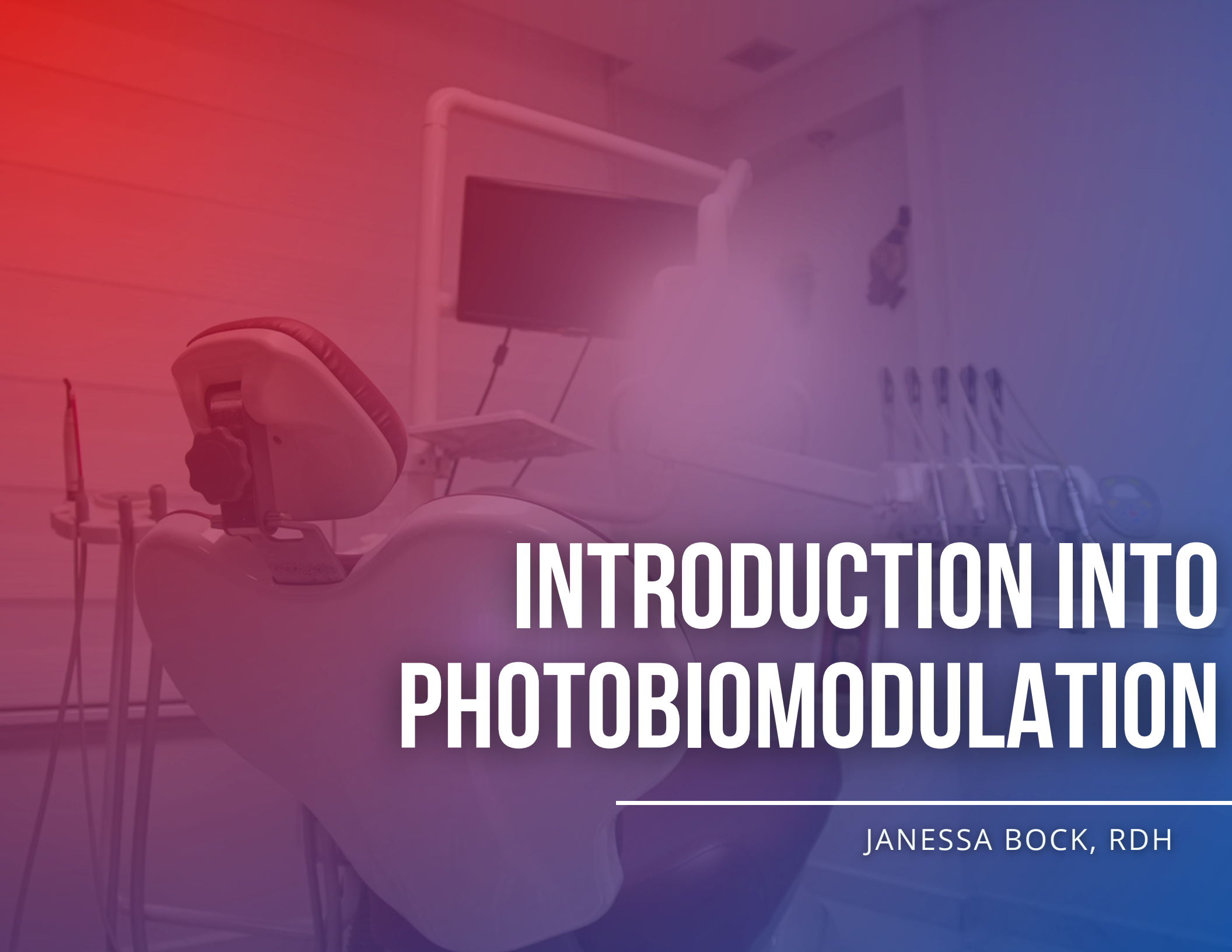


INTRODUCTION INTO PHOTOBIOMODULATION

JANESSA BOCK, RDH

TABLE OF CONTENTS

BE THE CHANGE IN DENTISTRY AND START USING PBMT

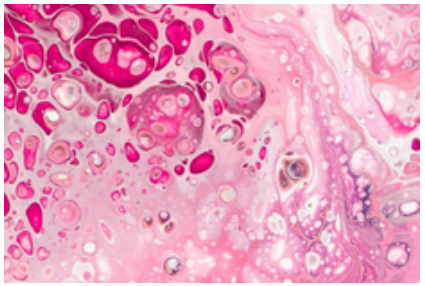
BREAKING DOWN PHOTO BIOMODULATION

WHAT IS PHOTOBIOMODULATION?

Photobiomodulation is utlization of non-ionizing electromagnetic energy to trigger photochemical changes within cellular structures that are receptive to photons

1966 Dr. Endre Mester was one of the first people to use photobiomodulation. It was used in a study regards to lasers causing cancer. Study found it to aid in healing and stimulating hair growth back on the rats and did not stimulate the cancer cells

Light at a wavelength in the red to infrared range of the spectrum (660 to 905 nm) is generally employed because such wavelengths can penetrate the skin and deeper tissues, resulting in a reduction in inflammation, pain relief, and accelerated regeneration of tissues, or act as an acupuncture needle (Cotler, Chow and Hamblin).



You are energizing the cells that can heal the body, treat medical conditions, and support general wellness

OTHER NAMES FOR PHOTOBIOMODULATION

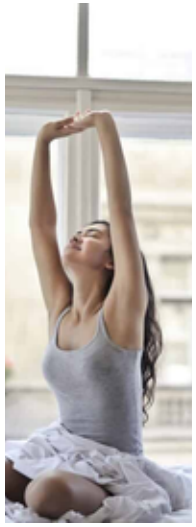
- **Red Light Therapy**
- **Low Level Laser Therapy**
- **Cold Laser Therapy**

In 2015 thanks to the efforts of Dr. Praveen Arany, PBMT and PBM was added to the National Library of Medicine MeSH database as an entry term to the existing record of laser therapy, low-level. (Anders)

WHY IMPLEMENT PHOTOBIOMODULATION THERAPY?

- Easy, simple, shorter chair time that is technique sensitive but greatly accepted by patients.
- With PBMT you have reduced pain intensity, stimulating healing, better coagulation and most of the time do not need sutures
- PBMT can also be used for failed standard treatments or as an adjunct to traditional treatment

THE IMPACT OF SLEEP-WAKE CYCLES



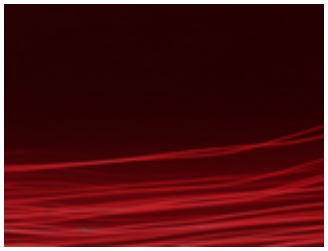
Circadian rhythms are biological processes that occur on a roughly 24- hour cycle. These rhythms are regulated by an internal clock that responds to external cues, such as light and temperature.

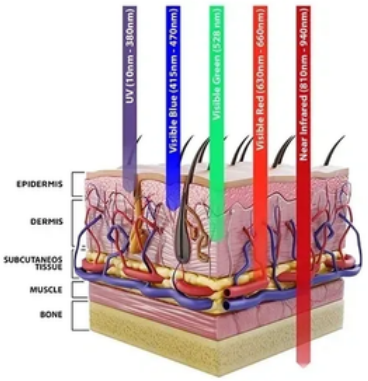
To maintain healthy circadian rhythms, it is important to have regular sleep- wake cycles and exposure to natural light during the day.

Absorption of certain vitamins

PBMT is using a *Light Amplification and stimulated* Emission Radiation (LASER) to address the focus areas on our patients

https://nigms.nih.gov/





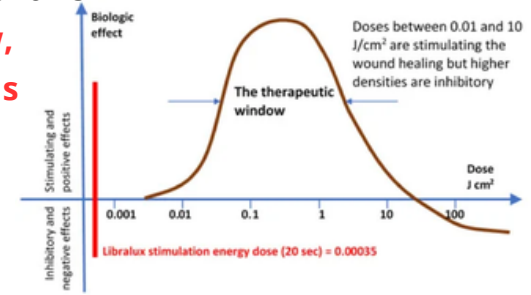
Diode lasers can differ in wavelength, power, and time

Diode lasers can differ in wavelength, power, and time

photobiomodulationstudio.uk

BREAKING DOWN PHOTOTHERMAL EFFECT WITH PBM

Photobiomodulation follows **the Arndt Schultz law, which is referred to as the Biphasic Dose Response.** Low doses create a different response within the tissue then higher doses.

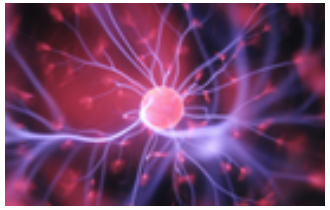


(Huang, Chen and Carroll)

Low doses create a different response within the tissue then higher doses.

PRIMARY PHASE

Release of reactive oxygen species (ROS) and conformational change in biomolecular structure.

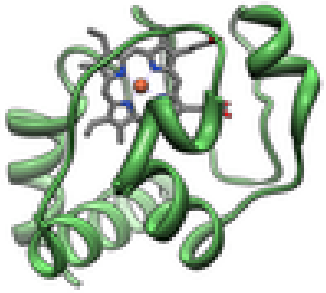


Indirect events that happen PBM dissociated ROS

- Modulates antioxidants
- Gene Expression
- Inactivates phosphates
- Activates NF-KB signaling pathway
- Activates TGF-B1

Indirect events with PBM dissociated CCO (Cytochrome C oxidase)

- **Increases ATP production**
- Synthesis of DNA,RNA, proteins, enzymes
- Repair and regeneration of cells, tissues
- Dissociation of NO from Fe/Cu redox centers
- NO promotes keratinocyte proliferation
- Vasodilation
- Wound healing

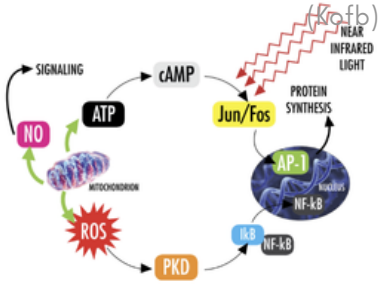


SECONDARY PHASE

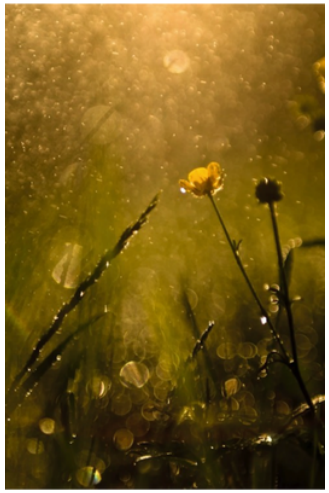
- Stimulation of platelet aggregation + activation of coagulation pathways
- **Proliferation and degranulation of mast cells**
- Stimulation of cytokines and growth factors
- Proliferation of oral keratinocytes, fibroblasts, EMC synthesis
- Neovascularization, Angiogenesis
- Re-epithelialization, repair and reorganization

TERTIARY PHASE

- Context and Cell type specific Cell
- Proliferation
- Migration
- Apoptosis
- Inflammation

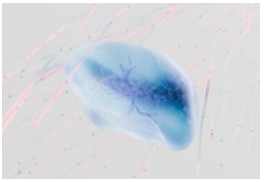


This process can be used in promoting the proliferation of osteoblasts to stimulate bone remodeling/healing.

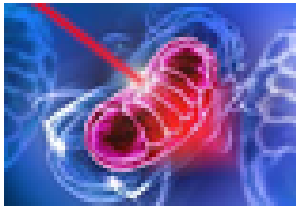


The photons produced stimulate a chemical change in the neurons and the energy can be converted to metabolic energy have an influence then on the function and survival of other neurons. PBM triggers those photochemical changes in the body in the same way photosynthesis effects plants, or sunlight effects vitamin D synthesis

Photobiomodulation- can aid in procedures as an adjunctive therapy to any neuron that would be in distress. It is a non-focused treatment.



Putting your therapy into the Grotthus- Draper law- <u>without</u> absorption there can be no reaction.



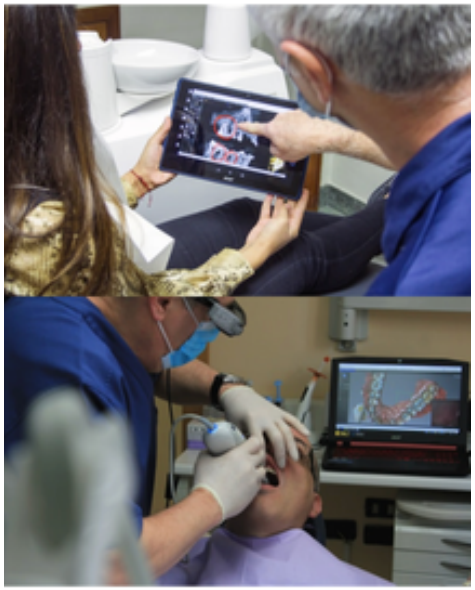
The first FDA treatment approved for PBMT was for Carpal Tunnel Syndrome which many of you may suffer from. In more severe cases surgery is still required. PBMT has been proven to be very effective in Carpal Tunnel Syndrome treatment. It alleviates the pain and tingling in arms, hands and fingers. (Wong, Chennan and Mason)

Photobiomodulation devices are a device is designed to deliver a non-heating dose of light energy into the body to provide clinical benefit to the patient.

FDA HAS APPROVED PHOTOBIOMODUBLATION FOR OVER 20 YEARS

Recently the name changed from Low Level Light Therapy to- Photobiomodulation therapy January 12,2023.

Released a new draft in the guidance of PBM devices for comment (26 pages long) Companies manufacturing PBM devices will have new guidelines to follow once the comment time has ended. This will not affect users- unless looking for a company to produce a new model.



Main procedures approved for use and marketing by FDA

- PAIN MANAGEMENT
- INFLAMMATION

LASER SAFETY AND CONSIDERATIONS

SAFETY

Items to consider in preparation for use of a PBM device/adapter

Wavelength specific protective eyewear must be worn by the Patient, Provider, and Assistant (Laser safety googles that come with laser or purchased for loupes)

When using a laser in office for PBMT you must display the laser warning sign outside of the op.

Caution should be exercised when using PBM device/laser on skin that lacks normal sensation. (i.e. Bell's Palsy, Anesthetized, etc.)

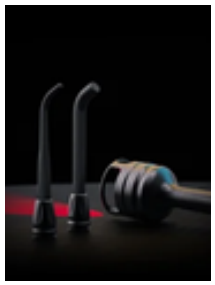
Use accessories that came with that laser/approved by manufacture.

Liquids should be eliminated or reduced around laser.

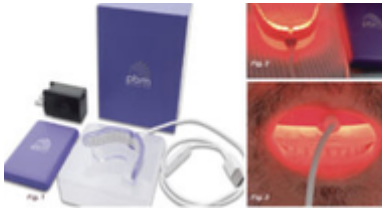
TREATING WITH PBM

Variables to consider when treatment planning for a PBMT appointment.

Power output of your laser



Distance from the skin. Different lasers have spacers with adapters.

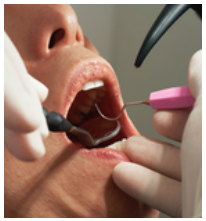


Range of movement for the handpiece of laser

WHERE THE PATIENT IS ON FITZPATRICK SKIN TYPE SCALE?

Is the patient wearing make up?

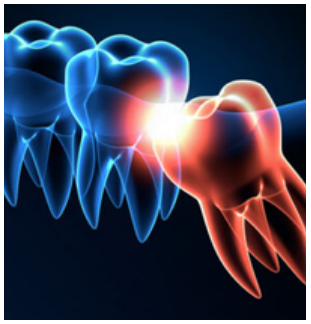
Size of area you are treating.



DENTIST PROCEDURES

POST EXTRACTION

Greatly reduces the pain once anesthesia wears off, but also starts coagulation immediately so site stays clean and dry socket risk is dramatically reduced.



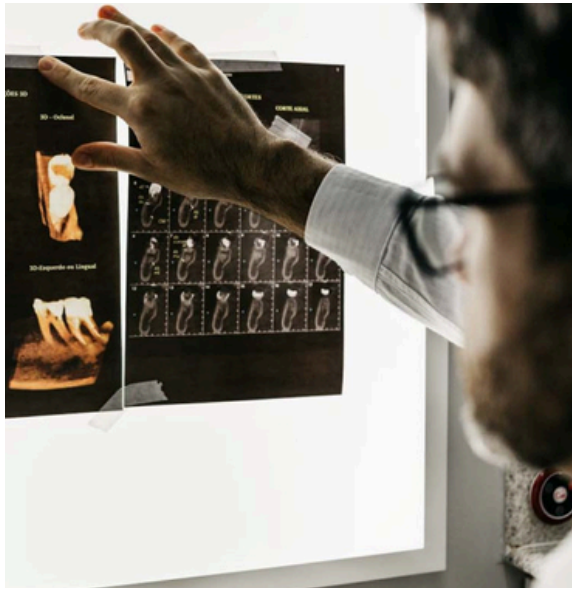
A total of 101 third molar extractions were performed in 44 patients.
The mean age was 28 years old.
Comparing control and intervention, PBMT group showed a significant effect on the reduction of postoperative pain at T6 to control.
The same statistically significant effect on the reduction of postoperative pain was observed at T24 and T48.
PBMT significantly reduce the postoperative pain scores when assessed 6, 24, and 48 hours after third molar extractions.

ALVEOLAR OSTEITIS (DRY SOCKET)

(Isolan C)

Research:

Adult nonsmokers with diagnosed AO were included. Patients were randomly divided into 4 groups. In Group 1, patients underwent mechanical curettage (MC) with copious normal saline irrigation. In Group 2, patients underwent MC + Alveogyl dressings in extraction sites which were changed every 48 hours until cessation of pain. In Group 3, patients underwent MC + Alveogyl followed by PBMT using a 660- nm diode laser. In Group 4, patients were treated solely with PBMT. The visual analogue scale was used up to 3 postoperative days to assess SPP up to 3 days at 6- (T0) and 12-hour (T1) intervals.



Result:

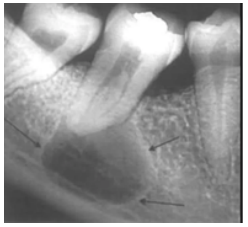
In all, 14, 13, 14, and 14 individuals with AO were included in groups 1, 2, 3 and 4, respectively. All patients had undergone extraction of mandibular third molars. At baseline and on day 1, there was no difference in SPP in all groups.

On days 2 and 3, mean visual analogue scale (VAS) scores at T1 (P <.01) and T2 (P < .01) intervals were significantly high in Group 2 compared with Group 3. On days 2 and 3, mean VAS scores at T1 (P < .01) and T2 (P < .01) intervals were significantly high in Group 4 compared with Group 3. There was no difference in SPP in groups 3 and 4 on day 3 at T0 and T1 intervals.

PBMT following MC and Alveogyl dressing is more efficient in reducing SPP compared with MC with or without Alveogyl dressing in patients with AO.

(Huang Y.Y.,Chen A.C.H.,Carroll J., Hamblin M)

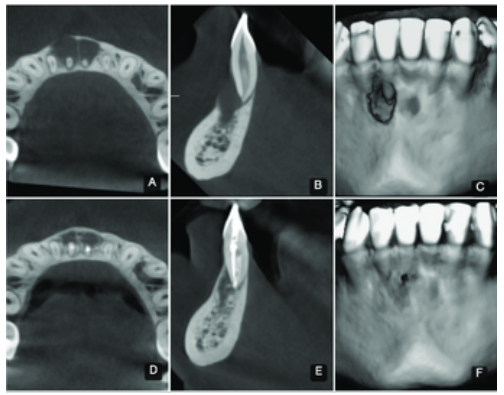
ENDODONTIC / PULPOTOMY



When completing PBMT you are stimulating the perirdicular bone tissue.

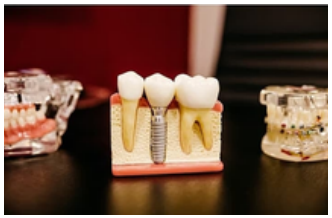
Case Study:

Male 21 years old with no relevant medical history- Panoramic and periapical X-ray examination showed an osteolytic lesion with mesio-distal width of 13.2mm, causing slight thinning of the lingual cortical plate and expansion and fenestration of the buccal plate. Traditional endodontic therapy completed. Hand instrumentation, irrigation then dry disinfectant with diode laser. Sealed using calcium hydroxide (Ultracal XS, Ultradent) PBMT completed using 940- nm (Epic- X Biolase) without tip on handpiece. 1.0 W continuous mode for 40 seconds per point. Repeated following week with 2 sessions of PBMT, then 3rd and 4th week post op had 1 session of PBMT. Cone beam then taken at 6-month interval at recall appointment.



Result:

It was shown that PBMT in a low energy density range accelerated repair in this case, with bone neoformation, recovery of lingual cortical plate thickness and closure of the vestibular fenestration after 6 months. It should be considered that the application of LLLT is a complement to conventional endodontic therapy.



IMPLANTS

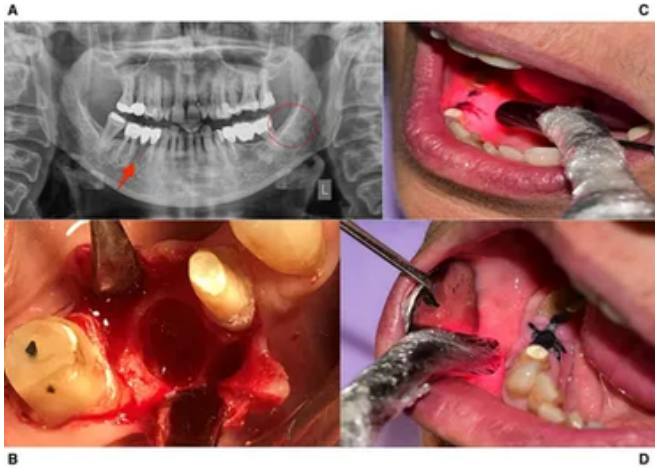
Studies show that PBMT increased implant stability at 10 days after it was inserted over control group.
It also reduced the marginal bone loss at 6 months. Several also noticed that patients had less post- operative swelling on sites that PBMT was utilized.

BONE GRAFTS

(Qu C)

PBMT enhances bone regenerations/int energizes or encourages the differentiation and proliferation of mesenchymal stem cells into osteoblasts.

So, the body is encouraged to repair the site naturally.



With the mode in pulsed you are inducing porous activity by introducing that repetitive heat in the tissue and it stimulates angiogenesis by that new blood flow to the area. The process then starts the of forming osteoblasts/bone in the area you applied the PBMT and will continue to fill in until it hits <cold= areas. It aids in bone grafts by increasing the porosity of the graft placed. Then the living tissues generate with the bio stimulation causing graft to integrate at a faster rate.

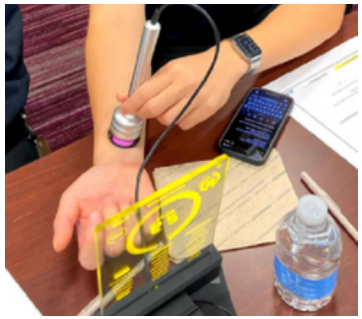
Case Study:

55- year old male patient with no notable medical history. He has been missing 15, 16, 17 for several years and only has 2-3 mm of bone height. Patient is experiencing problems chewing and would like dental implants. Sinus lift with external window and 2 cc of graft were placed in the site with a membrane.

(Ng and Chuan)

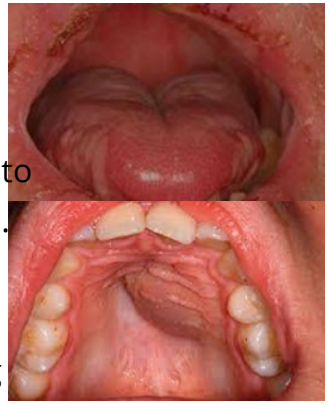
DENTIST AND HYGIENIST PROCEDURES

NAUSEA/ GAGGING



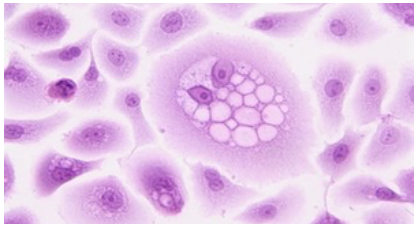
Central Nervous System reflex blocked for approx. 15 min while treatment is completed.

MUCOSITIS



In relation to Head and Neck Cancer patients it is important to note where the lesion/tumor is.

Currently there are conflicting studies about the PBMT having the ability to reduce the cancerous cells.

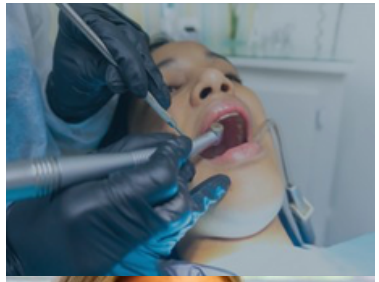


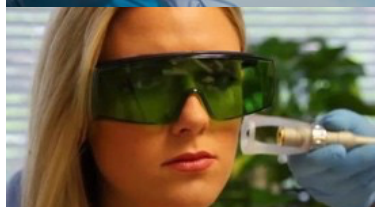
Interesting note- there is a study that shows PBMT inhibiting an in vitro model of squamous cell carcinoma in-situ (CIS). Results are showing that there is an inhibition of DIS colony expansion and the number of clusters at 72h with 36 J/cm2. This is a very high dose of PMBT, but the study concluded that PMBT inhibited the progression of the cancerous cells without disturbing the adjacent fibroblasts.

DISCOMFORT/ PAIN AFTER DENTAL TREATMENT

When a patient stays open for a long appointment, the chief complaint is pain in the masseter muscle.

Causes vasodilation and relaxes the muscles of mastication creating relief for the patient.





TEMPOROMANDIBULAR JOINT/ TEMPOROMANDIBULAR JOINT DISORDER

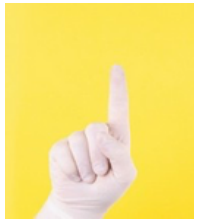
PMBT Application of Protocols can vary depending on severity of disorder/discomfort.
Chronic severe cases have a recommended protocol of 10 sessions for 2 weeks.
Slight-Moderate cases have a recommended protocol of 1 session per week until positive result with patient.

(Takemoto, Garcez and Sperandio)

SINUSITIS

Studies have shown that over 37 million Americans per year in the US are affected with sinusitis in one age bracket alone.

Many patients notice a significant difference after just 1 treatment of PBMT. They can breathe easier and less congestion, as sinus drainage is starting to occur.

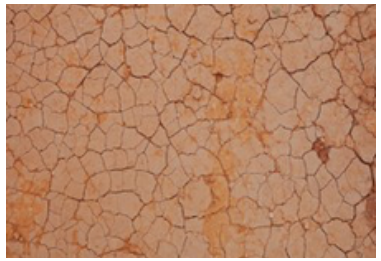


Research is also showing that they are less likely to get recurring sinus infections when treated with PMBT.

(Sigman, Mokmeli and Monici)

XEROSTOMIA/ DRY MOUTH

Sjogren's Syndrome, (Xerostomia) are discussions we have every day with our patients. Recent studies show we can use PBMT to help stimulate the salivary flow without medications or saliva substitutes



TRIGEMINAL NEURALGIA

1 in 15,000 people suffers from trigeminal neuralgia but numbers may actually be higher because it is difficult to diagnosis.

Several studies had different wavelengths, number of sessions, and types of lasers. The most beneficial when treating trigeminal neuralgia was the diode laser with 810-980 wavelength.

The medical community is starting to use PBM more and more when patients have inflammatory issues, but still relatively new.

This is an area where dentistry can lead the way!

Settings

Photobiomodulation is measured in energy (joules)
Joule = 1 watt/second
Ex 100mw (.1 Watt) = 1 Joule in 10 seconds 1 cm Tip for a Perfect 1 cm²
1 Joule with a 1 cm² tip = 1 Joule/cm²

“PHOTOBIOMODULATION FOR BRAIN DISORDERS WILL BECOME ONE OF THE MOST IMPORTANT MEDICAL APPLICATIONS OF LIGHT THERAPY IN THE COMING YEARS AND DECADES."

-Michael Hamblin, PhD.
Shining light on the head:
Photobiomodulation for brain disorders.

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Thank you!

JANESSA BOCK, RDH