Low Level Lasers for the Dental Hygienist

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Disclosure:

I have no financial interests regarding any low level laser companies.

I have received a Low Level Laser from Thor Laser company to assist in Laser education.
What are Low Level Lasers (LLLT)?
• Low Level Lasers
• Biostimulation
• Therapeutic lasers
• Cold lasers
As dentistry continues to advance with technology as it always has, there is one tool in particular that has rapidly become the universal standard of care for initial to advanced periodontal therapy procedures.

This is due to the fact that lasers in the hands of trained and skilled clinicians who utilize lasers in their daily routine. This will undoubtedly allow for the best care possible for our patients.
LLLT (Low Level Laser Therapy) is the application of red and near infra-red light over injuries or lesions to improve wound and soft tissue healing, reduce inflammation and give relief for both acute and chronic pain. First developed in 1967, it is now commonly referred to as LLLT.

The red and near infrared light (600nm-1000nm) commonly used in LLLT can be produced by laser or high intensity LEDs. The intensity of LLLT lasers and LED's is not high like a surgical laser. There is no heating effect.
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Low Level Lasers, 630nm-900nm
Light augments the metabolic rate of cells with compromised metabolism, but normal cells are not affected.

- Stimulates blood flow, macrophages, fibroblasts, etc.
- Reduces pain receptors
- Used post surgery, hypersensitivity and TMD
Low-level laser (light) therapy, biostimulation or photobiomodulation has been known for almost 50 years since shortly after the discovery of lasers in 1960. For many years it was thought that there was something special about laser light, but it is now known that many wavelengths of visible light (especially in the red or near-infrared regions) produced from LEDs or other light sources are equally effective. Longer red and near-infrared wavelengths are much better at penetrating tissue than shorter blue/ green wavelengths and are therefore preferred clinically.
Dosage and Mechanisms of Laser Light
The effects of LLLT are photochemical (like photosynthesis in plants) When the correct intensity and treatment times are used, red and near infrared light reduces oxidative stress and increases ATP.

This improves cell metabolism and reduce inflammation. These effects can be enhanced with pulses however when analgesia is required there is a second mechanism which works best when a strong continuous beam is applied.
It is difficult to find the ideal dosage for the lasers. The tissue dosage is made is fluence or energy density, allowing it to be measured in joules per square centimeter.

Increase of adenosine triphosphate (ATP)
- Fuel of the cells
- Produced in the mitochondria of the cells
- ATP is the end product of the Krebs cycle
- Photon acceptor enzyme cytochrome-c oxidase is inhibited by nitric acid.
Numerous studies have shown that PBM affects the mitochondria of the cell, primarily cytochrome-c oxidase in the electron chain and porphyrins on the cell membrane. Mitochondria, Cellular power plant where food molecules are converted into energy in form of ATP via oxidative phosphorylation. This site for initial effects of light, leads to Increased ATP(adenosine triphosphate, the fuel that powers the cells) production.
Modulation of Reactive Oxygen Species (ROS), by reducing oxidative stress, as well as the induction of transcription factors.

When cells are stressed, Nitric Oxide (NO) inhibits oxygen consumption by mitochondrial cytochrome c oxidase. This reduces production of ATP and causes oxidative stress leading to increased inflammation and reduced production of ATP. Low Level Laser Therapy displaces Nitric Oxide from cytochrome c oxidase and reduces inflammation and restores ATP production, helping tissues heal faster.
Currently, the way clinicians deal with acute and chronic pain is to prescribe pain medication and analgesics, these also come with several side effects.

Healing is accelerated by stimulation of fibroblasts and osteoblasts. The analgesic effect is the opposite mechanism.

High power density lasers inhibit ATP production (rather that stimulate). This effect leads to a local nerve block (analgesia).
Stimulation/Inhibition
Keep in mind that too small of a stimulus doesn’t trigger any effect. Increasing the dose means that the stimulation is gradually reduced and at high doses, any stimulation can be inhibited. Depending on what your desired outcome is, will help you determine your correct settings.

Ex. If you have a patient that has pain management as goal, you want to be able to inhibit as opposed to stimulation.

Ex. If we have a wound in need of healing, then we would want stimulation of the cells to aid in healing, but if pain was associated with it, we would also want to create inhibition too.
LLLT is used to: increase the speed, quality and tensile strength of tissue repair; resolve inflammation and relieve pain (analgesia).

LLLT is popularly used for soft tissue injuries, joint conditions, neuropathic pain, non-healing leg and pressure ulcers.

The three benefits of LLLT are it improves wound tissue regeneration, reduces inflammation and has an analgesic effect.
Treatment Protocols
Low level laser therapy are cumulative, so that the dose given one day will have outlasting results on day 2, allowing long term effects of inhibition.

As with all patients, dosages will depend on pain tolerances, reaction to medications and individualized care.
Contraindications and Side Effects
The worst result with LLLT is that nothing happens. There are normally no adverse effects from LLLT, however, patients occasionally experience mild discomfort / ache after treatment. This is due to a restimulation of the inflammatory phase and should settle down after 24 - 48 hours. Because LLLT stimulates cell growth, we have to be aware of the presence of malignancies. In our dental world we also have to be careful that we don’t irradiate the thyroid gland.
Laser Safety
Lasers that are therapeutic lasers are less than 500mW and are classified as low risk devices by the U.S. Food and Drug Administration (FDA).

Another very important aspect, will be to always make sure laser safety eyewear is utilized for everyone within the laser nominal hazard zone. Class 3B or Class 4 lasers could potentially damage the eyes. Always remember to wear the correct laser safety glasses never direct the beam into the eyes of others.
There are precautions that should be taken into consideration with LLLT, they include, thyroid gland, pregnant women and radiation therapy patients. Steroids will also make laser therapy ineffective.

To be sure, always check with your laser manufacturer for the most up to date information. The significance for patients and healthcare services is huge. LLLT is proving to be more effective than current drug therapies without the high costs and with no side effects.
Uses of Low Level Lasers
• Biostimulation
• Hygiene
• Acupuncture
• Anesthesia
• Aphthous Ulcers / Herpetic Lesions
• Endodontics
• Extractions
• Implants
• Inflammation

• Orthodontics
• Pain
• Periodontics
• Bone Regeneration
• Hypersensitivity
• Sinusitis
• Temporomandibular Disorders
• Wound Healing
There is also strong evidence that the future of LLLT lasers will have effects in Stroke patients, as well as those who suffer from Depression, PTSD, Traumatic Brain injury and Nerve regeneration.
There are many treatment modalities that PBM can be beneficial for, they include but are not limited to, post extraction, dry socket, oral mucositis, soft tissue lesions and dental infections.

Other applications that can be utilized in the dental world are, nausea, gagging, uptake and elimination of anesthetic, implant placement, orthodontics, periodontics, endodontics, TMJ and facial pain.
• Recordkeeping
• Laser Maintenance
• Laser Safety Officer
• Continuing Education
• Adverse Reporting Mechanisms
• Informed Consent
Current Research
Even though Low Level Laser therapy (LLLT) BioStimulation and Photobiomodulation have been around for many years, it has just in the last few years that there have been enough studies that have been published to document their effectiveness.
Current articles are indicating that LLLT will be used in can also be effective if delivered to normal cells or tissue before the actual insult or trauma, in a pre-conditioning mode. Muscles are protected, nerves feel less pain, and LLLT can protect against a subsequent heart attack.

These examples point the way to wider use of LLLT as a pre-conditioning modality to prevent pain and increase healing after surgical/medical procedures and possibly to increase athletic performance.
Another exciting result suggest that pre-conditioning with LED prior to UV exposure provided significant protection against UV-B induced erythema.

The study was completed by exposing people to LLLT prior to being out in the sun, a portion of the upper thigh was exposed to LLLT and then UV-B (Barolet and Boucher, 2008).
LLLT has many advantages in that it is painless, inexpensive if LEDs are employed, and free of potential side effects, making it a “no-brainer” before surgery or potentially hazardous adventures.

Moreover, the multiple demonstrations of LLLT effectiveness for preconditioning of muscles before exercise, suggests that it will soon be taken up by the general public, and may in fact have to be regulated by the athletic authorities as a concern that could be called “light-doping”.

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The biological effects promoted by these therapeutic resources are similar and are related to the decrease in inflammatory cells, increased fibroblast proliferation, angiogenesis stimulation, formation of granulation tissue and increased collagen synthesis.
Conclusion:

Always get your information from organizations that the primary objective and responsibilities are to educate or advise clinicians on the laws of physics or how to provide quality health care.

The proper place to gain this kind of information is to look for scientific literature and academic environments. These groups are providing noncommercial and unbiased material to allow you the opportunity to gain knowledge regarding this type of technology.
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Thank You