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Healing With Low Level Laser Therapy: A Review

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Abstract:
In the medical and dental fields, lasers have a wide variety of applications. Both soft tissue and hard tissue are treated with LLLT. Low doses of LLLT promote the proliferation of fibroblasts, resulting in the higher tensile strengths of tissue needed for proper wound healing.,Various biological mechanisms are involved, including reduced levels of prostaglandin, tumour necrosis factor, interleukin-1, and COX-2 expression, which reduce edoema and post-trauma hemorrhagic formation, improved microcirculation, and a reduction in edoema and post-trauma hemorrhagic
Keywords- Bio-Stimulatory, LLLT, Dentistry.

Introduction:

Today in this modern era, almost everyone has used laser in some form or the other. Laser has been used in various common electronic instruments like CD player or laser pointer. From last several years, due to recent researches and experiments, laser technology has markedly improved. [1]The acronym 'LASER' stands for 'Light Amplification by Stimulation Emission of Radiation.' Earlier Laser was used in different type of surgeries like ENT, Gynecological surgeries, for treatment of tattoo and was also used in plastic and cosmetic surgeries.

Now days various dental diseases like dental caries, gingivitis, periodontal disease, pulp therapy, minor surgical procedures like operculcectomy, biopsy, surgical exposure of teeth for orthodontic treatment, frenectomy etc. have been managed using conventional methods. [2] All these procedures require use of Local Anaesthesia with needle, use of rotary instruments which produces sounds (noise), vibration causing more time consuming and may require multiple sittings and leads to patient inconvience.

In Infants and children their anxiety, fear, and uncooperative behaviour make these procedures tedious for pediatric dentist. Above all these drawbacks, Laser has overcome majority of these issues by eliminating need of high speed drill, preventing haemorrhage due to sealing of blood vessels, providing excellent visibility and reducing operating time. Low-level lasers are a form of laser that is less well-known. Relatively small, low-cost lasers in the milliwatt range, ranging from 1-500 milliwatts, are common. "Low Level Laser Therapy" (LLLT) or simply "laser therapy" and "therapeutic lasers" are terms used to describe these lasers.These lasers have been named "soft laser" and "low intensity level laser," while the treatment has been labelled "biostimulation" and "biostimulation therapy".[3] The mechanism of LLLT involves

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biostimulation and photodynamics therapy. LLLT uses small energies over large surface area causing increase in cellular activity by photochemical and photobiological action.
In photodynamic therapy (PDT) produces singlet oxygen which is highly reactive free radical causing tissue necrosis by injecting intravenously dihematoporphyrin ether(DHE).[4] Lasers have been used widely in medicine and dentistry since its development by Maiman in 1960. The use of LLLT has been shown to have a beneficial effect on pain relief, [5] wounds[6] and nerve injury.[7] Endre Mester, a pioneer of the biostimulatory effect of low-level laser in Budapest in the late 1960s, demonstrated an improvement in collagen synthesis in skin wounds.

Mechanism of Action:
The mechanisms of LLLT are complex, but essentially rely upon the absorption of particular visible red and near infrared wavelengths in photoreceptors within electron transport (respiratory) chain within the membranes of mitochondria.[8] The activation of adenosine triphosphate (ATP), which is the key energy source for the stimulation of normal cell function, occurs when LLLT is absorbed by mitochondria. Biological effects of LLLT is caused due to the deposition of low energy into tissues which results in the analgesic and anti-inflammatory effects as well as shows improvement in healing.
Increased stimulation and optimum dose result in the best effect; however, increasing the dose further decreases the effect. Since LLLT triggers the release of endorphin, which reduces nociceptive signals and regulates pain mediators in the nerves, it can be used as an analgesic. LLLT activates lymphocytes, macrophages, and mast cells, as well as increasing ATP output in mitochondria and cell proliferation, both of which are anti-inflammatory agents.[9]
By changing the hydrostatic pressure of the capillary, LLLT has an effect on the microcirculation, which reduces oedema. The ideal dose of LLLT facilitates the development of new endothelium and blood vessels, which assist in the formation of granulation tissue and speed up the healing process. Patients with artificial pace makers as prolonged contact with electromagnetic, laser can affect the working of the pacemaker. Presences of malignant disease as well as precancerous lesions because LLLT stimulates cell growth.
Lasers should not be used during pregnancy, menstruation, or febrile conditions. Therapeutic lasers with a power of less than 500 mW are considered low-risk devices, but both the patient and the clinician must wear protective glasses.

Application of LLLT:
Aphthous Ulcer-
Recurrent Aphthous ulcer found to be successful treated with LLLT causing painless treatment. LLLT causes faster healing, pain relief, reduction in erythema, ulcer size reduction without any side effect. LLLT also reduces recurrence rate of Aphthous ulcer.[10]

Oral Lichen Planus:
LLLT found to be effective in reduction of lesion size and cause significant reduction in pain without any side effects.[11]

Oral leukoplakia:
Leukoplakia ablation found to be effective by using LLLT. Low level laser therapy causes faster wound healing, faster blood clotting, reduction in pain.

Herpes Simplex:
Herpes simplex found to be most commonly seen during dental treatment. If visited at very early stage of occurance , LLLT found to be very effective in treating the lesion, promotes pain relief , remission of blister and even the recurrence of lesion also get reduced without any side effect when compared with anti- viral drugs.[12]

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Mucositis:
Mucositis found mainly after chemotherapy and radiotherapy. Patient suffer from severe pain due to mucositis which causes poor quality of life leading to poor nutrition intake. LLLT found to be effective in reducing pain due to mucositis.[13] TMD- pain due to TMD is very severe, people suffer from extreme pain, difficulty in mouth opening. Pain may be either due to arthritis or myogenic cause. LLLT found to be very effective in treating such condition.[14]

Zoster:
Herpes zoster along trigeminal nerve should be treated at its earliest as it causes extreme pain. If not treated persist for many years. LLLT found to be effective in treating zoster without any side- effects.[15]

Paresthesia:
Paresthesia is common complication occurs after the surgical extraction of third molars. Inferior alveolar nerve gets damaged, GaAlAs diode laser of wavelength 820-830 nm for 90 s in 20 applications found to be effective.[16]

Xerostomia:
Stimulating both parotid gland and submandibular glang using infrared laser with wavelength 904 nm found to be effective in stimulating salivary secretions.[17]

Periodontitis:
Periodontitis cause of loss of tooth. LLLT (670 nm) together with conventional periodontal treatment found to be effective in healing as well as collagen formation., homogenization in gingival lamina propria based on histopathology reports.[18]

Dentinal Hypersensitivity:
Repeated use of desensitizing toothpastes, subjects gets only temporary relief from dentinal hypersensitivity. Composites curing can be an alternative treatment. It has been found that treating dentinal hypersensitivity with LLLT is very effective.[19]

Orthodontic treatment:
Due to tooth movement during orthodontic treatment patient suffers from extreme pain. LLLT found to be effective in pain reduction.
According to the mechanism of LLLT reduces pro-inflammatory molecule prostaglandin E2 and interleukin-1 from fibroblast cells that reduced pain after.[20]

Implant:
Failure or success of bone implant mainly depends upon osseointegration, In one of the study it was found that LLLT might have a favourable effect on healing and attachment of titanium implants with the alveolar bone.[21]

Laser Safety Measures-
Before using any system or instrument, it is important to consider its safety. When evaluating a product like a dental laser for patient use, we must consider its protection as well as its efficiency and efficacy.
LLLT can case ocular injury and tissue damage. Proper safety measures like using protective eyewear for both operator and patient can be helpful in avoiding such damages. Adequate use of LLLT with proper dosage and wavelength with specific time at particular site help to prevent tissue damage.

Conclusion-
LLLT is an adjuvant treatment modalities used in dentistry for both soft tissue and hard tissue. LLLT promotes faster healing, pain reduction which mainly depends on walenghth, duration of laser application

and dosage to be applied at certain site.

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