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1

EFFECTS OF THE THERAPY OF PHOTOBIMODULATION IN PATIENTS WITH THIRD-DEGREE BURNS .

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This research is a randomized, prospective study, with the aim of action of photobiomodulation therapy with low-level laser in the treatment of wounds from third degree burns, compared to conventional treatment. The research will be carried out in a hospital classified as a reference in the treatment of burns. The target patient population will be those admitted to the burn treatment unit who suffer third degree burns on the chest and / or abdomen. Justification: Third degree burns are extremely harmful, have a high morbidity and mortality Objective: Evaluation of photobiomodulation therapy in the treatment of third degree burns, to define an effective, safe and less invasive dosimetry, to develop a treatment proposal to decrease the permanence of the patient in the hospital environment. Criteria to be evaluated: blood dosage of interleukin-6, tumor necrosis factor-alpha, biomarkers, creatine phosphokinase, low-density lipoproteins, polymerase chain reaction, erythrocyte sedimentation rate and blood count. Methodology: Patients as far as possible will receive verbal explanations and subsequently a term of free consent as determined by the Declaration of Helsinki (2013), and will follow the rules for research on human beings. The photobiomodulation therapy will be applied through the DMC-Therapy EC brand laser device, with red wavelength at (660 nm) and infrared (808 nm), at a power of 10 mm, registered with ANVISA under number 80030810013 ; Low-intensity laser will be applied in a point-to-point pulsed mode with a spacing of 1/1 cm around the wound. The target population to be researched will be composed of two groups of 25 patients per group, and in the first group, only the conventional treatment with Silver Sulfadiazine ointment and the second group with the addition of the laser.

Key words: Photobiomodulation, third degree burn, low-level laser, nursing.

Protocolo clínico ou experimental (Clinical or experimental protocol)

2

Evaluation of the effects of high powered laser and electrocautery in lingual frenectomy surgeries in infants - blind randomized controlled clinical study.

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Abstract: Ankyloglossia is an anomaly that is characterized by an abnormally short, thick or thin lingual frenulum that can restrict the movements of the tongue and has been identified as one of the factors that can negatively interfere with breastfeeding, decreasing the ability of the newborn to handle proper. According to the Ministry of Health in Brazil, the percentage of newborns with this anomaly is 3% to 16%. Ankyloglossia can negatively impact breastfeeding. The lingual frenectomy procedure can be performed using various surgical techniques. The objective of the study will be to evaluate the release of the lingual brake through the lingual frenectomy performed with a high-power diode laser or with an electrocautery. The use of high-power laser for this purpose has been identified as an effective resource in the incision of the lingual frenulum, with postoperative advantages. operative period, with reduction of edema, pain and inflammation, quality of tissue repair and patient comfort. **Methods:** The present study will be a blind randomized controlled clinical trial, in which 56 volunteers, infants aged 0 to 3 months, with normal health status, who are breastfeeding, diagnosed with ankyloglossia and indication for surgery, will participate. Those responsible for the children will be informed about the study procedures and after signing the Informed Consent Form, authorizing them to participate in the study. The non-blinded researcher will conduct the evaluation, screening and procedures, and another blinded researcher will be the evaluator 15 days after the procedure. The distribution of volunteers in the groups will be random and randomized: Surgery Group with electrocautery (G1- EC) and Surgery Group with high power diode laser (G2-L). The procedures for patient preparation, asepsis and infection control will be strictly followed in accordance with Biosafety rules. In both groups, infants will be submitted to anamnesis, clinical evaluation and standardized photograph of the lingual frenulum region before the surgical procedure and application of the Bristol frenulum evaluation protocol, the nursing mother will be submitted to the evaluation of pain VAS during breastfeeding, before, shortly after and 15 days after the surgical procedure for the evaluation of the result of the lingual frenectomy.

Key words: laser, ankyloglossia, frenectomy, breastfeeding

Protocolo clínico ou experimental (Clinical or experimental protocol)

3

Effects of photobiomodulation preconditioning in third molar surgeries.

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Preconditioning the tissue offers good results in preventing mucositis in cancer treatments and in preventing muscle injuries in fatigue protocols. On the other hand, in third molar surgeries, photobiomodulation has been widely used in the treatment of postoperative complications such as pain, edema, and trismus. This study aims to evaluate the effects of photobiomodulation preconditioning in third molar surgeries. This is a clinical, randomized, double-blind, and placebo-controlled study. Adults over 18 years old, with an indication of removal of third molars, compatible with the inclusion criteria, after signing the Informed Consent Term, their facial and interincisal measurements were measured. They received treatment according to randomization (treatment group-TG / control group-CG) and after one hour they underwent removal of the third molar. After 48h and 7 days, measurements were taken, pain analysis according to a visual analog scale and randomized treatment.

Key words: third molar, Photobiomodulation, pain, edema, trismus.

Protocolo Clínico.

4

Photobiomodulation increases resolvin D1 in an experimental model of lung fibrosis.

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INTRODUCTION: Pulmonary fibrosis (PF) is a chronic lung disease characterized by lesion of the pulmonary parenchyma, inflammatory infiltrate and interstitial fibrosis. It is triggered by the excessive and disordered deposition of collagen and other extracellular matrix components, which results in severe changes in the architecture of the alveolus wall. **AIM:** The aim of the study was to investigate the effect of treatment with Photobiomodulation (PBM) on the course of PF. **METHODS:** Adult male C57BL6 mice were submitted to the induction of PF by the administration of Paraquat and after 7 days of induction, the mice were treated during 7 days with LED. Device specifications: BioLambda Apparatus LEDs São Paulo, Brazil; Probe Design, Single Probe; Wavelength: 660 nm; Radiant Power: 160 mW; Power Density: 38,5 mW/cm²; spot area: 4,15 cm²; Density of energy: 5,8 J/cm²; Issuance: Continuous (cw); Total Radiant Emission: 24 J. Treatment specifications: Exposure time: 152 s; Irradiated 1 point; Direct skin contact; Anatomical location: trachea and lungs; Number of treatments: 1 day, seven applications. **RESULTS:** We showed that PBM reduced cell influx into the bronchoalveolar lavage and elevates the level of resolvin D1 without altering the levels of IL-6, TNF- α , IL-10, and IL-17A in the lung homogenates. **CONCLUSIONS:** The reduced cell migration induced by PBM might be attributed, at least in part, to elevated levels of resolvin D1. Thus, PBM showed beneficial effects on inflammation and more studies are needed. **Financial support:** Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP, 2017/006444-9).

Key words: Pulmonary Fibrosis, Fotobiomodulation, Resolvin D1

Protocolo clínico ou experimental (Clinical or experimental protocol)

TRANSCUTANEOUS SYSTEMIC PHOTOBIMODULATION AMELIORATES THE LUNG INFLAMMATION INDUCED BY SEPSIS.

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INTRODUCTION: Sepsis is a severe disease with a high mortality index. The acute lung injury (ALI), characterized by alveolar damage, lung inflammation, and impaired gas exchange, is a serious manifestation of sepsis, which is not efficiently treated by current drugs. ALI is a pathology with high morbidity and mortality. Photobiomodulation (PBM) has been showing good results for several inflammatory diseases. **AIM:** The aim of this study was to analyse the effect of systemic PBM with red LED in the management of inflammatory parameters. **METHODS:** Male rats were injected with lipopolysaccharide (LPS) or saline (i.p.) and, irradiated or not with light emitting diode in the caudal vein, for 150 s, 2 and 6 h after the LPS injections. After 24 h the LPS or saline injections, the inflammatory parameters were investigated. **Device specifications:** Bio Lambda LEDstar, Black Box Mini Model, São Paulo, Brazil; **Probe Design,** Single Probe; **Wavelength:** 660 nm; **Radiant Power:** 160 mW; **Power Density:** 38,5 mW/cm²; **spot area:** 4,15 cm²; **Density of energy:** 5,8 J/cm²; **Issuance:** Continuous (cw); **Total Radiant Emission:** 24 J. **RESULTS:** Our results point to the beneficial effects of systemic PBM on the LPS-induced ALI, as it reduced the number of neutrophils recruited into BAL, myeloperoxidase activity and also reduced IL-1 β , IL- 6 and IL-17 in the lung. **CONCLUSION:** Our data showed beneficial effects of transcutaneous systemic PBM treatment on ALI caused by sepsis, and suggest that PBM application as an inexpensive and non-invasive additional treatment for sepsis. **Financial support:** CNPq 305099/2017-5.

Key words: systemic photobiomodulation, cytokines, lung inflammation.

Estudo experimental em animais (Experimental study in animals)

6

Evaluation of the clinical efficacy of optical therapies in pre- anesthetic analgesia and healing of extractions.

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Laser radiation has been routinely employed in many areas of health sciences, as well as photodynamic therapy (PDT) has been featured as a coadjutant in the prevention of bacterial resistance. Although both methods are employed in different dental clinical protocols, there is still a need for randomized clinical trials to verify if there are effects on the reduction of pre-anesthetic pain and post-exodontic repair. This study aimed to evaluate the action of low level laser therapy (LLLT) on preoperative analgesia of dental extractions, as well as the effect of PDT on postoperative tissue repair. A randomized double-blind clinical study was conducted with 80 adult volunteers, with indication of upper molar tooth extraction with live pulp. They were randomly distributed into two distinct experimental groups (n = 40, LASER or PLACEBO group). Patients belonging to the LASER group were irradiated with GaAIA laser (805 nm, 100 mW, 4 J, 5.6 W/cm², 40s). Patients in the PLACEBO group received treatment with the same equipment, but with the obliterated beam. The patients in the LASER group were also treated with PDT, in which the alveolus was irrigated with 0.01% methylene blue and, after 5 minutes, irradiated using a red emitted laser (660 nm, 50 mW, 12 J, 2.55 W/cm², 264s), while patients in the PLACEBO group had the alveolus irrigated with 0.05% chlorhexidine and also irradiated with the obliterated beam. The pain of the periodontal soft tissue was evaluated at 8 different moments (before laser irradiation, after laser irradiation, 0s, 30s, 60s, 90s and 120s after anesthesia and after extraction) and the healing of soft tissues was measured immediately and 7 days after the exodontia. In addition, local pain and edema were verified for 7 days. The data were statistically evaluated ($\alpha = 5\%$). It was observed that LLLT significantly reduced local pain immediately prior to needle puncture ($p < 0.001$), as well as prolonged the anesthetic effect ($p < 0.001$) in both men and women; but PDT did not interfere with tissue healing after 7 days. It was concluded that LLLT can be considered efficient in reducing pre-anesthetic pain in surgical procedures and in prolonging the anesthetic action, and the PDT played an important role in the clinical aspect of the surgical wound, allowing the effective repair of peri-alveolar soft tissues, acting in a similar way to chlorhexidine.

Key words: low intensity laser therapy, photodynamic therapy, anesthesia, healing, extractions.

Protocolo clínico ou experimental (Clinical or experimental protocol)

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PHOTOBIMODULATION AND INTRALESIONAL APPLICATION OF CORTICOID FOLLOWING THE KELOID SURGERY: DOUBLE-BLIND, RANDOMIZED CONTROLLED TRIAL PROTOCOL.

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INTRODUCTION: Keloids are fibroproliferative scars with high taxes of recurrence after treatments. The keloids etiopathogenesis is related to the disordered fibroblasts growth and an increase of the transforming growth factor beta (TGF- β) levels. The main intervention is the surgical removal associated with topical corticosteroids during the pre and postoperative periods. The photobiomodulation (PBM) with blue light has demonstrated in vitro studies an inhibition of fibroblasts and TGF- β levels. **OBJECTIVES:**The present study is a randomized, controlled, and double-blind clinical trial which aims to verify the effects of PBM associated with the corticoid treatment during the pre-and postoperative periods of keloid removal. **METHODS:** Participants (N=38) will be random allocated into two groups named: (1) Sham group (N=19) submitted to the standard procedure (corticoid + removal surgery) and (2) PBM group (N=19) submitted to the PBM with blue light ($\lambda=470\text{nm}$; P=400mW; E=24J per point being 1 point per linear scar centimeter) associated with corticoid before and after surgery. The rate of recurrence and the quality of the new scars will be analyzed using the Vancouver scar scale (VSS). The keloids and the new scar will be measured using silicone molds that will be converted into acrylic surface and an optical coherence tomography of these molds will be performed. The histopathology of the resected keloid will also be analyzed to verify the fibroblasts, TGF- β and collagen deposition and organization. Questionnaires (Qualifibro-UNIFESP and PSAQ) to assess the participant's quality of life and scar will be performed. The data will be submitted to statistical analysis.

Key words: Photobiomodulation, Keloid, LED, Surgery, Corticosteroids

Protocolo clínico ou experimental (Clinical or experimental protocol)

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EVALUATION OF ANTIMICROBIAL PHOTODYNAMIC THERAPY MEDIATED BY METHYLENE BLUE IN SURFACTANT VEHICLE FOR ADJUVANT TREATMENT OF PERIODONTAL DISEASE: PROTOCOL OF RANDOMIZED, CONTROLLED, DOUBLE-BLIND CLINICAL TRIAL.

Kassa CT(1), Godoy-Miranda B (1), Salviatto LTC (1), Deana AM (1), Pavani C (1), Prates, RA (1)

(1) Universidade Nove de Julho

Introduction: Periodontal disease is an inflammatory disease that affects supporting tissues of the teeth in response to the presence of microorganisms. Gold standard treatment is scaling and root planing for calculus and biofilm removal. To reduce the use of antibiotics, antimicrobial photodynamic therapy (aPDT) has been studied as an adjunct in periodontal treatment. It is a noninvasive technique that employs a photosensitizer and a light source for the formation of reactive oxygen species that cause bacterial death. The main limitation of this technique is dimers formation that decreases the effectiveness of therapy. Sodium dodecyl sulfate showed the ability to decrease this dimerization effect. Objective: The aim of this study is to evaluate the photodynamic effect of methylene blue in sodium dodecyl sulfate at 0.25% for the treatment of participants with periodontitis. Methods: Forty participants will be included and all of them will be treated with scaling and root planing. After 40 days of periodontal treatment, patients will be randomized allocated into four groups: 1) group treated with root scraping and smoothing and aPDT with sodium dodecyl sulfate (SDS) at 0.25% (n=10); or 2) with aPDT with methylene blue (n=10); 3) and group treated with root scraping and straightening associated with photosensitizer without light irradiation (n=10), or 4) treated with sodium dodecyl sulfate photosensitizer without light irradiation. The photosensitizer will be in contact for 1 min and then the laser will be irradiated or not for 2 min per point. A laser (Therapy XT, DMC, São Carlos, Brazil) emitting at 660 nm and 100 mW output-power will be used. The quantitative microbiological evaluation by cultivation of subgingival biofilm will be carried out before and immediately after the irradiation procedures. The data will be submitted to statistical analysis. As the primary outcome, the microbial count will be evaluated and as secondary outcomes clinical probing depth will be measured, as well as clinical attachment level and bleeding on probing. Registration: ensaiosclinicos.gov.br RBR-2G9CF4. Registered in July 2020. Research ethics committee approbation: CAAE: 31985120.2.0000.5511 Number 4.079.283

Key words: antimicrobials, photosensitizer, photodynamic therapy, photodynamic antimicrobial chemotherapy, methylene blue.

Protocolo clínico ou experimental (Clinical or experimental protocol)

Use of low-power laser in the promotion of photobiomodulation: prevention of scar changes resulting from post-operative breast cancer.

Cadima MR (1), Carvalho LA (2), Preguiça JM (3), Renato de Oliveira Barguena.

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- (2) Centro Universitário das Faculdades Metropolitanas Unidas;
- (3) Universidade Nove de Julho.
- (4) Hospital Nove de Julho.

Introduction: Cancer is a disease that occurs due to an abnormal multiplication of cells, detected in the formation of a tumor. Breast cancer is the second most incident in the Brazilian population. After diagnosis, treatments are performed and one of these is surgery, where the tumor can be punctually removed or the breast can be removed completely. Surgery promotes the appearance of wounds, which in the postoperative period can be considered as first intention or intention. At this time, healing seeks to restore skin homeostasis naturally and this process occurs in three phases: inflammatory, proliferative and remodeling. Studies are carried out looking for techniques to optimize the healing process and, consequently, avoid the appearance of keloids and fibroids at the surgical site. One of these techniques is the low power laser. Non-invasive method that helps in closing wounds, optimizing the healing process after surgery. Objective: To verify in the literature the effects of low power laser on the wound healing process in the post-operative period of breast cancer, to identify its action in the inflammatory process and its benefits. Methodology: Bibliographic survey in reference databases (national and international), Scielo, Lilacs, Google Scholar, and PubMed. Result: Schawlow and Townes (1958) describe that the first studies with the use of the laser as a therapy date back to 1958. In 1967, Mester and collaborators obtained good therapeutic results using the new technique and in 1988, a study of Tina Karu explaining the molecular mechanisms related to the effect of light on the exposed fabric. Therapy is based on photochemical, photophysical, and photobiological effects on biological cells and tissues. Almeida (2006) describes that the use of lasers in the health area promoted major changes, such as a reduction in the length of hospital stay, a reduction in post-surgical complications, edema, inflammation and also optimized changes in the biomodulation of tissue healing. The laser is capable of regulating cytokines responsible for stimulating migration and proliferation of fibroblasts and currently several protocols are being tested, but the ideal wave use for low power laser treatments is not yet defined, but it is known that each wavelength interacts differently in each tissue, as described by Garcez et al., 2012. Conclusion: The low-power laser has been shown to be an effective treatment technique in controlling and reducing the inflammatory process, both vascular and tissue, as it is capable of reducing pain and local inflammation through blocking effects, causing an improvement in the healing process. Thus, it is possible to use laser therapy to reduce the length of hospital stay and use of a drain during the postoperative period of breast surgery, reducing complications, edema, the appearance of keloids and fibroids.

Key-Words: Cancer, Breast cancer, Healing, Low power laser.

Revisão /Review

10

Is it Possible to Improve Cytokines and Growth Factors Secretion in Healthy Mesenchymal Stem Cells with LEDs?

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- (2) Universidade Federal de São Paulo.

Background: Mesenchymal stem cells (MSCs) are being used in many clinical studies due to its characteristics of easy isolation and cultivation and, chiefly, for their well-known paracrine action, which can treat various diseases. Nevertheless, the loss of MSCs at the transplanted site lowers the efficiency of the cellular therapy. To unravel this problem, light sources are being used as a cytoprotective promising tool. Apart from the beneficial roles that light may play in the modulation of inflammation and angiogenesis, it is necessary to highlight the importance to seek the capability of the MSCs to remain stemless, viable, proliferating, self-renewing and recruiting other cells niches that may help on repairing the damaged tissue at the transplanted site as well. Aim: The present study worked toward irradiating healthy MSCs using LEDs in order to improve cell secretome seeking a more efficient cellular therapy. Methods: Adipose-derived MSCs were obtained from Fischer-344 male rats (CEUA 5883160218) and analyzed the influence of different radiant exposures (0.5, 2 and 4 J/cm²) and number of irradiations (single dose or once every other day). Irradiations were performed using a 630 nm LEDbox (Biolambda, Brazil) at a constant irradiance of 15 mW/cm². Control group was kept in the dark for the same time as 4 J/cm². TNF-alpha, IL-6, IL-10, IGF-1, VEGF, L-selectin and ICAM-1 analyses were performed 24 hours after the last irradiation by ELISA using the culture medium of the cells. Results: None of the irradiation quantity nor doses induced changes in the pattern of the chemotactic proteins secretion (L-selectin and ICAM-1). Single dose irradiation showed an increase in TNF-alpha levels in the 2 J/cm² group, whereas 0.5 and 4 J/cm² groups presented an increased secretion of VEGF. In the cells irradiated with multiple doses, the results exhibited no changes in the secretion profile of the 2 J/cm² group. The 0.5 J/cm² group showed a decrease in IL-10 secretion, on the other hand, the VEGF levels were higher than the control group. In the 4 J/cm² group, secretion of IGF-1 and IL-6 was increased, in comparison to the control group. Conclusion: Multiple irradiations with 4 J/cm² improved the secretion of IL-6 and IGF-1, which are responsible for stemless characteristics, viability, proliferation and self-renewal, showing that it is possible to photobiomodulate healthy MSCs, a great find that allows to future test its roles in improving cellular



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Diodes,

Photobiomodulation,

Key words: Mesenchymal Stem Cells, Growth Factors, Cytokines, Paracrine Effects, Cellular Therapy.

Estudo experimental em in vitro (Experimental study in vitro)

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PHOTOBIMODULATION THERAPY IN LOCAL LESION AND MUSCULAR EDEMA INDUCED BY THE VENOM OF THE SERPENT *Bothrops alternatus* IN ITS DIFFERENT DEVELOPMENT STAGES.

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Introduction: Bothrops snakes are responsible for the majority of snake accidents in Latin America. The envenoming by these snakes causes severe systemic and local effects. In addition, it is described that venoms of adult and young snakes have differences in their composition and this can lead to differences in the evolution of the local reaction. The botropic antivenom is the treatment of choice, however, its effectiveness is limited, being able to neutralize only systemic effects. In view of this, the search for supporting treatments to reduce local myotoxicity is extremely important. It has been demonstrated in previous studies, that the low level laser (LLL) is promising in reducing local effects induced by botropic venoms, however, the mechanism of action of LLL is not yet fully understood. Objective: Evaluate the effect of LLL on the marker of muscle injury, plasma creatine kinase (CK) and muscle edema, caused by the young and adult venoms of the snake *Bothrops alternatus* (VBa) in mice. Material and methods: The project was approved by the Ethics Committee on the Use of Animals (CEUA UNINOVE 8207061118). 25 Balb/C mice (20-25g) were used, divided into 5 groups (n= 5/group), 1st group: control (saline), 2nd group: young VBa, 3rd group: young VBa + LLL, 4th group: adult VBa and 5th group: adult VBa + LLL. The young and adult venoms were injected into the right gastrocnemius muscle (50 µg/muscle) of the animals, and the treatment with LLL was carried out at a wavelength of 685 nm, radiant exposure of 4 J/cm², power of 100 mW, for 40 seconds at the injection site. After 6 hours of inoculation of the venom/saline and treatment, blood samples were taken, the muscles were removed and the plasma CK was measured and edema was quantified by wet weight. Statistical analysis: The results obtained were analyzed statistically by Analysis of Variance (ANOVA) and expressed as mean ± standard error of the mean and a significance index of P<0.05 was considered. Results: It was observed that both young and adult venom promoted an increase in CK release, and LLL was able to reduce this release in both groups. The two venoms also caused muscle edema, however, the LLL was only able to reduce the edema caused by the venom from young snakes. Conclusion: Therefore, treatment with LLL has been shown to be beneficial in reducing local myotoxicity caused by the young and adult venoms of the snake *Bothrops alternatus*.

Key-words: *Bothrops alternatus*, photobiomodulation, myotoxicity, creatine kinase, muscle edema.

Estudo experimental em animais (Experimental study in animals)

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Photobiomodulation therapy promotes C2C12 cells differentiation and fusion when cultivated in the M1 macrophage-conditioned media.

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INTRODUCTION: Macrophages are considered key-effector cells in a microenvironment after an acute injury and the products secreted by them are capable to modulate the different phases of inflammatory process and muscle repair. The exacerbated pro-inflammatory macrophages (M1 profile) presence have an adversely impact at cellular levels in the injured muscular tissue, such as the proliferation of myoblasts (activated satellite muscle cells) and their differentiation into myotubes, impacting tissue regeneration and individual rehabilitation. The photobiomodulation therapy (PBM) has demonstrated positive effects during the muscle repair and the modulation of involved cells in the inflammatory process, especially macrophages. **OBJECTIVE:** The aim was to evaluate the effects of PBM in the differentiation and fusion process of C2C12 myoblasts cultivated in an also irradiated pro-inflammatory J774 macrophages-conditioned media. **METHODOLOGY:** J774 cells were incubated with LPS (1.0µg/mL) and IFN- γ (0.2µg/mL) for 2h to induce macrophages to a M1 profile and following the irradiation was performed with a diode low level laser GaAlAs (780 nm, 70 mW, 17.5 J/cm², 15 s, 1J). Then the J774 cells were plated for 24h to obtain the macrophage-conditioned media (MCM). C2C12 cells were cultivated in DMEM and 2% of horse serum (DM) for 72h to induce the differentiation process. After this period, the cells were also irradiated with the same parameters, plated in a 96-well plate and MCM was diluted (1:1) and added according to the experimental group. C2C12 cells were divided into the following experimental groups: (1) C2C12 cultivated in DM, (2) C2C12 in MCM0 (non activated macrophage-conditioned media), (3) C2C12 in MCM1 and (4) C2C12 + PBM in MCM1 + PBM. The C2C12 cells were incubated for 24 and 48h, after this period were submitted to May-Grunwald Giemsa staining, photographs were taken and distribution of cells nucleus were evaluated (mono, bi and multinucleated) to generate fusion index calculation. **RESULTS:** After 24h, a lower fusion index was found in the C2C12 in MCM1 in comparison to C2C12 in MCM0 ($p < 0.001$). A significant increase was found in the C2C12 + PBM in MCM1 + PBM group compared to the C2C12 in MCM1 untreated group at 24 and 48h ($p < 0.001$). **CONCLUSION:** PBM therapy performed concomitantly on pro-inflammatory macrophages and myotubes was able to stimulate the differentiation process and fusion induction.

Key words: M1 macrophages, Myotubes, Cell differentiation, Photobiomodulation, Low Level Laser Therapy.

Estudo experimental em in vitro (Experimental study in vitro)

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METHYLENE BLUE ASSOCIATED WITH UREA IN PHOTODYNAMIC INACTIVATION OF PERIODONTOPATHOGENS BACTERIA.

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Periodontal disease is an inflammatory response to oral biofilm and the treatment consists of scaling and root planing. Antimicrobial photodynamic therapy (aPDT) has been used as adjunct to this treatment and it is the use of photosensitizer (PS) and a light source for the formation of reactive oxygen species. However, there are difficulties in performing aPDT clinically and it is believed that this is due to the PS dimerization. Literature reports that the association of urea with methylene blue can improve aPDT effects. The aim of this study was to evaluate the use of aPDT in *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis*, as well as the optimization of parameters. *A. actinomycetemcomitans* and *P. gingivalis* were cultivated in microaerophilia and anaerobiosis for 48h. Then, the experiments were performed in triplicate, with 6 groups: a)Control, without intervention; b)Light, which was irradiated only; c)PS, where only PS was used; d)PDT1 which was irradiated for 1min; e)PDT3 with 3 min irradiation; and f)PDT5 irradiated for 5 min. Methylene blue was used as PS in the final concentration of 100 μ M, in association with urea with a final concentration of 2M, and irradiated with laser at $\lambda=660$ nm (Photon Lase III, DMC, São Carlos, Brazil) with output power of 100mW and radiant exposure until 215 J/cm². After microbial growth, colony form units (cfu) were counted and transformed into cfu/mL for analysis followed by statistical differences comparison that were assessed by ANOVA and Tukey when $p<0.05$. Optical absorption spectroscopy was performed to quantify PS uptake on bacteria. The control, light and PS on *A. actinomycetemcomitans* groups showed 1x10⁹ cfu/mL and a microbial reduction of 7 orders of magnitude was achieved after 5 min of aPDT irradiation. In the control, light and PS groups of *P. gingivalis*, no significant differences were observed in relation to microbial decrease, but in the groups in which aPDT was performed, there was a difference in the pattern of microbial death, with 3 and 5 min of irradiation showing complete reduction with PBS and PBS+U+SDS. In the uptake analysis, *A. actinomycetemcomitans* incorporated 20% more PS than *P. gingivalis* in the PBS and U+PBS solutions, however MB did not accumulate into bacterial cells in the presence of SDS. It is concluded that aPDT was effective in the microbial inactivation of periodontopathogens, however SDS decreased uptake and aPDT effect on both bacterial species.

Key-words: Photodynamic antimicrobial chemotherapy (PACT), phototherapy, methylene blue, periodontitis, urea.

Estudo experimental em in vitro (Experimental study in vitro)

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Evidence from a clinical study on the use of ascorbic acid as a therapy for skin injuries.

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Introduction: Skin injuries are characterized as the disruption of tegumentary continuity resulting from several factors. Accordingly, health care for people with skin injuries should be multidimensional and interdisciplinary among health professionals. One of the therapeutic alternatives that has been gaining space in the treatment of patients with skin injuries is the use of natural products, such as ascorbic acid. Objective: To analyze the best scientific evidence regarding the use of ascorbic acid as a therapeutic method in skin injuries. Method: This is a Systematic review, where we searched for studies on the Pubmed, Scopus, Cinahl and Web of Science databases; and on The Cochrane Database, in this case, for research on the applicability of ascorbic acid in skin injuries. When formulating the research question, we adopted the PICO strategy. Thus, the question that guided the systematic review study was: What are the scientific evidences pointed out by the studies on the use of ascorbic acid in the treatment of skin injuries? Through the search strategy, we identified 38 articles in the analyzed databases. Soon after the cataloging process, the studies underwent an evaluation and quality analysis through the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) for observational research; the Consolidated Standards of Reporting Trials (CONSORT) for clinical trials studies; and analysis of the level of evidence through the classification of The Joanna Briggs Institute. Thus, the final sample consisted of six articles. Results: After analyzing the clinical trials, we perceived that they showed scientific robustness and allowed us to claim that ascorbic acid contributes to healing, thus reducing the inflammatory process and leading to neovascularization, concentration of macrophages, as well as concentration of fibroblasts and collagen fibers. Conclusion: Among the analyzed studies, it shows evidence that the use of ascorbic acid has an effect on the therapeutic process in patients with skin injuries and that it promotes the healing process markedly, but there is a need for further studies to supplement this thesis.

Key words: Ascorbic acid, Evidence-based nursing, Nursing care, Skin.

Revisão /Review

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EVALUATION OF PHOTOBIMODULATION IN THE SALIVARY PRODUCTION OF PATIENTS WITH XEROSTOMY INDUCED BY ANTIHYPERTENSIVE DRUGS – A BLIND, RANDOMIZED, CONTROLLED CLINICAL TRIAL.

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Introduction: Arterial hypertension is a systemic condition that affects about 30% of the world population. The drugs that are used for its control can produce hyposalivation and have the potential to induce xerostomia. Objective: In this work, we demonstrate the effect of photobiomodulation on the salivary flow of subjects who are using antihypertensive drugs. Material and methods: 40 subjects were randomly allocated in one of two groups: control (placebo) and photobiomodulation. The subjects had their salivary glands (20 sites) irradiated with a laser emitting at 808nm, 4J/site once a week for 4 weeks, and had their salivary flow measured before and after the whole treatment. Results The intragroup analysis (before and after treatment) shows a significant difference for both non-stimulated and stimulated salivary flow in the photobiomodulation group ($p=0.0007$ and $p=0.0001$, respectively) Comparing the placebo with the photobiomodulation group, significant differences were found for both non-stimulated ($p=0.0441$) and stimulated salivary flow ($p=0.0441$) after the treatment. Conclusion: This clinical trial showed that PBM is capable of significantly increasing the salivary flow of patients who are using antihypertensive drugs.

Key-words: LLLT, antihypertensive drugs, xerostomia, laser, photobiomodulation, hypertension, saliva.

Ensaio Clínico (Clinical Trial)

EVALUATION OF ANTIMICROBIAL PHOTODYNAMIC THERAPY IN AGGREGATIBACTER ACTINOMYCETEMCOMITANS MEDIATED BY METHYLENE BLUE IN SURFACTING VEHICLE.

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Disease is a public health problem and has a greater incidence in the adult population, which can lead to loss of teeth and aggravating systemic diseases such as bacterial endocarditis. The treatment is the elimination of pathogens present in the periodontal pocket. Antimicrobial photodynamic therapy (aPDT) has been studied as an adjunct to this treatment, but in the oral environment, the photochemical effects face challenges such as dimming the photosensitizer (FS), diluting with saliva and the presence of different microorganisms organized in a biofilm. The use of sodium dodecyl sulfate (SDS) produces the chemical breakdown of FS and has been shown as an alternative to PDT. The aim of this study was to investigate the effect of aPDT mediated by methylene blue (AM) on a periodontal pathogen in a vehicle with SDS. The behavior of aPDT mediated by methylene blue (AM) in phosphate buffered solution (PBS) and 0.25% surfactant vehicle (SDS) was evaluated. For that, inoculum of pure strain of *A. actinomycetemcomitans* ATCC 29523 was grown from stocks in brain and heart infusion agar (BHI) at 37 ° C in a microaerophilic atmosphere. APDT was performed with a diode laser (Photon Lase III, DMC, São Carlos, Brazil) with a wavelength of 660 nm, output power of 100 mW, well irradiation of 250 mW / cm², energy of 6.18 and 30 J corresponding to the times of 60, 180 and 300s and radiant exposure of 15, 45, 75 J / cm², respectively. Microbial death was evaluated by counting colony-forming units (CFU); the incorporation of FS by the bacteria was evaluated by optical absorption spectroscopy of the supernatant; as well as the morphology of microorganisms was investigated by scanning electron microscopy (SEM). The results indicated that aPDT with AM in PBS led to a reduction of 4.8 logs (orders of magnitude) of bacterial death; however, the association with SDS reduced the effect of aPDT considerably to 1.45 logs. The presence of 0.25% SDS in this bacterium caused an 80% reduction in the incorporation of AM, and the SEM images indicate that clusters of extracellular substances are formed in contact with SDS. It was concluded that aPDT in 0.25% SDS prevented the photodynamic action in *A. actinomycetemcomitans*; the same in contact with this periodontopathogen, prevented the entry of FS in the bacteria.

Key words: Surfactant vehicle, SDS, microbial resistance, periodontopathogens, photodynamic antimicrobial chemotherapy (PACT), antimicrobial photodynamic therapy (aPDT), periodontal disease.

Estudo experimental em in vitro (Experimental study in vitro)

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The Effect of Light-Emitting Diodes (LEDs) on Healthy Mesenchymal Stem Cells Respiration Under Metabolic Stress.

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Background: Mesenchymal stem cells (MSCs) are the topic of many clinical studies to treat various diseases. Nevertheless, the loss of MSCs at the transplantation sites lowers the efficiency of the cellular therapy due to the hostile micro-environment that does not supply enough nutrients to the cells. To unravel this problem, light sources are being used as a cytoprotective promising tool, with well-known roles in the mitochondria and ATP production. However, the participation of light in improving cellular survival in hostile conditions still needs studies. Aim: The present study aimed to use LEDs to irradiate MSCs, in order to analyse cellular respiration under metabolic stress, reproducing the hostile micro-environment of the transplanted sites. In this milieu, we evaluated the oxygen consumption rates (OCR) using Seahorse Analyser. Methods: Adipose-derived MSCs were obtained from Fischer-344 male rats (CEUA 5883160218), irradiated once every other day for a week and analysed the repercussion of different radiant exposures (0.5, 2 and 4 J/cm²). Irradiations were performed using a 630 nm LEDbox (Biolambda, Brazil) at a constant irradiance of 15 mW/cm². Ct group was kept in the dark for the same time as 4 J/cm². OCR were determined using a XF24 analyzer (Seahorse Bioscience, MA, USA). ATP synthesis, driven by the respiration and the respiration based in proton leak, was determined by the addition of oligomycin (1 µg/mL). After three cycles of analysis, 5 µM of cyanide-p-trifluoromethoxyphenylhydrazone carbide (CCCP) was added to determine maximum respiratory capacity. After three additional evaluation cycles, 1 µM of rotenone and 1 µM of antimycin A were added to block complex I and III, respectively, ceasing the consumption of mitochondrial oxygen. Results: A negative impact of the radiant exposures of less magnitude was noted. Comparing with the Ct group, the MSCs irradiated with 0.5 J/cm² exhibited significantly lower values of baseline and maximum respiration, and proton leak. Similar findings were observed with irradiation of 2 J/cm² in addition to the lower respiratory reserve capacity of the MSCs. Cellular respiration remained intact with a radiant exposure of 4 J/cm². Conclusion: The use of multiple irradiations with red LEDs at 0.5 or 2 J/cm² had a negative impact in the respiration of the cells under metabolic stress, while irradiations with 4 J/cm² kept the cells resistance in hostile conditions.

Key words: light-emitting diodes, mesenchymal stem-cells, photobiomodulation, mitochondrial respiration, atp production.

Estudo experimental em in vitro (Experimental study in vitro)

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Single or cluster photobiomodulation in pain intensity in patients with grade IV knee osteoarthritis.

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Introduction: Osteoarthritis (OA) is a chronic disease that grows exponentially with advancing age. It's a condition that causes pain and difficulties to execute daily activities, especially when the knee is the affected joint as in most cases. Photobiomodulation (PBM) is a painless and non-invasive method that assists in analgesia of chronic diseases, but there are still no differences regarding the effectiveness of this treatment in severe OA patients. A possible explanation for this it's about the application using different parameters and techniques adopted in many studies in this area. Objectives: Evaluate the effect of single or cluster photobiomodulation in pain intensity of patients with stage IV knee osteoarthritis. Methods: The study was developed at the Federal University of São Paulo, Baixada Santista campus. Fifty-six patients of both sexes, with the medical diagnosis of grade IV knee OA, were recruited. The volunteers were randomly allocated to one of three groups: placebo group (n = 20), single PBM group (n = 20) and cluster PBM group (n = 16). All groups started by performing a balance protocol followed by the PBM application, using to single photobiomodulation laser AsGaAl 830 nm, 100 mW, 4 J per point, and to cluster photobiomodulation laser AsGaAl 810 nm, 200 mW, 4 J per point. The treatment was performed with a frequency of 3 times a week for 4 weeks, totalizing 12 sessions of photobiomodulation. The evaluations on the baseline, twelfth treatment session, and follow up, through questionnaires KOOS, WHOQOL-reduced, and CSI; and through the pressure pain threshold test, Pain Number Scale, Sit to Stand Test and Timed Up and Go. Results: Until now no statistical analysis has been carried out. The PBM groups showed improved pain intensity when compared to placebo. However, the cluster PBM group has shown better results in some assessments like END, KOOS, and WHOQOL when compared to other groups. Conclusion: The PBM groups (single and cluster) have shown better results in pain intensity and function.

Key words: Osteoarthritis, Photobiomodulation, Low-Intensity Light Therapy, Pain, Physiotherapy Modality, Knee

Ensaio Clínico (Clinical Trial)

The Use of Light-Emitting Diodes (LEDs) to Improve the Metabolism of Healthy Mesenchymal Stem Cells for Future Cellular Therapy.

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Background: Mesenchymal stem cells (MSCs) are being studied due the possibility of their usage in the treatment of various diseases. However, there is a low survival rate of the MSCs at transplanted sites, on account of the local hostile micro-environment, usually with hypoxia and inflammatory mediators. These conditions are believed to contribute to the initiation of an apoptotic process in transplanted cells, owing to mitochondrial dysfunction. Hence, the use of light sources may be a promising tool, due to their well-known benefits in modulating oxidative stress and improving cellular metabolism. Aim: In this study, we intend to irradiate MSCs using red LEDs to improve cell metabolism, in order to perform the cellular therapy in the future with more resistant cells. Methods: Adipose-derived MSCs were obtained from male Fischer-344 rats and two variants were analyzed: the repercussion of different radiant exposures (0.5, 2 and 4 J/cm²) and the influence of the number of irradiations (single dose or once every other day, totalizing three irradiation doses), using irradiance of 15 mW/cm² and 630 nm LEDbox (Biolambda, Brazil). The control group was kept in the dark for the same time as the 4 J/cm² group. DNA damage, MDA, protein oxidation, ATP production, NOx index (nitrate and nitrite ratio), MTT, AlamarBlue and cell quantification analyses were performed 24 hours after the last irradiation. Results: None of the irradiations improved cellular proliferation, damaged the DNA or increased oxidative stress, as indicated by MDA and protein oxidation analyses. MTT increased in all single dose groups, however, this improvement in cell viability was only confirmed by the AlamarBlue in the 4 J/cm² group. A single irradiation increased NOx index in the MSCs in the 4 J/cm² group as well. Furthermore, with multiple irradiations, only the 4 J/cm² group presented improvement of cell metabolism, seen by MTT and AlamarBlue, and an increase of ATP production and NOx index. Conclusion: None of the irradiations damage the cells at either protein or DNA levels. In addition, single or multiple irradiations with red LEDs at 4 J/cm² improved cellular metabolism. Funding sources: Sao Paulo Research Foundation (FAPESP #2018/06865-7) and Higher Education Personnel Improvement Coordination (CAPES #1794278). Acknowledgment: We thank the Gynaecology Department for the use of their Cell Culture Laboratory.

Key words: Photobiomodulation, Mesenchymal Stem Cells, Light Emitting Diode, Cellular Metabolism, Myocardium Infarction.

Estudo experimental em animais (Experimental study in animals), Estudo experimental em in vitro (Experimental study in vitro)

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THE ROLE OF PHOTOBIMODULATION IN PULMONARY FUNCTION IN THE EXPERIMENTAL MODEL OF ASTHMA.

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Introduction: Asthma is a chronic inflammatory disease characterized by lung cell recruitment and airway hyperresponsiveness. Several factors develop or aggravate asthma, and bronchoconstriction episodes are the main responsible for hospitalizations. Its treatment consists in bronchodilator, corticoids or leukotrienes antagonists, but sometimes are not effective, and cause many side effects. Photobiomodulation (PBM) has emerged as an efficient toll to treat lung diseases with low costs and side effects. Here we focused on evaluating the effects of PBM on the pulmonary function in the experimental model of asthma. Methods: Male Wistar rats were or not sensitized and challenged with ovalbumin (OVA) and treated or not with PBM (1h and 4 h after each OVA challenge). After 24 h after the last OVA challenge, the lung function and the levels and gene expression of nitrites and eicosanoids were evaluated. Device specifications: Bio Lambda LEDstar, Black Box Mini Model; Probe Design, Single Probe; Wavelength: 660 nm; Radiant Power: 160 mW; Power Density: 38,5 mW/cm²; spot area: 4,15 cm²; Density of energy: 5,8 J/cm²; Issuance: Continuous (cw); Total Radiant Emission: 24 J. Treatment specifications: Exposure time: 150 s; Irradiated points: 1 point; Irradiation Method: Direct skin contact; Anatomical location: trachea and lungs; Irradiation rhythm: punctual Results: Our data showed that PBM in allergic rats caused reduced respiratory resistance (Rrs), respiratory elastance (Ers) to cholinergic stimuli. The effects seem to be dependent on nitric oxide and eicosanoids balance, since we showed elevated levels of nitrites concomitantly to decreased levels of eicosanoids in the lung explants. We also showed increased gene expression of nitric oxide synthase (NOS) and decreased gene expression of cyclooxygenases enzymes (COX1 and COX2) in the lung tissue after PBM treatment. Conclusions: Together, data herein presented show that PBM treatment reduced the respiratory mechanics during allergic response by altering nitric oxide/eicosanoids relationship. These data open the possibilities to treat bronchoconstriction episodes with PBM. Conflict of interest: The authors declare that there are no conflicts of interest regarding the publication of this paper. Financial support: CNPq 305099/2017-5.

Key words: photobiomodulation; rats; asthma; corticosteroids.

Estudo experimental em animais (Experimental study in animals)

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Patellar or Achilles Tendinopathy treated with Cluster versus Single Photobiomodulation associated with eccentric exercises: A comparative single-blind, randomized clinical trial.

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Introduction: Tendinopathy is characterized by localized pain in the tendon and is related to physical activity. Although advances in scientific evidence are evolving for lower limbs tendinopathies, there is still a lack of good-quality studies that support the use of some electrophysical agents such as photobiomodulation (PBM). With the advancement of technology, there is an emergence of equipment with greater versatility allowing fine-tuning of parameters and dose, for example. One such example is the PBM cluster probe, which allows the delivery of PBM to larger areas in a shorter time. Despite studies indicating the use of PBM added to an exercise protocol, however, there are no current comparisons regarding the types of the cluster and single application in clinical studies. Aim: To compare the effect of cluster or single photobiomodulation when associated with eccentric exercise on symptomatology in patients with patellar and Achilles tendinopathy. Method: A blind randomized controlled trial was performed. Forty-two individuals were included and after being randomized, 21 individuals were included in the cluster PBM group and 21 patients were allocated to a single PBM. The exercise protocol was performed twice a week for 4 weeks. PBM was performed using 3 points after the exercise protocol with the following parameters: PBM single 810 nm (GaAsAl), 200 mW, 6 J (30 sec) per point and PBM cluster 5 x 810 nm (GaAsAl), 1W of output power, 30 J (30 sec) per point. The evaluations were carried out in 3 moments: pre-treatment, end of treatment (4th week) and follow-up of 4 weeks (8th week). Were used: NRS-11 (rest, worst pain e during the single leg hop test), VISA-P or VISA-A, pressure pain threshold (PPT) and modified blazing scale. An independent sample t test was performed for the analysis of the primary outcome (VISA at the 4th week) and for other analyzes, repeated measures ANOVA and the effect size calculation were used. Results: The VISA questionnaire at the 4th week showed no difference between the groups ($p = 0.81$, $es = 0.06$). For other analyzes, there was no intergroup difference. For worst pain measured by the NRS-11, there was no intergroup difference ($p = 0.79$ and $es = 0.08$). Regarding the LDP, there was no intergroup difference ($p = 0.3$ and $es = 0.37$). Conclusion: There was no difference between the modes of application of PBM (cluster or single) in the symptoms in patients with patellar and Achilles tendinopathy.

Key words: Tendinopathy, Low-Level Laser Therapy, Eccentric exercises, Photobiomodulation.

Ensaio Clínico (Clinical Trial)

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Effects of photobiomodulation therapy with blue light-emitting diode (LED) on the healing process of skin burns.

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Introduction: Burns are defined as traumatic injuries that occur due to the exposure of organic tissues to chemical, physical or biological agents. Non-fatal burns are one of the main causes of morbidity, including prolonged hospitalization and disfigurement. Among the therapeutic resources recently used, photobiomodulation therapy with use of light emitting diode (LED) has been the focus of several studies. **Objective:** The aim of this study was to evaluate the effects of blue LED on the healing process of skin burns. **Methods:** This research was approved by the Committee of Ethics on Animal Use (CEUA) of the Center for Higher Education and Development (CESED) (protocol number 6809092016) and respected standards issued by the National Council for the Control of Animal Experimentation—CONCEA. Forty male Wistar rats were divided into two groups: control (CTRL) (n = 20) and blue LED (LED) (n = 20), with subgroups (n = 5) for each time of euthanasia (7, 14, 21, and 28 days). LED (470 nm, 1 W, 12.5 J/cm² per point, 28 s) was applied at four points of the wound (total: 50 J/cm²). The Wound Retraction Index (WRI) was assessed and macroscopic analyzes were performed by two previously trained evaluators and independently. Histological sections were submitted to hematoxylin and eosin staining. **Results:** It was observed that there were no statistically significant differences in the WRI of the LED group in relation to CTRL group ($p > 0.05$) at the evaluation times. No animal showed purulent drainage or hyperemic halo on the day of euthanasia. At 21 days, 40% (n = 2) of the animals in the LED group still had a scab on the wound. In the CTRL group, no animal (n = 0) presented this condition in this experimental period. At 7 days, there was a statistically significant increase in the angiogenic index (AI) in LED (median: 6.2) when compared to CTRL (median: 2.4) ($p = 0.01$) and all animals in LED had already started re-epithelialization. **Conclusion:** This study suggests that blue LED, at the dosimetry used, positively contributed in initial stages of the healing of skin burns. Future studies are important to deepen the knowledge about the effects of this type of light on the repair of these wounds.

Key words: photobiomodulation, LED, burns, healing, low-intensity light therapy.

Estudo experimental em animais (Experimental study in animals)

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EFFECTS OF GREEN LIGHT EMITTING DIODE (LED) IN THE REPAIR PROCESS OF SKIN BURNS.

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Introduction: Burns are the fourth most common type of trauma, with about 180,000 fatalities per year worldwide. Burns can be defined as traumatic injuries, caused mainly by heat, radiation, electricity, friction or contact with chemicals, the severity of which is causally related to the depth of the injury generated. Among the therapies used for tissue repair, photobiomodulation therapy with the use of Light Emitting Diode (LED) stands out. **Objective:** The objective of this study was to evaluate the effects of the green LED in the repair process of the skin burns. **Methodology:** Forty male Wistar rats were divided by simple randomization into two experimental groups: control (CTRL) (n = 20) and green LED (LED) (n = 20), with subgroups (n = 5) for each moment of euthanasia (7, 14, 21 and 28 days). The irradiations with the LED (λ 520 \pm 30 nm, 180 mW, 60 J/cm² per point, 120s) were performed daily at four points of the wound (total: 240 J/cm²). After euthanasia, the Wound Retraction Index (WRI) was evaluated. The macroscopic analysis of the wounds was performed by two evaluators previously calibrated and blindly. In histological sections, the degree of reepithelization and the angiogenic index (AI) of the wounds were analyzed. **Results:** The LED group showed less wound retraction when compared to the CTRL, at 7 (p = 0.04), 14 (p = 0.09) and 21 days (p = 0.06). At 28 days, the WRIs of the groups were similar, with no statistically significant differences (p = 0.43). At the time of euthanasia, purulent secretion drainage and the presence of an erythematous halo in the wounds were not observed in any of the groups. At 21 days, only 20% (n = 1) of the animals in the LED group still had a scab on the wound. In all the analyzed periods, the LED group presented AI higher than the CTRL, with 80% (n = 4) of the animals in the treated group having started reepithelialization. **Conclusion:** In conclusion, the green LED had beneficial effects on the skin burn repair process, especially in the initial periods.

Key words: Burns, LED, Low-Intensity Light Therapy, Photobiomodulation, Repair.

Estudo experimental em animais (Experimental study in animals)

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Photodynamic therapy for squamous cell carcinoma of the head and neck a systematic review of clinical trials barra AMC(1), Motta LJ(1), Lino ADS(1), Silva DFT(1), Nunes FD(2), Rodrigues MFSD(1)

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INTRODUCTION: Squamous cell carcinoma of the Head and Neck is the fifth most prevalent neoplasm among Brazilian men and represents a high international morbidity. Approximately 30% of diagnosed cases include metastases, therefore the combination of radio and chemotherapy treatments is required, both have adverse effects that impact the patient's quality of life. The development of new therapeutic methodologies is fundamental to improving the quality of life and survival of cancer patients. **OBJECTIVE:** This systematic review aimed to evaluate the effect of PDT on SCCHN, comparing its effectiveness by tumor staging as well as the adverse effects reported by current clinical research. **METHODOLOGY:** The review was carried out according to the PRISMA protocol, the risk of bias assessment was performed by the JBI critical assessment tool, this study was approved on the PROSPERO platform. **Results:** Among the 34 complete articles included; optical fiber irradiation was the most performed light delivery, the complete response rate varied in relation to tumor stage and photosensitizer, being more effective in early stage tumors. **CONCLUSION:** PDT presents itself as an effective therapeutic modality, however, new studies must be carried out with longer follow-up and control groups to confirm this statement.

Key words: photodynamic therapy, squamous cell carcinoma of the head and neck, tumor response, systematic review.

Revisão /Review

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Different doses of photobiomodulation in patients with chronic shoulder pain.

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Introduction: Shoulder pain presents a high prevalence among musculoskeletal disorders, some limitations such as the range of motion can lead to the loss of daily and work activities, helping to worsen the function. Although some systematic reviews and randomized clinical trials suggest that photobiomodulation (FBM) can be an effective physiotherapeutic intervention to decrease pain and functional loss or disability, and lead to an improvement in tissue repair, there is still an absence of studies that fully support its dosimetric parameters. Objective: Compare the effect of doses with 120s and 30s on pain intensity and functionality in patients with chronic shoulder pain. Methods: Controlled, randomized, double blinded clinical trial. Developed at the Federal University of São Paulo - UNIFESP, Baixada Santista campus. 26 volunteers with a diagnosis of chronic shoulder pain were recruited and were randomly randomized into 3 groups. Being: Group 1: exercise protocol and placebo application of FBM (GP). Group 2: exercise protocol and FBM with 30s of duration (GFBM30). Group 3: exercise protocol and FBM with 120s of duration (GFBM120), which were submitted to 6 weeks of treatment, twice a week. Pain was assessed using the Numerical Rating Scale (NRS-11) for: rest, the activity that causes the most pain and during sleep, using the Pressure Pain Threshold (LDP). The functionality was analyzed using the SPADI and Patient Specific Functional Scale (PSFS) questionnaire in 3 moments: Pre-Treatment, Post-Treatment (6th week) and Follow Up (10th week). Results: Due to the insufficient number of participants required, according to the sample calculation, the statistical analysis of the study has not yet been carried out. The results are presented in means and differences between the times. In the SPADI questionnaire, GFBM30 showed a reduction of 19.6 points at the end of treatment, while GFBM120 showed a difference of 31.8 between the initial and final evaluation, and the GP showed a reduction of 24.2 points. Regarding the evaluation of the NRS-11 for the activity that causes the most pain, the GFBM30 group showed a reduction of 4.4 points between the initial and final evaluation, while the GFBM120 showed a difference of 5 points at the end of the treatment and the GP presented a reduction of 4.6 points. Conclusion: To date, no dose has shown superiority in terms of improved functionality and decreased pain.

Key words: shoulder, chronic pain, photobiomodulation, dosimetry, physiotherapy.

Ensaio Clínico (Clinical Trial)

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BETTER A-PDT EFFICACY WITH DIMETHYL METHYLENE BLUE COMPARED TO METHYLENE BLUE IN STAPHYLOCOCCUS AUREUS.

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Introduction Antimicrobial photodynamic therapy (aPDT) has demonstrated efficacy on the reduction of microorganisms number. This technique consists of the use of light in an adequate wavelength, associated to a photosensitizing agent (PS) in the presence of oxygen. The PS excitation is followed by the production of singlet oxygen and free radicals, resulting in cytotoxicity. Different species are susceptible to aPDT. Staphylococcus aureus is a gram positive, facultative anaerobic bacterium, with spheric form and staphylococcus arrangement, being an etiologic agent of many pathologies and whose aPDT susceptibility has been investigated. The objective of this study was to compare the efficacy of Methylene Blue (MB) and Dimethyl Methylene Blue (DMMB) on aPDT in Staphylococcus aureus in suspension, in vitro. Methods MB and DMMB solutions were incubated for 5 minutes at 37°C in darkness with the bacteria inoculum at $1,5 \times 10^8$ UFC/mL in different concentrations. On the experiments with aPDT, the bacterial samples and PS were exposed to a treatment with 660 ± 10 nm LED, with irradiance at $11,2$ mW/cm² and radiant exposure at $4,7$ J/cm² for 7 minutes. The dark control samples were protected from light using aluminium foil. Then, the serial dilution and culturing in 1% sucrose BHI agar on petri dishes were made. The dishes were incubated for 24 hours at 37°C and aerophilia. For the uptake tests, the bacterial inoculum was kept in contact with the PS at 20 µg/mL with no light and the percentage of the incorporation was determined by spectrophotometry. The data was submitted to the non-parametric Student-Newman-Keuls test, with the Biostat program, considered a global level of significance of $\alpha=0,05$. Results The MB did not demonstrate microbial reduction in the dark while DMMB showed total bacterial death with PS concentrations above 10 µg/mL. With aPDT, MB at 50 µg/mL demonstrated complete microbial eradication, while DMMB did it in all evaluated concentrations. Data analysis and conclusion The uptake of the DMMB was determined as 85% and MB uptake. DMMB is more efficient than MB because it has presented higher bacterial cell uptake.

Key words: photodynamic therapy, Dimethyl Methylene Blue, Staphylococcus aureus, Methylene Blue.

Estudo experimental em in vitro (Experimental study in vitro)

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PHOTODYNAMIC THERAPY WITH METHYLENE BLUE, AZURE A AND AZURE B IN STAPHYLOCOCCUS AUREUS.

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Staphylococcus aureus is a gram positive aerobic bacteria and has a spherical morphology. It is common in acquired infections, easily disseminated and highly resistant to antibiotics. Photodynamic Therapy has an effect through the association of light and a photosensitizer (PS) in the presence of oxygen, being denominated antimicrobial photodynamic therapy (aPDT) when applied to microbial treatments. The microbial death is caused by reactive oxygen species generated when the PS is stimulated by an adequate wavelength of light. The purpose of this study is to compare the aPDT efficacy in Staphylococcus aureus in vitro suspension when using Azure A (AA), Azure B (AB) and Methylene Blue (MB). PS solutions were incubated for 5 minutes in the dark with the bacteria inoculum in $1,5 \times 10^8$ UFC/mL suspension, $20 \mu\text{g/mL}$ concentration, and a control group with sterile milli-Q water. Following, samples were irradiated (660 ± 10 nm, 4.7 J/cm^2 for 7 minutes, $11,2 \text{ mW/cm}^2$). Dark samples were protected from light. All samples were diluted and incubated for 24 hours at 37°C and aerophilic. Also, the PS uptake in Staphylococcus aureus suspension was evaluated by spectrophotometry. The data were submitted to Kruskal-Wallis non-parametric trial, and the averages were compared through Student-Newman-Keuls test, using Biostat software, considering a global significance level of $\alpha=0,05$. The results showed no bacterial reduction in the dark, on both PS. On aPDT there was total inactivation using AA and AB, however the same did not occur with MB (1log reduction). AB presented higher uptake (40%), followed by AA (30%), and MB (10%). No toxicity in the dark has been found on the photosensitizers AA, AB E MB, and AB had a greater effectiveness due to its higher cell uptake level.

Key words: Azure A, Azure B, Staphylococcus Aureus, Methylene Blue.

Estudo experimental em in vitro (Experimental study in vitro)

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PHOTOBIMODULATION TREATMENT AMELIORATES ALLERGIC LUNG DISEASE MEDIATED BY REDUCED MAST CELL DEGRANULATION.

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Introduction: Since asthma is a multifactorial disease whose treatment sometimes is not effective, new therapies that improve the respiratory discomfort of patients are of great importance. Photobiomodulation (PBM) has emerged as an important tool to treat lung diseases characterized by inflammation. So our objective was to investigate the effects of PBM on allergic lung disease by an evaluation of lung cell migration, mucus secretion, tracheal responsiveness, and mast cell degranulation. Methods: Male Balb/c mice were or not sensitized and challenged with ovalbumin (OVA) and treated or not with PBM (1h and 4 h after each OVA challenge). Twenty-four hours after the last OVA challenge the analysis was performed. Analysis was performed 24h the last LED treatment or OVA challenge. Device specifications: Bio Lambda LEDstar, Black Box Mini Model, São Paulo, Brazil; Probe Design, Single Probe; Wavelength: 660 nm; Radiant Power: 160 mW; Power Density: 38,5 mW/cm²; spot area: 4,15 cm²; Density of energy: 5,8 J/cm²; Issuance: Continuous (cw); Total Radiant Emission: 24 J. Results: Our results showed that PBM treatment in asthmatic mice reduced the lung cell infiltration, the mucus production, the tracheal's contractile response. The effects of PBM treatment on these parameters may be modulated by mast cells, since the degranulation was decreased (P<0.05). Conclusions: This study may provide important information about the effects of PBM, and in addition, it may open the possibility of a new approach for the treatment of asthma. Financial support: CNPq 305099/2017-5.

Key words: laser, photobiomodulation, LED, lung, allergic disease.

Estudo experimental em animais (Experimental study in animals)

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Effect of transcutaneous irradiation on radial artery in hypertensive patients: clinical, randomized and double blind study.

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INTRODUCTION: Systemic Arterial Hypertension (SAH) is a multifactorial clinical condition, with a high rate of morbidity and mortality and low control rates. Although photobiomodulation (PBM) is able to induce a photobiological interaction inside cells and modify the micro and macrovascular response in situ, there is a lack of studies that demonstrate its systemic effect, mainly clinical and placebo-controlled studies. **OBJECTIVE:** This study aimed to evaluate the modulatory effects on the control of blood pressure in hypertensive patients after transcutaneous photobiomodulation of the radial artery. **METHODOLOGY:** In this study, 44 participants were randomly divided into 4 groups, one group being irradiated for 60 minutes daily for 5 days, being repeated after 20 days with a total of 3 cycles (Group A), and their respective placebo (Group B); the third group was irradiated for 30 minutes daily, for 10 days, being repeated after 20 days, also totaling 3 cycles (Group C), and their respective placebo (Group D). All participants continued with conventional drug treatment previously instituted. In group A, the energy delivered per session was 360J, totaling 15 sessions. While in group C it was 180J, for a total of 30 sessions. Before the interventions, after each cycle and at the end of them, blood pressure and heart rate were measured. Before and at the end of the interventions, blood samples were collected to measure interleukins 6 and 1 β . The data were checked for normality using the Kolmogorov-Smirnov test. Since the data were normal and of homogeneous variances, the ANOVA two-way test for repeated samples was applied to compare the four groups in the different irradiation cycles. Sidak's post-hoc test, suitable for multiple comparisons, was used with $\alpha = 0,05$. **RESULTS:** Modulatory effects have been shown to control blood pressure in hypertensive patients after photobiomodulation. Group A showed a better response to decrease hemodynamic variables than group C. Group A showed less expression of interleukins IL - 1 β and IL-6 compared to group C. **CONCLUSION:** Multidisciplinary care may have increased adherence to treatment for all groups, including placebo groups, which also decreased hemodynamic variables. However, group A still performed better.

Key words: Photobiomodulation, Interleukin 1 β , Interleukin 6, Systemic arterial hypertension; low level laser therapy.

Ensaio Clínico (Clinical Trial)

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PHOTOBIMODULATION THERAPY ASSOCIATED WITH THE USE OF CARBON BIOMATERIAL IMPREGNATED WITH SILVER NANOPARTICLES IN THE PROMOTION OF BONE REPAIR WITH INFECTION CONTROL.

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Bone lesions are increasingly frequent in Brazil. Carbon materials, associated with silver nanoparticles, activated by photobiomodulation. They are promising in the treatment of infectious or aseptic bone failures. The objective of this research is to evaluate the use of photobiomodulation associated with carbon material impregnated with nanosilver in the bone repair process in an experimental model of bone lesion in the tibia of rats. Wistar Rats (200-250g), 90 days of life, 120 animals will be used. Bone injury will be performed in the tibia, with a bone defect of 1.5 mm \varnothing x 0.5 mm deep (method proposed by Bossini). Biochemical analyses (quantification of alkaline phosphatase, acid phosphatase-TR) - RT-PCR will be performed to quantify gene expression: BMP-4, BMP-7, RANKL, OPG, OCC, MMP; morphological analysis, with the preparation of histological slides; and functional, with resistance tests (Fmax and Dmax). Followed by statistical analysis of the results.

Key words: biomaterials, laser, photobiomodulation.

Protocolo Experimental / Experimental Protocol

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Speech Therapy and LASER systemic therapy in delaying children's language development.

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INTRODUCTION: Communication disorders have significant impacts on the child's life, social, emotional and academic life. The language development can manifest itself very early in the baby's life, and may be present in individuals without physiological changes as well as in syndromic cases or neurological disorders. The speech therapist is the professional qualified to identify, diagnose and treat individuals with disorders of oral and written communication, voice and hearing. In this case report, speech therapy was performed on a child aged 2 years and 8 months, with language delay, traditional speech therapy and the concomitant use of systemic LASER therapy and infrared LASER. Human communication does not only cover speech, but also gestures, voice and expressions, being an essential element for socialization and integration in the community. Communication disorders are some of the most common childhood diseases, manifesting as delay or atypical development involving hearing, speech and / or language at varying levels of severity. Most of the time these disorders are noticed by parents, teachers and the Pediatrician who accompanies the child. They report that the child has difficulty speaking or does not speak, often pointing to request something. It is known, for example, that children with delayed language development will present, at school age, important and persistent neuropsychological abnormalities, including specific learning disorders. **OBJECTIVE:** This study aims to show the case of a male child, 2 years and 8 months old, an only child, referred by the Pediatrician for speech therapy evaluation and treatment. The consultations started on March 31, online in a pandemic caused by COVID19. The parents' complaint is that T. "speaks a few words, points out when he wants something and has great difficulty in expressing his wishes". Speech therapy treatment consisted of anamnesis, parental, behavioral guidance, auditory research, traditional speech therapy for oral language stimulation and the use of LASER systemic therapy and infrared LASER protocols weekly for 5 months.

Key words: laser, photobiomodulation, children delay, language development, speech therapy.

Protocolo - Ensaio Clínico (Clinical Trial)

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A discussion about optical properties and histology of healthy and burned rat skin.

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Background: The interaction between light and biological tissue occurs through reflection, refraction, absorption, scattering, and transmittance. Determining such properties is important for optical devices to be properly designed, diagnostic signals to be well interpreted, and for phototherapy protocols to be safe once the optical properties of tissue affect the light's behavior. Diffuse optical spectroscopy has advanced as a promising tool for non-invasive determination of reflectance and transmittance. Once this data is collected, the Kubelka-Munk equation can be used to determine the absorption, reduced scattering, and reduced attenuation coefficients. Since the skin is the major physical barrier during photonic therapies and that injured tissue behaves differently compared to healthy tissue, it is important that the optical properties of the skin be known in both physiological states. Aim: To analyze the optical and histological differences between healthy rat skin and rat skin after burn induction. Method: Wistar rats were divided into 2 groups: HG, which is the group of healthy animals; and BG, which is the group of animals that suffered induction of scalding burn. Through spectroscopic analysis, skin biopsies had their transmittance and reflectance values collected between 350 and 1400 nm wavelengths. Data was processed by the Kubelka-Munk equation to obtain the absorption, reduced scattering, and reduced attenuation coefficients. The biopsies were processed and stained with hematoxylin and eosin for inflammatory evaluation. Results: 3 days after burn induction the absorption, reduced scattering, and reduced attenuation coefficients were higher in group HG. Histologically, was observed an intense inflammatory infiltrate with loss of epithelium and part of the dermis. 7 days after burn induction all the coefficients studied were higher in group BG. Histologically, biopsies showed dermal remodeling and reepithelization below the injured area. 14 days after burn induction, the absorption and reduced attenuation coefficients remained higher in group BG, while the reduced scattering coefficient was higher in group HG. Histologically, complete epidermal repair and absence of cutaneous attachments were noticed. Conclusion: The optical properties of the skin change both when comparing the different physiological conditions and during the tissue repair process. It indicates that the irradiation parameters must be changed according to the skin condition.

Key words: absorption coefficient, scattering coefficient, attenuation coefficient, Kubelka-Munk, burn.

Estudo experimental em animais (Experimental study in animals)

THE USE OF PHOTOBIO-MODULATION AND LOW FREQUENCY ULTRASOUND FOR REDUCTION OF LOCALIZED FAT CAN INDUCE CHANGES IN THE LIPID PROFILE? – AN INTEGRATIVE LITERATURE REVIEW.

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INTRODUCTION: Localized lipodystrophy, popularly known as localized fat, consists of the accumulation of subcutaneous adipose tissue in certain regions of the body and its presence is closely related to the percentage of total body fat. Currently, several technologies that aim to treat this aesthetic dysfunction are available, such as cryolipolysis, high-intensity focused ultrasound (HIFU) and radiofrequency. However, photobiomodulation (PBM) and low-frequency ultrasound (LOFU), remain little explored, especially with regard to the consequences generated by these treatments on the lipid profile and liver function of the individuals submitted, since most studies have mainly focused on visual changes (reduction of measures). **AIM:** The main objective of this study was to elucidate whether the use of PBM and LOFU in treatments aimed at reducing measures can cause significant changes in the lipid profile, especially in serum levels of triglycerides and total cholesterol. **METHODS:** It is an integrative literature review, whose bibliographic survey was carried out using three databases, namely: Google Scholar, SciELO and Pubmed, and were selected original articles that were published between 2010 and 2020 were searched. The search strategy involved the use of the most commonly used descriptors (keywords) for each technique as LLLT, phototherapy, ultrasound, and cavitation. The references of the articles were also analyzed in order to identify additional studies. **RESULTS:** After a thorough search, ten papers were surveyed. After a critical analysis of all the selected studies, the results found in relation to the lipid profile after this interventions proved to be very contradictory. Regarding the PBM, there was no consensus between the results found after the use of different wavelengths (532 nm, 635 nm, 780 nm, 830 nm, and 904 nm) ranging since the reduction to the increase in levels of total cholesterol and triglycerides. The studies found involving the use of LOFU also showed different results, however, in general these treatments caused an increase in the lymphatic and blood levels of both analyzed indicators, regardless of the dosimetric parameters applied. It was concluded that the results related to the lipid profile after the use of PBM and LOFU were inconclusive, mainly due to the different parameters used for both techniques. **CONCLUSION:** Thus, the proper planning of clinical trials using standardized dosimetric parameters will be extremely relevant to obtain results with a higher level of reliability.

Key words: Subcutaneous fat, Esthetics, LLLT, Cavitation, Cholesterol, Triglycerides.

Revisão /Review

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EFFECTS OF PHOTOBIMODULATION IN PRESSURE INJURIES STAGES 2 AND 3: CONTROLLED, RANDOMIZED AND BLIND CLINICAL STUDY.

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Introduction: The high incidence of pressure injuries (PIs) is considered a serious public health problem as well as a negative indicator when considering the quality of the nursing care provided. With the goal of changing this scenario, this study aims to compare the effects of photobiomodulation (PBM) with LED to that of PBM with laser and LED on PIs during the hospitalization of patients in a tertiary public hospital. **Methods:** The study will be a randomized controlled blinded clinical trial, divided into three groups, with 10 patients per group: the conventional group (G1), the LED group (G2) and the LED group with LED on the lesion bed + laser on the lesion edge (G3). G1 procedures will be performed once a day every 24 hours with polyhexamethylene biguanide (PHMB) and hydrogel. G2 will be treated with PHMB and a red LED array, large enough to cover the entire lesion, including the edges, every 48 hours. G3 will be treated with PHMB and a red LED array only covering the lesion bed, as the edges will be irradiated with a red laser, every 48 hours. All groups will receive secondary cellulose membrane dressings. The radiant exposure ($H = 3J / cm^2$) will be the same in groups G2 and G3. The lesions will be evaluated using the Bates-Jensen scale and pH. The severity of the patients' condition will be assessed using the Therapeutic Intervention Scoring System-28, the Nutritional Risk Screening and by the serum levels of Hb, Ht, VHS and PCR. Treatment will occur during the participants' hospitalization and last for 15 days. **Statistical analysis:** Data will be checked for normality and subjected to appropriate tests in order to compare the groups. Analysis of the correlation between the different variables will also be performed. All data analysis will be performed with Origin 2017 software (OriginLab, USA) and with a significance level of $\alpha = 0.05$.

Key words: Phototherapy, LLLT, LED, Laser, Wound, Ulcer.

Protocolo clínico ou experimental (Clinical or experimental protocol)

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Comparative clinical study of the blue, red and combined led in inflammatory acne.

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Introducion: Light therapies have been used in dermatoses, including acne. Some studies indicate that the blue LED inhibits the proliferation of C. bacterium acnes and that the red light acts to decrease the inflammatory condition. Several studies have been analyzed, some in vitro, others in vivo, however, few studies have compared and analyzed the in vivo use of LED in acne. Objective: Therefore, the objective of this study is to compare the effect of the blue LED, the red LED and the combined red and blue LEDs in patients with mild and moderate inflammatory acne (grades II and III). Methodology: 108 participants with inflammatory acne will be selected, according to the classification of the Brazilian Society of Dermatology and IGA (Investigator's Global Severity Assessment) and also the degree of skin color according to the Fitzpatrick scale (I to IV). Participants will be treated with an LED mask, applied over the entire face, for 10 minutes, 3 times a week, in the UNINOVE laboratory, divided into 3 groups, where the first group will use a mask with blue LED, the second with LED red and the third with combined blue and red LED. The evaluations will be made through photos and counts of papules and pustules, in the baseline, on the 15th and 30th day of treatment by a blind evaluator. Participants will also assess their perception of improved appearance after the end of treatment, using the CADI questionnaire (CARDIFF ACNE DISABILITY INDEX).

Key words: Acne, low level light therapy, LED.

Protocolo Clínico / Clinical protocol

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EVALUATION OF HYDROXYL RADICAL SUPPRESSION BY ANTIBIOTIC MEROPENEM ASSOCIATED WITH METHYLENE BLUE PHOTOSENSITIZER.

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Introduction: Meropenem is an antibiotic that acts against a broad spectrum of anaerobic and aerobic bacteria and it is used in clinical practice to treat various infections. Photodynamic therapy consists of the interaction of light in the presence of oxygen with an exogenous photosensitizer and is considered a noninvasive therapy that can be applied together with other types of treatments. It has been widely used in the medical field. The study of the association between photodynamic therapy and antibiotic use is necessary to elucidate the effects of these treatments together. The hydroxyl radical is an important reactive oxygen species that can be generated by the type I photochemical reaction of methylene blue, that is used in photodynamic therapy as a photosensitizer. Objective: This study aimed to determine if meropenem suppresses the methylene blue's generation of hydroxyl radical. Materials and methods: Hydroxyl radical generation was analyzed using the p-nitrosodimethylaniline probe. The study was developed in two phases. In the first phase, the samples contained methylene blue and the probe. In the second phase, the samples contained methylene blue, the probe and meropenem. Both samples were irradiated 12 times with a red laser ($\lambda=660$ nm), for 60 seconds each time and later taken to the UV-Vis spectrophotometer. Results: According to the analysis performed the meropenem with methylene blue and the probe showed the largest generation of hydroxyl radical. Conclusion: Thus, it was concluded that meropenem does not suppress the methylene blue's generation of hydroxyl radical, but rather intensifies the process, increasing oxidative stress. However, the extension and clinical impact of this result still needs further investigation.

Key words: Antibiotic, reactive oxygen species, laser, aPDT.

Estudo experimental em in vitro (Experimental study in vitro)

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CYTOKINES SERUM LEVELS IN PATIENTS WITH ORAL LICHEN PLANUS TREATED WITH PHOTOBIO-MODULATION.

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Oral Lichen Planus (OLP) is a chronic mucocutaneous inflammatory disease with different clinical presentations, degrees of discomfort and pain. Deregulated release of cytokines have been associated with its pathogenesis. The standard treatment for OLP patients is topical or systemic corticosteroids, which can lead to side effects and/or a lack of response to therapy. The Photobiomodulation (PBM) is an effective treatment in inflammatory diseases, modulating inflammatory cytokines, promoting analgesia and tissue repair. In OLP, we have previously observed that PBM is effective as corticoid in reducing pain. The aim of this study was to evaluate the serum concentration of TNF- α , IL-1 β , IL-6, IL-10, IL-4 and IL-17 in OLP patients treated with PBM. Thirty-four patients with OLP were randomized into the following groups: Control (topical 0.05% clobetasol propionate, 3 times a day for 4 weeks) and PBM (laser twice a week, 680 \pm 20nm, 100mW, 177J/cm², 5s, 0.5J, for 4 consecutive weeks). Peripheral blood was collected at baseline (D0) and at the end of treatment (D30) and the serum levels of TNF- α , IL-1 β , IL-6, IL-10, IL-4 and IL-17A were evaluated by ELISA. The IL-6 serum levels decreased at D30 when compared to baseline only in Control group ($p=0.04$). No significant difference was noticed in the concentration of TNF- α , IL-1 β , IL-10 and IL-17A at the end of treatment in relation to baseline in both groups. IL-4 levels were detected only in 4 patients. Thus, PBM was not capable of modulating the serum levels of cytokines involved in OLP pathogenesis. Probably, other molecular and cellular mechanisms triggered by PBM may be involved in OLP.

Key words: oral lichen planus, photobiomodulation, cytokines.

Ensaio Clínico (Clinical Trial)

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Counseling and Photobiomodulation Therapy in the Management of Temporomandibular Disorders: Early Results in Pain and Mandibular Mobility.

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Introduction: Low-Intensity Laser Photobiomodulation Therapy (PBMT) has been used for pain relief in several clinical conditions, including Temporomandibular Disorders (TMD). As musculoskeletal pain often leads to changes in motor behavior, it is common for TMD patients to present restricted mandibular mobility. Objectives: This early analysis of a double-blind randomized clinical trial aimed to evaluate the effect of a combined counseling and PMBT approach on pain and range of mandibular movements for TMD patients. Methods: Forty participants presenting joint and muscle pain were selected based on the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). All participants were instructed on self-care strategies for pain control to substitute medication intake on a counseling session two weeks prior to PBMT. After this period, those who still presented pain over 4 cm in a visual analog scale (VAS) were randomly assigned to four treatment groups (n=10): G1, placebo (SHAM); G2, PBMT with red laser (660 nm, 100 mW, 3 J/point, 12 points, θ 0.034 cm²); G3, PBMT with infrared laser (808 nm, 100 mW, 3 J/point, 12 points, θ 0.034 cm²); and G4, PBMT with red and infrared laser alternated between sessions. Treatment consisted of 8 sessions of PBMT, two times a week. The effectiveness of the proposed therapy was measured by: spontaneous pain reduction in VAS; reduction in VAS for pain upon palpation of the TMJ, superficial masseter and anterior temporal muscles; pressure pain threshold on the same areas; and amplitude of mouth opening, lateral and protrusive movements. Data was collected at four different times: T1, initial; T2, immediately after the first PBMT session; T3, end of treatment; and T4, 30 days after the last PBMT session. Statistical analysis was conducted with 2-way ANOVA for repeated measures with post hoc Tukey tests ($p < 0.05$), and intention-to-treat analysis was also applied. Results: PBMT proved to be superior to placebo for reducing pain upon palpation on TMJ and masseter muscle; the active therapy promoted an improvement equal to placebo in the other outcomes. The benefit acquired was still present after 30 days. Conclusion: In early analysis, the presented PBMT protocols - combined to counseling strategies - are effective in reducing pain upon palpation in TMJ and masseter muscle in individuals with TMD.

Key words: Temporomandibular disorder, counseling, phototherapy, multiple wavelengths, orofacial pain, pain pressure threshold, mandibular function.

Ensaio Clínico (Clinical Trial)

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Evaluation of the influence of the culture medium in the effect antimicrobial blue light therapy on periodontopathogens.

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Periodontal disease (PD) is a chronic inflammatory disease caused by bacterial biofilm which is highly prevalent around the world. PD treatment is based on scaling and root planning and control of bacterial load of periodontal sites around the teeth. Antimicrobial blue light (ABL) therapy is a technique to inactivate bacterial cells using blue light to excite endogenous chromophores inside microorganisms, which may produce reactive oxygen species (ROS) and then kill periodontopathogen bacteria. The aim of this study is to evaluate the potential of bacterial death by ABL and the influence of culture media on chromophores formation inside bacterial cells. *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis* microorganisms were grown from vial stocks in brain heart infusion medium or blood agar medium, and an inoculum was prepared with 10^9 bacterial cells per mL. Bacteria suspension was irradiated with a blue light at $\lambda=403\text{nm} \pm 15$ LED (blue / violet) with an output power of 1W, irradiance of 588.2 mW/cm^2 , for 0, 1, 5, 10 min in 4 different groups: A. *actinomycetemcomitans* cultivated in BHI; *P. gingivalis* grown in BHI; *A. actinomycetemcomitans* grown in blood agar; and *P. gingivalis* grown in blood agar. Following irradiation, bacterial suspensions were diluted from 10^{-1} to 10^{-6} the original concentration and plates were incubated for cfu formation. All experiments were performed in triplicate. The groups were compared with ANOVA and TUKEY and means were considered different when $p < 0.05$. Absorbance of bacterial chromophores were reached by optical spectroscopy from 300 to 800 nm. We observe that no bacterial inactivation was achieved under the parameters used in this experiment ($p > 0.05$). Even following 10 min of irradiation, bacterial inactivation was not observed. However, optical spectroscopy showed that *A. actinomycetemcomitans* produced a chromophore molecule with compatible absorbance with riboflavin and *P. gingivalis* produces chromophores compatible to riboflavin and porphyrin especially when they are cultivated in culture medium with blood. In conclusion, periodontopathogen bacteria were not inactivated by ABL under the parameters used in this study until now; however, those bacteria present the required chromophores with the potential to generate cell death with blue light.

Key words: blue light antimicrobial therapy, *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, endogenous photosensitizer, Antimicrobial Photodynamic Therapy (aPDT), Photodynamic Antimicrobial Chemotherapy (PACT).

Estudo experimental em in vitro (Experimental study in vitro)

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Photobiomodulation associated with plant extracts for the treatment of collagen biomodulation in skin photoaging: a literature review.

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Introduction: with advancing age, many physiological functions are altered, characterizing the aging process, which encompasses biophysiological, pathological and psychosocial factors. Thus, skin aging is stimulated through intrinsic and extrinsic factors, among which we have ultraviolet radiation, which leads to photoaging, promoting oxidative stress and damaging elastin and collagen fibers. Thus, phototherapy has been widely used in tissue repair and healing, as an adjunct treatment in photoaging. In addition, plant extracts have high antioxidant capacity by polyphenol content, whose goal is to decrease oxidative stress, which, in turn, when it is elevated results in increased inflammation and, consequently, increases the expression of metalloproteinases, some responsible for degrading collagen and elastin. Therefore, the possible combination with plant extracts and phototherapy associated with red LED may be a potential treatment. Objective. The present study aims to evaluate the efficacy of photobiomodulation and vegetal extracts in stimulation of collagen synthesis. Materials and methods. This is a review that was sought in the Databases Scielo, Pubmed, Web of Science and Medline, during the period from September 24 to October 5, selecting articles from the last 10 years. The keywords used were photobiomodulation, photodamage, skin rejuvenation and phototherapy. Results / Discussion. We found 18 articles, of which 4 were selected, based on the analysis of the data obtained, we showed that the treatment with different types of LED (red, yellow, blue), the red and yellow LED system, showed a significant improvement in the increase in expression in the synthesis of type I and III collagen, skin improvement and wrinkle reduction, and the use of blue LED in different doses of energy, demonstrate that it is capable of inducing photoaging. The use of extracts with different polyphenolic contents demonstrates increased viability, decreased inflammation and delays the effects of skin photoaging. Conclusion. Studies have shown that both the use of extracts and the use of some light sources in specific red LED, because many studies have shown promise, are able to treat photoaging, and lead to increased synthesis of collagen and elastin even so, it is essential to investigate in vitro, the combined treatment of extracts and photobiomodulation, after UVA exposure in order to determine an effective therapeutic treatment for skin photoaging.

Key words: photobiomodulation, photodamage, skin rejuvenation, phototherapy.

Revisão /Review

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Photodynamic therapy decreases cellular viability and colony formation in oral squamous cell carcinoma cell lines.

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Introduction: Squamous cell carcinoma is the most prevalent malignant neoplasm in the oral cavity. The main therapeutic modalities of OSCC are surgery and radiotherapy alone or in combination with cisplatin. Photodynamic Therapy (PDT) is based on the use of photosensitizers, whose cytotoxicity is activated by light, leading to the death of target cells. Some studies have demonstrated that PDT can be applied in OSCC patients with early stage tumors. Objective: The aim of this study was to evaluate the effects of PDT in cellular viability as well as in colony and sphere formation in OSCC cell lines. Material and Methods: CA1 and Luc4 cell lines were cultivated in DMEMF12+10%FBS and medium supplements. A total of 5×10^4 cells were plated in 96-well plates and divided into the following groups: control, LED, 5-aminolevulinic acid (5-ALA) and 5-ALA-PDT (5-ALA+LED). Cells in the 5-ALA and PDT groups were incubated with 1mM 5-ALA at 37°C for 4h. Next, cells were washed and the groups LED and PDT were irradiated with a diode emission light (LED) using the BioLambda LedBOX, 660nm, 6 J/cm^2 , 49.5 mW/cm^2 and 80% of power capacity. Cell viability was evaluated after 24h using the MTS and Neutral Red assays. For the colony assay, 250 cells were plated in a 6-well plate and after 7 days, the cells were fixed, stained with violet crystal 0.05% and the colonies were counted. In the sphere assay, 100 cells were plated in low attachment plates and counted after 7 days. Results: In the MTT and NR assays, CA1 and Luc4 cell lines showed a significant decrease in cellular viability after 5-ALA-PDT when compared to all groups. In addition, there was a significant decrease in the number of colonies and spheres after 5-ALA-PDT in relation to all groups. Conclusion: PDT was able to decrease the cellular viability in OSCC cell lines as well as ability to form colonies and spheres, both associated with the self-renewal and anchorage independent growth potential, respectively.

Key words: Oral Cancer, Stem Cells, Photodynamic Therapy.

Estudo experimental em in vitro (Experimental study in vitro)

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Photobiomodulation and chamomile extract to reduce skin photoaging: a review of literature from in vitro studies.

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Introduction Photoaging is a cumulative process in which the skin expresses how it is transformed according to the degree of exposure to environmental factors, especially solar radiation. The effects of this phenomenon are visual changes such as irregular pigmentation, wrinkles and lesions. Photobiomodulation is a treatment based on the action exerted by light on tissues that try to stimulate cellular metabolism and tissue regeneration, Plant extracts rich in polyphenolic constituents have been widely used in anti-aging products due to their antioxidant activities and ability to neutralize free radicals. Therefore, a possible treatment of photoaging with a light source combined with the use of plant extracts may be promising. **Objective.** The present study aims to perform an analysis of the best scientific evidence of the use of photobiomodulation and chamomile extract to reduce skin photoaging caused by UVA radiation in terms of in vitro studies. **Methodology.** This is a review that was sought by studies in the databases Scielo, PubMed, Medline, Web of Science, during the time of September 24 to October 6, selecting articles from the last 6 years. **Keywords used:** Photoaging; photobiomodulation; UVA irradiation. **Results and discussion.** We found 11 articles, of which 4 were selected, based on the analysis of the studies, it was evidenced that the use of red LED, decreasing the activity of senescence-related proteins such as p53, p21, p16, and the matrix activity of metalloproteinases that degrade collagen and elastin (MMP-1 and 16), thus delaying the cumulative effects of UVA. And the use of plant extracts, with different polyphenolic contents, has a protective preventive potential of photoaging, and chamomile extract has high anti-inflammatory activity against pro-inflammatory agents, and much of the literature reviewed points to extracts as promising alternatives, for reducing the number of inflammatory cells, besides influencing the level of cytokines. **Conclusion.** Studies have shown that the use of both extracts and the use of photobiomodulation with red LED to reduce skin photoaging, are promising treatments. It is essential an in vitro investigation of the combined treatment of the use of red LED with plant extracts in order to determine a treatment and understand the effects of treatments with phytocosmetics.

Key words: Photoaging, photodynamic therapy, UVA irradiation. Revisão /Review

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HYDROXYL RADICAL GENERATION IN THE ASSOCIATION BETWEEN METHYLENE BLUE AND THE CEFTRIAXONE ANTIBIOTIC.

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Background: Due to bacterial resistance to antibiotics, antimicrobial photodynamic therapy (aPDT) is gaining more visibility. In the presence of an infectious clinical situation, the gold standard treatment is antibiotic therapy. But there may also be an indication for aPDT. For the two treatments to work together, it is necessary to know more about the possible photochemical interactions between them. Higher hydroxyl radical production means higher photodynamic activity coefficient which can be used to study photochemical interactions between samples. Aims: To investigate the photochemical interaction between antibiotic and aPDT with methylene blue (MB). Methods: The production of hydroxyl radicals was determined by registering the absorption spectra to evaluate the bleaching the RNO probe, when MB is irradiated alone or in the presence of ceftriaxone (Rocefin®, 1g), using 660nm, I= 270mW/cm² and H= 5,4J/cm² for 720s and each 60s an absorption spectrum was made. The absorption spectrum of ceftriaxone was also recorded. The data were analyzed and the RNO bleaching constant was determined in both cases. This constant is proportional to the production of hydroxyl radicals. All samples were solubilized in MilliQ® water. Results: Ceftriaxone showed a low absorbance in visible range of electromagnetic spectrum, with exception of violet and blue range, which means it is not excited by red light. The RNO bleaching constant was higher in MB irradiated with laser alone than in the presence of ceftriaxone, but there was still a photochemical effect. Conclusion: It was observed that there was suppression of the generation of hydroxyl radicals by MB when associated with ceftriaxone, however it has low effect. Thus, ceftriaxone may reduce the aPDT effect when antibiotic therapy is associated to PDT, however the extension and clinical impact of this reduction still needs further investigation.

Key words: photodynamic therapy, aPDT, absorbance, laser, RNO.

Estudo experimental em in vitro (Experimental study in vitro)

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Evaluation of MICA/B and HLA-ABC in oral squamous cell carcinoma cell lines submitted to photodynamic therapy.

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Introduction: Oral Squamous Cell Carcinoma (OSCC) is the fifth most common cancer worldwide. The main etiology factors of this tumor is tobacco, alcohol and HPV. Most of OSCC patients are diagnosed at advanced stages of the disease and thus, the prognosis is still poor, despite the advances in the understanding of its biology and progression. The main treatment modality is surgery, associated with radiotherapy or chemotherapy. However, the recurrence rate in OSCC patients is more than 50%. Thus, there is a need for new treatment modalities. In this context, photodynamic therapy as well as immunotherapy has been described as an alternative and effective therapy in cancer. Natural killer cells are responsible for the innate immune defense against virus and cancer cells and have a potential to recognize stressed cells and induce their death. Objective: The aim of this study was to evaluate the expression of MICA/B (stressed-induced ligand for Natural Killer cells) and HLA-ABC in OSCC cell lines after treatment with photodynamic therapy. Ca1 and Luc4 cell lines were divided in the following groups: control, LED, 5-aminolevulinic acid (5-ALA, 1mM) and 5-ALA-PDT (5-ALA+LED) groups. Cells were irradiated with a diode emission light (LED) using the BioLambda LedBOX, 660nm, 6J/cm², 49.5 mW/cm². Cells were incubated for 24h and then collected to evaluate the expression of MICA/B and HLA-ABC by flow cytometry. Results: The expression of MICA/B showed a significant increase after PDT in both, Ca1 and Luc4 cell lines when compared to Control, 5-ALA and LED groups. No difference was observed regarding the expression of HLA-ABC. Conclusion: PDT is able to induce the expression of MICA/B, and important ligand for the activation of NK cells and thus, can contribute to improve the immunotherapy mediated by these cells.

Key words: PDT, MICA/B, HLA-ABC, OSCC, NK cells.

Estudo experimental em in vitro (Experimental study in vitro)

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USE OF LASER ACUPUNCTURE IN THE TREATMENT OF TMJ- CASE REPORT.

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INTRODUCTION: There are several techniques that can be used in cases of temporomandibular dysfunction: occlusal plaques, botulinum toxin, among others, Traditional Chinese Medicine (MTC) with ancient knowledge shows excellent results. The use of laser favors painless treatment for patients with TMJ signs and symptoms. Increasingly, laser has been used in Acupuncture treatments instead of needles (laserpuncture), especially in the treatment of children, the elderly, diabetic patients and those who fear needles. The low-power laser used in acupoints produces photobiological induction, generating biochemical and bioelectric effects on cells, providing anti-inflammatory, analgic and cell regenerative therapy. When imbalances occur in certain meridians, there is a stagnation of Qi (energy) and Xue (blood), altering the TMJ. In the MTC view, happens when the Triple Heater and Gallbladder meridians are affected by external pathogenic factors, such as: Wind, Heat, Humidity-Heat. The emotions generated by the stress change the Liver meridian, responsible for the muscles and tendons, including the facial muscles, where the main report of patients refers to the tension of these muscles during periods of stress.**OBJECTIVE:** Use of Laser Acupuncture for the treatment of TMJ. **METHODOLOGY:** Patient L.M.D., 44 years old, female, with typical TMJ clinical picture, strong pressure on the teeth, consequently neck pain, accompanied by periods of insomnia. Initially, the energy diagnosis, observation of the tongue, pulses and Ryodoraku energy diagnosis were performed, where it was possible to diagnose: Lung Yin Deficiency; Yin Deficiency of the Liver and Stomach; Gallbladder Yin deficiency; Spleen-pancreas Yang deficiency and Xue's stasis. The treatment strategy was developed with the points: VB3, E7, ID19 and VB20 with application of Red Laser, power of 3 joules and the point with bilateral anmian stiper. The Visual Analogue Scale (VAS) was applied to verify the intensity of pain. A total of 10 sessions were held, one session per week. **RESULTS:** The patient presented a favorable result, visible from the first session where an Eva scale decreased considerably from 7 to 0. After 10 combinations, the signs and symptoms of TMD, insomnia and migraine disappeared. **CONCLUSION:** Laserpuntura enabled a beneficial contribution in the treatment of TMD and associated pathologies in the present case report.

Key words: Acupuncture, laser, Laserpuncture, TMD, dentistry, Biophotonics.

Relato de caso / Case report

Effectiveness of photodynamic therapy in squamous cell carcinoma of the head and neck: a systematic review of clinical studies.

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Introduction: Squamous cell carcinoma of the head and neck (SCCHN) is the fifth most prevalent neoplasm among Brazilian men and represents a high international morbidity. Approximately 30% of SCCHN present metastases at diagnosis, requiring the combination of radio and chemotherapy treatments, both of which have adverse effects that affect the patient's quality of life. Despite the different treatment modalities, overall survival is still poor. Thus, alternative therapies are needed to improve the quality of life and survival of SCCHN patients. In this context, photodynamic therapy has been described as an effective therapy in basal cell carcinoma and other types of solid tumors, However, the effectiveness of PDT in SCCHN remains unclear. **Objective:** This systematic review aimed to evaluate the main outcomes of OSCC patients treated with PDT. **Material and Methods:** The protocol was approved by PROSPERO and was carried out according to the PRISMA protocol. The search was limited to the English language followed by the P.I.C.O. strategy terms terms. The databases searched were PubMed, MEDLINE, Scielo, Web of Science, Embase (Excerpta Medica Database) and LILACS (Latin American & Caribbean Health Sciences Literature). The study included randomized control trials (RCTs), controlled clinical trials, case-control, cohort studies and case series reports, in which the treatment response and outcome of SCCHN patients submitted to PDT were reported. The risk of bias was performed by the JBI critical assessment tool. **Results:** The search strategy resulted in 201 articles and after screening, 143 studies were excluded. However, only 34 studies were included after complete reading, comprising 30 case series, two cohort studies and two prospective before-after clinical trials. A total of 1472 SCCHN patients were included. The majority of the studies were classified at high risk of bias. The most photosensitizer used was mTHPC and the optical fiber irradiation was the most performed light delivery system. The complete response rate varied in relation to SCCHN staging and type of photosensitizer used for PDT. It was observed that PDT was more effective in early stage tumors than in advanced tumors. However, only two studies showed a comparator group. **Conclusion:** PDT can be considered an effective therapy in early stage SCCHN, but due to the methodological limitations of the included studies, further clinical trials must be conducted to clarify its effects in SCCHN.

Key words: Squamous Cell Carcinoma of the Head and Neck, Tumor Response, Photodynamic Therapy, Systematic Review.

Revisão /Review

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Functional motor assessment through the sciatic functional index in Wistar rats after peripheral nerve injury treated with photobiomodulation therapy and exercise.

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Introduction: Studies demonstrate that photobiomodulation therapy (PBMT) has been used as a tool for modulating the peripheral nerve injury (PNI) repair process and can be associated with the exercise promoting an increase in neuromuscular transmission. Objective: The aim of the present study was to assess the effects of photobiomodulation with LED therapy (LEDT) associated with exercise on the functional motor recovering following peripheral nerve injury in Wistar rats. Methods: 45 Wistar rats were randomly divided into five 5: Control; Injury; Injury+LEDN+Exercise (LED over nerve); Injury+LEDNM+Exercise (LED over nerve and muscle); Injury+Exercise and were analyzed 7 and 14 days after injury. The LEDT was performed in the nerve region – LEDN 4 points, 20s/point, energy density of 0.8 J/cm² and in the muscle region - LEDM 8 points, 10s/point, energy density of 0.4 J/cm². The exercise started 24h after the injury, and it was performed 30 min/day, 5 days a week, without inclination. Functional gait analysis for all groups was performed using the Sciatic Functional Index (SFI). Results: After 7 days all injured groups with or without any intervention (LED or exercise) showed worse functional motor capacity (higher SFI score) in comparison to the control group. However, the Injury+LEDN+Exercise group showed a better result (lower SFI scores) when compared to the Injury+LEDNM+Exercise and Injury+Exercise groups. After 14 days, there was also a worse motor capacity in all groups of injured groups including those who performed LEDT and exercises in relation to the control group. Furthermore the Injury+LEDN+Exercise group showed the best result in comparison to the other injured groups at the same period and in comparison only to the injury group, the Injury+LEDN+Exercise group showed the best result for the motor assessment. Conclusion: Considering the results it is possible to conclude that in both experimental periods of 7 and 14 days, the Injury+LEDN+Exercise group showed a better result presenting a reduction in SFI score in comparison to the other injured groups including those who performed LEDT and exercises but still presenting a smaller motor function when compared to the control group. In view of the results, it can also be concluded that PBMT using LED can contribute to a functional improvement when applied to the nervous region associated with exercise.

Key words: Photobiomodulation, LED, Exercise, Peripheral nerve injury.

Estudo experimental em animais (Experimental study in animals)

Effect of low-power laser therapy on bone guided regeneration.

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The bone guided regeneration process continues to be a challenge for oral rehabilitation, since it depends on several factors such as: blood supply and mechanical stability, from the blood supply all the necessary nutrients are obtained for the process of proliferation and differentiation of osteoblasts, for the subsequent formation of the osseous structure. The use of low level laser therapy (LLLT) is used in treatments with therapeutic action in soft tissue healing, but the effect of laser therapy on bone structure is still controversial, so the objective of this study was to investigate the effect of low level laser therapy on the bone guided regeneration process, in rats' skull at 7, 15 and 30 days. For this study, 24 male rats (Wistar) were used, divided into 3 groups: group I, collagen membrane plus low level laser therapy (LLLT), group II, control, without membrane and without laser therapy, group III, collagen membrane only; A critical defect skull of 8 mm was created, the animals of group I were submitted to session of low level laser therapy $\lambda = 830 \text{ nm.}$, the application was punctual during 2 minutes; animals were euthanized in 7, 15, 30 days after surgery. The bone defect was removed and processed to perform the histometric analysis; For the statistical analysis, the ANOVA and Bonferroni analyzes were used for multiple comparisons ($P < 0.005$). As results, in the 7-day period, no significant difference was observed between the three groups; but for the period of 15 and 30 days a significant difference was observed between the groups. We can conclude that low level laser therapy (LLLT) has a positive effect on the guided bone regeneration process.

Key words: Bone Regeneration, Guided tissue Regeneration, laser therapy.

Estudo experimental em animais (Experimental study in animals)

Low power infrared laser modulates mRNA levels from genes of base excision repair and genomic stabilization in heart tissue from an experimental model of acute lung injury.

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Introduction: Acute lung injury and acute respiratory distress syndrome are known as inflammatory disorders of the lungs, which can be caused by sepsis. Although many organ systems are affected by sepsis, the heart is the most frequently affected organ. Despite studies that showed beneficial effects of low power lasers on heart in experimental models, no studies have been conducted to evaluate the photobiomodulation effects on the heart in experimental models of acute lung injury by sepsis. **Objective:** The aim of this study was to evaluate photobiomodulation effects on mRNA relative levels from genes of base excision repair and genomic stabilization in heart tissue from an experimental model of acute lung injury by sepsis. **Methods:** For experimental procedure animals were assigned to six main groups: (1) CONTROL GROUP were animals treated with intraperitoneal saline solution; (2) LASER-10 were animals treated with intraperitoneal saline solution and exposed to an infrared laser at 10J cm⁻²; (3) LASER-20 were animals treated with intraperitoneal saline solution and exposed to an infrared laser at 20J cm⁻²; (4) ALI were animals treated with intraperitoneal LPS (10 mg kg⁻¹); (5) ALI-LASER10 were animals treated with intraperitoneal LPS (10mg kg⁻¹) and, after 4 hours, exposed to an infrared laser at 10J cm⁻² and (6) ALI-LASER20 were animals treated with intraperitoneal LPS (10mg kg⁻¹) and, after 4 hours, exposed to an infrared laser at 20 J cm⁻². Irradiation was performed only once and animal euthanasias for analysis of mRNA relative levels by RT-qPCR. **Results:** Our results showed that there was a reduction of mRNA relative levels from ATM gene and an increase of mRNA relative levels from P53 gene in the heart of animals with ALI when compared to the control group. Also, there was an increase of mRNA relative levels from OGG1 and APE1 gene in hearts from animals with ALI when compared to the control group. After irradiation an increase of mRNA relative levels from ATM and OGG1 gene was observed at 20J cm⁻². **Discussion:** The increase in the OGG1 and APE1 mRNA levels suggest an attempt to defend against heart tissue injury. In addition, these results suggest that low power laser therapy at ideal doses could modulate the ATM function in heart tissue from LPS-induced ALI animals. **Conclusion** Low power laser modulates the mRNA relative levels from genes of base excision repair and genomic stabilization in the experimental model of acute lung injury evaluated.

Key words: ATM, P53, base excision repair, low power laser, photobiomodulation.

Estudo experimental em animais (Experimental study in animals)

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THE USE OF INFRARED THERMOGRAPHY AS A METHOD OF DIAGNOSIS AND EVALUATION IN AESTHETICS.

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Introduction: Image capture by infrared thermography (TIV) is a non-invasive technique, without ionizing radiation, easy to interpret and low cost. It has been widely used in the health field, such as oncology, angiology, sports medicine, for improving the diagnosis and serving as a post-treatment evaluation method. Objective: To identify the use and effectiveness of infrared thermography as a method of diagnosis and evaluation in aesthetic procedures. Method: This is an integrative review of the literature where the Keywords photobiomodulation, aesthetics, thermography and thermometry were searched in the Scientific Electronic Library Online (SCIELO), PubMed and LILACS databases, with kinetic production of the last five years. Studies that respond to the purpose of the study were included. Results: Obeying the inclusion and exclusion criteria, in order to meet the selection principles related to the theme, 11 articles were included in the research. Knowing that circulation is important in thermoregulation and that some factors such as accumulation of fat affect local circulation, aesthetic procedures can have a great ally in IVT in diagnosis, and in post-treatment evaluation, since studies show improvement in vascularization local, after procedures such as modeling massage, endermotherapy, electrolipolysis, and photobiomodulation, showing the effectiveness of the treatment. Conclusion: It was observed with this study that TIV is still a poorly used method in this area, which demonstrates the need for more publications for the dissemination of the method since, using thermography to evaluate the microcirculation of the treated site becomes a fundamental aspect of analysis in aesthetics.

Key words: photobiomodulation, aesthetics, thermography, thermometry

Revisão /Review

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Antimicrobial Photodynamic therapy with Methylene blue in *C.albicans*: A literature review of the applied dosimetry.

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Introduction: The number of *Candida* species has increased significantly in the last few years. *Candida* species are the most common in fungal infections in hospitals, around 78%. Antifungals are the most used treatments, however, their use during long periods can trigger the selection of resistant strains. Photodynamic therapy (PDT) is a promising treatment option that can be used in several areas of health sciences. The technique is based upon the combination of a photosensitizing agent (PS) and light. The PS after exposure to visible radiation, generates reactive oxygen species that causes cell death. PDT does not promote fungal resistance. Methylene Blue (MB) has been extensively investigated as an antimicrobial agent for PDT, however, it is known that the physicochemical properties of MB affect its photochemical / photobiological action and may make treatment with PDT unfeasible. In addition to optimizing the vehicle used, dosimetry also plays an important role in the outcome of therapy. Objective: To perform a literature review on the dosimetry of antimicrobial photodynamic therapy in *Candida albicans* using MB as a PS. Method: A literature review was performed in the databases Scientific Electronic Library Online (SciELO), US National Library of Medicine National Institutes of Health (PubMed) and Medical Literature Analysis and Retrieval System Online (Medline). The inclusion criteria were articles published in the last 10 years and the keywords photodynamic therapy, methylene blue, colony forming units and *Candida albicans*. Results: After checking the abstracts, 10 works were selected. From these, 7 studies caused less than 1Log reduction independently of the dosimetry. Sabino et al (2019), reached 3 log₁₀ CFU/mL with 100 μmol/L MB in PBS with a 660nm LED at 25 J/cm². Souza et al reached the same result with used 469 μmol/L, in a 1: 1 mixture of saline with culture medium, 3333 mW / cm² and 426 J / cm². On the other hand Collina et al (2018) demonstrated a reduction of 3 log₁₀ CFU/mL when 61 μmol/L MB applied in 0.25% SDS was irradiated with 640nm LED for 30 minutes (2.6 mW/cm² , 4.7J/cm²) while in the other media there was no reduction in the same parameters. Conclusion: Depending upon the MB media, the dosimetry used needs to be increased to reach *C.albicans* inactivation (3 log₁₀ CFU/mL reduction).

Key words: Photodynamic Therapy, Methylene Blue, *Candida albicans*.

Revisão /Review

EVALUATION OF NEW PHOTOSENSITIZERS FOR PHOTODYNAMIC THERAPY IN THE TREATMENT OF INTRADERMAL INFECTION WITH STAPHYLOCOCCUS AUREUS IN A MURINE MODEL.

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Introduction: Bacterial infections are a public health problem, among these, MRSA is the main causative agent of bacterial infections in the world. In this context, antimicrobial photodynamic therapy appears as a promising tool through microbial inactivation with the use of light. Thus, this work proposes in a pioneering way the use of Resveratrol and the extract of *Myrciaria cauliflora* as photosensitizers in antimicrobial therapy against MRSA. Methods: In vitro tests were performed to determine the antibacterial activity of photosensitizers photoactivated with blue LED light, as well as experiments with uric acid to verify the formation of singlet oxygen. Possible structural changes in Resveratrol were evaluated by HPLC. In in vivo tests, the air pocket model was performed on C57Bl/6 mice to assess the antimicrobial activity of photoactivated Resveratrol, in addition to the evaluation of cell migration by histological techniques and cytokine production by the ELISA technique. In another analysis, a model of intradermal infection in the left ear was performed to evaluate the two photosensitizers, separately, in Balb / c mice. After infection and euthanasia, the ear was collected and the immunohistochemistry technique was used to mark myeloperoxidase (MPO) and E-cadherin. The lymph node of the animals was removed to assess bacterial load and cytokine production. Results and Discussion: The photoactivated Resveratrol exhibited an increase in labeling for MPO with its antibacterial action, possibly caused by the formation of singlet oxygen. In the air pocket model, TNF- α and IL-17A cytokines were produced, reducing the load bacterial and, consequently, decreasing inflammation after 24 hours of infection. The decrease in the number of cells in the inflammatory environment was associated with less inflammation, together with greater production of IL-10. In addition, it was observed in the ear dermis of the animals that photoactivated Resveratrol promoted an increase in MPO production with a reduction in the bacterial load in the draining lymph node. In relation to *M. cauliflora*, a reduction in bacterial load was observed in in vitro tests, with an increase in the production of TNF- α , 17A in the draining lymph node and MPO in the intradermal site of infection. Conclusion: Resveratrol and *M. cauliflora* extract are promising photosensitizers for antimicrobial photodynamic therapy, especially for the control of bacterial load in intradermal infections caused by MRSA.

Key words: Antimicrobial photodynamic therapy; Resveratrol; *Myrciaria cauliflora*; *Staphylococcus aureus*.

Estudo experimental em animais (Experimental study in animals)

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Evaluation of the Surface of Dental Implants After the Use of Instruments Used in Biofilm Removal: A Comparative Study of Several Protocols.

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Introduction:In order to study the morphological changes in the roughness of the surfaces of osseointegrated implants, after the usual clinical scraping of biofilm, necessary for clinical longevity in implantology. **Objective:**The purpose of this in vitro study was to evaluate the damage caused to the surface of dental implants after different conditions of simulation of mechanical removal of the biofilm and scraping using several different protocols. **Methodology:** Twenty-five sterile implants of the Singular Implants® brand (Parnamirim, Brazil) were divided into 05 groups: G1 control- C (n = 5), G2 Ultrasound-US (n = 5), G3 Stainless Curette- INX (n = 5), G4 Teflon-TF curtain (n = 5), G5 Laser-L (n = 5). Scraping was performed on the first three turns of the G2, 3 and 4 implants. The G5-L received irradiation with Laser Er: YAG (50 J, 1.5 W, 30 Hz). After the procedures, the implants were evaluated in SEM (1500-3000 X) at the LCT-POLI / USP-SP laboratory.**Results:** It can be observed that in G4-TF there was no change in surface morphology and roughness, however residues of TF were deposited on the surface; in G3-INX important morphological changes were observed, with impression on the titanium of parallel striations typical of the use of cures; in G5-L, flattening of the roughness peaks was observed, but not in the valleys; in G2-US several morphological changes were observed: total kneading of the roughness in some areas and fine scratches in others.**Conclusion:**It is concluded that of the protocols used, the least harmful to roughness was the laser, followed by stainless steel cures and ultrasound. Teflon cures did not change the surface roughness, but added material residues to the surface.

Key words: dental implants, Peri-implantitis, Ultrasound, Laser cures.

Estudo experimental em in vitro (Experimental study in vitro)

Photobiomodulation effects in cells from mouse periodontal ligament.

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Introduction: Photobiomodulation (PBM) is widely used in dental practice to modulate the inflammatory responses, pain relief and to promote wound healing. For instance, there are no PBM reports in literature about side-effects for both red and infrared radiations. Side-effects absence could be related to non-thermal effects and low production of reactive oxygen species (ROS). However, if light energy delivered is too high, injuries paradoxically tend to be exacerbated by increased oxidative stress and such events may lead the cell to death. Objective: the aim was to evaluate if PBM changes mRNA relative levels and proteins cell death-related, such as caspase-6 and Bcl-2, in periodontal ligament. Methods: Mice were divided in three groups (n=11): (I) control, (II) 3 Jcm-2 and (III) 30 Jcm-2. Low power infrared laser (830 nm) parameters were: power at 10 mW, energy densities at 3 and 30 Jcm-2 in continuous emission mode, exposure time of 15 and 150 s, respectively for four days in a row. Twenty-four hours after last irradiation, the animals were euthanized. Their jaws were either fixed and decalcified (immunocytochemical techniques; n=5) or immersed in liquid nitrogen, macerated and total RNA was extracted by phenolic buffer technique (n=6). Caspase-6 and Bcl-2 were analyzed by real time polymerase chain reaction and immunocytochemical techniques, and DNA fragmentation was evaluated by TUNEL. Results: Statistical differences were not significant to Caspase-6 mRNA relative levels in tissues from jaws at both energy densities, but Bcl-2 mRNA relative levels were significantly increased at 30 Jcm-2 group. Moreover, 30J/cm⁻² group showed caspase-6 positive-labeled cells decreased and Bcl-2 positive-labeled cells significantly increased. TUNEL-labeled cells demonstrated DNA fragmentation decreased at 30Jcm-2. Conclusions: Bcl-2 mRNA relative level and both caspase-6 and Bcl-2 proteins were altered as well as DNA fragmentation was reduced after PBM by low-level laser, indicating that PBM may modulate cell survival in periodontal ligament cells. Further studies should be carried out to describe PBM biphasic effects, aiming always the usage of optimum doses for clinical treatments.

Key words: Periodontal ligament, photobiomodulation, apoptosis, low-level laser therapy, dentistry.

Estudo experimental em animais (Experimental study in animals)

EFFECTS OF PHOTOBIO-MODULATION (PBM) AND / OR HORMONAL TREATMENT ON BONE REPAIR IN THE OSTEOPENIC EXPERIMENTAL MODEL.

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Introduction: Bone injuries are more common in women after menopause who have decreased bone density due to a lack of estrogen. Hormonal treatments can be used, but there are limitations for some patients. Experimental work has shown that Photobiomodulation (PBM) could be interesting for helping with bone repair without known side effects. Objective: to evaluate the effect of Hormonal treatment (H) and PBM Therapy, used independently and associated in the bone repair process after induction of injury in tibias of ovariectomized rats (OVX). Materials and Methods: Wistar rats randomly distributed in groups: Sham; I (Injury); CTL (OVX); NT (OVX + I); H (OVX + I + H) -equivalent to 280 µg / kg of 17β-estradiol - single dose IM; PBM (OVX + I + PBM) 808nm, 60s, 6J, 100mW, 200J / cm² and H + PBM (OVX + I + H + PBM). After 7 days of ovariectomy, non-critical bone damage was induced in both tibiae and after 30 days they were euthanized. Blood and tibia were collected for Biochemical (Alkaline Phosphatase-ALP, Tartarate Resistant Phosphatase-ACP), Morphological and Functional - Mechanical Property (MP) - Fmax / Dmax analyzes. Results: Although the MP presented similar values between the OVX-Treated groups, the H + PBM group showed bone repair in a more mature stage, as observed in the Biochemical and Morphological analyzes. Conclusion: The exclusive use of PBM can be an interesting alternative for patients who cannot receive hormonal treatment. The use of PBM + H maintained the improvement of bone repair and considering the analgesic and anti-inflammatory effects of PBM, the use of this association may be interesting for the treatment of bone injuries.

Key words: Photobiomodulation (PBM), Low Intensity Laser Therapy (TLBI), bone repair, ovariectomy, hormonal treatment, estrogen

Estudo experimental em animais (Experimental study in animals)

Photobiomodulation as treatment of trismus and paresthesia of the lower alveolar nerve: a clinical case report.

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Introduction: Once lower third molars have a close relationship with lower alveolar nerve, injuries during surgery may occur, leading to paresthesia and/or analgesia. Photobiomodulation by low-level laser has been shown to be an excellent therapeutic modality in dentistry for such neurosensory disorders, stimulating tissues repair and neuronal responses from absorption of light. Objective: The aim was to describe a case report of low-level laser therapy in trismus and paresthesia of the lower alveolar nerve as a consequence of extraction of left lower third molar. Methods/case report: Female patient, 38 year-old, paresthesia diagnosed of the left lower alveolar nerve after extraction of tooth 38. Post-surgical medical drugs (antibiotic and anti-inflammatory drugs in the first week) and vitamin B1 were used. Low-level laser therapy was indicated due to facial paresthesia that extended from the angle to central jaw regions, below tooth 31. Laser parameters were: 808 nm wavelength, power 100 mW, energy per point 2.8 J and energy density 100 Jcm⁻² in continuous mode, time exposure 28 s/point, 1 cm point distance, both intra-oral and extra-oral regions, 24 consecutive sessions, once a day. Results: From the fourth session, the patient reported pain relief, recovering body jaw region sensitivity, but still with numbness in an area innervated by mental nerve. Regarding trismus, significant improvement was observed: from 1.1 cm opening mouth on the first session to 1.7 cm on the second one and 1.9 on the fourth one. By the 13th session, the mouth opening range achieved 2.9 cm. From clinical application, photobiomodulation is increasingly used since it has no side-effects described and it is not an invasive technique. In this case, irradiation in the nerve and region affected by paresthesia demonstrated to be effective in sensory improvement. Conclusion: Photobiomodulation by low-level laser is a non-invasive, painless and effective treatment for neurosensitive disorder cases, improving the post-surgical and patient recovery due to their photochemical and photobiological actions.

Key words: Lower alveolar nerve, Paresthesia, Photobiomodulation, Low-level laser.

Relato de caso / Case report

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Low power infrared laser modulates telomere length in heart tissue from an experimental model of acute lung injury.

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Introduction: Acute Lung Injury and Acute Respiratory Distress Syndrome can occur as a result of sepsis. Cardiac dysfunction is a serious component of multiorgan failure that is caused by severe sepsis. Telomere shortening is related to several heart diseases. Telomeres are associated with the shelterin protein complex that contribute to the maintenance of telomeres length. Low power infrared laser modulate mRNA levels from shelterin complex genes. Objective: The aim of this study was to evaluate effects of low power infrared laser on mRNA relative levels from genes of telomere stabilization and on telomere length in heart tissue from an experimental model of acute lung injury by sepsis. Methods: Animals were divided into six groups treated with: intraperitoneal saline solution; saline solution and exposed to an infrared laser at 10J cm⁻² and 20J cm⁻²; lipopolysaccharide (LPS); LPS and, after 4 hours, exposed to low power infrared laser at 10J cm⁻² and 20 J cm⁻². Exposure to laser was performed only once. Analysis of mRNA relative levels and telomere length by RT-qPCR were performed. Results: Data showed that there is a telomere shortening and reduction of mRNA relative levels from TRF1 mRNA in heart tissue of LPS-induced ALI animals. Also, exposure to laser was able to increase the telomere length at 10 J cm⁻² and modulate the mRNA relative levels from TRF1 at 20 J cm⁻² in healthy animals. Discussion: Our results showed that exposure to low power laser at 10J cm⁻² increased the telomere length in heart tissue from rats after LPS-induced ALI. Under these conditions, photobiomodulation by low power infrared laser could have activated signaling pathways that contributed to increased telomere length. These results show the importance of photobiostimulation by low power infrared laser as a therapeutic approach for repairing injured tissues and the importance of using adequate laser irradiation parameters to achieve beneficial effects of low power lasers. Conclusion: In conclusion, low power infrared laser at low therapeutic fluences could contribute for telomere maintenance in heart tissue from animals affected by acute lung injury by sepsis.

Key words: Low Power Laser; Telomere length; Telomerase.

Estudo experimental em animais (Experimental study in animals)

TREATMENT OF SNAKEBITES: THERAPIES COADJUVANT TO CONVENTIONAL SEROTHERAPY USING PHOTOBIO-MODULATION (LIGHT EMITTING DIODE) AND DEXAMETHASONE.

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Introduction: Snakebite accidents are a serious and complex public health problem affecting mainly the tropical, subtropical areas of developing countries. Due to its magnitude, ophidism has been reinserted in the World Health Organization's list of Neglected Tropical Diseases. Worldwide, reported cases annually reach 2.1 million, of which 81 to 138,000 die and another 300,000 develop permanent sequelae. Among the four snake genera of medical interest, the Bothrops genus is the most important, as it is responsible for about 90% of snakebites. Among the snake species of medical interest, Bothrops jararacussu and Bothrops atrox, found in the south, southeast and north, respectively. Treatment with ophidic serum is effective for systemic effects and ineffective against local effects. Objectives: Was to evaluate the photobiomodulation treatment with LED and/or dexamethasone associated with conventional serum therapy to treat local damage caused by envenoming by these two snake species. Methods: the experimental envenoming was conducted in gastrocnemius muscle of male Swiss mice of mass between 18 and 22 grams (divided into groups of 5 animals) by intramuscular inoculation of 25 µg of B. jararacussu venom and 50 µg of B. atrox venom. After 30 minutes, the proposed treatments were administered alone or in combination. After 3 hours, blood and muscle samples were collected for myotoxicity, cytotoxicity, histological analysis and IL-1β assay. Statistical analyzes were performed using the GraphPad Prism 7.0 program. Analysis of variance (ANOVA) was performed followed by Tukey's post-hoc test for comparison between groups. The data were presented using the average; standard deviation. Results: Results reaffirmed that serum therapy is not effective in treating local damage and demonstrated that LED photobiomodulation alone was able to decrease the leukocyte infiltrate in the inoculated muscle, as well as hemorrhage and myotoxicity. Dexamethasone treatment then showed good results in inhibiting myotoxicity against B. jararacussu venom and proved to be an excellent resource for the treatment of the inflammatory process against both venoms. Conclusion: It was concluded that the combination of serum therapy, LED and dexamethasone was very promising for the treatment of snakebites caused by the two species in question, as it will provide efficacy not only to systemic damage, but also to local damage, thus avoiding disfigurement of the affected limb.

Key words: Ophidism, Photobiomodulation, Light emitting diode, Serum therapy, Dexamethasone, Treatment.

Estudo experimental em animais (Experimental study in animals)

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PRE-CLINICAL STUDY OF THE EFFECT OF PHOTOBIO-MODULATION THERAPY ASSOCIATED WITH THE USE OF L-ARGININE ON MUSCLE FATIGUE IN AN EXPERIMENTAL MODEL OF AEROBIC TRAINING.

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Introduction: Muscle fatigue is a decline in muscle performance linked to the decreasing of muscle functionality. The practice of physical exercise induces changes to the muscle adaptation, with improvement of strength and endurance. To prevent deleterious effects of muscle fatigue many resources are used, such as photobiomodulation therapy (PBMT) and supplementation with L-Arginine. Objective: Evaluate the effects of PBMT associated or not with L-Arginine supplementation on markers of oxidative stress, muscle injury and muscle fatigue in an experimental model of aerobic training. Methods: 24 Wistar rats were divided into 4 groups, all practiced aerobic exercise on treadmill for 30 minutes daily, 5 times a week for 4 weeks and had a period of adaptation of the exercise in 2 previous weeks. The SHAM group did not receive any type of supplementation or treatment, L-ARG received L-Arginine 100 mg/kg/day before exercise, PBMT obtained previous treatment with PBMT on the anterior tibial muscle and L-ARG associated with PBMT received supplementation with L-Arginine and PBMT. After the exercise protocol, all groups were submitted to electrically induced muscle fatigue, each animal underwent 4 tetanic contractions, then the blood and muscle were collected, the animals were euthanized after and biochemical markers CK, LDH, MDA, SOD and GPx were evaluated; maximum strength obtained (Fmax), basal contraction (BC) and force decay time in 50% of the peak in the induced tetanic contraction assays and histological analysis of the anterior tibial muscle of the animals was performed. Results: CK and LDH levels were reduced in the PBMT group, MDA was elevated in the PBMT and L-Arginine association group, demonstrating that its association did not prevent lipid peroxidation, being lower in the PBMT, L-Arginine and SHAM groups, SOD groups PBMT and association of PBMT and L-Arginine obtained higher levels demonstrating better antioxidant action and GPx obtained higher levels in the SHAM and PBMT + L-Arginine groups than the L-Arginine group. The Fmax, BC and the decay time of the force in 50% demonstrated that the use of PBMT and L-Arginine optimized muscle strength and endurance. Histological analysis did not present hypertrophy or muscular atrophy. Conclusion: the application of PBMT and association between PBMT and L-Arginine were effective in attenuating muscle fatigue and preventing muscle injury induced by aerobic exercise.

Key words: photobiomodulation; L-Arginine; aerobic exercise; muscle fatigue; oxidative stress

Estudo experimental em animais (Experimental study in animals)

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Laser therapy for labial lentigines in patients with Peutz-Jeghers syndrome: the first review. Medeiros YL (1), Faria LV (1), Chandretti PCS (1), Mainenti P (2).

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Background: Labial lentigines associated with Peutz-Jeghers syndrome (PJS) are challenging and represent a cosmetic problem. Laser can be used to treat the disease's macules. However, to date, there are no guidelines or robust discussion regarding the different types of protocols found in the literature. **Aim:** The aim of this study was to review the pertinent literature aiming a critical review of the various papers and the laser techniques regarding the therapy for labial lentigines in patients with PJS. **Methods:** A detailed literature search was conducted in seven databases (Cochrane Library, Embase, Lilacs, PubMed, SciELO, Scopus and Web of Science) from database inception to April 2020 in addition to hand search of reference list of included studies. No restrictions were placed on publication year and publication language. Data were extracted and analyzed from selected studies including study design, sample size, participants' age and gender, characteristics of the laser used in the study, interval and total sessions of laser application, results obtained and follow-up time. **Results:** Thirteen out of 95 published studies met our eligibility criteria, covering 81 patients. The most used laser in studies was the Q-switched ruby laser (694nm), with total sessions ranging from 1 to 12 and the interval between sessions ranging from 2 to 16 weeks. All studies have shown satisfactory results, with no further complications. The follow-up ranged from 2 to 97 months. **Conclusion:** All lasers and light systems used have been shown to be effective in the treatment of lentigines associated with SPJ. However, the included studies designs were heterogeneous, preventing the determination of ideal parameters.

Key words: Laser therapy, Lasers, Peutz-Jeghers syndrome, Lentigo.

Revisão /Review

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MCP-1 EXPRESSION DECREASED IN PERIARTICULAR INFLAMMATORY PROCESS OF ARTHRITIS ZYMOSAN-INDUCED AFTER PHOTOBIMODULATION. Anjos LMJ (1), Fonseca AS (2), Gameiro J (3), Paoli F (1)

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Background: Rheumatoid arthritis (RA) is a degenerative joint disorder characterized by inflammation involving multiple cell types, resulting in the progressive destruction of the affected joints. An essential component of joint destruction is the production of chemokines which recruit mononuclear cells, such as lymphocytes and monocytes, to the inflamed joint. The monocyte chemoattractant protein-1 (MCP-1 or CCL2), is a monocyte/macrophage, B-cell, and T-lymphocyte chemoattractant belonging to the CC subfamily of chemokines, produced by macrophages, endothelial, synovial fibroblasts, and chondrocytes in RA joints. The MCP-1 production through NF κ B activation, plays an important role in the perpetuation of joint inflammation in rheumatoid arthritis (RA). Aim: Although photobiomodulation (PBM) has been presented an anti-inflammatory behavior and it is currently being evaluated for the treatment of RA, the molecular mechanisms underlying its effectiveness remain unclear. Thus, this study investigates PBM modulation of MCP-1 and NF κ B in a mice arthritis model. Methods: Inflammatory process was induced in mice ankle by zymosan administration in two groups: untreated and PBM treated. The animals were exposed to low-level laser (830 nm Ga-Al-As diode at 30J/cm²). Morphological analysis by H&E staining, gene expression by RT q-PCR (MCP-1 and NF κ B) and ELISA (MCP-1) were performed after animal euthanasia. Results: The inflammatory process was decreased after PBM treatment, as well as the tissue expression of MCP-1. Interestingly, an increase in gene expression of NF κ B was observed while MCP-1 gene expression presented the same level of untreated group. Conclusion: Our results suggest that PBM at 30J/cm² fluence was able to modify the inflammatory process of arthritis-induced zymosan by MCP-1 synthesis decrease which in turn, leads to low inflammatory cells recruitment at inflammation site.

Key words: Photobiomodulation, MCP-1, NF κ B, Zymosan.

Estudo experimental em animais (Experimental study in animals)

EFFECT OF LIGHT EMITTING DIODE PHOTOBIMODULATION ON MURINE MACROPHAGE FUNCTION AFTER Bothrops ENVENOMATION.

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Several reports have suggested that photobiomodulation, owing to its analgesic, anti-inflammatory, and healing effects, may be an effective therapeutic option for local effects of snakebites when the availability and accessibility of conventional serum therapy are inefficient and far from medical care centers. Although there have been studies that demonstrate the application of photobiomodulation in the treatment of local adverse events due to snakebites from snakes of the genus *Bothrops*, its role in the activation of leukocytes, particularly macrophages, has not been evaluated. Here, we assessed the effect of light-emitting diode (LED) treatment on macrophage activation induced by *B. jararacussu* venom (BjV). LED treatment caused an increase in the viability of macrophages incubated with BjV. This treatment reduced reactive oxygen species (ROS) and nitric oxide (NO) production by macrophages after incubation with BjV. However, LED treatment did not interfere with IL-1 β and IL-10 production by macrophages after incubation with BjV. In conclusion, this study showed that LED treatment has the potential to be used in combination with conventional serum therapy to prevent or minimize the progression of local to severe symptoms after *Bothrops*.

Key words: *Bothrops jararacussu* venom, Macrophages, Light Emitting Diode.

Estudo experimental em in vitro (Experimental study in vitro), Outros / Others

Low Level Laser Therapy in Spinal Cord Injury: a literature review.

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Introduction: The use of light as a therapeutic resource for neurological disorders provides numerous positive effects according to the studies in the literature. The studies using experimental models of Spinal Cord Injury (SCI) and light sources being mainly in the red and infrared wavelengths showed effects such as the reduction of pro-inflammatory markers, increase in neuroprotective mechanisms and improvement in functionality. However, some results are controversial and it is necessary to investigate the best dosimetry to be used to achieve the best results. Aim: this study aims to review the therapeutic effects of photobiomodulation (PBM) using the Low Level Laser Therapy (LLLT) following SCI in experimental models. Methods: the search of studies in the literature was performed in the following databases: PubMed / MEDLINE, SCOPUS and SPIE Digital Library and included original articles published in English from January 2009 to April 2020 which used the LLLT in experimental models of SCI. Results: 14 original articles were selected and demonstrated the effects of LLLT on functional recovery, on modulating the expression of inflammatory cytokines, on increasing the concentration of glial cells and nerve connections around the lesion, indicating a neuroprotective role played by this resource. Among the selected articles, n=13 applied direct current, with 69% using light at the infrared wavelength while the others applied the red wavelength. There was a great variation in the PBM parameters being the power (mW) between 25 to 200mW, total energy (J) between 0.5J and 450J and the time of exposure between 8 to 3000 seconds. Considering the 14 selected articles, irradiation was performed at the injury site and in 64% of the studies was only at a single point. Furthermore, in 10 studies (71,43%) the irradiation was initiated in the immediate phase of SCI (immediately after the trauma), the PBM protocol was used for 5 to 21 days, mostly performed continuously, and the follow-up after SCI was between 3 and 4 weeks. Conclusion: LLLT is a phototherapeutic resource that can be applied as an auxiliary therapy for the treatment of SCI, playing a neuroprotective role and enabling functional and sensitive recovery. However, it is still necessary to establish the best protocol and PBM parameters to be used in the different recovering phases.

Key words: Low Level Laser Therapy, Photobiomodulation, Spinal cord injury.

Revisão /Review

Effect of photobiomodulation therapy on joint injury control in an experimental model of rheumatoid arthritis - Morphological and functional aspects.

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Introduction: Rheumatoid Arthritis (RA) is a chronic, autoimmune, inflammatory, progressive disease that leads to irreversible destruction of cartilage and bone. Experimental in vivo studies using photobiomodulation therapy have demonstrated positive effects on the modulation of the inflammatory process. Objective: To analyze the effects of photobiomodulation therapy on cell organization and the mechanical properties of knee cartilage in an experimental model of Rheumatoid Arthritis induced by type II Collagen. Methodology: A pilot study with 12 animals was carried out to determine the parameters of Collagen II and Freund's Adjuvant for RA induction. In the second phase of the study, twenty-five male wistar rats were divided into 5 groups, CTL (control), RA (rheumatoid arthritis) with 7 days (AR7) and 14 days (AR14), in addition to the groups treated with PBM in 7 days (AR7 + PBM) and 14 days (AR14 + PBM). For RA induction, the animals received 2 intradermal injections of the lesion-inducing solution on days 0 and 7 and after 21 days a 3rd dose was applied to the knee joint. For the treated groups, PBM (808nm; 2J; 50mW) started on the 21st, immediately after the last induction. Results: A reduction in Rupture Force (Fracture) and maximum Deformation (Dmax) was observed in RA groups, in addition to histological changes such as tissue disorganization and the presence of inflammatory infiltrate. PBM reduced the biomechanical changes caused by RA and promoted better histological organization, preventing the progression of the disease. Conclusion: The model of RA induction using Collagen II and Freund's Adjuvant with 1st and 2nd intradermal induction and 3rd knee induction was effective in inducing RA with clinical signs characteristic of the disease. PBM improved the morphological and functional characteristics, reducing the impact on cartilage resistance and tissue organization. PBM appears as an important therapy in the treatment of RA with no known side effects.

Key words: Photobiomodulation, Rheumatoid arthritis, Cartilage, mechanical properties.

Estudo experimental em animais (Experimental study in animals)

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Photobiomodulation therapy promotes improvement of scar quality in an experimental model of skin lesion.

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Introduction: The skin is a covering fabric that undergoes permanent action by the environment, often aggressively, leading to the injury of this tissue. Usually in its repair process, structural changes occur that evolve to the development of a scar. In this case, the tissue may present morphological changes that interfere with its mechanical properties and this repair process produces a tissue with different properties from the original tissue. Thus, the use of therapies that favor this repair is important to seek a better quality of the scar. Photobiomodulation therapy is a resource used to modulate the inflammatory process, helping in the skin repair process. Objective: To evaluate the effect of photobiomodulation therapy on the healing process in an experimental model of skin lesion. Methodology: Wistar rats, between 150g to 200g, with 3 months of age were used. The animals were anesthetized with an association of xylazine hydrochloride and ketamine (90mg / Kg and 10mg / Kg, respectively, intraperitoneal injection). After being anesthetized, 2 cutting injuries were performed using a surgical scalpel on the animal's back. The animals were divided into 4 groups of 5 animals: Control (C), Scar (S), Scar + anti-inflammatory (D), scar + 1J laser (1J). Pharmacological treatment and laser therapy were performed immediately after the lesion was induced and daily irradiation was maintained until the seventh day. After 28 days, the animals were euthanized with overdosage of the same anesthetic and the tissue was immediately removed for morphological analysis and traction tests. Discussion: The skin repair process from the lesion caused by a surgical scalpel promotes histological changes in the tissue that reflects the change in certain mechanical properties of the skin. Conclusion: Low power laser therapy at 1J energy and 110mW power contributed to the skin repair process.

Key words: Photobiomodulation, Skin, Scar, Collagen, Mechanical Properties.

Protocolo clínico ou experimental (Clinical or experimental protocol).

Photobiomodulation in a skin incision caused by the wires and pins of the Ilizarov circular external fixator device: clinical study, double blind placebo, controlled and randomized.

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Introduction: In Brazil, thousands of musculoskeletal surgeries are performed annually, and this high number of procedures has a social and economic impact for the country. The Circular External Fixator (CEF) is an orthopedic device made of steel, aluminum or carbon, with the function of maintaining the rigidity or stability of the severely traumatized bone structure, which connects to the CEF through wires and/or pins. The injury to the skin caused by wires and/or pins does not receive as much attention as the bone injury, can lead to complications, such as pain and infection, increasing the recovery time or even leading to new surgery. **Purpose:** Use of photobiomodulation (FBM) in skin incisions caused by the use of FEC (in the insertions of wires and pins) and collect clinical evidence using the BWAT scale, visual analog scale of pain, temperature and pH of the lesion and the recurrence after end of treatment in relation to the conventionally treated group. **Material and Method:** Clinical study, double blind, placebo controlled and randomized, composed of 5 participants in the placebo controlled group and 5 in the photobiomodulation group. All received a dressing with 0.9% saline plus fatty acids, but one group was irradiated, while the other received placebo irradiation. Interventions took place from the 3rd postoperative period, every 72 hours, for 3 months. Dosimetry was $\lambda = 660\text{nm}$, $t = 5\text{s}$, $E = 0.5\text{J}$, 4 points per injury. Interventions took place from the 3rd postoperative period, every 72 hours, for 16 weeks. The Bates-Jensen scale, visual analog scale of pain and temperature of the lesion were evaluated. **Results:** The result In the first session, the Bastes-Jensen scale score was 16 ± 3 , pain 2 ± 0 and $36.1^\circ\text{C} \pm 6$. In the 4th session, the Bastes-Jensen scale decreased to 13 ± 2 , pain 0 ± 0 , $36.0^\circ\text{C} \pm 6$. There was clinical evidence of improvement in lesions treated with FBM compared to the placebo controlled group. There was no recurrence in any of the groups and two participants in the FBM group evolved with a satisfactory response in bone healing and wound healing in the insertions of wires and pins, as they removed the FEC earlier than expected. **Conclusion:** The conclusion There was an adequate cure, improvement of local pain, reduction of inflammation and restoration of physical function after PBM. It is known that more studies with a larger sample of participants are necessary for the consolidation of FBM in this applicability.

Key words: Ilizarov, low level laser, Schanz Pin, Kirschner Wire, wound, orthopedics.

Ensaio Clínico (Clinical Trial)

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Low level laser therapy in the treatment of oral mucositis in head and neck cancer patients: a literature review.

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Background: Oral mucositis is characterized as an acute inflammatory change that affects the oral mucosa, affecting patients undergoing antineoplastic treatment for head and neck cancer. This condition can cause pain, inflammation, dysphagia and hinder patients' prognosis. Laser therapy, because it allows the treatment of mucositis lesions, is an auxiliary technique to improve the quality of life of cancer patients. Aim: Review the literature in order to demonstrate the effectiveness of low level laser therapy (LLLT) in the regression of oral mucositis. Methods: A detailed literature search was conducted in Pubmed between 2016 and 2020. The keywords "head and neck cancer" AND "laser therapy" AND "oral mucositis" were used. Results: Eleven studies were included in the present study. LLLT, when used correctly and following biosafety protocols, allows the management of mucositis lesions without causing pain and side effects. The use of LLLT is justified because it has a biostimulating effect on different cell populations, including fibroblasts, cells involved in tissue regeneration and healing. In addition, laser therapy reduces the healing time of oral lesions and the rate of abandonment of antineoplastic treatment. Conclusion: It is concluded that the LLLT has the ability to promote the healing of oral mucositis wounds and reduce pain experiences for the patient. Thus, it allows greater adherence to antineoplastic treatments for head and neck cancer.

Key words: head and neck cancer, laser therapy, oral mucositis

Revisão /Review

ANTIMICROBIAL PHOTODYNAMIC THERAPY ON *Candida albicans* AS A STRATEGY FOR UPCOMING FUNGAL TREATMENT- STUDY PROTOCOL. Rossi AL, Godoy-Miranda B, Kassa CT, Pavani C, Prates RA.

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INTRODUCTION: *Candida albicans* is a commensal yeast and it can become pathogen inducing infection on the mammalian host. *Candida* infection is commonly treated using antifungal drugs and fluconazole represents the first treatment option for clinicians. However, drug protocols may have limited efficacy and high levels of toxicity. The action mechanisms of antifungal drugs work on reducing yeast mitoses by reducing ergosterol synthesis, which impairs the formation of yeast wall. **OBJECTIVE:** The aim of this study is to evaluate death pathways of yeast under aPDT challenger. **METHODOLOGY:** *Candida albicans* ATCC 90028 will be grown aerobically on Sabouraud dextrose agar and incubated at 37 °C for 24 hours. In a 1mm diameter silicone membrane, yeast will be grown for 48 hours in Sabouraud broth medium, at 37^o C. After yeast growth, the membrane will be placed in twelve 24-well plates and will be washed 2 times in 2 mL of PBS. The plates will be divided into three assays experiments; cell quantification by colony form units (CFU) quantification; scanning electronic microscopy (SEM); and comet assay. On all plates, 100 µM methylene blue (MB) will be used as PS, and irradiated with a laser emitting at $\lambda = 660\text{nm}$ (Photon Lase III, DMC, São Carlos, Brazil) with an output power of 100mW and radiant exposure until 135 J/cm² for 0, 3, 6 and 9 min. After irradiation, the UFC experiment will be performed for microbiological testing, where the photoinactivation of the fungus will be verified and an irradiation time versus effect line will be created. For SEM tests, the plates will be fixed in 2.5% glutaraldehyde solution (Greentec) for 1 hour, and then it will be dehydrated in a growing concentration of alcohol beginning at 70% (Synth / PA-ACS- CH₃CH₂OH) for 1 hour. The plate will be prepared for SEM (FEI Quanta 250), the membrane inoculum will be fixed over a stub and metallized with a 20nm layer of gold (Sputtering Leica ACE200). In the Cometa Assay Group, the tests will be developed according to the protocol of Singh et al. The data will be submitted to statistical analysis.

Key words: *Candida albicans*, photodynamic therapy, photodynamic antimicrobial chemotherapy (PACT), methylene blue, Cometa Assay.

Protocolo clínico ou experimental (Clinical or experimental protocol)

Photobiomodulation therapy on temporomandibular disorder: preliminary results of multidimensional quality of life analysis.

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Introduction: Despite the indisputable relevance of affective-emotional factors in the experience of pain, there is still a lack of studies that comprehensively analyze the impact of photobiomodulation therapy (PBMT) on the quality of life of individuals with temporomandibular disorders (TMD). Objectives: This study presents preliminary results of a randomized double-blind clinical trial about the influence of PBMT with low-power laser on pain, quality of life (QOL) and perception of mandibular functional impairment (MFIQ) of individuals with TMD. Methods: After self-care educational measures and two weeks of follow-up, 40 participants who maintained spontaneous pain above 4 cm on a visual analog scale (VAS) were distributed among the study groups ($n = 10$): G1 (placebo); G2 (660 nm, 88 J / cm^2 , 100 mW, 3 J); G3 (808 nm, 88 J / cm^2 , 100 mW, 3 J); and G4 (PBMT alternating the wavelengths between sessions). The temporomandibular joints, masseter and anterior temporal muscles received irradiation at 2 points each, twice a week, for 4 weeks. For data collection, VAS, SF-36, OHIP-14 and MFIQ questionnaires were used in the times: T1, initial; T2, after the first session; T3, end of treatment; and T4, 30 days after T3. Data analysis: The groups were compared using 2-way analysis of variance and the Tukey test. Results: The placebo and active groups improved equally for pain and MFIQ. Photobiomodulation therapy positively influenced specific quality of life domains on the active group. Those benefits were not observed on the group that was treated with placebo equipment. Part of the benefits was maintained for 30 days. Conclusion: Photobiomodulation therapy, associated with educational measures, positively influences the quality of life of individuals with temporomandibular disorders.

Key words: Temporomandibular Disorders, Quality of Life, Photobiomodulation Therapy.

Ensaio Clínico (Clinical Trial)

PHOTODYNAMIC THERAPY IN BREAST NEOPLASTIC CELL VIABILITY.

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INTRODUCTION: Photodynamic therapy (PDT) is an alternative treatment for breast cancer, demonstrating selectivity and important cytotoxicity to malignant tissues. This type of therapy involves the use of two non-toxic components: a photosensitizer substance and a light source (such as low-power lasers). In combination, they may induce cellular and tissue effects through an oxygen-dependent process, leading tumor cells to death by necrosis and apoptosis. So, the aim was to carry out a photosensitizer dose-response curve in order to establish photosensitizer dose and incubation time optimum for breast neoplastic cell line. **MATERIAL AND METHODS:** Breast tumor cell line 4T1 was cultured in RPMI medium supplemented with 10% fetal bovine serum (FBS) and 1% antibiotic at 37°C and 5% CO₂. Methylene blue (MB) was dissolved in RPMI medium in concentrations 5, 10, 15, 20, 25, 50 and 100 µM, filtered and cells were incubated for 30 min at 37°C. Afterward, MB solution was removed, plates washed and new RPMI medium added. Irradiation was performed using low-power red laser (660nm - AsGaAl) in following parameters: power 100mW, energy density 100 Jcm⁻², energy per point 2.8 J, continuous wave emission mode, and exposure time 28 s. Viability measurement by MTT was performed after 24h MB incubation and laser irradiation. **RESULTS:** Cell viability results indicate that MB concentrations from 5 to 50 µM were not toxic for 4T1 cells. On the other hand, 4T1 cells incubated with MB solution and irradiated by low-level laser presented their viability decreased at the same concentrations (5 to 50 µM). Regarding to 100 µM concentration, both MB and PDT were able to reduce cell viability, indicating that higher MB concentrations may be toxic. **CONCLUSION:** PDT using methylene blue as a photosensitizer was able to reduce cell viability without toxicity in breast tumor cell line. Further improvements will be performed in order to understand the PDT applicability using in vitro and in vivo models.

Key words: Photodynamic therapy; low-level laser; Breast tumor cell; Methylene blue.

Experimental study in vitro

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Low-level laser in the xerostomia control after head and neck radiotherapy: a case report.

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BACKGROUND: Squamous cell carcinoma (SCC) is the most common neoplasm in the oral cavity. Treatment with chemotherapy (QT) and radiotherapy (RT) can result in dry mouth and hyposalivation, symptoms that can be treated with low-level laser therapy (LLLT). The hypofunction of the salivary glands is a common and often permanent adverse effect in patients irradiated in this region. **AIM:** The objective was to report a case of improvement of xerostomia and hyposalivation in a patient irradiated in the head and neck region treated with LLLT. **METHODS:** A 48-year-old male patient complained of dry mouth and reported having undergone surgical treatment, QT and RT due to a SCC in the tongue base. Low level laser therapy (Laser Duo Portátil®, MMO Ltda., São Carlos, São Paulo, Brazil) was applied in continuous infrared mode with a wavelength of 808nm, power of 100mW, spot size of 3mm², 1J (10s) per application point. The applications were distributed in extraoral and intraoral areas. In the extraoral area, 6 bilateral points were distributed in the region of the parotid gland and another 5 bilateral points in the submandibular gland region. In the oral cavity, 3 bilateral points were distributed on the mouth floor, 6 bilateral points on the jugal mucosa and 3 points on the inner areas of the upper and lower lips and was prescribed an artificial saliva. Improvement in the case was observed using a visual analog scale. **RESULTS:** A significant improvement was noted. Initially, the classification on the scale was 6, stabilizing on scale 2 after the 5th session. As the objective of improving xerostomia was reached, the patient was provisionally discharged after 6 months of follow-up and periodic quarterly returns were planned for further evaluations. After treatment, the patient also reported partial recovery of taste. **CONCLUSION:** RT in the head and neck region has considerable impacts, including xerostomia and hyposalivation. LLLT has proven to be an effective form of treatment for these conditions. However, further studies are needed in order to provide greater standardization of clinical parameters and greater clinical safety.

Key words: Squamous cell carcinoma, Radiotherapy, Low-level light therapy

Outros / Others: relato de caso / case report

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Lingual frenectomy and the use of high intensity laser in the Pediatric Dentistry.

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Background: Ankyloglossia is an alteration that may be due to the short and thick lingual frenulum, or the fusion of the lower part of the tongue with the floor of the mouth. It can cause, among other problems, difficulties in breastfeeding, speech problems, malocclusions and gingival recessions. Lingual frenectomy is a surgical approach strongly indicated in the literature as the best approach to treat ankyloglossia. Aim: Review the literature on the use of high intensity laser as a substitute for the conventional scalpel in the treatment of ankyloglossia in children. Methods: Search for articles in English in the PubMed database, using the search strategy: [Laser Therapy OR Lasers] AND [Lingual Frenum OR Tongue tie OR frenectomy], in the last 10 years. Results: The search identified 378 scientific articles, with seven studies selected, after selection by title and full reading. Lingual frenectomy is a surgical procedure traditionally performed with the use of scalpels or blades, and which aims to section the lingual brake, using simple excision techniques. This technique can be performed using the high intensity laser, which is considered an excellent alternative to the traditional method, due to the reduction of treatment time, compared to the scalpel, which allows greater patient collaboration. In addition, post-surgical pain and discomfort are minor and do not require suturing in most cases, in addition to lower bleeding after treatment, together with a reduced risk of postoperative infection. The four main types of laser surgical devices applied to pediatric patients for lingual frenectomy are Carbon dioxide (CO₂), Diode, Erbium Family and Neodymium Family and must be carefully selected to ensure that the procedure is effective. Conclusion: The use of laser surgical devices in pediatric dentistry has great validity, due to the advantages when compared to techniques with scalpel and blades, especially with regard to children's perceptions of postoperative pain and discomfort. It is essential that dentists are trained in the use of the device, in order to guarantee the quality of the treatment to be performed.

Key words: Laser Therapy, Lasers, Lingual Frenum, Tongue tie, frenectomy.

Revisão /Review

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Low level laser therapy: advances and innovations in dental procedures.

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Background: Low level laser therapy (LLLT) has the potential to assist dental protocols, reducing costs and modernizing consultations. Therefore, it is important that dentists know the therapeutic possibilities offered by this technology. Aim: Review the literature on the advances in the dental sector, obtained through the LLLT. Methods: Public documents from the Federal Council of Dentistry (FCD) were used and a bibliographic search of articles in English published in the Medline database was carried out between 2016 and 2020, using the keywords “laser therapy” AND “Dentistry”. Results: Brazilian FCD, by means of Article 1 of Resolution 82 of September 25, 2008, regulated to dentists the exercise of laser therapy as a complementary form to oral health. The included studies demonstrate that LLLT has an anti-inflammatory and biostimulant action. Therefore, its use helps in the success of dental treatments. It is described that the most diverse fields of work in Dentistry have benefited through the regulation of the use of laser therapy. In Hospital Dentistry, LLLT can be used to assist in the healing of wounds resulting, for example, from antineoplastic treatments. In Temporomandibular Dysfunction, the laser helps to reduce pain by allowing the deactivation of trigger points. During surgeries, laser therapy assists in analgesia, treatment of paresthesias and other therapies. Conclusion: It is concluded that LLLT, through its properties, increased the therapeutic possibilities, standing out as an innovative resource that enhances the quality of dental clinical care.

Key words: laser therapy, dentistry.

Revisão /Review