (HeNe) can provide pain relief and accelerate healing.(11,12,13)

Diode laser with the chosen parameters had better effects on pain relief and no distinct advantage on wound healing comparing with medication. (14)

Malignancy - laser therapy , which act in the treatment of malignancies of the oral mucosa, particularly multi-focal squamous cell carcinoma, generates reactive oxygen species, which in turn, directly damages the cells and the associated blood vascular network, triggering both necrosis and apoptosis; this activates the host immune response, and promotes anti-tumor immunity through the activation of macrophages and T lymphocytes. (15)

Lichen Planus- Diode laser therapy seemed to be an effective alternative treatment for relieving the symptoms of OLP. Low level laser therapy showed better result than CO laser therapy as and alternative therapy.(14)

Leukoplakia – CO laser caused only minimal pain and swelling so it may be alternative method to conventional surgery in treating patients with oral leukoplakia. Photodynamic therapy with 5-aminolevulinic acid and pulsed dye laser could be used to achieve regression of oral leukoplakia. (17)

Mucocele - Laser management is preferable over the conventional surgical procedure as it provides good hemostasis, reduced postoperative swelling, reduction in bacterial population at the surgical site, lesser need for suturing, faster healing, and less postoperative pain. (18)

Hemangioma - It has been proven that Nd:YAG laser therapy can be effective in the treatment of superficial venous malformations, but in deeper lesions because of photon energy absorption in skin and mucosa, low level laser therapy in many sessions may be beneficial in the shrinkage of hemangioma.(19)

HARD TISSUE LESIONS

INDICATION:

- Laser is used in incisional and excisinal biopsies by providing haemostatis during surgery.(18)
- Laser therapy is used in debulking of tumors by causing less damage to normal tissues.(18)
- Laser therapy helps in dissection and coagulation of ablated tissue
- Laser assisted frenectomies of the lip, tongue, or cheek is much more comfortable to the patient as no scalpel or stitches are required.(19)
- In Salivary gland diseases like lithotripsy, intraglandular abscess, transient sialadenitis
- Soft palate surgery that is laser-assisted uvulopalatoplasty [LAUP], tongue-base reduction [sleep surgery].(20)

COMPLICATIONS:

- Laser plume is produced while doing the procedure. - Laser vaporization of tissue understandably produces smoke, leading to environmental contamination, with CO lasers producing the maximum amount of smoke and neodymium:yttrium-aluminum-garnet (Nd:YAG) lasers producing much less. This smoke, or plume, has the typical odor of charred tissue that is bound to cause a degree of revulsion to anyone or everyone in the operating room and may even lead to somatic manifestations such as headache, nausea and lacrimation.(20)
- Perforation of blood vessel is sometime caused during laser therapy. - The high-energy concentration of a laser beam may lead to perforation of viscus or blood vessels. Large vessels (greater than 5 mm) cannot be coagulated with a laser, so conventional ligation has to be done. Potentially fatal complications such as pneumothorax have occurred, and strict vigilance is required in the intraoperative, perioperative, and postoperative stages.
- Laser surgery can cause air embolism due to co- axial clearing / cooling gas flow. (21) -The gas coolant used with lasers has been reported to have caused lethal embolism into the venous circulation, especially with the Nd:YAG laser (although it has also happened, very rarely, with the CO laser). Saline as a coolant is advised when using a laser in body cavities, but this has the other undesirable effect of causing a fluid overload.

CONCLUSION:

Laser technology for hard tissue application and soft tissue surgery is at a high state of refinement. The field of laser-based photochemical reactions holds great promise for additional applications, particularly for targeting specific cells, pathogens, or molecules. A further area of future growth is expected to be a combination of diagnostic and therapeutic laser techniques.

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