10º Biophotonics International Forum

Proceedings of FIB

Volume X

Anna Carolina R.T. Horliana
Raquel Agnelli Mesquita-Ferrari
Organizadoras

Universidade Nove de Julho – UNINOVE
Rua Vergueiro, 235/249
CEP 01054-001 – Liberdade – São Paulo, SP – Brasil
Tel (11) 3385-9241

Editores

Raquel Agnelli Masquita-Ferrari
Anna Carolina R.T. Horliana
Kristianne Porta S. Fernandes

Os conceitos emitidos neste proceedings são de inteira responsabilidade dos autores

04,05 e 06 de novembro de 2024

São Paulo, São Paulo Brasil

Realização:
Programa de Pós-Graduação em
Biofotônica-Medicina

Universidade Nove de Julho

.....

Author(s), "Title of Paper," in Proceedings of FIB, edited by Raquel Aguinelli Mesquita-Ferrari
Anna Carolina R.T. Horliana, Vol. X (2024). page number

.....

Sumário:

Comitê Científico:

Coordenadora: Profa.ª Dr.ª Raquel Agnelli Mesquita Ferrari (UNINOVE)

Vice coordenadora: Profa.ª Dr.ª Anna Carolina Ratto Tempestini Horliana (UNINOVE)

Membros:

Profa. Dra. Kristianne Porta Santos Fernandes (UNINOVE)

Prof. Dr. Adenilson de Souza Fonseca (UERJ)

Prof. Dr. Afonso Salgado (EUA)

Prof. Dr. Alessandro Melo Deana (UNINOVE)

Prof.ª Dr.ª Ana Paula Ligeiro de Oliveira (UNINOVE)

Prof.ª Dr.ª Anna Carolina Ratto Tempestini Horliana (UNINOVE)

Prof. Dr. Carlos Eduardo Pinfildi (UNIFESP)

Prof.ª Dr.ª Christiane Pavani (UNINOVE)

Profª Drª Cinthya Cosme Gutierrez Duran (UNINOVE)

Prof. Dr. Cleber Ferraresi (UFSCAR)

Prof.ª Dr.ª Ilka Kato (UFABC)

Prof. Dr. José Antônio Silva Júnior (UNINOVE)

Profª Drª Lara Jansiski Motta (UNINOVE)

Prof.ª Dr.ª Maria Aparecida Dalboni (UNINOVE)

Prof.ª Dr.ª Maria Cristina Chavantes (UNINOVE)

Prof.ª Dr.ª Maria Fernanda Setúbal Destro Rodrigues (UNINOVE)

Prof.ª Dr.ª Maria Lucia Zarvos Varellis (UNINOVE)

Prof.ª Dr.ª Manoela Domingues Martins

Prof. Dr. Nivaldo Parizzotto (UFSCAR)

Prof. Dr. Praveen Arany (EUA)

Prof.ª Dr.ª Raquel Agnelli Mesquita Ferrari (UNINOVE)

Prof. Dr. Raymond Lanzafame (EUA)

Prof.ª Dr.ª Rebeca Boltes Cecatto

Prof. Dr. Ricardo Navarro (FOUSP)

Prof. Dr. Richard Liebano (UFSCAR)

Prof. Dr. Rodrigo Labat Marcos (UNINOVE)

Prof.ª Dr.ª Silvia Nunez (IPEN - USP)

Prof.ª Dr.ª Stella Maris Lins Terena (UNINOVE)

Prof.ª Dr.ª Stella Regina Zamuner (UNINOVE)

Comissão Organizadora:

Presidentes: Prof.ª Dr.ª Maria Fernanda Setúbal Destro Rodrigues (UNINOVE); Prof. Dr. José Antônio Silva Junior (UNINOVE); Prof.a Dr.a Maria Cristina Chavantes (UNINOVE).

Membros:

Profa. Dra. Kristianne Porta Santos Fernandes (UNINOVE)

Prof. Dr. Alessandro Melo Deana (UNINOVE)

Prof.ª Dr.ª Ana Paula Ligeiro de Oliveira (UNINOVE)

Prof.ª Dr.ª Anna Carolina Ratto Tempestini Horliana (UNINOVE)

Prof.ª Dr.ª Christiane Pavani (UNINOVE)

Profª Drª Cinthya Cosme Gutierrez Duran (UNINOVE)

Prof. Dr. Jose Antônio Silva Junior (UNINOVE)

Prof.ª Dr.ª Lara Jansiski Motta (UNINOVE)

Prof.ª Dr.ª Maria Fernanda Setúbal Destro Rodrigues (UNINOVE)

Prof.ª Dr.ª Raquel Agnelli Mesquita Ferrari (UNINOVE)

Prof.ª Dr.ª Rebeca Boltes Cecatto

Prof. Dr. Renato Araujo Prates (UNINOVE)

Prof. Dr. Rodrigo Labat Marcos (UNINOVE)

Prof.ª Dr.ª Sandra Kalil Bussadori (UNINOVE)

Prof.ª Dr.ª Stella Regina Zamuner (UNINOVE)

Patrocínio:


COSMEDICAL


DMC


MMO
tecnologia para a saúde


COMERCIAL LASER
CLSP
SÃO PAULO
DISTRIBUIDORA


ecco
FIBRAS E DISPOSITIVOS


HTM
TECNOLOGIA DE RESULTADO


Author.K


Fotona
choose perfection


IBRAMED


eccovet

Realização:


UNINOVE
Universidade Nove de Julho


PPG em
BIO
FOTÔ
NICA
Biofotonica-Medicina

1

EFFECT OF PHOTOBIOMODULATION ON THE SALIVARY GLANDS OF PATIENTS WITH HYPOSALIVATION INDUCED BY THE USE OF BENZODIAZEPINES: DOUBLE-BLIND RANDOMIZED PLACEBO-CONTROLLED CLINICAL STUDY

Bezerra CDS (1), Varellis MLZ (1), Pavesi VCS (1), Bussadori SK, Mello ES (1), Deana AM (1)

e-mail de correspondência: cicerodayves@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Introduction: Depression is one of the most common mental illnesses. Benzodiazepines are the mainstay of treatment for those affected by this condition and this class of drugs is associated with adverse reactions, one of which is hyposalivation. Saliva performs multiple functions and plays a vital role in protecting oral health. Reduced salivary flow is most often manifested by symptoms of dry mouth, a subjective complaint called xerostomia. Users of antidepressant medication have a number of important systemic and oral complications, including hyposalivation. The infrared laser has been shown to significantly improve salivary flow in patients with hyposalivation due to diabetes, hypertension and chronic renal failure. Objective: evaluating the volumetric and biochemical parameters of unstimulated and stimulated saliva samples before and after the application of photobiomodulation in patients with depression taking benzodiazepines. Material and Method: Forty-eight participants were included in the protocol, after signing the Informed Consent Form (ICF), they underwent an anamnesis, physical assessment and questionnaires on self-perceived oral health and symptoms related to salivary gland function and were then randomized into two groups: Photobiomodulated (FBM) (n=24) ; their major salivary glands were irradiated with a diode laser (808nm, 4J per point, 40s) and SHAM (n=24), which underwent a simulation. We performed pre- and post-treatment sialometry to compare saliva volume and biochemical analysis, where we measured total proteins and calcium. Results: 58% of patients believe that hyposalivation related to other oral problems, with hyposalivation being the most prevalent alteration. After the photobiomodulation protocol, the MBF group showed a significant increase in salivary flow, unlike the SHAM group, as well as an increase in biochemical elements. We observed significant differences in both volume and biochemical elements. Conclusion: Photobiomodulation caused a significant improvement in sialometric and biochemical parameters in the samples analyzed from these groups of patients.

Key words: photobiomodulation, salivary glands, hyposalivation, depression, benzodiazepines

Study type: Ensaio Clínico (Clinical Trial)

2

"THE EFFECT OF PHOTODYNAMIC THERAPY AS A COMPLEMENTARY TREATMENT FOR PERIODONTITIS IN AN EXPERIMENTAL MODEL OF SILICA-INDUCED INFLAMMATORY PULMONARY RESPONSE"

Soares,KS (1), Ligeiro de Oliveira, AP (1)

e-mail de correspondência: keilla.soares@uni9.edu.br

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Cystic fibrosis is an autosomal hereditary disease caused by mutations in the CFTR gene located on the long arm of chromosome 7, encoding a transmembrane conductance regulator. Absence or dysfunction of this protein leads to abnormal activity of exocrine glands, particularly in the respiratory and digestive tracts, characterized by excessive mucus production and accumulation in the lungs, causing airway obstruction and bacterial infections. Treatment often involves antibiotic therapy for respiratory infections, and systemic consequences include pancreatic insufficiency, reduced nutrient absorption, and infertility.Previous studies have shown a strong link between periodontitis and pulmonary diseases such as asthma and chronic obstructive pulmonary disease (COPD). This study aims to evaluate the effect of Antimicrobial Photodynamic Therapy (aPDT) as a complementary treatment for periodontitis in an experimental model of cystic fibrosis, assessing the interactions between these two conditions.Materials and methods: Animals will be divided into 8 groups: Group I: Baseline, Group II: Periodontal Disease (PD), Group III: PD + Conventional Treatment, Group IV: PD + Conventional Treatment + PDT, Group V: Cystic Fibrosis, Group VI: CF + PD, Group VII: CF + PD + Conventional Treatment, Group VIII: CF + PD + Conventional Treatment + PDT. Periodontal disease will be induced by ligature technique, and treatment will involve periodontal curettage using mini-five curettes and aPDT with methylene blue (0.005%), λ= 660 nm, energy density of 6.369 J/cm², 9J per point in 2 points. After 21 days, animals will be euthanized for morphological analysis of the lungs and mandible. Cytokines IL-4, IL-5, IL-10, IFN-γ, TNF-α, IL-1β, IL-6, and mucus production will be evaluated."

Key words: Keywords: Pulmonary fibrosis, Low-Level Laser Therapy, Periodontitis.

Study type: Protocolo de Estudo experimental em animais (Experimental study in animals protocol)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

3

Could low-power infrared laser (808 nm) modulate p53 protein aggregation and alter viability in breast cancer cells?

Ribeiro RS (1), Fonseca AS (2), Vieira TCR (1)

e-mail de correspondência: rickson.ribeiro@bioqmed.ufrj.br

(1) Instituto de bioquímica médica Leopoldo de Meis, Universidade Federal do Rio de Janeiro;
(2) Departamento de Biofísica e Biometria, Instituto de Biologia Roberto Alcantara Gomes, Universidade do Estado do Rio de Janeiro.

Abstract

Introduction: Lasers emit monochromatic, coherent, collimated, and high energy density radiation beams. These characteristics at low-power are critical for effects involved in photobiomodulation as ATP production, DNA and RNA synthesis, and cell proliferation,. Applications of low-power lasers on cancer patients is debated due such effects, with controversial results. Breast cancer is the leading type of cancer in women globally, often associated with mutations in the p53 gene, which disrupt cell cycle control and increase cell proliferation and aggressiveness. Due to tumor complexity, new strategies, and approaches are needed to treat these conditions. Objective: This study aims to evaluate the effects of a low-power infrared laser (808 nm) on p53 protein aggregation and cell viability in MCF-7 and MDA-MB-231 breast tumor cells. Methodology: MCF-7 (Wild-type) and MDA-MB-231 (p53 mutant) cells were irradiated with a low-power infrared (808 nm) laser at 10, 15, and 20 J/cm², with non-irradiated cells as control. After that, cells were incubated for 24 and 48 hours at 37 °C, 5% CO2. Cell extracts were prepared, and protein concentrations were determined using the Lowry protein assay. Protein aggregation was assessed using a dot blot assay with p53, A11, and OC antibodies, visualized with the Chemidoc system. Cell viability assay was measured using an LDH cytotoxic assay. Data analysis: ImageJ software was used for quantification and statistical analyses were conducted using GraphPad 9.3.0 software. Control normalized data, and calculated mean and standard deviation. Results: Our data suggest that the low-power infrared laser enhanced wild-type p53 protein content in MCF-7 cells in 24 hours, at 15 and 20 J/cm². In all fluences evaluated, total oligomers were decreased only in MDA-MB-231 at 48 hours. In addition, amyloid fibers were decreased in MCF-7 at 24 and 48 hours. Cell viability was not altered in both cells at 24 and 48 hours. Conclusion: Our findings suggest that low power infrared laser potentially modulates p53 protein expression and aggregation of oligomers and fibers in cell models with sild-type and mutant p53. An increase in wild-type p53 and a decrease in aggregated species can benefit oncogenic cell treatment. However, additional studies are required to improve the understanding of the photobiomodulation on expression, aggregation, and cellular dynamics of p53 protein aggregation, and cell viability in MCF-7 and MDA-MB-231 breast tumor cells.

Key words: Cancer, infrared laser, p53, photobiomodulation, protein aggregation
Study type: Estudo experimental em in vitro (Experimental study in vitro)

4

SEPSIS AND INFLAMMATORY RESPONSE IN FEMALE RODENTS: EFFECTS OF LOCAL AND SYSTEMIC PHOTOBIOMODULATION TREATMENT ON PULMONARY COMPLICATIONS

MARLON DA PALMA CRUZ (1), ANA PAULA LIGEIRO DE OLIVEIRA (1).

e-mail de correspondência: marlonpc1302@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Introduction: Sepsis, usually caused by Gram-negative bacteria, is strongly associated with Acute Lung Injury (ALI). Lipopolysaccharide (LPS), an endotoxin from Gram-negative bacteria, is crucial to its pathogenicity and triggers immune and inflammatory responses. Studies with LPS in laboratory animals show that it induces changes in immune and inflammatory cells, increasing the permeability of the airways and recruiting neutrophils to the lungs. Despite advances in understanding ALI, therapeutic options are limited, with mechanical ventilation being the primary treatment, although it is costly and limited in effectiveness. Other approaches, such as low tidal volume ventilation and Extracorporeal Membrane Oxygenation (ECMO), are also high-cost and have limited efficiency. Thus, Photobiomodulation (PBM) emerges as a promising and safe adjunct therapy, showing positive results for various inflammatory conditions, including respiratory diseases. Objective: This project aims to evaluate the effects of local and systemic Photobiomodulation (PBM) in a model of acute lung inflammation induced by LPS. Methods: To this end, adult female Black-C57 mice will be subjected to either LPS injection (Salmonella abortus equi, intraperitoneally) or no injection and will be irradiated or not with local and systemic LASER 2 and 6 hours after LPS injection. Parameters will be investigated 3 days after LPS injection. Specifications of the laser for LOCAL treatment: wavelength: 660 nm, exposure time: 60s/point, irradiated points: 3 locations (trachea, left and right lung lobes), number of treatments: 1 day, two applications, irradiation dose: 5.4 J/min. Specifications of the laser for SYSTEMIC treatment: wavelength: 660 nm, exposure time: 60s/point, irradiated point: 1 point (caudal artery), number of treatments: 1 day, two applications, irradiation dose: 1.8 J/1min.

Key words: Sepsis, LPS, Photobiomodulation, Acute Lung Injury, Pulmonary Inflammation, Inflammation.

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

5

PHOTOBIOMODULATION ASSOCIATED WITH BIPHASIC BIOCERAMICS GRAFTING IN SCAFFOLD FOR ALVEOLAR BONE PRESERVATION AFTER MOLAR EXODONTICS: a randomized, triple-blind clinical study

Dalapria V (1), Mello ES (1), Toledo L (1), Bezerra CDS (1), Luque LD (2), Pereira SRS (1), Bussadori SK (1), Deana AM (1)

e-mail de correspondência: odontologia.dalapria@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Universidade Cidade de São Paulo, Graduação em Odontologia.

Abstract

The present study aimed to evaluate the efficacy of an 808 nm laser in preserving alveolar bone in permanent molars, both first and second, with or without association with a synthetic biomaterial, in cases indicated for extraction. Preservation of alveolar bone is essential to prevent atrophy and bone deformity after tooth extraction. Photobiomodulation using laser effectively accelerates bone healing, favoring the integration of the biomaterial into bone tissue, stimulating blood flow, activating osteoblasts, and reducing osteoclastic activity. A total of 43 patients aged 18 years or older participated in the study, of which 2 were excluded due to protocol deviation. Patients were randomized and distributed into four groups (n=15): Exo, Exo+Laser, Exo+Biomat, and Exo+Biomat+Laser. The Plenum® OSShp and Plenum® Guide biomaterials were applied immediately after tooth extraction. In the groups that received laser treatment, a diode laser device (Therapy EC-DMC, Brazil) was used, operating in continuous mode with a wavelength of λ = 808 nm and a power of 100 mW. Irradiance was achieved at 3.6 W/cm², totaling a radiant exposure of 107 J/cm², with a radiant energy of 3 J per point applied in contact, at three points (vestibular, occlusal, and lingual/palatal), totaling 9 J per session and 18 J over two sessions, performed during surgery and after a 10-day interval. For alveolar dimensional assessment and fractal analysis, computed tomography scans were performed preoperatively and three months after surgery.

Key words: Bone regeneration, Laser therapy, Photobiomodulation, Scaffold biomaterial, Alveolar preservation.

Study type: Protocol Study

6

Assessing the Efficacy of aPDT and Trans-Thoracic Irradiation in Treating Infectious Endocarditis: An Animal Model Study Protocol

Mello ES (1), Dalapria V (1), Salviato LTC (1), Prates R(1), Bussadori S (1), Deana AM (1)

e-mail de correspondência: erikasmello@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Introduction: Endocarditis is an infection caused by opportunistic bacteria that migrate to injured endocardial tissue. It affects 3-10 people per 100,000 annually, with a mortality rate of 30%. Staphylococcus is the most frequent and destructive microorganism responsible for this disease. Typically, bacteria originate from infections at other sites, often the teeth, travel through the bloodstream, and colonize damaged areas of the myocardium, such as prosthetic valves, leading to vegetation and tissue damage. Aim of this research: This protocol aims to evaluate the use of antimicrobial Photodynamic Therapy (aPDT) with transthoracic irradiation and Methylene Blue in treating Infective Endocarditis in an animal model. Methodology: To induce endocarditis, a catheter will be surgically introduced into the carotid artery to create a slight injury to the myocardium. Two days later, the animals will be infected with Staphylococcus aureus. An hemogram will confirm the infection. Methylene Blue will be administered diluted in drinking water one hour before the irradiation procedure. The study groups are as follows: 1. Infected control group, 2. aPDT group with a single treatment, 3. aPDT group with five consecutive treatments (3 days). Each irradiation will be performed for 20 minutes with an 800 mW LED emitting at 630 nm (342 J/cm² at the surface of the rat's thorax). Survival rates, as well as microbiological and imaging analyses, will be conducted for all groups.

Key words: aPDT, Infective Endocarditis, Cardiac Valves, Methilene Blue.

Study type: Experimental Protocol (Experimental protocol)

7

EFFECTS OF AN IMPROVED TOLUIDINE BLUE O PHOTOSENSITIZER FOR ANTIMICROBIAL PHOTODYNAMIC THERAPY ON GROWTH AND VIABILITY OF THE FIBROBLASTS L929

Claudio Teruo Kassa(1), Aline Souza Silva(1), Valherya Silva Rodriguez(2), Raquel Agnelli Mesquita Ferrari (1), Mark Wainwright (3), Christiane Pavani (1), Renato Araujo Prates (1)

e-mail de correspondência: claudiotkassa@hotmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Undergraduate Program in Biomedicine – Universidade Nove de Julho – São Paulo - Brazil;
(3) School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, United Kingdom.

Abstract

The phenothiazinium derivative toluidine blue O is widely employed as a photosensitizer in Dentistry clinical trials. However, its activity against the pathogenic microorganisms is not significantly different to the most used methylene blue. This work will provide more information about the improved toluidine blue as known as butyl toluidine blue O – BuTBO, which was demonstrated to be better than others photosensitizers: increased in visible absorption wavelength and lipophilicity; decreased aggregation; higher production of singlet oxygen; remarkable increases in activity against Gram-negative Pseudomonas aeruginosa; and greater activity against conventional antibacterial and antifungal drugs as well as biocides commonly used for local disinfection.. OBJECTIVES: Evaluate the cellular viability and growth in presence of methylene blue, toluidine blue O and butyl toluidine blue O in dark. Compare the effects among the three photosensitizers. Determine which concentration induces minimal cellular alterations. METHODS: Cell culture will be cultured in Dulbecco´s modified Eagle´s medium supplement with 10% fetal bovine serum and antibiotics and antimycotics at 37°C in a humidified atmosphere of 5% CO2. They will be enzymatically dissociated with trypsin and will be counted under Neubauer chamber using trypan blue staining protocol and seeded in a 96-well plate, afterwards they will be stained for 1, 24 and 48h. Methylene blue, toluidine blue O and butyl toluidine blue O will be diluted on purified water at 100µM final concentration (approx. 0,003 mg/mL each) and will be serial diluted at 1:2 – started at 100µM and finish at 0,78µM. Afterwards, the cells will be assessed by MTT assay, Crystal violet assay and Flow cytometry. RESULTS: Up to now, data have demonstrated no differences between photosensitizers in cellular growth and viability. CONCLUSION: The photosensitizers used in this work had the same effects on the tested cells.

Key words: antimicrobial photodynamic therapy, photosensitizer, cytotoxicity
Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

8

EFFECTS OF PHOTOBIOMODULATION ON CELL DEATH AND OXIDATIVE STRESS IN HCC-1937 TRIPLE-NEGATIVE BREAST CANCER CELLS

Oliveira-da-Silva MC(1), Fonseca AS(1), Troyack R(1), Themistocles GB(1), Siqueira PB(1), Rodrigues MMS(1), Sales MC (1), Mencalha AL(1), Pires BRB(1)

e-mail de correspondência: millene.cristina40@gmail.com

(1) Departamento de Biofísica e Biometria, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro.

Abstract

Breast cancer is the leading cause of cancer-related death among women worldwide. Among the primary risk factors are mutations in the BRCA1/2 genes, which play a crucial role in DNA double-strand repair. Recent studies have shown that PBM, the application of low-power light to a biological system, could potentially induce mitotic recombination events and sensitize cancer cells. OBJECTIVE: The aims project is to evaluate the effects of low-intensity therapeutic lasers on inducing programmed cell death and oxidative stress in triple-negative BRCA1-mutated BC cells. METHODS: Human BC HCC1937 cells carrying the BRCA1 mutation were exposed to red and infrared lasers using the Photo Laser III equipment at 0.9 and 1.9J. Cellular viability was assessed using the WST1 method, and a colony formation assay was conducted to evaluate the effects of laser exposure on cell proliferation. Apoptosis and necrosis induction were assessed by flow cytometry using Annexin V and 7AAD. The oxidative profile was evaluated using the fluorescent marker DCFH-DA, quantifying ROS levels in response to experimental conditions compared to controls. Additionally, the mRNA levels of superoxide dismutase (SOD1), catalase (CAT), NAD(P)H quinone oxidoreductase 1 (NQO1), and Kelch-like ECH-associated protein 1 (KEAP1) were evaluated by RT-qPCR. Then, protein extracts were separated by SDS-PAGE, transferred to nitrocellulose membranes, and incubated with anti-Nrf2 antibody to assess its levels. RESULTS: Proliferation and viability assays did not show statistically significant changes in irradiated cells; however, the clonogenic assay revealed a significant reduction ($p=0.008$) in irradiated conditions. Flow cytometry analysis indicated an increase in apoptosis in the conditions with 660 nm at 0.9 J and at 1.9 J Furthermore, although it was not statistically significant, qPCR results showed an increase in the expression of CAT, SOD1, NQO1 and KEAP1 in all exposure conditions. Immunoblotting demonstrated an overexpression of NRF2, especially at 1.9 J for both lenghwaves. DATA ANALYSIS: Student's t-test or ANOVA, depending on the number of comparisons and distribution. A p-value ≤ 0.05 was considered statistically significant. CONCLUSION: Our findings suggest a correlation between the reduction of colony-forming capacity, induction of apoptosis, and overexpression of genes related to oxidative stress, contributing to the understanding of the mechanisms involved in PMB in BRCA1-deficient tumor cells.

Key words: Breast cancer, BRCA, Laser, Photobiomodulation

Study type: Estudo experimental em in vitro (Experimental study in vitro)

9

Is there an effect of photobiomudulation on breast cancer stem cell phenotype?

Themistocles GB (1)*, Silva LL (1)*, Troyack R (1), Oliveira-da-Silva MC (1), Siqueira PB (1), de Sousa MM (1), da Fonseca AS (1), Mencalha AL (1), Salviano I (1,2), Pires BRB (1).

e-mail de correspondência: giuliathemistocles@gmail.com

(1) Departamento de Biofísica e Biometria, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro;
(2) Laboratório de Alimentos Funcionais, Instituto de Nutrição Josué de Castro, Universidade Federal do Rio de Janeiro.

Abstract

INTRODUCTION: Breast cancer stem cells (BCSC) favor tumor progression. Low-power laser therapy (TLBP) is commonly used in medical applications, however, there is a lack of safety studies for cancer patients. OBJECTIVES: Our study aims to evaluate the effects of TLBP on BCSC to comprehend the effects of photobiomodulation (PBM) in the context of aggressive breast cancer features. METHODS: To study the relevance of the transcription factors associated to BCSC, analyses were conducted through the Kaplan-Meier method (Q1 vs Q4, and $p<0.05$) correlating to the gene expression of SRY-box transcription factor 2 (SOX2), nanog homeobox (NANOG) and octamer-binding transcription factor 4 (OCT4), also known as (POU5F1) with patient data from The Cancer Genome Atlas (TCGA) representing the triple-negative breast cancer subtypes: basal like-1, basal like-2, immunomodulatory, mesenchymal, mesenchymal stem-like and luminal androgen receptor. Additionally, Human BC HCC-1937 cells were exposed to red and infrared lasers (660nm and 808nm, respectively) at 0.9J and 1.9J. The mRNA levels were evaluated by RT-qPCR and GAPDH mRNA levels were used as a reference to the 2 -CT method. RESULTS: Our findings showed an overexpression of OCT4 in luminal androgen receptor ($p=0.0193$), basal-like-2 ($p=0.0302$) and basal ($p=0.0321$) subgroups were associated with a poor prognosis, and the overexpression of SOX2 in basal-like-2 ($p=0.0103$). Our results also demonstrated a possibly protective role for NANOG in subtype mesenchymal ($p=0.021$) and OCT4 in subtype basal-like-1 ($p=0.0182$). We observed increased levels of NANOG (at 0.9J and 1.9J in 808nm) and OCT4 (at 1.9J in 660 and 808nm) transcripts in HCC-1937 cells. DATA ANALYSIS: Data were analyzed using Student's t-test or ANOVA, depending on the number of comparisons and distribution (Kolmogorov-Smirnov test). A p-value ≤ 0.05 was considered statistically significant. CONCLUSION: Future studies are necessary to understand these biological effects of PBM in TNBC cells related to cancer stemness, including self-renewal capacity and tumorigenicity.

Key words: Breast cancer, Triple negative subtype, POU5F1, SOX2, NANOG, Prognosis
Study type: Estudo experimental em in vitro (Experimental study in vitro)

10

EFFECTS OF PHOTOBIOMODULATION THERAPY IN AN EXPERIMENTAL MODEL OF NITRIC ACID-INDUCED BRONCHIOLITIS

Moraes MV, de Oliveira APL

e-mail de correspondência: marcus.moraes@uni9.pro.br

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Introduction Bronchiolitis is a frequent acute disease in children under two years of age, more predominantly in children under 12 months of age, leading to significant rates of morbidity and mortality. With the exception of oxygen therapy and fluid therapy, the disease lacks consensus in the scientific literature on treatment alternatives. To date, studies have shown controversy or lack of solid results in the treatment of bronchiolitis with bronchodilators, corticosteroids, leukotriene inhibitors, inhalation with hypertonic saline, epinephrine, and nitric oxide. In this way, it is notorious that the disease lacks really effective treatment alternatives. The infeasibility for direct experimentation of new treatment alternatives in children brings us the need for this application in experimental models. To date, there is no scientific content available on photobiomodulation applied to the treatment of nitric acid-induced bronchiolitis.

Objectives The aim of this study will be to evaluate whether photobiomodulation therapy (low-level laser) is able to reduce the inflammatory effects of bronchiolitis in mice, evaluating the inflammatory and histological effects, through microscopic analysis of lung tissue and bronchoalveolar lavage, in lungs of mice that will be submitted to photobiomodulation, after bronchiolitis induction. Methodology This controlled experimental study in 90 Balb/C mice will be submitted to the Animal Research Ethics Committee. To induce pulmonary inflammation, the animals will be submitted to intra-tracheal instillation of 2% nitric acid. The animals will be irradiated from the 3rd day, after orotracheal instillation of 2% nitric acid and euthanized on the 7th and 14th day. The animals will be divided into 2 groups (control and experiment) and 6 subgroups each (local irradiation with low-level laser and vascular irradiation with low-level laser). The analysis will consist of: evaluating the cell migration of lung tissue, performing bronchoalveolar lavage to evaluate the quantification and phenotyping of recovered cells, quantifying the levels of cytokines (IL-1-β, IL-2, IL-4, IL-6, IL-8, IL-9, IL-10, IL-12, Interferon-Y, TNF-α) and CD4+ and CD8+ lymphocytes of the BAL by ELISA method and using histological techniques, to analyze airway remodeling, bronchoconstriction index, bronchiolar edema, intra- and peri-bronchiolar inflammation, to quantify collagen using the Picrossirius method and mucus using the PAS technique.

Key words: immunology, bronchiolitis, experimental model, photobiomodulation, low level laser

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

11

JOINT REGENERATION WITH LOW-POWER LASER IN A PATIENT WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION: CASE REPORT

Campos MCV (1), Tanganeli JPC (2)

e-mail de correspondência: mayra.vilela@uni9.edu.br

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

(2) Faculdade de Odontologia da APCD

Abstract

Introduction: Temporomandibular joint degeneration is a process that occurs with advancing age and is usually accompanied by orofacial pain and functional impairment. Conventional and minimally invasive treatments for this condition are palliative, relieving pain and improving function. The subsequent invasive step consists of replacing the joint with a prosthetic joint, a high-cost procedure that has an impact on the patient and no guarantee of success. Objective: To report the qualitative imaging aspects of the temporomandibular joint in a degenerative process before and after laser therapy treatment. Methodology: A patient diagnosed with degenerative articular TMD received photobiomodulation treatment at 4 joint points for 3 months, once a week. A computed tomography scan was performed before and after treatment. Results: The final computed tomography scan demonstrated qualitative differences in the uniformity of the contour of the right and left condyle. The right TMJ, initially with marked erosion, showed only flattening in the same region. Conclusion: Photobiomodulation has regenerative potential for ATM, and randomized clinical trials are needed to demonstrate its effectiveness.

Key words: Temporomandibular joint osteoarthritis, Low Level Laser Therapy, , Photobiomodulation.

Study type: Relato de caso/Serie de casos (Case report/Case series)

12

Assessment of REFIX technology for the remineralization of initial caries simulated on bovine teeth analyzed using laser speckle tracking: an in vitro study

Mandetta ARH (1), Machado MAAM (2), Santos EM (3), Leal ML (3), Sobral APT (3), da Silva JVP (1), Prates RA (1), Deana AM (1), Bussadori SK (1)

e-mail de correspondência: amandahonorio@hotmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

(2) Department of Pediatric Dentistry, Orthodontics and Public Health, Dental School of Bauru, USP - Universidade de São Paulo, Bauru, SP, Brazil;

(3) Postgraduation Program in Health and Environment, Universidade Metropolitana de Santos -UNIMES

Abstract

Objective: To assess the effectiveness of the REFIX technology in the remineralization process of initial caries simulated on bovine enamel. The assessment involved the analysis of backscatter intensity, which was determined from laser speckle images. Method: Twenty-one bovine teeth were divided into three groups: G1 and G7 were submitted to treatment with the REFIX technology for one and seven days, respectively. The control group was treated with deionized water. Results: A significant difference in backscatter was found between the carious and sound areas in all groups ($p = 0.0038$, $p < 0.0001$ and $p = 0.0002$ for the control group, G1 and G7, respectively). The intergroup comparison revealed no significant difference among the groups studied. Conclusion: REFIX technology did not alter the optical properties of the samples of bovine teeth with simulated initial caries lesions after one and seven days of treatment.

Key words: Keywords: remineralization; laser speckle; caries lesion; REFIX

Study type: Estudo experimental em in vitro (Experimental study in vitro)

13

Effects of low-power lasers and LEDs on oxidative stress and cell death in breast cancer cells

Thayssa Gomes Farias (1), Marisa da Cunha Sales (1), Ana Julia Cardoso Borges (1), Priscilla Soares dos Santos (2), Andre Luiz Mencalha (2), Adenilson de Souza da Fonseca (1).

e-mail de correspondência: thayssa.biomed@gmail.com

(1) Laboratório de Biofotônica, Departamento de Biofísica e Biometria, IBRAG/UERJ, RJ, Brasil;
(2) Laboratório de Biologia do Câncer, Departamento de Biofísica e Biometria, IBRAG/UERJ, RJ, Brasil.

Abstract

INTRODUCTION: Breast cancer is the type of neoplasm that most affects women worldwide. Radiations emitted by low-power lasers and LEDs (light-emitting diodes) has been used for therapeutic purposes based on the photobiomodulation (PBM). However, the molecular mechanisms involved in PBM induced by such radiations as well as the effect depend on the conditions of irradiation and biological system. Studies indicate that levels of reactive oxygen species (ROS) and cell death mechanisms, such as apoptosis and necrosis, could be involved in the effect of PBM. However, the participation of these mechanisms in PBM on cancer cells is not yet understood. OBJECTIVE: This study aimed to evaluate the levels of ROS, apoptosis and necrosis in breast cancer cells exposed to low-power red laser and blue LED. METHODOLOGY: MCF-7 and MDA-MB-231 cells were exposed to red laser (658 nm) at 69 J/cm2 (0.77 W/cm2, 100 mW; spot size of 0.13 cm^2) and blue LED (470 nm) at 482 J/cm2 (5.35 W/cm2, 1500 mW; spot size of 0.28 cm^2), individually or simultaneously, in continuous emission mode. After exposure, cell viability was assessed by WST-1 assay. By flow cytometry, ROS, apoptosis, and necrosis levels were evaluated by using H2DCFA, Annexin V, and 7-AAD, respectively. RESULTS: The red laser and blue LED, alone or simultaneously, were not able to significantly modify ($p>0.05$) cell viability when compared to the control group in MCF-7 and MDA-MB-231 cells. In MCF-7 cells, exposure to the red laser alone significantly increased ($p<0.05$) total ROS levels. Thus, exposure to the red laser alone significantly increased ($p<0.05$) early apoptosis. Furthermore, exposure to the red laser and blue LED simultaneously significantly increased ($p<0.05$) early and late apoptosis. In MDA-MB-231 cells, exposure to the red laser and blue LED, alone or simultaneously, significantly decreased ($p<0.05$) total ROS levels. Thus, alone or combined, the red laser and blue LED significantly reduced early apoptosis ($p<0.05$). CONCLUSION: Our findings suggest that the effect of PBM is involved with total ROS levels and early and late apoptosis.

Key words: photobiomodulation, oxidative stress, apoptosis, laser, LED.
Study type: Estudo experimental em in vitro (Experimental study in vitro)

14

Effect of blue light in câncer: Sistematic Review

De Lima BES (1) Cecatto RB (1) Labat RM (2) Rodrigues MFSD (1)

e-mail de correspondência: barbara.e.s.delima@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Cancer is a chronic disease that kills millions of people every year, and its incidence has been significantly increasing due to population aging and shifts towards unhealthy lifestyles, especially in less developed countries. The disease has a multifaceted profile with various types of cancer in different locations, making treatment challenging and often scarce, typically involving surgery, radiotherapy, and chemotherapy. These treatments are frequently associated with increased tumor aggressiveness and disease recurrence. The urgent need for new therapies that can encompass all cancer profiles is evident. Recently, studies have shown that blue light irradiation (450-470 nm) has antitumor and proapoptotic effects in in vitro and in vivo models, presenting a promising and less invasive alternative for the treatment of various neoplasms. However, little is known about the mechanisms by which blue light influences neoplastic cells. This study consisted of a qualitative systematic review using the PRISMA strategy, covering the period from 2002 to 2024. The research was conducted in various bibliographic databases, including MEDLINE/PubMed, EMBASE, and LILACS. In vitro and in vivo studies published in English, Spanish, French, Portuguese, or Italian that investigated the use of PBM with blue light in cancer were included. Data extraction included information on the year of publication, author, type of study, objectives, models used, methods of evaluation, outcomes analyzed, treatment groups, parameters used, control group, follow-up time, side effects, limitations, biases, and conclusions of the authors. Descriptive qualitative analyses of the presented data were performed. The analysis of 26 studies demonstrated the capacity of blue light treatment in neoplastic models, showing promising results. However, the lack of homogeneity in protocols and the absence of some details indicate the need for further studies to better elucidate the mechanisms by which blue light acts on tumor tissues.

Key words: Blue light, photobiomodulation, cancer, in vivo models, in vitro models
Study type: Revisão Sistemática (Systematic Review)

15

Use of photobiomodulation and photodynamic therapy in the treatment of burn in a feline: case report

Silva GD (1), Alzamora Filho F (2), Farias GN (3), Pinto TM(3), Rocha J (3), Oliveira A (3)

e-mail de correspondência: gisellediaas@hotmail.com

(1) Universidade Estadual de Santa Cruz, Ilhéus-Bahia, Brasil.
(2) Universidade Estadual de Santa Cruz, Ilhéus-Bahia, Brasil.
(3) Clínica veterinária, Ilhéus-Bahia, Brasil.

Abstract

The treatment of burns is a challenge in Veterinary Medicine, as it requires initial stabilization of the patient, closure of the wound, prevention of secondary bacterial infection and renewal of different types of tissue. The present work aimed to report a case of 3rd degree burn in a feline treated through the association between laser photobiomodulation and photodynamic therapy. The animal was rescued after being subjected to ill-treatment and had approximately 36% of its body burned, with areas of tissue loss in the ears, head, neck and thoracic limbs, with an unfavorable prognosis. The intervention consisted of systemic stabilization of the patient using fluid therapy, anti-inflammatories and systemic antibiotics. Subsequently, photobiomodulation was used, with a diode laser (P:0.1W, A: 0.03cm2, □: 660nm and 808nm), with the dosimetric parameters, energy and fluence, varying according to the characteristics of the lesion and in photodynamic therapy (PDT), 1% methylene blue, 5 minutes of pre-irradiation, □: 660nm, energy: 9J/point, varying the number of irradiated points according to the extent of the wound, in addition to the adoption of photobiomodulation vascular for 10 minutes in the carotid artery. The protocol was maintained for four months with a two-day interval between sessions. The patient showed improvement in pain from the 2nd session, with greater mobility and increased food intake, accelerated debridement of necrotic tissues, modulation of the inflammatory process and gradual reduction of the wound. At the end of the treatment, there was complete healing of the wound, with the return of hair growth and movement of the forelimbs. It is suggested that such results are due to the ability of photobiomodulation to stimulate angiogenesis, analgesia, collagen deposition and epithelialization. Vascular photobiomodulation provided improvement in systemic inflammation and the patient's immunity. PDT was crucial in this process, given that secondary bacterial infection is one of the main causes of failure in the treatment of burns. The association between the different modalities of light therapy highlights the versatility of the use of light in Veterinary Medicine, in addition to encouraging its use in situations that are not very responsive to traditional, long-term protocols.

Key words: Healing, laser light, photosensitization, Veterinary Medicine.
Study type: Relato de caso/Serie de casos (Case report/Case series)

16

Antimicrobial Photodynamic Therapy and Deproteinization in Teeth with Molar Incisor Hypomineralization: A Case Series

Ribeiro CDPV (1), Mandetta ARH (1), Motta LJ (1), Horliana ACRT (1), Fernandes KPS (1), Mesquita-Ferrari RA (1,2), Duran CCG (1) Deana AM (1), Bussadori SK (1).

e-mail de correspondência: caroldvieirap@uni9.edu.br

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Postgraduate Program in Rehabilitation Sciences, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

In this case series, we examined the clinical effects of antimicrobial photodynamic therapy (aPDT) and deproteinization with Papacárie on teeth with molar incisor hypomineralization (MIH) and carious lesions, focusing on decontamination, hypersensitivity control, and restoration longevity with the use of minimally invasive techniques. The teeth selected had carious dentinal lesions and post-eruptive fractures, with an indication for restorative clinical treatment. Selective chemical-mechanical removal of carious tissue and deproteinization were performed using Papacárie™, followed by antimicrobial photodynamic therapy. A laser device was used, which emitted red light (wavelength: 660 nm, 100 mW, 6 J per spot, 3571 mW/cm², 214 J/cm², 60 seconds). The teeth were then restored with a combined method involving resin-modified glass ionomer cement and bulk-fill composite resin. Antimicrobial PDT proved to be promising treatment for decontamination and hypersensitivity control in molars with hypomineralization and dentinal caries. Moreover, deproteinization with Papacárie offers a promising, minimally invasive approach for enhancing restoration longevity.

Key words: aPDT, ART, MIH, Photochemotherapy, Hypersensitivity.
Study type: Relato de caso/Serie de casos (Case report/Case series)

17

Evaluation of a Clinical Protocol for Photodynamic Therapy in Endodontic Treatment of Primary Teeth: A Randomized Controlled Clinical Trial

Romano IMF(1), Mota LJM(1), Horliana ACRT (1); Fernandes KPSF (1), Mesquita-Ferrari RA (1,2), Duran CCG(1), Mandetta ARH (1), Pernomiam FC (1), Bussadori SK (1)

e-mail de correspondência: iarafromano@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Postgraduate Program in Rehabilitation Sciences, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Evaluation of a Clinical Protocol for Photodynamic Therapy in Endodontic Treatment of Primary Teeth Photodynamic therapy (aPDT) has been proposed as an adjunctive therapy to endodontic treatment with the aim of eliminating microorganisms present in the root canal system that are resistant to chemical-mechanical preparation. The application of this promising technology presents several variables, such as the dye to be used, the type of light, or the irradiation time. The objective of this study is to evaluate a dosimetric parameter for aPDT in endodontic treatment of primary teeth, considering bacterial reduction, clinical and radiographic aspects. Twenty anterior primary teeth with a diagnosis of pulp necrosis will be selected. The teeth will be randomly divided into two groups, which will receive different treatments: Group 1 (G1): conventional endodontic treatment (n=10); Group 2 (G2): Treatment with aPDT (9J) using optical fiber (n=10). For aPDT, methylene blue (Chimiolux®) will be used as a photosensitizer at a concentration of 0.005%, applied inside the root canal with a pre-irradiation time of 3 minutes, associated with the application of a laser with a wavelength of 660nm (DMC, Laser THERAPY XT). The canal will be irradiated with the equipment previously calibrated with energy of 9J and power of 100mW. For microbiological analysis, two samples of the intracanal content will be collected with paper cones, one before and one immediately after the proposed treatments in both groups. Radiographic aspects will be evaluated, considering the repair process. Clinically, the presence of fistula and mobility will be evaluated. Evaluations will be carried out at 1 and 3 months after treatment. The data obtained will be subjected to the Shapiro-Wilk normality test, where the statistical analysis to be used for this study will be defined, adopting a significance level of 95% ($p<0.05$).

Key words: Keywords: Endodontic treatment, Primary teeth, Photodynamic therapy, Antimicrobial, Root canal infection, Dental pulp necrosis

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

18

Antimicrobial Photodynamic Therapy in Diabetic Amputation Ulcers: Case Series Evaluating Wound Healing Quality

Priscilla Farias Chagas (1); Thais Barbosa dos Santos (1); Gesiane dos Santos Trivino (2), Sandra Kalil Bussadori (1,3); Cinthya Cosme Gutierrez Duran (1); Kristianne Porta Santos Fernandes (1); Rebeca Boltes Cecatto1; Anna Carolina Ratto Tempestini Horliana (1); Raquel Agnelli Mesquita-Ferrari (1,3)

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Chefe da Atenção Primária, Coordenadoria Geral de Atenção Primária 5.1, Secretaria Municipal de saúde do Rio de Janeiro/RJ
(3) Postgraduate Program in Rehabilitation Sciences, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Diabetic foot ulcers affect 10.5% of the global population, significantly compromising the quality of life for patients and overburdening public health systems. Antimicrobial Photodynamic Therapy (aPDT) emerges as a promising technology for treating chronic wounds, being effective against antibiotic-resistant bacteria that often cause infections in wounds. Compared to conventional systemic antimicrobials, aPDT offers advantages as the treatment focuses on the area irradiated by light, minimizing the risk of adverse systemic effects and resistance to the antibiotic used. OBJECTIVE: This study aimed to explore the application of antimicrobial photodynamic therapy (aPDT) in tissue repair through a progressive case series analysis of the quality of the wound healing. METHODS: The study design involved a case series with two patients, each monitored three times per week over a total of 10 aPDT sessions. The Bates-Jensen Wound Assessment Tool (BJ) was used to evaluate individuals with diabetic foot ulcers and monitor the healing process during the aPDT protocol. A cluster with four red lasers was used, with an average radiant power of 100 mW and radiant energy per emitter of 6 J/cm² (wavelength of 660 nm). The exposure time was 1 minute, resulting in a total radiant energy per session of 24J. RESULTS: The results of patients undergoing aPDT showed that Patient 1 initially scored 37 points on the BJ scale, which decreased to 24 points by the end of the treatment, reflecting a 13-point improvement. Similarly, Patient 2 started with a score of 36 points and achieved complete healing, finishing with a final score of 14 points. CONCLUSION: These findings indicate that aPDT can lead to considerable enhancements in the healing of diabetic amputation ulcers following just 10 treatment sessions. This highlights the potential of aPDT as an effective therapeutic option in managing complex diabetic wounds. This study reinforces clinical practice by implementing aPDT in patients with diabetic foot-related wounds and encourages new clinical research with larger samples to provide support for a safe approach based on well-defined protocols and high levels of scientific evidence.

Key words: Antimicrobial Photodynamic Therapy (aPDT); Diabetic Foot Ulcers; Wound Healing; Bates Jasen Scale

Study type: Relato de caso/Serie de casos (Case report/Case series)

19

Evaluation of Photobiomodulation in Excitatory Hippocampal Neurons Subjected to Hypoxia

Gabriel Alves(1), Marília Inês Móvio(1), Débora Sterzeck Cardoso(1), Alexandre Hiroaki Kihara(1), Silvia Honda Takada(1), Ilka Tiemy Kato Prates(2)

e-mail de correspondência: a.gabriel@aluno.ufabc.edu.br

(1) UFABC - Universidade Federal do ABC, CMCC- Centro de Matemática, Computação e Cognição

(2) UFABC - Universidade Federal do ABC , CECS-Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas

Abstract

Perinatal asphyxia (PA), characterized by a lack of oxygen at birth, can lead to hypoxic-ischemic encephalopathy, affecting 0.1-0.3% of full-term newborns and about 60% of premature low-weight infants. Approximately 20-50% of neonates who experience PA do not survive, and among the survivors, 25% present neurological sequelae, such as cerebral palsy and cognitive, auditory, and visual deficits. Currently, there are no effective treatments to minimize these sequelae. In this context, photobiomodulation emerges as a promising therapy due to its ability to modulate inflammatory processes. This study evaluated the effects of photobiomodulation on M-hippo E18 hippocampal neurons exposed to hypoxia (95% N2, 5% CO2, 37°C for 24h). The cells were irradiated with an LED (λ=660 nm, 50 mW/cm², 3 J/cm² for 60 s), and 24 hours after reoxygenation, cell viability was assessed using trypan blue exclusion and hypoxia-induced factor 1-alpha (HIF-1α) expression was analyzed through immunofluorescence. Photobiomodulation was observed to increase cell viability and regulate the expression of proteins induced by hypoxic stress.

Key words: Neuroinflammation,Cell death, Perinatal asphyxia, LED, Photobiomodulation, Hypoxia

Study type: Estudo experimental em in vitro (Experimental study in vitro)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

20

The effect of vascular photobiomodulation on sleep quality, relaxation and stress control: study protocol for a randomized crossover controlled trial

(1) Sousa LP, Motta LJ (1)

e-mail de correspondência: lperesdesousa@uni9.edu.br

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Sleep quality is directly related to the human being's quality of life. It is during sleep that we have, for example, the strengthening of the immune system, secretion, and release of hormones, and memory consolidation, so the lack of rest or inappropriate rest impairs the performance of these functions Methods: This paper presents a methodology to evaluate the effect of photobiomodulation transcutaneous vascular technique on salivary biomarkers related to stress and sleep a randomized crossover trial including 72 with poor sleep quality participants. The experimental group will receive laser therapy and compare it with the sham group. The study will evaluate the effect of treatment on sleep quality (PSQI and Epworth) and salivary markers (Chromogranin A and Cortisol). The active application will be performed with a red wavelength of 660 nm ± 10 nm and power of 100 mW, with an application time of 30 minutes, twice a week with 10 sessions in total. The device will be positioned with the spot located on the radial artery of the participant's preferred arm (right or left) and attached to the wrist with a specific wristband. Discussion: We expect that photobiomodulation has positive effects on sleep quality, relaxation, and stress and is an alternative for treatment with reduced use of drugs for these health problems.
(Clinical trial registration NCT05413993).

Key words: Photobiomodulation; Blood laser irradiation; Systemic Laser Therapy; Stress; sleep quality; sleep disorders.
Study type: Protocol Ensaio Clínico (Clinical Trial)

21

EFFECT OF PHOTOBIOMODULATION IN THE EXPRESSION OF BIOMARKERS OF OXIDATIVE STRESS IN HUVEC CELLS SUBJECTED TO HYPOXIA

Guilherme Rabelo Nasuk (1), Gabriel Almeida da Silva (1), Allan Luís Barboza Atum (2), Bruna Calixto de Jesus (2), and José Antônio Silva Júnior (1,2)

e-mail de correspondência: guilhermenike@uninove.edu.br

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Postgraduate Program in Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Introduction: Long considered an inert cell layer, the endothelium is recognized as an important regulator of key physiological functions. Endothelial cells respond to chemical stimuli and secrete factors that modulate several physiological processes, especially under hypoxia. This condition can trigger adaptive responses and have detrimental effects if persisted for prolonged periods, causing transcriptional modifications that result in alterations in cellular homeostasis. Photobiomodulation (PBM) therapy can stimulate collagen production, promote DNA and protein synthesis, increase ATP content, modulate cell migration and proliferation, accelerate tissue repair, and induce cell differentiation. In this context, the evaluation of cellular adaptations to hypoxia can provide knowledge to improve treatments and reduce these losses. Objectives: The present in vitro study aimed to evaluate the effects of PBM pre-induction of hypoxia in human umbilical vein endothelial cells (HUVECS), to prevent possible damage caused by hypoxia. The methodology included gene expression and protein activity through in vitro tests. Methodology: The cells were characterized by the expression of CD31 APC and CD146 APC by the flow cytometry method. The cells, maintained in culture, were released from a 75 cm2 matrix bottle and seeded in 25 cm^2 bottles in the amount of 1x106. Results: Our results showed that hypoxia only promoted a strong reduction in cell viability and that FBM with red laser 660 nm; 1.5 J/cm2; 60s) pre-hypoxia increased this parameter. The mRNA expressions of the antioxidant enzymes SOD1 and CAT were reduced by hypoxia, and were increased with the use of FBM. The activities of SOD and GPx were increased by FBM. The expression of Hsp1a/b (HSP70), a biomarker of cellular damage, was increased by hypoxia, and this effect was blocked by the action of PBM, demonstrating HSP70 levels similar to the control. Increased levels of TBARS and free radicals were found in the hypoxia group compared to the control. Interestingly, in the group previously treated with PBM therapy before hypoxia, we observed a decrease in these markers of oxidative stress, bringing values similar to the control. Conclusion: Taken together, the data suggest that PBM has potential as a cellular protection therapy against oxidative damage under hypoxic conditions, evidenced by the expression of antioxidant enzymes and reduction in the levels of carbonyl proteins and free radicals.

Key words: Photobiomodulation, HUVEC, antioxidant enzymes, oxidative stress.
Study type: Estudo experimental em in vitro (Experimental study in vitro)

22

IS THERE AN EFFECT OF PHOTOBIOMODULATION ON NF-kappaB SIGNALLING IN HCC-1937 TRIPLE-NEGATIVE BREAST CANCER CELLS?

Troyack, R (1), Oliveira-da-Silva, MC (1), Themistocles, GB (1), Siqueira, PB (1), de Sousa MS(1), Fonseca AS (1), Mencalha, AL (1), Pires BRB (1).

e-mail de correspondência: rebeccatroyack1914@gmail.com

(1) Departamento de Biofísica e Biometria, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro

Abstract

INTRODUCTION: Breast cancer (BC) is the leading cause of cancer death among women worldwide. Among the primary risk factors are mutations in the BRCA1, which has a critical role in DNA double-strand repair. Recent studies have shown that photobiomodulation could influence NF-κB activity and inflammatory cytokine expression. OBJECTIVES:Thus, this study aims to evaluate the effects of low-intensity therapeutic lasers on NF-κB signaling in triple-negative BRCA1-mutated breast cancer cells. METHODS: Human BC HCC-1937 cells, which are BRCA1-mutant (c.5266dupC) cells were exposed to red (660 nm) and infrared (808 nm) lasers at 0.9 and 1.9J using the "inflammatory processes" protocol of the Photo Laser III (DMC) equipment. After 48h, total protein was extracted and quantified by the Bradford method. Then, 30µg of protein extracts were separated by 8% sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE), transferred to nitrocellulose membranes, incubated with anti-NF-κB/p65 (1:1,000), anti-phospho NF-κB/p65 (Ser536) (1:1,000) antibodies, followed by incubation with the appropriate secondary antibody at a 1:2,000 dilution. Anti-GAPDH (1:10,000) was used as loading control for the Immunoblotting analysis. Antibody binding was detected using enhanced chemiluminescence with Pierce Plus Western Blotting Substrate. Images were obtained using a C-DiGit Imaging System instrument. Densitometric analysis was conducted using ImageJ. Values obtained for GAPDH staining were used to normalize the densitometry values to the probed targets. RESULTS: Immunoblotting analysis demonstrated increased levels of phospho-NF-κB/p65 and total NF-κB/p65 when the cells were exposed to infrared (808 nm) lasers at 0.9 and 1.9J. DATA ANALYSIS: Data were analyzed using Student's t-test or ANOVA, depending on the number of comparisons and distribution (Kolmogorov-Smirnov test). A p-value ≤ 0.05 was considered statistically significant. CONCLUSION: Our findings have shown that low-intensity infrared (808 nm) laser treatments did impact NF-κB pathway activation in BRCA1-mutant BC cells. This supports the need for further research into the potential of photobiomodulation to influence NF-κB activity, offering a promising direction for future studies in the field of oncology.

Key words: Breast cancer, BRCA, NFkappaB, Laser, Photobiomodulation
Study type: Estudo experimental em in vitro (Experimental study in vitro)

23

EFFECTS OF PHOTOBIOMODULATION IN THE POSTOPERATIVE FRACTURES OF THE PROXIMAL HUMERUS: A DOUBLE-BLIND, RANDOMIZED, CONTROLLED, CLINICAL STUDY.

Luiz Cláudio de Freitas (1,2), Luis Fumio Sato (2), Raquel Agnelli Mesquita Ferrari (1,3), Sandra Kalil Bussadori (1,3), , Nilton Iuichi Takahashi(2), Lara Jansiski Motta(1), Cinthya Cosme Gutierrez Duran (1), Anna Carolina Rato Tempestini Horliana (1), Kristianne Porta Santos Fernandes (1)

e-mail de correspondência: freitaslc52@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Clínica de Ortopedia e Traumatologia do Hospital Dr. Alípio Correa Netto (HMACN), Secretaria Municipal de Saúde, São Paulo
(3) Postgraduate Program in Rehabilitation Sciences, Universidade Nove de Julho, São Paulo/SP, Brazil;

Abstract

Among the various complications of postoperative evolution of fractures of the proximal humerus are pain and joint stiffness, generating significant functional limitation in the affected limb. Conventional physiotherapy is the current standard of care for both surgical and non-surgical cases. Studies have shown positive effects of photobiomodulation (PBM) on repair and regeneration of fractures, as well as on analgesia and improvement of physical function. However, they suggest standardization and additional evidence. This randomized controlled double-blind clinical study aims to evaluate the effects of PBM on the postoperative evolution of participants with fractures of the proximal humerus surgically treated with special locking plates. The 42 participants will be randomized and equally divided into 2 groups according to the type of therapy they will receive postoperatively. The Control group (conventional physiotherapy associated with simulated PBM) and the PBM group (conventional physiotherapy associated with active PBM). PBM will be performed using a device containing 140 LEDs (70 LEDs of 635 nm and 70 LEDs of 850 nm) using 10J/cm2 per LED. Sessions will be held 7 times a week for 12 weeks. Patients will be evaluated 24 hours after the surgical procedure and after 7, 14, 21, 60 and 90 days, except for the radiographic evaluation which will be every 4 weeks. The main outcome will be the recovery of shoulder function using the Quick-DASH functional outcome scale (Disabilities of the Arm, Shoulder and Hand). Secondary outcomes will be shoulder ROM, muscle strength, pain spontaneity during function and healing of fractures.

Key words: Keywords: photobiomodulation, humerus, bone fracture, surgery.
Study type: Protocolo Ensaio Clínico (Clinical Trial)

24

Low-power infrared laser on Escherichia coli: survival, proliferation, and bacterial filamentation

Ferreira ACS (1), Silva TG (1), Sales MC (1), Pires BRB (1), Mencalha AL (1), Fonseca AS (1) (2) (3).

e-mail de correspondência: ferreira.sanacaroline@gmail.com

(1) Universidade do Estado do Rio de Janeiro, Departamento de Biofísica e Biometria;
(2) Universidade Federal do Estado do Rio de Janeiro, Departamento de Ciências Fisiológicas;
(3) Centro Universitário Serra dos Órgãos, Centro de Ciências da Saúde.

Abstract

Experimental and clinical studies have demonstrated that photobiomodulation is able to treat arthritis, muscle and nerve injuries, and promote wound healing and pain relief. Escherichia coli is the most prevalent commensal inhabitant of the gastrointestinal tract of humans and warm-blooded animals, and some studies suggest that photobiomodulation is able to alter human microbiome. Thus, the aim of this study was to evaluate the effect of photobiomodulation induced by a low-power pulsed infrared laser on survival, proliferation, filamentation, plasmid DNA, and mRNA levels from filamentation repressor gene in E. coli cultures. For this, E. coli C600 cultures and bacterial plasmids were exposed to a low-power pulsed infrared (13 mW, 5 kHz, 904 nm) laser at different energies (0.0, 0.3, 0.7, and 1.1 J). Bacterial survival, proliferation, filamentation, electrophoretic profile of plasmid DNA, and mRNA levels from lexA were evaluated. Results showed that exposure to the pulsed low-power infrared laser did not alter bacterial survival, proliferation, filamentation, electrophoretic profile of plasmid DNA but increased mRNA levels from the filamentation repressor gene in E. coli C600 cells. Thus, photobiomodulation induced by such radiation could not change the content and filamentation phenotype of E. coli.

Key words: Escherichia coli, filamentation, laser, phobiomodulation
Study type: Estudo experimental em in vitro (Experimental study in vitro)

25

EFFECTS OF HOME PHOTOBIOMODULATION IN THE POSTOPERATIVE PERIOD OF DISTAL RADIUS FRACTURES: A DOUBLE-BLIND RANDOMIZED CONTROLLED CLINICAL TRIAL

Takahashi NI (1,3), de Freitas LC (1,3), Motta LJ (1), Duran CCG (1), Bussadori SK (1, 2), Horliana ACRT (1), Mesquita-Ferrari RA (1,2), Fernandes KPS (1)

e-mail de correspondência: nil.takahashi@gmail.com

(1) Postgraduate Program in Biophotonics Medicine, Universidade Nove de Julho, São Paulo/SP, Brazil;
(2) Postgraduate Program in Rehabilitation Sciences, Universidade Nove de Julho, São Paulo/SP, Brazil;
(3) Hospital Municipal Prof. Dr. Alípio Correa Netto (HMACN), Clínica de Ortopedia e Traumatologia.

Abstract

Distal radius fracture (DRF) is a common adult fracture, often leading to pain, functional loss, joint stiffness, reduced grip strength, prolonged work leave, and fracture reduction loss. This double-blind randomized controlled trial aims to assess the adjunctive effect of home photobiomodulation on the rehabilitation of surgically treated DRF, combined with an unsupervised home exercise protocol. A total of 42 participants will be randomized into two groups (1:1). The Control Group will undergo standard surgery, perform prescribed home exercises, and use an inactive LED plate. The PBM Group will follow the same protocol but with an active photobiomodulation (PBM) device. Home exercises will start 24 hours post-surgery, performed twice daily for 12 weeks. The LED device, with 100 diodes of varying wavelengths (630 nm, 680 nm, 760 nm, and 830 nm), will be applied once daily for 12 minutes to the wrist (6 minutes on each side). The Control Group will undergo standard surgery, perform prescribed home exercises, and use an inactive LED plate. The PBM Group will follow the same protocol but with an active photobiomodulation (PBM) device. Home exercises will start 24 hours post-surgery, performed twice daily for 12 weeks. The LED device, with 100 diodes of varying wavelengths (630 nm, 680 nm, 760 nm, and 830 nm), will be applied once daily for 12 minutes to the wrist (6 minutes on each side). Participants will be unaware of their group allocation and assessed at 24 hours, and at 2, 4, 6, and 12 weeks post-surgery by blinded evaluators. The primary outcome will be wrist function, measured by the Quick-DASH tool. Secondary outcomes include wrist range of motion, grip strength, pain (using the PRWE-BR tool), and fracture healing. Data will be stored and analyzed with appropriate statistical tests, maintaining a significance level of 5%

Key words: photobiomodulation, distal radius, volar locked plate, fracture
Study type: Protocolo Ensaio Clínico (Clinical Trial)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

26

EFFECT OF VASCULAR PHOTOBIOMODULATION AS AN ADJUVANT TO THE TREATMENT OF ACUTE LOW BACK PAIN: PILOT CLINICAL TRIAL

Fernandes SM (1), Motta LJ (1)

e-mail de correspondência: sm.fernandes@uni9.edu.br

(1) Universidade Nove de Julho, Programa de Pós Graduação de Biofotônica aplicada às Ciências da Saúde

Abstract

Low back pain directly affects people's quality of life, as it can lead to: inability to perform basic daily tasks, absence from work, reduced social interaction, excessive spending on medications and long-term treatments; factors that can harm the individual's mental health. According to studies, Vascular Photobiomodulation (VPBM) acts to: increase blood oxygenation, repair tissue and analgesia, among other benefits. Objective: The objective of this research project is to evaluate the effect of Vascular Photobiomodulation associated with manual therapy and physical exercises on participants with acute low back pain. Method: This pilot clinical trial will involve people between 18 and 65 years old with complaints of low back pain and who are between the 1st and 5th week of pain. The treatment will last 4 weeks, and participants will answer the following questionnaires: Owestry Disability Index 2.0, Roland Morris Questionnaire and Visual Analogue Scale at the first and last appointment. The selected participants will be divided into 2 groups with 10 people in each group, chosen randomly (by drawing lots). Both groups will undergo treatment using manual therapy and exercises, and the application of Vascular Photobiomodulation. One group will receive low-intensity placebo light and the other group will receive the active device. Results: The Questionnaires and the Visual Analogue Scale will be compared, analyzed and it will be verified whether or not there was a difference between the 2 treated groups.

Key words: Keywords: Low-intensity light therapy, low back pain, physiotherapy services, myofascial release therapy, physical exercise.

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

27

Evaluation of the Preventive Effect of Photobiomodulation on Periorbital Ecchymosis in the Postoperative Period of Rhinoplasty: A Randomized, Controlled, Double-Blind Clinical Trial

Azevedo MA (1), Quedas A(2), Dolci ELL(2), Kitamura RH(1), Bussadori SK(1,3), Horliana ACRT (1), Mesquita-Ferrari RA(1,3), Fernandes KPS(1), Duran CCG(1).

e-mail de correspondência: milene.azevedo@uni9.edu.br

(1) Postgraduate program in Biophotonics Medicine, Universidade Nove de Julho, UNINOVE;
(2) Department of Otorhinolaryngology of Irmandade da Santa Casa de Misericórdia de São Paulo;
(3) Postgraduate program in Rehabilitation Sciences, Universidade Nove de Julho, UNINOVE,

Abstract

Introduction: Rhinoplasty, a surgery aimed at correcting functional and aesthetic alterations of the nose, is the third most performed plastic surgery in Brazil. Postoperative complications like ecchymosis and periorbital edema are influenced by surgical technique, care, and individual characteristics, impacting recovery and causing discomfort. Photobiomodulation (PBM) relieves pain, modulates inflammation, and minimizes edema, potentially benefiting recovery in plastic surgeries. Preventing ecchymosis can speed recovery and improve satisfaction. Few studies evaluated PBM in this context. This study evaluates the preventive effect of PBM in reducing ecchymosis after rhinoplasty, using the Kargi Scale (2003). Secondary objectives assess PBM's effect on edema, skin thickness, temperature, pain, bleeding, nasal obstruction, and analgesic use. Analyses will be performed on the 7th and 30th postoperative days. Methodology: A randomized, double-blind, controlled trial at the Otorhinolaryngology Department of Santa Casa de São Paulo with 60 participants, statistical power of 80%, and significance level of $\alpha = 0.05$. Inclusion: structured primary rhinoplasty, ASA I patients, aged 18 to 50, both genders. Exclusion: revision rhinoplasty, complications, corticosteroid use, and prior modeling. Participants will be randomized: Control group (G1), without PBM, and Intervention group (G2), with PBM 1 hour before surgery. Treatment will be simulated in the control group. Blinding will apply to the evaluator and participants. Dosimetry: Two wavelengths will be used: 630 nm (red LED) and 850 nm (infrared LED). Red LED: 0.25 W/LED, irradiance 0.06 W/cm², 48 s exposure, 3 J/cm², 60 J total (5 points). Infrared LED: 0.3 W/LED, irradiance 0.06 W/cm², 40 s exposure, 2.4 J/cm², 48 J total (4 points). A single session will be applied 1 hour before surgery. Data analysis: Paired t-test for numerical data, Mann-Whitney for ordinal data, and specific tests for categorical data, depending on distribution. Significance level will be $\alpha = 0.05$.

Key words: photobiomodulation, rhinoplasty, ecchymosis, edema, nasal fracture
Study type: Protocolo Ensaio Clínico (Clinical Trial)

28

ADJUVANT TREATMENT WITH PHOTOBIOMODULATION AND PHOTODYNAMIC THERAPY IN POST-DECOMPRESSIVE CRANIECTOMY WOUND DEHISCENCE: CASE REPORT

Ellen da Silva (1,2), Thomas Stravinskas Durigon(1), Ellen Cristina Zamberlan Milan(1), Flavia Roberta Nagano(1), Edneia Siqueira(1), Alexandre Rocha Santos Padilha(2,3), Anna Carolina Ratto Tempestini Horliana(1), Raquel Agnelli Mesquita-Ferrari (2,3), Cinthya Cosme Gutierrez Duran (1)

e-mail de correspondência: ellendasilva.enf@gmail.com

(1) Hospital Municipal de Barueri Dr. Francisco Moran, HMB, Barueri, São Paulo, Brazil
(2) Programa de Mestrado e Doutorado em Medicina Biofotônica, Universidade Nove de Julho,
(3) Secretaria de Relações Institucionais da Presidência da República, Brasil

Abstract

Introduction: Patients with severe traumatic brain injury (TBI) often require decompressive craniectomy to control intracranial pressure and improve functional outcomes. Photobiomodulation (PBM) and antimicrobial photodynamic therapy (aPDT) have shown benefits in tissue repair and wound healing. Methodology: Patient A.C.V., male, 48 years old, suffered severe TBI after a car accident, with extensive hemorrhagic contusion and edema. He underwent decompressive craniectomy and duraplasty on the left lobe in December 2023. After complications with wound dehiscence, he presented with persistent infection despite treatment with antibiotics and analgesics. The medical team opted for aPDT to control the infection, followed by PBM to optimize healing. The light treatment was performed over 3 months in a specialized outpatient clinic under medical supervision. aPDT was performed in 10 sessions, and after infection control, the patient received 18 PBM sessions. Pain was monitored using the Visual Analog Scale (VAS). aPDT used a 660 nm wavelength in continuous mode, 100 mW power, irradiance of 1 mW/cm², with a beam area of 0.1 cm² per laser. The exposure time was 60 seconds per point, with 6 J of radiant energy per point. Before each session, the wounds were cleaned with 0.9% saline solution and irrigated with 0.01% Methylene Blue. After 5 minutes of pre-irradiation, the irradiation was applied every 1 cm of the wound. The wounds were protected with silver-containing hydrofiber dressings. PBM was performed with 660 nm in continuous mode, 100 mW power, irradiance of 100 mW/cm², with a beam area of 1 cm², and exposure time of 50 seconds per point, totaling 50 J of radiant energy. The study was approved by the UNINOVE Ethics Committee, under the number 7.115.260. Results: At the beginning of treatment, the patient reported severe pain (VAS = 10), with a wound presenting purulent exudate, edema, and devitalized tissue. After 10 aPDT sessions, there was a significant reduction in exudate and infection control, with pain reduced to VAS = 6. PBM was started in the fifth week, resulting in complete healing after 18 sessions, with functional recovery and no signs of infection. Conclusion: Adjuvant treatment with aPDT and PBM was effective in controlling infection and healing the wound after decompressive craniectomy. The combination of these therapies may be an effective option in managing surgical complications such as dehiscence in patients with severe TBI.

Key words: Surgical wound dehiscence, Craniectomy, Photobiomodulation, Photodynamic Therapy.

Study type: Relato de caso/Serie de casos (Case report/Case series)

29

Evaluation of the Effects of Photobiomodulation on Human Platelet Viability

Mohammad Hossein Shaker(1); Henrique Roman Ramos(1); Sandra Kalil Bussadori(1,2); Lara Mota(1); Anna Carolina Ratto Tempestini Horliana(1); Maria Fernanda Destro Setubal(1); Raquel Agnelli Mesquita-Ferrari(1,2); Kristianne Porta Santos Fernandes(1); Cinthya Cosme Gutierrez Duran (1)

e-mail de correspondência: mhshaker26@uni9.edu.br

(1) Postgraduate program in Biophotonics Medicine, Universidade Nove de Julho, UNINOVE, São Paulo
(2) Postgraduate program in Rehabilitation Sciences, Universidade Nove de Julho, UNINOVE, São Paulo

Abstract

Introduction: Platelets are essential for hemostasis and play key roles in immune-inflammatory processes and tumor development. Over the past decades, the clinical use of platelet transfusions, platelet-rich plasma (PRP), and platelet-rich fibrin (PRF) has increased significantly. Photobiomodulation (PBM), which uses light to modulate biological processes, has demonstrated benefits such as tissue regeneration, pain relief, inflammation modulation, and increased collagen synthesis. However, few studies have explored the direct effects of PBM on human platelets. Objectives: This study aims to evaluate the effects of PBM, using LEDs with wavelengths of 660 nm and 780 nm, on cell viability, apoptosis, morphology, and nitric oxide (NO) levels in human platelet concentrates. Methodology:
This is an experimental study that will use human platelets obtained from segments of platelet bags collected via apheresis. The use of hemocomponents will not be compromised, as the platelets will be transfused as normal. The experimental groups will be divided according to the irradiation time (Day 1, Day 5, and Day 10) and, for each day, two wavelengths (660 nm and 780 nm) will be used, with corresponding non-irradiated control groups. The dosimetric parameters used for irradiation will be: wavelengths of 660 nm and 780 nm, with an output power of 70 mW and a beam area of 0.04 cm^2. The applied power density will be 1750 mW/cm^2 and the energy density will be 17.5 J/cm^2. The irradiation time will be 15 seconds per point, resulting in a total energy of 1 J per irradiation point. The platelets will be stored at 20-24°C with constant agitation. The parameters to be evaluated include cell viability (using annexin V, DAPI, and MTS assays), platelet morphology (via microscopy), and nitric oxide levels (measured by the GRISS method). The study sample will include male donors aged between 25 and 40 years. This experimental protocol will provide a structured methodology to investigate the isolated effects of PBM on human platelets, contributing to the scientific understanding of how light therapy can modulate platelet functions. The results will be analyzed and conclusions drawn upon completion of the study. Data Analysis: Statistical analysis will be performed using GraphPad PRISMA software. ANOVA will be used to evaluate data distribution and normality.

Key words: Photobiomodulation, Platelets, Cell Viability, Apoptosis
Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

30

Pilot Randomised, Controlled, Double-Blind Study Comparing Amber Photobiomodulation and Tranexamic Acid in the Treatment of Melasma

Galache, TR (1), Pavani, C (1)

e-mail de correspondência: thais.galache@uol.com.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction: Melasma, the main pigmentation disorder in women (90% of cases), has a partially known etiology. Tranexamic acid (TXA) treats melasma by inhibiting the conversion of plasmin to plasminogen and activating autophagy. In vitro studies indicate that amber photobiomodulation (PFBM) also activates autophagy. Objective: To evaluate the effect of amber PBM on melasma, compared with TXA. Methodology: This controlled, randomized, double-blind study had patients divided into 2 groups: PBM with amber LED + placebo cosmetic (Group 1) and sham PBM + 5% TXA cosmetic (Group 2). Weekly sessions for 12 weeks and cosmetic home use within 3 months with 2 months of follow-up. Results: 21 women around 44 years old were included. No significant differences were found in the intragroup analysis in the MASI parameter over time for both ATX (13.8 ±2.8; 11.7 ±2.1; 11.8 ±2.2) and FBM (16.4 ±3.0; 16.8 ±2.2; 16.2 ±2.0), as well as no significant differences were found between the groups in all periods investigated. The Global Face Assessment revealed improvements in melasma in both groups, with a median score of 4 [4-5] for PBM and 4 [3-4] for TXA. An improvement in quality was observed of participants' lives, as indicated by reduction in MelaQoL questionnaire scores (47.9 ± 15.6; 37.0 ± 17.0; and 19.3 ± 11.5 for PBM; 46.6 ± 12.9; 38.1 ± 9.7; and 26.8 ± 13.6 for TXA at baseline, in the sixth week and after completion of treatment, respectively). This reduction was significant after the sixth week of treatment in both groups , although no difference in quality of life was observed between the two groups. Conclusion: In this pilot study, no improvement effects were found in melasma throughout the treatment and follow-up based on the MASI index in any of the treatments, nor were any differences found. between treatments.

Key words: Melasma, Photobiomodulation, Tranexamic Acid
Study type: Ensaio Clínico (Clinical Trial)

31

EFFECT OF PHOTOBIOMODULATION THERAPY ON THE EXPRESSION OF OXIDATIVE STRESS BIOMARKERS IN HUVEC CELLS SUBJECTED TO HYPOXIA

Guilherme Rabelo Nasuk (1), Allan Luís Barboza Atum (2), Bruna Calixto de Jesus (2), Gabriel Almeida da Silva(1), and José Antônio Silva Júnior (1 and 2).

e-mail de correspondência: julio.batista@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil
(2) Postgraduate Program of Medicine (UNINOVE), São Paulo, Brasil

Abstract

Doxorubicin (DOX) is an antibiotic used to treat various cancers. However, it can cause acute cardiac injuries, which are generally reversible, and more frequently result in late-onset toxicity, leading to heart failure. Photobiomodulation (PBM) is a low-risk, non-invasive therapy that promotes tissue repair, reduces inflammation, and relieves pain. We analyzed the effects of PBM preconditioning on the expression of 19 cardiac dysfunction-related genes in doxorubicin-exposed ventricular cardiomyocytes derived from pluripotent stem cells (hiPSC-vCMs). The in vitro experimental study used human-induced pluripotent stem cell-derived ventricular cardiomyocytes (hiPSC-vCMs) that were preconditioned with PBM and exposed to doxorubicin (DOX). The hiPSC-vCMs were divided into three groups: 1) the Control group, which did not receive DOX or PBM; 2) the DOX group, which was treated with 2µM DOX for 24 hours; and 3) the DOX + PBM group, which was treated with PBM for 500 seconds and then exposed to 2µM DOX. The PBM preconditioning was performed using an LED device that emitted light with a wavelength of 660nm ± 10nm and an irradiance of 10 mW/cm2 for 500 seconds, resulting in a dose of 5 J/cm2. The cell viability assay was performed using the MTT colorimetric assay, and mRNA expression was analyzed using TaqMan qPCR. After 24 hours of doxorubicin treatment on hiPSC-vCMs, we observed changes in the expression of 18 genes related to cardiac dysfunction—12 genes were upregulated and 6 downregulated. Pre-treating with PBM before DOX modified the expression of 10 genes, resulting in 6 upregulations and 4 downregulations. Notably, while the expression of apoptosis and inflammation genes increased with DOX, PBM decreased their expression. In support of these findings, genes related to cellular stress (Hsp1a1 and TNC) and antioxidant enzyme genes (Cat and GPx4) showed lower and higher expression in the PBM+DOX group compared to the DOX group. Our results showed that doxorubicin altered the mRNA expression of several biomarkers associated with cellular dysfunction in stem cell-derived cardiomyocytes. However, when these cells were pre-treated with PBM, the signaling for the harmful effects of doxorubicin was significantly reduced, resulting in increased cell viability viability and decreased toxicity

Key words: Photobiomodulation, HUVEC, antioxidant enzymes, oxidative stress
Study type: Estudo experimental em animais (Experimental study in animals)

32

Effect of preconditioning with photobiomodulation on expression of microRNAs related to cardiac dysfunction in human ventricular cardiomyocytes derived from pluripotent stem cells undergoing doxorubicin.

Bruna Calixto De Jesus(1), Leonardo Paroche De Matos(1), Allan Luis Barboza Atum(1), Gabriel Almeida Da Silva(2), Guilherme Rabelo Nasuk(2), Júlio Gustavo Cardoso Batista(2), José Antônio Silva Júnior(1, 2).

e-mail de correspondência: brunacalixto.j@gmail.com

(1) Programa de Pós-graduação em Medicina - Ciências da Saúde – Universidade Nove de Julho – São Paulo – SP – Brasil.

Abstract

Cardiotoxicity is a widely recognized adverse effect linked to cancer therapies, with potentially severe immediate and long-term impacts. Doxorubicin (DOX), a frequently used chemotherapy drug for treating malignant tumors, proves effective but is notorious for its cardiac toxicity, leading to substantial concerns regarding its use. Photobiomodulation (PBM) triggers a series of molecular actions that provide therapeutic benefits for cardiovascular conditions. Light-emitting diode (LED) irradiation has been investigated as a therapeutic approach, positively impacting biological tissues. This study aimed to analyze the microRNA expression profile in ventricular cardiomyocytes derived from pluripotent stem cells (HiPSC-vCMs) that underwent photobiomodulation preconditioning and were exposed to doxorubicin. This in vitro experimental study involved using HiPSC-vCMs that were preconditioned with PBM before treatment with doxorubicin. The HiPSC-vCMs were assigned to three groups: 1- Control group (neither exposed to DOX nor PBM; irradiated with a standard light lamp and with the addition of sterile saline); 2- DOX group (exposure to 2µM DOX for 24 hours); and 3- DOX+PBM group (PBM preconditioning followed by 24-hour exposure to 2µM DOX). PBM preconditioning was performed with an LED device that emitted light at 660nm ± 10nm, at an irradiance of 10 mW/cm² for 500 seconds, providing a dose of 5 J/cm². MicroRNA expression was quantified in cellular cytotoxicity tests using a real- time PCR assay. After 24 hours of treating HiPSC-vCMs with doxorubicin, alterations in the expression of 12 miRNAs (92%) linked to cellular dysfunction were observed. Administering PBM before doxorubicin treatment resulted in changes to the expression of 9 miRNAs (69%) due to irradiation. The findings indicated that doxorubicin substantially alters the microRNA expression linked to cellular dysfunction in cardiomyocytes derived from stem cells. However, in most experimental assessments, photobiomodulation considerably reduced the harmful impact of doxorubicin on these cells.

Key words: Photobiomodulation, ventricular cardiomyocytes, pluripotent stem cells, miRNAs, cardiotoxicity.

Study type: Estudo experimental em in vitro (Experimental study in vitro)

33

Impact of Photobiomodulation Preconditioning on Gene Expression Linked to Hypertrophy, Calcium Dynamics, and Metabolism in Stem Cell-Derived Human Ventricular Cardiomyocytes Exposed to Doxorubicin

Da Silva, Gabriel Almeida (1), De Matos, Leonardo Paroche (1), Atum, Allan Luis Barboza (1), Prates, Renato Araujo (1), Zamuner, Stella Regina (1), Silva Junior, Jose Antonio (1).

e-mail de correspondência: almeidagabriel06@outlook.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Background: Heart damage associated with doxorubicin (DOX), a chemotherapy medication used to treat multiple types of cancer, can manifest as cardiotoxicity and potentially result in heart failure. Photobiomodulation (PBM) is a non-invasive and safe therapy that accelerates tissue repair, reduces inflammation, and alleviates pain.
Aim: This study investigated the effect of PBM preconditioning on the expression of 28 genes related to cardiac hypertrophy, calcium kinetics, and metabolism in ventricular cardiomyocytes derived from human induced pluripotent stem cells (hiPSC-vCMs) after doxorubicin exposure.
Methodology: The hiPSC-vCMs were categorized into three study groups: 1) the Control group, which was not treated with DOX or PBM; 2) the DOX group, which was exposed to 2µM DOX for 24 hours; and 3) the DOX + PBM group, which received PBM for 500 seconds before 2µM DOX exposure. PBM preconditioning was carried out using an LED device that emitted light at a wavelength of 660nm ± 10nm, with an irradiance of 10 mW/cm² for 500 seconds, delivering a dose of 5 J/cm². Cell viability was measured using the MTT colorimetric assay, and mRNA expression was assessed through TaqMan qPCR. Result: After 24 hours of exposure to doxorubicin, the expression of 18 genes (64%) associated with cardiac dysfunction was changed, with 8 genes showing increased and 10 genes showing decreased expressions. Preconditioning with PBM before DOX exposure altered the expression of 10 genes (36%), resulting in the upregulation of 8 genes and the downregulation of 2 genes. PBM significantly decreased the expression of genes associated with adverse outcomes in cardiac dysfunctions, including Brain natriuretic peptide (Nppb) and Endothelin (End1), when applied before DOX exposure. The PBM+DOX group displayed heightened expression levels of genes directly linked to metabolism and calcium kinetics. Conclusion: Our findings showed that doxorubicin considerably increased the mRNA expression of various biomarkers associated with cellular dysfunction in stem cell-derived cardiomyocytes. Nonetheless, pre-treatment with PBM notably reduced doxorubicin's harmful effects, enhancing cell viability and lowering toxicity.

Key words: Cardiotoxicity, Doxorubicin, Gene expression, Photobiomodulation.
Study type: Estudo experimental em in vitro (Experimental study in vitro)

34

PHOTOBIOMODULATION THERAPY FOR BOTHROPIC ENVENOMATION: COMPARING NON-INVASIVE VASCULAR AND LOCAL APPLICATIONS

Gouveia VA (1), David AC (1), Sales JB (1), Zamuner SR (1)

e-mail de correspondência: vivianeagouveia@hotmail.com

1. Universidade Nove de Julho, Programa de Pós Graduação de Medicina - Biofotônica

Abstract

Introduction: Snakebites have been recognized as neglected tropical diseases by the World Health Organization (WHO) since 2017, predominantly affecting vulnerable populations and leading to severe health and socioeconomic impacts. Globally, approximately 5 million snakebites occur annually, resulting in irreversible injuries and over 100,000 deaths. In Brazil, the Bothrops genus accounts for about 90% of these bites. While antivenom therapy effectively addresses systemic envenomation, it often fails to mitigate local effects such as intense inflammation, myonecrosis, and hemorrhage, which can lead to muscle loss. Photobiomodulation (PBM) therapy applied in the local of envenomation has shown promise in reducing these local effects, offering analgesic, anti-inflammatory, and wound-healing benefits. However, studies investigating the efficacy of non-invasive vascular PBM in treating snakebite-induced injuries are scarce. Objectives: This study aims to evaluate the effects of non-invasive vascular PBM using low-level laser therapy on inflammatory responses and muscle recovery, in comparison to local PBM following Bothrops jararacussu venom injection. Methods: Male Wistar rats from the Nove de Julho University bioterium were utilized, with venom-induced injuries inflicted on the gastrocnemius muscle. Thirty minutes post-venom injection, rats were treated with either non-invasive vascular or local PBM, based on group assignment. The PBM protocol involves the application of a 660 nm wavelength laser, with 100 mW power, an energy dose of 4 J, applied in the local of the venom injection or in the caudal vein for 40 seconds to a single point. Muscle tissue and blood samples were collected at 3 hours, 24 hours, 3 days, 7 days, and 21 days post-treatment to assess edema, levels of pro- and anti-inflammatory cytokines, and histological changes. Pain levels were evaluated using the Von Frey test. Results: Preliminary results suggest that PBM reduces edema in both treatment approaches. The local PBM showed more immediate effects, particularly within the first few hours, while the vascular application also demonstrated positive results. Conclusion: This study seeks to provide alternative therapeutic strategies to alleviate the local effects of Bothrops envenomation, contributing to the development of more effective and accessible treatments.

Key words: Bothrops venom, inflammation, photobiomodulation

Study type: Estudo experimental em in vitro (Experimental study in vitro)

35

Inactivation of Staphylococcus aureus by Photobiomodulation with Blue and Green Light

Schneider LAM (1), Souza LCO (1), Duarte LG (2), Benz CF (3), Chiarelli-Neto O (4)

e-mail de correspondência: leticiamschneider@hotmail.com

(1) Department of Dentistry, University Center of Espírito Santo (UNESC), Colatina, Espirito Santo, Brazil.
(2) Department of Medicine, Santa Casa de Misericórdia Higher School of Sciences (EMESCAM).
(3) Clinical Analysis Laboratory Santa Maria – LAC, Colatina, Espírito Santo, Brazil.
(4) Department of Medicine, University Center of Espírito Santo (UNESC), Colatina, Espirito Santo, Brazil.

Abstract

The emergence of antibiotic-resistant bacterial strains, such as methicillin-resistant Staphylococcus aureus (MRSA), has driven the search for alternative antimicrobial therapies. Light therapy has demonstrated bactericidal effects, influenced by wavelength, dosage, and bacterial density. This study aimed to develop a protocol for inactivating Staphylococcus aureus using blue and green light while preserving host cells. The bactericidal effects of blue (465 nm) and green (525 nm) light were tested in vitro on Staphylococcus aureus (ATCC 29213) cultured for 24 hours and diluted to concentrations of 0.75 x 108 CFU/mL and 0.375 x 108 CFU/mL. Blue light at 60 J/cm² was applied three times within 24 hours, whereas green light at 100 J/cm² was administered once. Both wavelengths effectively reduced bacterial colonies, with the most significant reductions observed in the lower-density colonies (0.375 x 108 CFU/mL,), achieving a 95% reduction with blue light and 78% with green light. In higher-density colonies (0.75 x 108 CFU/mL), blue light resulted in a 22% reduction, while green light achieved a 47% reduction. Although complete eradication was not achieved, the significant reductions, especially at lower densities, suggest that photobiomodulation with blue or green light is a promising approach for reducing Staphylococcus aureus populations.

Key words: Staphylococcus aureus, photobiomodulation, blue light, green light.
Study type: Estudo experimental em in vitro (Experimental study in vitro)

36

EFFECT OF LOCAL AND VASCULAR PHOTOBIOMODULATION ON TISSUE ORGANIZATION AND BONE STRENGTH - EXPERIMENTAL STUDY

Santos GG (1), Souza DV (1), Mello DC(1), Labat RM (1).

e-mail de correspondência: giovana-gleice@outlook.com.br

(1) Programa de Pós Graduação em Medicina Biofotônica, Universidade Nove de Julho

Abstract

Introduction: Bone injuries are common and affect a large part of society. Current treatments aim to control the inflammatory process and improve healing, focusing on the patient's functional recovery. Photobiomodulation therapy (PBM) has shown satisfactory results by modulating the inflammatory process, accelerating bone healing, and enhancing tissue strength; however, Vascular Photobiomodulation (PBMV) has not been extensively studied. Objective: To compare the effects of local photobiomodulation therapy (PBML) and systemic vascular photobiomodulation (PBMV) on bone formation and mechanical resistance in an experimental model of tibial injury in rats. Methodology: Adult male Wistar rats were divided into four groups with N=5: CTL (Control), NT (Untreated injury), PBML (Injury treated with local photobiomodulation), and PBMV (Injury treated with vascular photobiomodulation). Bone lesions were induced in both tibiae, and therapy was initiated post-surgery under the following parameters: PBML (808 nm; 6 J; 100 mW) and PBMV (808 nm; 15 J; 100 mW). Euthanasia was performed on the 30th day post-induction. Tibiae were dissected and stored at -80ºC for mechanical and histological analysis.Preliminary Results: Initial findings indicated that PBMV significantly increased the maximum bone breaking strength (Fmax) compared to the untreated injury group. Additionally, a more efficient tissue organization was observed in the PBM-treated groups, with less granulation tissue, suggesting improved repair quality. PBML showed benefits in bone deformation (Dmax) compared to the untreated group, although it was less effective than the vascular application in terms of mechanical resistance.

Key words: Bone injury, vascular therapy, mechanical resistance.
Study type: Estudo experimental em animais (Experimental study in animals)

37

Photobiomodulation in the treatment of post-COVID orofacial sequelae: applications and possibilities.

Ana Júlia Lacerda Lunardi(1), Mayra Costanti Vilela Campos(1), Adriana Cátia Mazzoni(1), Francine Cristina da Silva(2), Kristianne Porta Santos Fernandes(1), Raquel Agnelli Mesquita-Ferrari(1), Anna Carolina Ratto Tempestini Horliana(1), Sandra Kalil Bussadori

e-mail de correspondência: anajulunardi@gmail.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil
(2) Universidade Federal da Bahia, Instituto de Saúde Multidisciplinar.

Abstract

Introduction: The clinical spectrum of COVID-19 has ranged from asymptomatic infection to fatal disease. Recent evidence shows that in some individuals who had COVID, symptoms persist or develop after the acute infection has resolved, a condition known as long COVID. The use of photobiomodulation is enabling the rehabilitation of patients with a variety of sequelae from COVID-19. This technology allows for the combat of inflammatory and painful issues arising from post-COVID, acting directly on systemic, respiratory, neuropsychiatric, and musculoskeletal sequelae, aiming to enhance its effect and reduce rehabilitation time.
Objective: To evaluate the use of photobiomodulation in the treatment of symptoms and complications of long COVID syndrome in individuals recovered from COVID-19. Materials and Methods: This article is based on a descriptive literature review from articles found in the PubMed and BVS databases, using the descriptors “Long COVID,” “Post-acute COVID-19,” and “Photobiomodulation.”Results: Long COVID syndrome presents a set of symptoms that persist for months after an asymptomatic, mild, or severe infection by SARS-CoV-2. We can highlight the photonic technologies that are enabling the rehabilitation of patients with various sequelae from COVID-19, such as loss of smell and taste, facial paralysis, tinnitus, muscle and joint pain with or without muscle weakness, dizziness and balance issues, sleep disturbances, concentration and memory changes, paresthesias, as well as decreases in respiratory capacity. Photobiomodulation is responsible for several beneficial effects, including: reduction of edema and the inflammatory process; increased analgesic effects; tissue healing; collagen synthesis; and ATP production, acting on the regulation of tissue homeostasis. Conclusion: The long-term clinical implications of long COVID remain enigmatic. The use of photobiomodulation therapy, through low-level laser, in the treatment of post-COVID syndrome has proven beneficial in addressing the complications of the disease. Further studies are needed to better define the risk factors associated with persistent COVID symptoms and the impact of the emergence of new strains of SARS-CoV-2.

Key words: Long COVID, Post-acute COVID-19, Photobiomodulation
Study type: Revisão (Review)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

38

EFFECTS OF PHOTOBIOMODULATION THERAPY IN AN EXPERIMENTAL MODEL OF NITRIC ACID-INDUCED BRONCHIOLITIS

Moraes MV(1), de Oliveira APL (1)

e-mail de correspondência: marcus.moraes@uni9.pro.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction: Bronchiolitis is a common acute disease in children under two years of age, more predominantly in children under 12 months of age, leading to significant rates of morbidity and mortality. With the exception of oxygen therapy and fluid therapy, studies lack really effective treatment alternatives. Thus, the scenario brings the need for new forms of treatment. To date, there is no scientific content available regarding photobiomodulation therapy in bronchiolitis. However, it is clear that photobiomodulation is effective in the treatment of other lung diseases, such as asthma and chronic obstructive pulmonary disease. Objective: To evaluate whether photobiomodulation therapy is capable of reducing inflammatory effects in an experimental model of nitric acid-induced bronchiolitis. Methodology: This controlled experimental study in 50 Balb/C mice will be submitted to the Animal Research Ethics Committee. For the induction of bronchiolitis, the animals will be submitted to intra-tracheal instillation of 2% nitric acid (D0). The animals will be irradiated daily at 3 points with a local application laser from the 1st day, until the day of euthanasia (3rd and 5th day) with the parameters: 660 nm of wavelength, 3 J of radiant energy, 100 mW of average radiant power, resulting in 5.4 J of total energy. The animals will be divided into 2 groups (control and experimental). The control group will consist of 2 sub-groups: Basal (non-manipulated) and FBM (Laser-irradiated). The experimental group will consist of 4 subgroups: BR 3 d (Bronchiolitis 3rd day), BR 5d (Bronchiolitis 5th day), BR 3d+FBM (bronchiolitis plus laser irradiation and euthanasia on the 3rd day) and BR 5d + FBM (bronchiolitis plus laser irradiation and euthanasia on the 5th day). The analysis will consist of: evaluating cell migration in bronchoalveolar lavage fluid (BAL) for quantification and phenotyping of macrophages, neutrophils and T lymphocytes (CD4+ and CD8+), quantifying cytokine levels (IL-1-β, IL-2, IL-4, IL-6, IL-8, IL-9, IL-10, IL-12, Interferon-Y, TNF-α) in the BAL supernatant by the ELISA method. The evaluation of airway remodeling will be carried out through the analysis of mucus production (PAS) and collagen deposition (Picrossirius) by histomorphometry.

Key words: bronchiolitis, pulmonary inflammation, cell migration, photobiomodulation therapy, low-level laser

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

39

Analysis of keratin expression in keratinocytes exposed to photobiomodulation with simultaneous irradiation Utilizing 660nm and 808nm laser

Corrêa L, Zuffo RC, Santos A

e-mail de correspondência: re.carrasco_zuffo@gmail.com

(1) Universidade de São Paulo, Departamento de Estomatologia, Disciplina de Patologia Geral

Abstract

Recently, simultaneous dual irradiation with 660nm and 808nm lasers has been adopted in dental clinical practice; however, its mechanism of action is still poorly understood, particularly regarding its effect on the cytoskeleton of keratinocytes. The objective of this study was to verify the effect of simultaneous irradiation with 660nm and 808nm lasers on the expression of keratins in keratinocytes subjected to cell culture and wound assays. Immortalized keratinocytes (HaCat lineage) were maintained in cell culture and divided into: Group I – no treatment; Group II – irradiated with 660nm; Group III – irradiated with 808nm; Group IV – simultaneously irradiated with 660nm and 808nm. In the irradiated groups, the parameters adopted were: 100mW, 20s of irradiation for the isolated wavelengths and 10s for simultaneous irradiation, 1.11W/cm², 22.2J/cm². The cell viability assay was performed using the MTS technique. The wound's size was analyzed immediately after irradiation (0h) and after 24h and 48h. The analysis of keratin pairs 1/10 and 5/14 was conducted by immunofluorescence after normal culture of the keratinocytes and after the wound assay. Differences were detected between the groups regarding the pattern of cell migration and keratin expression. The results in the wound's size show that photobiomodulation with simultaneous irradiation induced a cell migration rate similar to the one induced by 808nm alone, exceeding the one of 660nm. The analysis of keratin expression revealed that simultaneous irradiation resulted in lower expression of Ck1 and higher expression of Ck5 at the wound edge, suggesting the presence of undifferentiated cells, and greater migratory potential. In conclusion, the findings indicate that photobiomodulation may alter the expression of keratins, contributing to keratinocyte migration.

Key words: Low intensity laser, Cytoskeleton, keratinocytes, Photobiomodulation, keratins, Double simultaneous irradiation

Study type: Estudo experimental em in vitro (Experimental study in vitro)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

40

Bone resistance in controlling the effect of photobiomodulation therapy associated with silver nanoparticles embedded in carbon material.

Souza VD (1), Marcos LR (1), Santos SSGG (1), Rodrigues FA (1), Mello CD (1).

e-mail de correspondência: drielliviana@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

In Brazil, thousands of osteomuscular surgeries are performed annually, and this high number of procedures has a significant social and economic impact on the country. This is especially relevant when treatment extends over long periods, due to high rates of postoperative infections in elderly patients or those with underlying systemic diseases. Bone infections are difficult to control and often require long treatments, such as prolonged use of antibiotics or the combination of multiple drug classes. Some biomaterials, such as activated carbon impregnated with silver nanoparticles, can be used as bone substitutes, helping to control infection due to their bactericidal and fungicidal properties. Photobiomodulation therapy (PBM) is also used to manage the inflammatory process and modulate tissue repair. The aim of this study is to evaluate the effect of PBM therapy on carbon materials impregnated with silver nanoparticles in the process of bone formation in an experimental model of tibial injury in rats. Methodology: In this experiment, male Rattus norvegicus (Wistar) rats aged 12 to 16 months (elderly) were used, distributed into 5 groups of N=5, totaling 25 animals and 50 tibiae. The groups were distributed as follows: CTL (control group), NT (untreated bone lesion group), and the treated groups: PBMl (group with bone defect irradiated with local laser (830nm, 6J, 100mW)); CA+NP (group with bone defect using carbon material impregnated with silver nanoparticles); and CA+NP+PBM (group with bone defect using carbon material impregnated with silver nanoparticles, irradiated immediately after surgery with laser at the following parameters (830nm, 6J, 100mW)). After 30 days, the animals were anesthetized and euthanized, and surgical removal of the right and left tibiae from all groups was performed for analysis of mechanical properties, blood collection for histological, functional, and biochemical analyses. Preliminary Results: Following preliminary statistical analysis, it was observed that the bones of the NT, CTL, PBMl, and CA+NP groups showed a reduction in Maximum Force at Rupture (FMAX) and Deformation in the bone tissue region (DMAX). In contrast, the animals treated with CA+NP+PBM exhibited an increase in FMAX compared to the NT group.

Key words:
Biomaterials, osteoclasts, osteoblastos, nanosilver, carbono material, photobiomodulation, bone repair, FMAX, DMAX.

Study type: Estudo experimental em animais (Experimental study in animals)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

41

In vitro evaluation of the optimized protocol of Antimicrobial Photodynamic Therapy (aPDT) on *Staphylococcus aureus*

Ferreira BS (1), Bezerra DT (1), Prates RA (1), Suguimoto ESA (1),Bussadori SK (1), Duran CG (1), Mesquita-Ferrari RA (1), Fernandes KPS (1), Motta LJ, Horliana ACRT (1)

e-mail de correspondência: ferreira.bruno@uni9.edu.br

(1) Programa de Pós-graduação em Medicina-Biofotônica, Universidade Nove de Julho

Abstract

Introduction: *Staphylococcus aureus* is a Gram-positive bacterium frequently associated with severe infections, particularly in immunocompromised individuals, such as hemodialysis patients, due to using catheters and other invasive devices. The growing concern over bacterial resistance has made these infections increasingly difficult to treat, creating an urgent need for alternative therapeutic strategies. Antimicrobial Photodynamic Therapy (aPDT) has emerged as a promising approach, utilizing the activation of a photosensitizer by light to generate reactive oxygen species that effectively eliminate pathogens without inducing resistance. Objective: This study aims to establish an optimized in vitro protocol for aPDT aimed at nasal decolonization of S. aureus and to compare its efficacy with a previously validated protocol (Teixeira et al., 2023) through quantitative microbiological analysis. Methodology: The bacterial strain *S. aureus* will initially be thawed and cultured on Brain Heart Infusion (BHI) agar at 37°C for 48 hours. After cultivation, an isolated colony will be transferred to BHI broth and incubated at 37°C for 16 hours (overnight). The following day, the culture will be adjusted to an optical density of 600 nm (OD600) and diluted at a ratio of 1:40, then incubated again until it reaches the exponential growth phase. The cultures will be used in 96-well plates for treatment with aPDT. The experimental protocol includes five groups: bacterial control, S. aureus treated with laser only, S. aureus treated with 0.01% methylene blue (MB) in gel or liquid, without irradiation, and two groups treated with MB plus laser irradiation (5 or 10 minutes). The light source will be a red light-emitting diode (LED) (λ = 660 nm), with an irradiance of 400 mW/cm², a radiant dose of 120 J/cm², and a distance of 3 mm. The bacterial cultures will be treated with methylene blue, incubated in the dark for 5 minutes before irradiation. After treatment, the samples will be diluted, plated on BHI agar, and incubated for 48 hours at 37°C for colony-forming unit (CFU/mL) counting. In parallel, biofilm formation will be assessed with crystal violet staining, and the aPDT treatment will be applied to biofilm cultures in the same way as for planktonic cultures. All experiments will be performed in triplicate, and the results will be statistically analyzed using the Kruskal-Wallis test followed by Dunn's post-test, with $p < 0.05$ considered significant.

Key words: Staphylococcus aureus, antimicrobial photodynamic therapy, methylene blue, bacterial resistance, nasal decolonization

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

42

Characterization of the Absorption Spectrum and Viability of Human Platelets During the Storage of Platelet Concentrates

Eliane de Queiroz Lima Cruz (1); Henrique Roman Ramos (1); Sandra Kalil Bussadori (1,2); Lara Mota (1); Anna Carolina Ratto Tempestini Horliana (1); Maria Fernanda Destro Setubal (1); Raquel Agnelli Mesquita-Ferrari (1,2); Kristianne Porta Santos Fernandes (1); Cinthya Cosme Gutierrez Duran

e-mail de correspondência: queiroz.eliane@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil
(2) Postgraduate program in Rehabilitation Sciences, Universidade Nove de Julho, UNINOVE, São Paulo, Brazil

Abstract

Introduction: Platelet concentrates are the second most transfused blood component, playing a crucial role in maintaining hemostasis in patients with thrombocytopenia, coagulation disorders, or in active bleeding situations. However, their availability is limited to only five days of storage due to the risk of bacterial contamination and physical and functional alterations that compromise their viability. During the storage process, platelets can undergo structural and functional changes that directly affect their therapeutic efficacy. Clinical and experimental studies on Photobiomodulation (PBM), focusing on the modulation of blood components, have gained relevance due to its potential benefits, such as tissue regeneration and inflammation modulation. However, the impact of PBM on the preservation and viability of human platelets during storage remains underexplored. Objective: This study aims to characterize the absorption spectrum and analyze the viability of human platelets during the storage process of platelet concentrates, correlating spectral changes with alterations in cell viability. Methodology: This is an experimental study using human platelet concentrates obtained via apheresis from healthy male donors, aged 25 to 40 years. The platelets will be stored at 20-24°C under constant agitation and analyzed at three distinct time points: Day 1, Day 5, and Day 10 of storage. The absorption spectrum will be characterized by spectrophotometry within the range of 400 to 700 nm. Cell viability will be assessed through cell integrity assays (annexin V, DAPI, MTS) and morphological analysis by microscopy. The absorption spectrum will be measured using a UV-Vis spectrophotometer, and viability will be correlated with the spectral data across different storage days. Data Analysis: The collected data will be analyzed using GraphPad PRISMA software, applying ANOVA and correlation tests to explore the relationship between changes in the absorption spectrum and cell viability. This study will contribute to the understanding of the biophysical and functional changes in human platelets during storage, establishing a correlation between the absorption spectrum and cell viability. The results may provide valuable insights to optimize the storage conditions of platelet concentrates, directly impacting the therapeutic quality of transfusions.

Key words: Photobiomodulation, Platelets, Cell Viability, Absorption Spectrum
Study type: Protocolo Estudo experimental em in vitro (Experimental study in vitro)

43

Postoperative Pain Following Single Visit Root Canal Treatment of Maxillary Molars Combined with Photobiomodulation: A Randomized Double-Blind Clinical Trial

(1) Machado, GGAM; (1) Ferreira, GF; (1) Mello, ES;(1) Suguymoto, ESA;(1) Roncolato, VL; (1) Oliveira, MRC; (1) Tognini, JA;(1) Camacho, CP; Bussadori SK (1), Duran CG (1), Mesquita-Ferrari RA (1), Fernandes KPS (1), Motta LJ, (1) Horliana, ACRT

e-mail de correspondência: glaugoncales@gmail.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction: The evidence regarding photobiomodulation (PBM) for postoperative pain following endodontic instrumentation is classified as being of low or very low certainty, highlighting the need for further studies. Systematic reviews emphasize the need for standardization of dental samples (for example, including only molars), dosimetric parameters, and the control of medication use. Additionally, longitudinal postoperative pain assessments over the 24-hour time course are critical, and studies should further explore these pain periods. This study evaluated the effect of PBM on pain following single-session endodontic instrumentation of maxillary molars at 4, 8, 12, and 24 hours. Methodology This double-blind, randomized controlled clinical trial was approved by the Research Ethics Committee with number 5.598.290 and registered on Clinical Trials (NCT06253767), initially recruited participants requiring endodontic treatment only in maxillary molars of both genders aged between 21 and 70 years, excluding certain health conditions, medication use, or complexities hindering single-session treatment. Fifty-eight maxillary molars treated endodontically in a single visit were randomly allocated into two groups: the PBM Group (n=29), which received conventional endodontic treatment combined with PBM (100mW, 333mW/cm2 and 9J distributed in 3 points near root apices), and the Control Group (n=29), which received conventional treatment with a PBM simulation. The primary outcome was spontaneous pain 24 hours post-treatment. Secondary outcomes included pain reported at 4, 8, and 12 hours, pain during palpation, and percussion at 24 hours. Pain levels were assessed using the Visual analogic scale (VAS). Statistical analyses included chi-square, Mann-Whitney, and Friedman tests with SPSS 29 software. Results: Ten participants were excluded: six for incorrect analgesic use and four for not experiencing pain post-treatment in any analyzed outcome. Thus, 48 patients were analyzed. No differences were found between groups in postoperative pain at 4, 8, 12, and 24-hour intervals or during palpation and percussion ($p>0,05$). Conclusion: No differences were found between groups, suggesting that FBM does not influence post-treatment pain in maxillary molars during any evaluation period in these experimental conditions.

Key words: Photobiomodulation, Low-Level Light Therapy, Pain, Pain Management, Inflammation, Periapical Periodontitis, Endodontics

Study type: Ensaio Clínico (Clinical Trial)

44

Preventive vascular photobiomodulation modulated MCP-1 levels and the recruitment of blood monocytes in a muscle injury animal model

Malavazzi TCS (1,2), Silva AS (3), Silva RLO (2), Caprioli B (2), Rodrigues MFSD (2), Fernandes KPS (2), Mesquita-Ferrari RA (2,3), Nunes FD (1)

e-mail de correspondência: taina_caroline_santos@hotmail.com

(1) Universidade de São Paulo, Faculdade de Odontologia (FOUSP),
(2) Universidade Nove de Julho, Programa de Pós-graduação em Medicina-Biofotônica
(3) Universidade Nove de Julho, Programa de Pós-graduação em Ciências da Reabilitação

Abstract

Introduction: Vascular photobiomodulation (VPBM), also referred to as modified ILIB (Intravascular or Intravenous Laser Irradiation of Blood), has proven effective in treating systemic diseases, metabolic disorders, and regulating immune functions. Although studies indicate that local photobiomodulation (PBM) using low-level lasers can impact muscle repair and key inflammatory cytokines in the regeneration process, the direct effects of VPBM on muscle injury are less well understood. Objectives: This study aimed to assess the effect of preventive and therapeutic VPBM on MCP-1 synthesis and blood monocytes in rats with acute muscle injuries. Methods: Male Wistar rats were randomly divided into: Control, Injury, Non-Injuried+VPBM, Previous VPBM+Injury, and Injury+VPBM after. Animals received VPBM using an AlGaAs diode laser (780 nm, 40 mW, 0.04 cm2, 3.2 J, 80 s) on the tail artery/vein. Subsequently, the rats were submitted to a cryoinjury on the tibialis anterior muscles (TA) and were euthanized at 1-, 2-, 5-, and 7-days post-injury. TA muscle samples were collected, and ELISA determined the protein expression of MCP-1. Blood samples were analyzed using an automated hematology analyzer to determine the relative monocyte count. Results: In the Injury+VPBM after group, MCP-1 protein levels were higher at day 1 compared to the other experimental groups. The Previous VPBM+Injury group exhibited higher MCP-1 on day 2 and consequently an increase of blood monocytes after 5 days. The Injury group has shown higher MCP-1 synthesis in comparison to the injured and treated groups. Conclusion: VPBM was effective in time-modulated MCP-1 protein expression and blood monocytes during the muscle repair process, with more pronounced results observed when preventive VPBM was administered.

Key words: Vascular photobiomodulation, modified ILIB, muscle injury, protein expression, MCP-1, monocytes.
Study type: Estudo experimental em animais (Experimental study in animals)

45

The use of phototherapy in the treatment of lesion caused by Habronema spp. in equid

Resende, HE, Zabeu, AMC

e-mail de correspondência: antonieta.zabeu@gmail.com

(1) Universidade do Vale do Paraíba - UNIVAP, Faculdade de Ciências da Saúde
(2) Vetlaser Fototerapia e Reabilitação Veterinária

Abstract

Introduction: Cutaneous habronemosis characterized by difficult to heal, inflammatory wounds that present exuberant granulomatous tissue in the skin, mucous membranes and genitalia of equines. Its etiological agents are Habronema spp. nematodes, whose vectors are flies. Phototherapy is a treatment through light, widely used in veterinary medicine for the treatment of wounds, due to its anti-inflammatory benefits, activation and cell proliferation, which stimulate the revitalization of tissues. Objective: The present case report aims to demonstrate the efficacy of phototherapy as a treatment for lesions caused by Habronema spp, in cases of recurrence and drug resistance. Methodology: Horse, castrated male, mixed breed, 12 years old, treated in São José dos Campos, Brazil, presented recurrent lesion of cutaneous habronemiasis in the labial commissure region. The initial treatment was systemic therapy with ivermectin and pyrantel pamoate every 7 days for 30 days, and local curative with ointment compounded with ivermectin, dexamethasone, enrofloxacin and zinc, which was not successful in the lesion regressing and its healing process was not established. Therefore, it was recommended 1 session every 72 hours totalizing 10 sessions of treatment with 660 nm diode laser (120 mW power and 6 Joules of energy) associated with 470 nm LED (400 mW power and 48 Joules of energy). The animal showed significant improvement in the initial sessions with phototherapy and complete tissue healing at the end of the ten sessions. Results and Conclusion: The predisposing environmental factors for habronemiasis infection are open manure and high temperatures, since the vector has higher proliferation levels under these conditions. Also, poor epithelial healing, due to different causes, and resistance to antiparasitic drugs contribute to the maintenance of this parasite. As a result of the wound healing, the animal's condition and the failure of the initially recommended pharmacotherapy, treatment with phototherapy was chosen to stimulate the metabolism of epithelial cells, modulate the inflammatory process and activate the tissue repair cascade, thus accelerating the healing process. By closing the wound, in addition to restoring the animal's health, the biological cycle of the nematode is broken and the incidence of parasitosis is controlled.

Key words: phototherapy, equines, habronemiasis, laser, LED
Study type: Relato de caso/Serie de casos (Case report/Case series)

46

USE OF INTEGRATIVE MEDICINE IN THE TREATMENT OF WOUNDS IN A DOG RESCUED BY THE PUBLIC SYSTEM – CASE REPORT

ANDRADE, C.F.S.(1), CASPARY, A.C.S.L.(2), BELIDO, N.M.(2), CARLOS, A.M.(3).

e-mail de correspondência: enfcathandrade@gmail.com

(1) Médica Veterinária da Regenerar Medicina Veterinária
(2) Médica Veterinária Autônoma
(3) Discente do curso de Medicina Veterinária UNESA (Campos dos Goytacazes – RJ)

Abstract

Rescued dogs often face adverse conditions, which can result in injuries generally caused by trauma, being run over, among others. These wounds vary according to severity and type, and can be superficial (minor scratches and cuts), more serious (deep lacerations, burns or infected wounds) or chronic and require prolonged care. The study reports the case of a dog, SRD, 12 kg, rescued on public roads by the CCZ in Campos/RJ presenting a lacerated wound on the left thoracic limb. Over the course of 2 months, conventional wound treatment was carried out with antibiotic-based ointment, anti-inflammatory and bandage as indicated in the literature, in addition to analgesia control, but with a long response. We opted for ozone bag therapy for 20 minutes at an initial flow of ¼ l/min at a concentration of 9 µg/ml, then a flow of ½ l/min at a concentration of 10 µg/ml and the last at a flow of ½ l /min at a concentration of 8 µm/ml, photomodulation with an infrared laser with the association of a 10J red laser and 60s of blue LED scanning. Dressing made with ozonized oil with 35% copaiba and Kerlix gauze and bandage, changing every 72 hours. In the first week of treatment, considerable progress in wound closure was noted. Ozone therapy and laser therapy are two complementary therapies that have been used in the treatment of treatment of wounds in dogs, often as part of an integrative approach to promote healing and the animal's well-being and not only function as a therapeutic complement to recommended treatments, but can also be an alternative when the initial treatment was not successful. satisfactory.

Key words: Keywords: Ozone therapy, wound, laser therapy.

Study type: Relato de caso/Serie de casos (Case report/Case series)

47

EFFECT OF PHOTOBIOMODULATION ON JOINT REGENERATION IN PATIENTS WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION

Campos MCV (1), Tanganeli JPC (2), Bussadori SK (1), Horliana ACRT (1), Mesquita-Ferrari RA (1), Fernandes KPS (1), Motta LJ (1)

e-mail de correspondência: mayra.vilela@uni9.edu.br

(1) Universidade Nove de Julho, Programa de Pós graduação de Medicina Biofotônica
(2) Faculdade de Odontologia da Apcd

Abstract

Introduction: Temporomandibular joint degeneration is a process that occurs with advancing age and is usually accompanied by orofacial pain and functional impairment. Conventional and minimally invasive treatments for this condition are palliative, alleviating pain and improving function. The subsequent invasive step consists of replacing the joint with a joint prosthesis, a high-cost procedure that has an impact on the patient and no guarantee of success. Objectives: The objective of this research is to evaluate the effect of infrared laser on temporomandibular joint regeneration. As a secondary objective, to evaluate the effect of photobiomodulation on pain relief and joint function. Methods: For this purpose, individuals diagnosed with articular TMD with degeneration and orofacial pain will be selected by convenience. Participants will be randomized into three groups: G1 will receive only supplementation with nutraceuticals Chondroitin Sulfate 400 mg and Glucosamine Sulfate 500 mg. G2 will receive the same supplementation and will be the placebo group for PBM, receiving laser application without the emission of infrared light in 4 periarticular points, and G3 will be the active group, undergoing application of photobiomodulation with local infrared laser in 4 periarticular points (808 nm, 100 mW, 2 J per point) for a period of 12 weeks with 12 application sessions associated with supplementation. The effects will be measured using the Visual Analog Scale (VAS), digital caliper and computed tomography. Data will be collected weekly before and after treatment and the ANOVA test for paired samples or Kruskall Wallis will be applied, according to the distribution of the data. $\alpha = 0.05$ will be considered as the level of statistical significance.

Key words: Temporomandibular joint osteoarthritis, Low-level laser therapy; Photobiomodulation

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

48

IS PHOTOBIOMODULATION THERAPY ABLE TO REDUCE BLOOD PRESSURE ON HYPERTENSION? A SYSTEMATIC REVIEW OF RANDOMIZED CONTROLLED TRIALS

Espósito LMB (1), Rocha FC (1), Ferraresi C (1)

e-mail de correspondência: larabataglia@estudante.ufscar.br

(1) Post-graduate Program in Physical Therapy, Federal University of São Carlos (UFSCar), São Carlos – SP, Brazil

Abstract

Background: Hypertension is associated with 10.4 million deaths per year, with poor control levels. New therapies that aim to reduce blood pressure (BP), such as photobiomodulation therapy (PBMT) are currently being study and are well needed. Studies have shown that PBMT can increase nitric oxide (NO) levels, resulting in reduced systolic (SBP) and diastolic blood pressure (DBP). However, even with the growing evidence, there is still no systematic review on the topic. Aim: The aim was to systematically review studies that evaluated the effects of PBMT on BP in hypertensive individuals. Methods: This systematic review followed the Cochrane Handbook and was registered in PROSPERO. Only randomized controlled trials (RCT) that assessed PBMT effects on BP in hypertensive individuals, compared to a placebo or control group were included. The outcomes of interest were SBP and DBP. A systematic search was carried out on PubMed, Embase, Cochrane Library, CINAHL and Web of Science, without language or date restrictions. The selection was conducted by two independent reviewers with established eligibility criteria. The main data were extracted, and descriptive analyzes were performed. The risk of bias was assessed using PEDro scale, and the certainty of the evidence was assessed using the GRADE system. Results: The search identified 176 articles, and 4 RCTs were included, totaling 229 hypertensive patients. All included studies evaluated the chronic effects of PBMT, ranging from 4-12 weeks of therapy and 1-3 sessions per week. All studies found reduced levels of SBP and DBP related to PBMT, applying laser acupuncture protocols. However, 2 of the 4 included trials only compared intra-group results. Three studies used infrared wavelengths, and one did not report the wavelength. The total energy used in one of the trials was 16J (8J per point), and the others did not report the energy. The irradiation time varied between 120 and 1440s, with 2 to 11 acupuncture points (AcPs). All studies included points in the thumb and elbow region (LI 4 and LI 11 AcPs), and one study also included points in the head and lower limbs. The risk of bias scale ranged from 4 to 7, and the certainty of the evidence was graded as very low. Conclusion: PBMT is a promising therapy for BP control in hypertension, being able to reduce SBP and DBP. However, the certainty of the evidence is very low, with a need for more high-quality RCTs investigating the effects of PBMT on hypertension.

Key words: Photobiomodulation, Hypertension, Laser Acupuncture

Study type: Revisão (Review)

49

Use of Photobiomodulation (PBM) and Antimicrobial Photodynamic Therapy (aPDT) in the Treatment of Pressure Injuries: Systematic Review and Participatory Study Using the RAND-Delphi Method.

Silva E(1,2), Santos TB(2) , Padilha ARS(2), Horliana ACRT(2); Cecatto RB(2); Duran CCG(2)

e-mail de correspondência: ellendasilva.enf@gmail.com

(1) Hospital Municipal de Barueri Dr. Francisco Moran, HMB, Barueri, São Paulo, Brazil
(2) Programa de Mestrado e Doutorado em Medicina Biofotônica, Universidade Nove de Julho, UNINOVE, São Paulo, Brasil

Abstract

Introduction: Pressure injuries are a serious public health issue and are directly related to the quality of hospital care. In Brazil, complications such as infection, pain, and prolonged hospitalization increase costs within the Unified Health System (SUS), potentially raising hospitalization time by up to 50%. These injuries affect patient safety and are considered an indicator of care quality. Complications may lead to secondary infections, physical and emotional suffering, and even death. Therapies like Photobiomodulation (PBM) and Antimicrobial Photodynamic Therapy (aPDT) have been studied, with preclinical and clinical studies demonstrating their efficacy in wound healing and infection control. However, standardized, evidence-based guidelines are necessary to guide clinical practice, consolidate scientific evidence, and enable the implementation of these therapies in different care settings. Methodology: This study will employ a systematic review and a participatory study using the RAND-Delphi methodology. The systematic review will follow PRISMA guidelines, utilizing the databases PubMed, EMBASE, LILACS, and Scopus. The quality of evidence will be assessed according to the PICO acronym, focusing on the efficacy of PBM and aPDT for pressure injuries. The study will be registered on the PROSPERO platform and will proceed to submission for scientific publication. A document based on the systematic review will be prepared, followed by the conduct of a RAND-Delphi study. A total of 25 specialists from the associations SOBEST, NPIAP, and WOCN will be invited to participate anonymously and will receive collective feedback. The main phases of this methodology will include: invitation to specialists, quantitative analysis of responses, evaluation of consensus, and compilation of results. The feedback provided will allow for progressive adjustments in responses, promoting the construction of a robust consensus among participants. It is expected that this study will contribute to validating the evidence on PBM and aPDT, developing standardized clinical guidelines for application in various care settings.

Key words: Pressure ulcer, pressure injury, low-intensity laser therapy, photobiomodulation, antimicrobial photodynamic therapy, Rand Delphi technique.
Study type: Protocolo de Revisão (Review)

50

Effect of Photobiomodulation on Reducing Pain Perception During the Insertion of Copper T 380 IUD for Contraception: A Randomized Controlled Clinical Trial

Ferraz ACN (1), Travezim MPS (1), Duran CCG (1), Motta LJ (1), Bussadori SK (1), Ferrari RAM (1), Fernandes KPS (1), Horliana ACRT (1)

e-mail de correspondência: a.c.ferraz@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Unplanned pregnancy affects up to 65% of women in some regions of Brazil, increasing the risks of unsafe abortions and contributing to maternal mortality. The copper IUD is an effective and long-lasting contraceptive option, but its use is still limited in Brazil, covering only 4.4% of women of reproductive age. One of the main barriers is the pain associated with its insertion, which leads to fear and low adherence to the method. Since pain can be of visceral or somatic origin, traditional approaches such as anti-inflammatories and anesthetics have shown inconclusive results in reducing this discomfort. Photobiomodulation (PBM) has anti-inflammatory and analgesic effects and has shown positive results in managing pelvic pain in other clinical contexts, such as labor. This study aims to evaluate the efficacy of PBM as a preemptive analgesic method during the insertion of the T 380 copper IUD. A randomized, double-blind clinical trial will be conducted with 72 participants randomly allocated into an experimental group (n=36) – active PBM and a control group (n=36) – PBM simulation. According to the Ministry of Health guidelines, patients will follow the IUD insertion protocol. Pain will be assessed at different times using the Visual Analog Scale (VAS) during insertion phases (Pozzi, hysterometry, and IUD insertion), at 5 and 15 minutes, and 24 and 48 hours after insertion. Additionally, analgesic use and quality of life (WHOQOL-100) will be assessed over 48 hours, along with anxiety levels (GAD-7), satisfaction with the procedure immediately after insertion (15 minutes), and adverse and side effects within 48 hours. The duration of pain in hours from the moment of IUD insertion until its resolution will also be evaluated, as well as the procedure's success rate. Statistical analysis will be performed with a significance level of 5% ($p < 0.05$). Statistical analysis will be performed with a significance level of 5%. The Friedman test will be applied for pain analysis (VAS) and variables such as anxiety and quality of life. Analgesic use with repeated measures ANOVA.

Key words: Contraceptive methods, intrauterine device (IUD), pain management, photobiomodulation therapy, randomized clinical trial

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

51

Effects of Photobiomodulation on Type I and Type III Collagen and Fibroblast Formation in Skin Flaps

Pinto EAFB (1), Chang AJB(1), Zamuner SR(1)

e-mail de correspondência: erikafbarros@uni9.edu.br

(1) Programa de Pós graduação em Medicina Universidade Nove de Julho

Abstract

The skin flap (SF) surgery is widely used in clinical practice for tissue reconstruction. However, it is a complex procedure that often leads to tissue necrosis, tissue loss, and serious consequences for the individual undergoing this type of intervention. Photobiomodulation (PBM) has the potential to neutralize the inflammatory process and stimulate neoangiogenesis, thereby reducing tissue necrosis. This study aims to evaluate the collagen on skin tissue in mice subjected to the SF surgical procedure after PBM irradiation. A total of 48 adult male mice (Balb/C, 20–25g) were used, divided into two groups: Control (n=24) and Experimental (n=24). SF were elevated on the back of the animals in both groups, and the experimental group received low-intensity laser irradiation on the flap. In the control group, a sham procedure was performed. The PBM applied to the flap pedicle used a wavelength of 660 nm with a radiant exposure of 2 J/cm² for a total scanning time of 20 seconds, with an energy of 3,2 J. After treatment, the animals were divided into three subgroups, each consisting of eight animals, based on the day of euthanasia (4, 7, and 10 days, postoperatively). The animals were euthanized and tissue samples were collected. Histological slides were prepared using picrosirius red and hematoxylin-eosin (HE) staining and analyzed via optical microscopy using a Nikon 2000 Eclipse 8000, photographed with a Nikon fdx35 camera with a standardized 10x magnification lens. The results showed that 4 days post-SF surgery, no differences in collagen fibers were observed between the control and PBM-treated groups. However, by days 7 and 10, there was a significant increase in collagen type I throughout the connective tissue and collagen type III in the subcutaneous tissue. On day 10, collagen type III remained significantly elevated in the PBM-treated group compared to the untreated group. Overall, these results suggest that PBM treatment during the surgical process can enhance SF survival by reducing necrosis and promoting neovascularization, which is essential for the reconstruction of injured tissue.

Key words: Keywords: Photobiomodulation, Skin flap, Skin, Tissue regeneration, Low-intensity laser, Tissue necrosis.

Study type: Estudo experimental em animais (Experimental study in animals)

52

Effect of Photobiomodulation on Healing and Pain Relief in Venous Leg Ulcers: A Randomized, Controlled, Double-Blind Clinical Trial

Moreira RG, Duran CCG, Motta LJ, Bussadori SK, Fernandes KPS, Mesquita-Ferrari RA, Horliana ACRT

e-mail de correspondência: rayanamoreira@hotmail.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Venous ulcers (VU) represent a major public health issue, characterized by long duration, high recurrence rates, and significant economic, social, and quality-of-life impacts on affected patients. Currently, the most widely used conventional treatment for VU includes topical agents, pharmacotherapy, and compressive therapy. Photobiomodulation (PBM) has been extensively used for wound healing techniques, accelerating the healing process and improving patients' quality of life. This study evaluates whether PBM combined with compressive therapy (gold standard) can accelerate wound healing and relieve pain in VU on the lower limbs. This will be a prospective, randomized, controlled, double-blind clinical trial. A total of 70 participants with venous leg ulcers will be randomized into two groups: the Experimental Group (n=35), which will receive compressive therapy combined with PBM (4J/cm², 660 nm, power of 30mW, twice per week), and the Control Group (n=35), which will receive compressive therapy and simulated PBM. All outcomes will be assessed weekly by the same researcher, a medical specialist, over 16 weeks. The primary outcome will be the time to complete wound healing. Secondary outcomes will include pain (measured by a visual analog scale), partial healing assessed by changes in size and depth (through standardized photographs), wound granulation, scar formation, healing time, exudate, pigmentation, and skin thickness. Statistical analysis will be performed with a significance level of 5% ($p < 0.05$). The Kaplan-Meier method will be used to analyze complete wound healing. Parametric data will be analyzed using repeated measures ANOVA, and non-parametric data will be analyzed using the Friedman test.

Key words: photobiomodulation, lasers, venous ulcers, varicose ulcers, phototherapy
Study type: Protocol of Ensaio Clínico (Clinical Trial)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

53

The effects of Photodynamic Therapy on wound healing in Cutaneous Tegumentary Leishmaniasis: Case report

Matos FAS (1,2), Carvalho HC (2,3), Lima CJ (1,3), Moreira LH (1,3)

e-mail de correspondência: enfengfranciane@gmail.com

(1) Anhembi Morumbi University (UAM), São Paulo/SP, Brazil
(2) Federal Technological University of Paraná (UTFPR), Campo Mourão/PR, Brazil,
(3) Center for Innovation, Technology and Education (CITÉ), São José dos Campos/SP, Brazil (3).

Abstract

Introduction: American Cutaneous Tegumentary Leishmaniasis (ACTL) is one of the forms of American Cutaneous Leishmaniasis (ATL), considered a disease of great relevance to public health worldwide. Objective: This study aimed to evaluate the effects of Photodynamic Therapy (PDT) on the healing of cutaneous wounds of American Leishmaniasis. Methodology: This is a case report (Ethical Approval: No. 5,901,332) related to a patient undergoing conventional treatment for confirmed ACL (single lesion) in the nasal region. The research was conducted at the Health Surveillance Division, in Santarem, Para. The light source (MSRD, Medical Systems LTDA, Beazil) has an emission wavelength of 630 nm (red), composed of 35 LEDs, reaching an irradiation area: 20 cm², power density (irradiance): 30 mW/cm². h. The lesion was first cleaned (with 0.9% saline solution), following the recommendations of the Brazilian Ministry of Health. Afterwards, the photosensitizer, 1% methylene blue, was applied, and allowed to dry for 10 minutes. The LED source device was used for 25 minutes, reaching an energy density of 50 J/cm2 in the lesion area. After each session, the lesion was closed with a standard dressing. The sessions occurred over two days, with 15-day intervals between them, and the images were recorded weekly during the 20 days of drug treatment that occurred simultaneously with the PDT applications. The analyses were performed according to the clinical characteristics of the wound. Results: A 44-year-old patient from a rural area of the Brazilian Amazon presented a single, irregularly shaped ulcerated lesion measuring an area of 0.181 cm², with discrete and hyperemic edges. Seven days after the first photodynamic therapy session, the lesion was already closed and had healed well. Thus, after wound evaluation, cleaning was performed, a second PDT session was applied, images were recorded, and the dressing was closed. In the third week, PDT was performed again, only to help improve skin elasticity. In the last week, the lesion was already fully healed with the epidermis fully established. Conclusion: The use of photodynamic therapy was beneficial in 25 minutes in ACL wounds, as improvement in wound healing was noted in less than 20 days, demonstrating a promising future for complementary alternatives for individuals affected by this pathology.

Key words: photodynamic therapy, American cutaneous leishmaniasis, wound.
Study type: Relato de caso/Serie de casos (Case report/Case series)

54

EFFICACY OF PHOTODYNAMIC THERAPY (PDT) IN COLORECTAL CANCER: SYSTEMATIC REVIEW

Pereira CHC (1)

e-mail de correspondência: cairohenrique@uni9.edu.br

(1) Universidade Nove de Julho, Faculdade de Medicina

Abstract

Photodynamic therapy (PDT) is a treatment modality based on a photosensitizing agent, which can be excited by a specific wavelength of light, generating reactive oxygen species (ROS) and inducing tumor cell death (Zhou, 2024). It is known that colorectal cancer (CRC) has a high global prevalence, making PDT an innovative approach to CRC treatment. Aim: To understand the efficacy of photodynamic therapy as a therapeutic approach in colorectal cancer. Methods: The databases searched and analyzed were the Virtual Health Library and Medical Literature Analysis and Retrieval System Online (MEDLINE) via PubMed. The descriptor used was "Photodynamic Therapy and Colorectal Cancer." Nineteen English-language articles published in the last year (between 2023 and 2024) were analyzed. Results/Data Analysis: PDT is an innovative approach in CRC treatment. In several studies, PDT was shown to induce cell death through marking with a photosensitizing agent. The IR700DX-6T-PDT (photosensitizer IR700DX-6T) was able to induce pyroptosis in colorectal cancer (Zhou, 2024). In another study, ATPP-PDT (photosensitizer ATPP-DTPA) induced cell death — through ROS generation — in early (stages I and II) and late-stage CRC (stages III and IV) (Mei, 2024). PDT was also used as a synergistic therapy in CRC treatment, showing significant tumor regression when combined with immunotherapy in a patient who refused CRC surgery (Wang, 2024). The use of Hematoporphyrin (photosensitizer) as a neoadjuvant therapy, combined with immunotherapy, also showed satisfactory results in CRC tumor regression (Huang, 2024). PDT is capable of disrupting multiple cellular signaling pathways, including autophagy, ferroptosis, and miRNA pathways. These modulations impact cancer cell proliferation and can lead to tumor regression (Deng, 2023). It is important to note that the absence of a standardized photosensitizer remains one of the barriers to the widespread use of PDT (Narayana, 2024). Conclusion: PDT is clearly a novel approach in CRC treatment, whether pre-surgical or post-surgical. However, there are a moderate number of studies that demonstrate its clinical efficacy in CRC (in patients). Therefore, further research is urgently needed to show PDT's utility in different stages of CRC and its long-term efficacy. Current studies, especially those published in the last year, suggest that PDT could offer a minimally invasive and potentially less harmful treatment option for patients.

Key words: Photodynamic Therapy, Colorectal Cancer, Treatment, Cell Death
Study type: Revisão (Review)

55

Results of low-level laser therapy in the adjuvant treatment of tissue repair in patients with peristomal irritant contact dermatitis: Case Series

Nascimento MEC (1),Soares RF (2), Bavaresco T (1),Baccin EG (1), Souza TES (5), Carvalho, AT (1)

e-mail de correspondência: mnascimento@hcpa.edu.br

(1) Hospital de Clínicas de Porto Alegre,
(2) Escola de Enfermagem da Universidade Federal do Rio Grande do Sul,

Abstract

Introduction: Moisture-associated skin damage occurs when the skin is repeatedly exposed to various sources of body secretions or effluents, from a stoma or fistula, often leading to peristomal irritant contact dermatitis (PICD), which is characterized by inflammation, erosion, burning and erythema (1). As an adjuvant to topical treatment (PT), Low Power Laser Therapy (TLBP) has been shown to be applicable in wound care with positive results in different types of injuries. It presents photochemical, photophysical and photobiological effects, capable of altering cellular behavior, favoring tissue repair (RT) (2). Objective: Describing the results of adjuvant treatment with (TP) and (TLBP) in tissue repair in patients with (CIPD). Method: This is a series of 3 cases carried out in a university hospital in southern Brazil, between May 2022 and October 2024. Data collection occurred through clinical examination and the RT process was evaluated by the Integrity result Tissue: skin and mucous membranes from the Nursing Outcomes Classification (NOC) (3), with its indicators: Skin integrity (IP), skin lesions (LP), erythema (Er) and texture (Te), as well as with photographs recorded in medical record. The analysis took into account the 5-point Likert scale, where 1 (Severely compromised) corresponds to the worst score and 5 (Not compromised) to the most desirable. Study approved by the Ethics and Research Committee under number 20210426. Result: Case 1, female patient, 66 years old, admitted for surgical treatment of rectal adenocarcinoma, which progressed to dermatitis 6 months postoperatively; case 2, male patient, 71 years old, admitted for surgical treatment of rectum tubulovillous adenoma evolving into dermatitis 7 months postoperatively; case 3, female patient, 31 years old, admitted for surgical treatment of rectal adenocarcinoma, which progressed to dermatitis 1 month postoperatively. All patients underwent 1 session of TLBP with application of Laser Therapy EC/DMC® with a wavelength of 660nm (Red) and 880nm (Infrared) concomitantly (1J/cm²); and showed an average improvement of 2-4 points on the Likert scale. Conclusion: The use of (TLBP) as an adjuvant to (TP) provided a significant result in the treatment of (DPAU) in 96 hours. In this way, we highlight the relevance of the search for adjuvant technological innovations for the qualification of nurses' care practice for these clinical scenarios.

Key words: Low-Level Light Therapy; Enterostomal Therapy; Dermatitis Contact

Study type: Relato de caso/Serie de casos (Case report/Case series)

56

Use of photobiomodulation for wound healing in patients with diabetes mellitus: Experience report

Silva GB (1), Medeiros JGT (1), Pinto TP (2), Rabin EG (1)

e-mail de correspondência: gbasso70@gmail.com

(1) Universidade Federal de Ciências da Saúde de Porto Alegre
(2) Santa Casa de Porto Alegre

Abstract

Introduction: Type 2 diabetes mellitus (T2DM) is one of the fastest growing chronic diseases in the world, being one of the main causes of amputations, difficult-to-heal injuries and deaths in elderly patients. Photobiomodulation is a treatment option that can increase the speed of wound healing and provide a better quality of life for these patients. Objective: To present the results obtained in the treatment with photobiomodulation in a wound due to suture dehiscence in an elderly patient with T2DM. To demonstrate that photobiomodulation is an important low-cost treatment method that can be used in elderly patients with difficult-to-heal injuries due to type 2 diabetes mellitus, reducing treatment time and providing a better quality of life for patients. Methodology: This is a descriptive exploratory study of the experience report of a 92-year-old man, with comorbidities including type 2 diabetes mellitus, who after a fall and a blunt injury to the left hand, presented suture dehiscence. In the initial approach, a protocol with weekly application of photobiomodulation was recommended (12 infrared (IR) points on the wound edge with an energy of 2 J and 15 red (R) points on the wound bed with an energy of 2 J, until the final session that used 5 points of (R) at 2 J). The analysis of the effects of the treatment was performed by means of photographic recording with a 32-megapixel digital camera, at a distance of 20 centimeters. The images were examined using ImageJ® software. Results: The wound closed 15 days after the start of treatment. Tissue repair showed excellent healing after daily laser treatment, without harming the area adjacent to the lesion. No local or systemic adverse events were observed during the period of study of the lesion. The results allow us to conclude that photobiomodulation in dehiscence-type lesions contributed to accelerate healing, improved the evolution of the lesion and the aesthetic result in the case studied. Conclusion: It is possible to infer that photobiomodulation can be indicated as an important resource to enhance the biological processes involved in the recovery of dehiscence-type injuries.

Key words: Diabetes mellitus, photobiomodulation, wound healing.
Study type: Relato de caso/Serie de casos (Case report/Case series)

57

Lighting the Path: Evaluating Light-Emitting Diode Therapy Versus Salicylic Acid Peel for Inflammatory . Acne- A Case Series Analysis

Diogo, MLG (1)*, Carvalho, FGM (1), Santos, RCS(2), Dourado, LF (2), Matuck, SP (1), Fernandes, KPS (1), Pavani, C (1) and Motta, LJ (1)

e-mail de correspondência: dermatomara3@gmail.com

(1)Universidade Nove de Julho, São Paulo, SP, Brazil.
(2)Universidade Adventista de São Paulo, SP, Brazil.

Abstract

Introduction: Acne is an inflammatory disorder that occurs in the pilosebaceous follicles and deeply affects the self-esteem and quality of life of individuals. Conventional treatments usually produce side effects and promote antibiotic resistance. Light therapy has emerged as a promising modality in clinical and scientific realms for acne management. This study aims to evaluate the effectiveness of red, blue and combined red-blue light therapy versus 20% salicylic acid peeling in the treatment of inflammatory acne grade 2 and 3. Aims: This study aims to assess the efficacy of red, blue, and combined red-blue light therapy versus 20% salicylic acid peel in treating Grades 2 and 3 inflammatory acne. Study Design: Cases studies. Place and Duration of Study: Universidade Nove de Julho, Universidade Adventista de São Paulo, São Paulo Brazil. Between March 2022 from April 2024. Methodology: We divided 20 participants into four groups who used a mask of LEDs. Group 1 used a mask with blue light (470nm), group 2 used a mask with red light (660nm), group 3 used a mask with red (660nm) and blue (470nm) lights combined in the same device. The groups that used the LED masks received the treatment 3 times a week for 30 days, totaling 12 sessions. Group 4 was submitted to two sessions of salicylic acid peeling at 20%, every 15 days. Results: Blue light (group 1) showed an improvement of 28.40% in the general skin condition. Group 4 of salicylic acid peeling had an improvement of 28.37%. The combined red and blue light group had an improvement of 26.43%, while the red light showed an improvement of 10.97%. Conclusion: Based on the series of cases presented, all groups showed improvement, but blue light showed higher results than red light and salicylic acid. However, studies with a larger number of participants should be performed and the ideal parameters for Led use in inflammatory acne should be discussed.

Key words: Keywords: Inflammatory acne; photo biomodulation; LLLT; LED.
Study type: Relato de caso/Serie de casos (Case report/Case series)

58

Low-power red laser and ultraviolet A LED irradiation on mRNA levels from DNA repair genes in Saccharomyces cerevisiae

Nunes BM (1,2), Pinheiro D (2), Costa ALS (1), Figueiredo JS (1), Oliveira MBN (1), Dantas FJS (1), Fonseca AS (2).

e-mail de correspondência: brennomendonca1@gmail.com

(1) Laboratório de Radio e Fotobiologia, IBRAG/UERJ, RJ, Brasil
(2) Laboratório de Biofotônica, IBRAG/UERJ, RJ, Brasil.

Abstract

BACKGROUND: Therapeutic protocols based on photobiomodulation (PBM) has been used for treatment of clinical conditions, as wounds, pain, inflammation processes . On the basis of PBM is absorption of a non-ionizing radiadiation at low power by the cytochrome c oxidase, which leads to production of reactive oxygen species. Such free radicals could causeoxidative in damage in DNA, which are repairedby base excision repair (BER) and nucleotide excision repair (NER) mechanisms. Up to date, there are few studies that assessed oxidative damage in DNA in consequence of low-power red lasers and ultraviolet A LED on expression of DNA generepair . AIM: This study aimed to assess the expression of genes related to BER and NER pathways in Saccharomyces cerevisiae after irradiation with low-power red laser and ultraviolet A LED. METHODS: Cultures of S. cerevisiae were irradiated with low-power red laser (660 nm, 21.2 J/cm2) and ultraviolet A LED (390 nm, 6 J/cm2), incubated for 1 hour in rich medium, total mRNA was extracted, cDNA was synthetized, and OGG1, APN1, RAD1 and RAD10 mRNA levels in S. cerevisiae FF18733 were evaluated by real-time quantitative polymerase chain reaction (RT-qPCR) by 2-ΔΔCT method. RESULTS: The results indicated that, at the fluences evaluated, the exposure to low-power red laser does not induce changes on genes expression but exposure to ultraviolet A LED alone, and to simultaneous ultraviolet A LED and low-power red laser significantly ($p<0.05$) reduce the APN1 and RAD10 mRNA levels in S. cerevisiae. CONCLUSION: Irradiation with low-power red laser could not affect mRNA from BER and NED but irradiation with ultraviolet A LED, and simultaneous low-power red laser and ultraviolet A LED, could decrease gene expression of BER and NER pathways in S. cerevisiae.

Key words: DNA repair, laser, light-emitting diode, photobiomodulation, yeast.
Study type: Estudo experimental em in vitro (Experimental study in vitro)

59

Photobiomodulation Therapy May Improve Inflammation and Lung Function in Asthmatic Patients: A Clinical Study?

GONÇALVES, TAWANY; ALVES, CINTIA ESTEFANO; PALMA, R. K.; CHAVANTES, M. C.; AIMBIRE, FLAVIO; OLIVEIRA, A. P. L.

e-mail de correspondência: tawany_goncalves@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil
(2) Facultat de Ciències Experimentales, Universidad Francisco de Vitoria, Pozuelo de Alarcón, Madrid, Programa em Medicina, Universidade Nove de Julho, SP, Brazil;
(3) Instituto de Ciências e Tecnologia,Universidade Federal de São Paulo, Unifesp, São José dos Campos, Brazil,
(4) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil.

Abstract

Introduction

Asthma is a heterogeneous disease characterized by chronic airway inflammation and respiratory symptoms such as wheezing, dyspnea, and cough, which vary over time in intensity and in causing airflow limitation. The excessive dependence on medications and their associated side effects have driven the exploration of new therapies with no side effects. The literature has reported the use of Photobiomodulation Therapy (PBMT) for treating inflammatory diseases, with the potential to safely and successfully modulate pro- and anti-inflammatory cytokines, making its application in lung diseases possible. Objective Thus, our aim was to investigate the effect of PBMT on the immune response and lung function in asthmatic patients. Methodology A pilot clinical study was conducted with six patients, in which laser treatment was applied twice a week, with one application of red laser (660 nm) and another of infrared laser (780 nm) on the same day, over a total of five weeks. All patients were reassessed after five weeks through the analysis of induced sputum cell phenotyping by flow cytometry and cytokine evaluation in sputum supernatant by ELISA, as well as lung function (PEF - Peak Expiratory Flow). Results Our results suggest that PBMT was able to reduce lung inflammation, with a decrease in eosinophils and IL-5 and IL-8 levels in the lung, as well as PEF. On the other hand, PBMT increased IL-10 and IFN-γ levels and, interestingly, the number of CD4+ T lymphocytes in the site. These results are consistent with the hypothesis that the ability to mobilize regulatory T cells to the airways may be responsible for reducing the allergen-induced lung response in asthmatic patients. Conclusion Finally, this study demonstrated that non-invasive sublingual PBMT attenuates airway inflammation and improves lung function, involving the upregulation of both IL-10 and regulatory T cells and, conversely, the downregulation of the eosinophil population and Th2 cytokines in the sputum of asthmatic patients.

Key words: asthma, chronic lung inflammation, lung function, Photobiomodulation Therapy.
Study type: Ensaio Clínico (Clinical Trial), Relato de caso/Serie de casos (Case report/Case series)

60

Effect of photobiomodulation therapy in the balance between effector and regulatory T cells in an experimental model of COPD

Alves CE (1), Santos TG (1), Oliveira APL (1).

e-mail de correspondência: estefano.alves@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction: The increase in CD4+ and CD8+ T cells expressing NF-κB, STAT4, IFN-γ, and perforin is associated with smoking, smoking history, airflow rate, obstruction, and pulmonary emphysema. Additionally, a deficiency in CD4+CD25+Foxp3+ regulatory T cells (Tregs) can impair the normal function of the immune system and lead to respiratory diseases. On the other hand, the anti-inflammatory cytokine IL-10, produced by Treg cells and macrophages, inhibits the synthesis of several pro-inflammatory cytokines involved in the pathophysiology of COPD. Therefore, immunotherapeutic strategies, such as Photobiomodulation Therapy (PBMT), aim to regulate the levels of cytokines, chemokines, and transcription factors in COPD. Objective: Consequently, the aim of this study was to evaluate effector and regulatory T cells, as well as the production of IFN-γ and IL-10 in the lung after PBMT in an experimental model of COPD. Methods: We induced COPD in C57BL/6 mice through orotracheal application of cigarette smoke extract. PBMT was applied immediately after each challenge, for seven weeks.
Data collection: Twenty-four hours after the final administration of cigarette smoke extract (end of seven weeks), the animals were euthanized, bronchoalveolar lavage (BAL) and lungs were collected, and analyses were performed. We quantified total and differential BAL cells, lung cell phenotyping, IFN-γ and IL-10 production, and lung remodeling. Statistical analysis: Statistical analysis was performed using one-way ANOVA, followed by the Newman-Keuls post-test, with significance levels adjusted to 5% ($p < 0.05$). Results: Our findings demonstrate that PBMT effectively reduces cell migration to the lung, levels of cytokines and chemokines, and alveolar enlargement. This reduction could potentially be attributed to the increased population of regulatory T cells (CD4+CD25+Foxp3+) producing IL-10 within the lung. Under these results, we suggest that these cells act by suppressing effector T cells (CD4+STAT-4+), known for producing IFN-γ. Conclusion: The significance of PBMT lies in its potential to regulate inflammation and treat pulmonary emphysema in individuals with COPD.

Key words: Keywords: COPD; effector T cells; regulatory T cells; cytokines; lung inflammation; Photobiomodulation Therapy.

Study type: Estudo experimental em animais (Experimental study in animals)

61

Clinical comparison between antimicrobial photodynamic therapy protocols as adjunctive treatment in the management of early pericoronitis: a randomized, controlled, double-blind clinical trial

Schalch TO (1), Duran CCG (1), Motta LJ (1), Bussadori SK (1), Fernandes KPS (1), Ferrari RAM (1), Suguimoto ESA (1), Horliana ACRT (1)

e-mail de correspondência: taniaschalch@gmail.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction: Pericoronitis is a common disease in the eruption phase of the third molars, sometimes debilitating, with an impact on quality of life. Despite the local and systemic damage that pericoronitis can cause, data in the literature on its treatments are limited. Several therapies have been proposed, but there is no standardization or election of a gold standard of treatment. Antimicrobial photodynamic therapy (aPDT) is an interesting alternative because it is an effective antimicrobial treatment, easy to perform and does not cause bacterial resistance. The methylene blue used in aPDT has been studied in a new oral formulation, whose delivery hinders aggregation, a phenomenon that has photochemical and photophysical repercussions. Objective: To evaluate and compare, clinically, the effectiveness of two aPDT protocols with different formulations of methylene blue in early pericoronitis in healthy individuals. Method: In this randomized, controlled, double-blind bioequivalence clinical trial, 34 healthy young patients with pericoronitis were evaluated. Pain (visual analogue scale), edema and mouth opening (digital caliper) have been evaluated at T0 (baseline) and T1 (4th day after aPDT). The individuals were randomized to the positive control group G1 (n=17): irrigation with sterile saline solution and photodynamic therapy (conventional methylene blue at a concentration of 0.005% and irradiation with low-intensity laser λ=660 nm, 9 J per point and radiant exposure of 318 J/cm2), and to the experimental group G2 (n=17) treated identically to G1, but using a new patented formula of methylene blue for oral use. Statistical analysis: was performed using ANOVA two-way, complemented by the Bonferroni test. Results: after treatment with aPDT, both G1 and G2 showed significant improvement in pain (p=0.014 and p=0.004, respectively) and mouth opening (p=0.001 and p=0.002, respectively). However, there was no difference in the final results between G1 and G2 for pain and mouth opening (p=0.560 and p=0.490). There was no statistical difference in the edema variable after treatments in G1 or in G2 (p=1.000 and p=0.735). There was also no significant difference between the final edema results between the two groups (p=0.822). Conclusion: Both protocols promoted significant improvement in pain and mouth opening of the participants, but did not improve their edema. No statistical difference was observed between the two groups in relation to the final results.

Key words: third molar, pericoronitis, photodynamic therapy, clinical analysis, laser, randomized controlled clinical study.

Study type: Protocol of Clinical Trial

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

62

Photodynamic therapy in antimicrobial control during the treatment of a complex wound. Case report.

Solange Beatriz Breunig Schmatz

e-mail de correspondência: solbbsc@gmail.com

Solange Beatriz Breunig Schmatz

Abstract

Photodynamic therapy in antimicrobial control during the treatment of a complex wound. Case report. Nurse. Solange Beatriz Breunig Schmatz – Specialist in Dermatology and Wound Treatment/ Laser Therapist. Introduction: This case report is about the evolution of the healing of a pressure ulcer at home caused after prolonged hospitalization in the intensive care unit due to a diagnosis of hemorrhagic dengue. Still in the hospital environment, he underwent surgical debridement. After being discharged from the hospital, the family sought me out to help treat the wound. Objective: This case report aims to prove that photodynamic therapy is extremely effective in antimicrobial control in the treatment of complex wounds. Conclusion: The association of photodynamic therapy with laser therapy in an appropriate way allowed a satisfactory evolution of the wound, with growth of granulation tissue and infection control, without the need for the association of technological dressings or industrialized antimicrobial solutions to control the local infection and the biofilm of the lesion.

Key words: Keywords: laser, Photodynamic therapy, Led.

Study type: Relato de caso/Serie de casos (Case report/Case series)

63

Antimicrobial photodynamic therapy with butil blue toluidine o (BuTBO) for inactivation of Aggregatibacter actinomycetemcomitans biofilm on bovine dental root

Silva-Rodriguez V (1,2), Tortamano AC (1), Kassa CT (1), Kato IT (2), Wainwright M (3), Prates RA (1)

e-mail de correspondência: valheryasr@uni9.edu.br

(1) Universidade Nove de Julho, Programa de Medicina-Biofotônica
(2) Universidade Federal do ABC, Engenharia Biomédica
(3) Liverpool John Moores University

Abstract

Periodontal disease is a chronic inflammatory condition caused bacterial biofilms that damage periodontal tissue. Treatment approaches typically involve the mechanical debridement and antimicrobials. However, antibiotics can lead to bacterial resistance. Antimicrobial photodynamic therapy (aPDT) is an alternative that can reduce dependence on antibiotics. BuTBO is a member of phenothiazine has significant potential in targeting periodontal pathogens. To assess the death of A. actinomycetemcomitans mediated by laser at 660 nm with the photosensitizer BuTBO, and to identify the morphological characteristics of the microbial biofilm after treatment with photodynamic therapy. A. actinomycetemcomitans (ATCC 29523) was grown in BHI medium at 37°C for 48 hours. Bovine root samples were cut into 2x4 mm segments were used as subtract. Samples were incubated with A. actinomycetemcomitans in BHI culture medium for 48 hours in a 5-10% CO2 atmosphere to induce bacterial biofilm growth. BuTBO was prepared in water solution, and it was used at 100 µM final concentration. Following a dark incubation period of 1 min, biofilm samples were illuminated by a diode laser (Photon Lase III, DMC, São Carlos, Brazil) emitting wavelength at □=660 nm, radiant output power of 100 mW, irradiance 250 mW/cm2, and radiant exposure of 15, 45, and 75 J/cm2. The experiment was divided into groups as following: control group without laser nor PS, irradiated laser group without PS, photosensitizer group without irradiation, and 3 parameters for aPDT groups irradiated by 1, 3, and 5 min. Colony-forming units (CFUs) were counted to quantify the bacterial load. Bacterial biofilm morphology was analyzed using Scanning Electron Microscopy (SEM). ANOVA followed by Tukey's test was performed for statistical comparisons. BuTBO aPDT mediated by 660 nm laser resulted in a significant reduction of A. actinomycetemcomitans bacterial load in treated groups. The microbiological analysis showed a decrease of 99,99% in CFUs counts in groups treated aPDT. SEM images revealed structural changes in the biofilm, demonstrating the effectiveness of aPDT in biofilm matrix and adherence. aPDT mediated by BuTBO effectively eliminates A. actinomycetemcomitans and impairs microbial biofilm structure, offering a promising alternative to improve periodontal treatment. The reduction in bacterial load indicates that aPDT could be a valuable approach in periodontal therapy, minimizing the risk of bacterial resistance.

Key words: Antimicrobial photodynamic therapy, Toluidine blue butyl O, bovine teeth, A. actinomycetemcomitans. Photodynamic antimicrobial chemotherapy (PACT)

Study type: Estudo experimental em in vitro (Experimental study in vitro)

64

Photodynamic therapy mediated by 5-ALA induces dysplastic oral keratinocytes to pyroptosis: an in vitro study

Tomo S (1), de Andrade LB (1), Corrêa L (1).

e-mail de correspondência: saygotomo@usp.br

(1) Department of Pathology, School of Dentistry, University of São Paulo, São Paulo, Brazil.

Abstract

BACKGROUND: Photodynamic therapy (PDT) offers a promising approach for managing oral epithelial dysplasia (OED), a condition prone to recurrence and malignant transformation despite surgical intervention. However, the limited understanding of the molecular events triggered by PDT hinders the development of optimized clinical protocols. Recent studies indicate that PDT can induce various forms of regulated cell death (RCD), including pyroptosis, in certain cancers. Pyroptosis, an immunogenic form of cell death mediated by gasdermin D (GSDMD), is of particular interest due to its potential to enhance anti-tumor immunity. Investigating whether PDT can induce pyroptosis in OED may uncover novel therapeutic strategies. AIM: To determine if PDT mediated by 5-aminolevulinic acid (5-ALA) induces pyroptosis in dysplastic oral keratinocytes (DOK). METHODS: DOK cells seeded in duplicate in 12-wells plates with cover slides in the bottom were incubated with 0.75 mM 5-ALA for 4 hours, followed by irradiation using a 630 nm Light Emitting Diode (LED) at a fluence of 3 J/cm². Cells were fixed at 4h, 12h, and 24h post-treatment with 4% paraformaldehyde and subjected to immunofluorescence labeling for phosphorylated gasdermin D (pGSDMD), a marker of pyroptosis, and DAPI (4',6-diamidino-2-phenylindole) for nuclear staining. The percentage of pGSDMD-positive cells was quantified at each time point. An untreated control group was included for comparison. RESULTS: The median percentage of pGSDMD-positive cells in the PDT-treated group was significantly higher compared to the control group at 4h ($p = 0.01$), 12h ($p = 0.04$), and 24h ($p < 0.01$) post-treatment. In the PDT group, pGSDMD-positive cells increased from a median of 15% at 4h to 32.7% at 24h ($p = 0.03$), while the control group showed no significant change in pGSDMD expression over time. CONCLUSION: The increased immunoexpression of pGSDMD in DOK cells following 5-ALA-mediated PDT suggests that this therapy induces pyroptosis in OED. The gradual rise in pGSDMD-positive cells over time suggests that pyroptosis may be a sustained or amplifying response to PDT, indicating that the signaling pathways leading to this form of regulated cell death continue to be activated hours after treatment. Further studies are needed to elucidate the precise mechanisms by which PDT induces pyroptosis, with the aim of refining therapeutic protocols to target its immunogenic potential in the treatment of OED.

Key words: Photodynamic Therapy, Oral Epithelial Dysplasia, Cell Death, Pyroptosis.
Study type: Estudo experimental em in vitro (Experimental study in vitro)

65

Effect of Photobiomodulation Combined with Dexamethasone on the Cell Viability of M1-Polarized Macrophages

Siqueira e Silva R.T. (1), Malavazzi, T.C.S. (2), Silva, A.S.,(2),Souza,N.C.C., Martins, A.L.S.(1), Silva-Junior, J.A (1); Kassa,C.T.(1), Fernandes, K.P.S.(1,2),Mesquita-Ferrari, R.A(1,2)., Duran, C.C.G(1).

e-mail de correspondência: rtsiqueira2015@gmail.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil
(2) Programa de Pós-graduação em Ciências da Reabilitação (UNINOVE), São Paulo, Brasil

Abstract

Introduction: M1 profile macrophages are crucial players in inflammation, pivotal in the immune response to infections, tissue damage, and cellular stress, influencing various stages of tissue repair through their secreted products. Dexamethasone (Dexa) is a widely used anti-inflammatory drug in clinical practice, but its effectiveness comes with the risk of numerous side effects, especially at higher doses and with prolonged use .Photobiomodulation (PBM) has shown positive effects on inflammation, modulating the transition to an anti-inflammatory phenotype, which promotes an improvement in tissue repair. Both PBM alone and corticosteroids have the potential to regulate the inflammatory process. Objectives: This study aims to evaluate the impact of PBM, with or without Dexa, on the cell viability of M1-polarized macrophages. J774 macrophages were divided into the groups: (1) Control, (2) M1, (3) M1 + PBM, (4) M1 + Dexa 2µM, (5) M1 + Dexa 4µM, (6) M1 + PBM + Dexa 2µM, and (7) M1 + PBM + Dexa 4µM. J774 macrophages were activated to M1 phenotype using DMEM supplemented with 5% FBS, LPS (1µg/mL), and IFN-ɣ (0.2µg/mL), followed by a 2h incubation at 37°C with 5% CO2. PBM groups were irradiated using a 780 nm AlGaArlaser (70 mW, 17.5J/cm2, 1J). Dexa (2µM and 4µM) were added to the respective groups, and all cells incubated for 24 and 48h.After incubation, the cell viability was analyzed by MTT assay. Results: After 24 hours the results showed that the combination of M1 macrophages with Dexa 2 µM and PBM indicated a synergistic effect, showing an increase in comparison with M1+Dexa 2 µM. M1 + PBM + Dexa 4µM group showed an increase in cell viability in comparison with M1 treated with Dexa in both molar concentration., After 48 hours, there was no difference between experimental groups. Conclusion: PBM treatment showed a time-dependent positive effect on cell viability when combined with Dexa, indicating a possible synergistic effect that protects macrophages under M1 polarization.

Key words: J774 macrophages, dexamethasone, pro-inflammatory, photobiomodulation, viability

Study type: Estudo experimental em in vitro (Experimental study in vitro)

66

Case Report: Efficacy of Laser Therapy and Photodynamic Therapy (PDT) in the Healing of a Traumatic Wound on the Right Arm of Elderly Patient with comorbidities

Almeida MS

e-mail de correspondência: magdaenferm@gmail.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction

M.J.S., a 72-year-old woman, sustained a traumatic wound on her right arm after an accident with a tree branch on January 2, 2024. Initial treatment at a local emergency unit was followed by referral to the General Hospital of the State in Salvador, where surgical intervention was performed. Objective: To evaluate the effectiveness of photodynamic therapy (PDT) and laser therapy in promoting wound healing and addressing complications in an elderly patient with a traumatic wound. Methodology: On January 15, 2024, the patient was assessed, revealing inflammation, edema, and delayed healing without foul odor. The treatment plan included wound cleaning with PHMB solution, hydrofiber dressing with silver, and application of infrared laser (3 joules) and red laser (3 joules) on the wound. PDT was conducted using methylene blue as a photosensitizer. Almeida-Lopes drainage and ILIB (Intravascular Laser Irradiation of Blood) were incorporated into the treatment regimen. Results: The combination of laser therapy and PDT effectively reduced inflammation and infection, leading to significant improvements in the wound healing process. Treatments were conducted every two days, allowing for consistent monitoring and adjustment of care. Analysis of Data: By February 15, 2024, the wound had completely healed, demonstrating the synergistic effects of laser therapy and PDT in elderly patients with traumatic wounds and comorbidities. Conclusion: This case illustrates the critical role of advanced therapeutic modalities like laser therapy and PDT in managing traumatic wounds, particularly in elderly patients. Further research is warranted to expand these findings and explore their applications in broader clinical settings.

Key words: Photobiomodulation, Wound Healing, comorbidities

Study type: Relato de caso/Serie de casos (Case report/Case series)

67

Lingual nerve paresthesia after third molar extraction: case report

Inácio MSC (1), Leite SHAL (1), Ferreira ACD (1), Silva FA (1), Gonçalves, RIS (1), Silva ARJ (1) Costa DR (1) Catão MHCV (1)

e-mail de correspondência: costa.m@aluno.uepb.edu.br

(1) Universidade Estadual da Paraíba, Programa de Pós Graduação em Odontologia

Abstract

Introduction: Paresthesia is a neurosensory disorder caused by an injury to neural tissue, characterized by alteration of normal sensations as a result of injury to nerve branches, of a transitory or permanent nature, due to complications that arise during surgical procedures, such as dental extractions. third molars. Objective: To report a clinical case of lingual paresthesia after third molar extraction. Methodology: The diagnosis was made through anamnesis and intraoral examination, at the laser clinic of the Interdisciplinary League of Lasertherapy at the Dental clinic of the State University of Paraíba (LIL-UEPB). Case report: Female patient, 24 years old, with no history of illness, attended LIL-UEPB, complaining of loss of sensitivity on the left side of the tongue, after extraction of tooth 38. In the anamnesis, the patient reported having used Injectable ETNA. During the intraoral clinical examination, sensitivity tests were performed on the affected area, confirming paresthesia in the lingual nerve during the surgery. The proposed treatment was low-intensity laser therapy, with an infrared laser, wavelength 808nm, 3 J/cm2 per point (100 mW and 30 sec) per point, applied to the back and edge of the tongue, lingual belly and along its entire length. of the affected nerve. All points were performed at a distance of approximately 1cm, by and in contact. Eleven sessions were held, twice a week over a period of five months. Results: After three applications, the patient reported feeling an improvement in tongue sensitivity, but began to feel tingling in the region. After eleven sessions, the patient reported no tingling, and began to normally feel the entire length of the tongue. Conclusion: Laser therapy accelerates the repair of nervous sensitivity, being an effective treatment alternative for cases of neurosensory disorders, with recovery of taste and improved sensitivity to mechanical and thermal stimuli, an excellent choice for the treatment of paresthesias.

Key words: Low Intensity Light Therapy, paresthesia, oral surgery.

Study type: Relato de caso/Serie de casos (Case report/Case series)

68

Effects of Photobiomodulation on the Viability, Migration, and Differentiation of C2C12 muscle cells Exposed to Dexamethasone

Martins ALS (1), Malavazzi TCS (2), Silva AS (3), Siqueira e Silva RT (1), Souza NCC, Duran CCG (1), Rodrigues MFSD (1), Bussadori SK (1,3), Fernandes KPS (1), Mesquita-Ferrari RA (1,3).

e-mail de correspondência: alessandrasilva.martins@uni9.edu.br

(1) Universidade Nove de Julho, Programa de Pós-graduação em Medicina-Biofotônica
(2) Universidade de São Paulo, Faculdade de Odontologia (FOUSP),
(3) Universidade Nove de Julho, Programa de Pós-graduação em Ciências da Reabilitação.

Abstract

Introduction: Skeletal muscle has a high capacity for growth and regeneration, making it a subject of numerous studies in response to various stimuli and injuries. Several pathophysiological conditions and prolonged use of corticosteroids, such as dexamethasone, can lead to an imbalance in the synthesis and degradation of skeletal muscle proteins, resulting in muscle atrophy. Many studies aim to investigate ways to mitigate the undesirable effects of dexamethasone. Photobiomodulation (PBM), a non-invasive therapy that uses low-intensity light, has shown potential to promote muscle regeneration and recovery. C2C12 muscle precursor cells have demonstrated favorable responses to photobiomodulation stimuli; however, its association with dexamethasone use has not yet been explored. Objective: To investigate, in vitro, the effects of PBM on the viability, migration, and differentiation of C2C12 cells after exposure to different concentrations of dexamethasone. Method: C2C12 cells will be cultured in DMEM with 10% fetal bovine serum to promote cell proliferation and in DMEM with 2% horse serum to stimulate cell differentiation. The experimental groups will be divided as follows: G1- control, G2-C2C12 + PBM, G3 - C2C12 + Dexa 10ug/ml, G4 - C2C12 + Dexa 20ug/ml, G5 C2C12 + Dexa 10µg/ml + PBM) and G6 (C2C12 + Dexa 20µg/ml + PBM). PBM will be performed using the 780nm laser with 0,4J of energy (according previous findings), average power of 70mW. The evaluation period will be 24, 48, and 72 hours. The groups will be assessed according to the following parameters: viability (MTT), morphology, proliferation (crystal violet assay), migration (wound healing assay), differentiation (CK activity), gene expression of myogenic regulatory factors (qPCR), and specific protein quantification such as IL-6 and TNF alfa (ELISA).

Key words: muscle cells, photobiomodulation, viability, differentiation, dexamethasone

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

69

Effects of low-power infrared laser on mRNA levels from DNA repair genes and reactive oxygen species levels in Escherichia coli

Sales MS (1), Farias TG (1), Borges AJC (1), Santos GP (2), Ferreira ACS (1), Pires BRB (1), Mencalha AL (1), Fonseca AS (1,2,3).

e-mail de correspondência: marisa.sales.bio@gmail.com

(1) Universidade do Estado do Rio de Janeiro

(2) Universidade Federal do Rio de Janeiro

(3) Centro de Ciências da Saúde, Centro Universitário Serra dos Órgãos

Abstract

Laser devices are light sources able to emit monochromatic, coherent, and collimated electromagnetic radiation beams. Consequently, low-power lasers are used in photobiomodulation (PBM), a method known for inducing a series of physiological effects in cells, tissues, animals, and humans, capable of promoting tissue regeneration, analgesia, and reducing inflammation. Despite therapeutic applications, mainly in continuous-wave, few data are available on PBM effects induced by low-power lasers in pulsed emission mode. Thus, this study aimed to evaluate the effects of a low-power pulsed infrared laser on the expression of genes related to base excision repair and reactive oxygen species (ROS) levels in Escherichia coli (E. coli) cells. For this, E. coli C600 cultures were exposed to a pulsed infrared laser of low power (5,000 Hz, 904 nm) at different energies (1.1, 2.3, and 4.6 J). Then, total RNA was extracted, cDNA synthesis was performed, and the mRNA levels from xthA and UNG genes were evaluated by RT-qPCR. ROS levels was evaluated by flow cytometry. The data suggested that exposure to the low-power pulsed infrared laser did not significantly change the mRNA levels of genes related to base excision repair but increased reactive oxygen species levels in E. coli C600 cultures exposed to such laser at the higher laser energy (4.6 J).

Key words: Escherichia coli, DNA repair genes, reactive oxygen species, laser, phobiomodulation.

Study type: Estudo experimental em in vitro (Experimental study in vitro)

10º Fórum Internacional de Biofotônica (FIB)/ 10th Biophotonics International Forum (BIF) 2024

70

Efficacy of Intense Pulsed Light and Diode Laser in Axillary Hair Removal in Women: A Randomized, Double-Blind Study

Barros RTB (1), Pavani C (2)

e-mail de correspondência: renatataylor.fisio@gmail.com

(1) Universidade Nove de Julho - Postgraduate program in Biophotonics-Medicine

Abstract

INTRODUCTION: Photoepilation is a popular method for removing unwanted hair. Among the most commonly used technologies are the Diode Laser and Intense Pulsed Light (IPL). The Diode Laser uses specific wavelength (810 nm) to target the melanin in the hair follicle, while IPL operates with a broad spectrum of wavelengths simultaneously. Despite their efficacy, more comparative studies between these technologies are needed, particularly regarding the use of a single wavelength versus the broad spectrum of IPL. OBJECTIVE: The aim of this study was to compare the efficacy of axillary hair reduction between IPL and the Diode Laser in female patients. METHOD: The methodology consisted of a split-body study with 49 patients. IPL was applied to one axilla, and the Diode Laser to the other, with sides randomly assigned. The study included women with skin types I to IV on the Fitzpatrick scale and dark hair, aged over 18 years. Patients underwent four sessions with monthly intervals. Follow-up occurred 30 days after the final session. Three variables were evaluated: pain (using the Visual Analog Scale -VAS), hair thickness, and hair count. RESULTS: The Diode Laser consistently showed higher VAS values, indicating greater discomfort, while IPL demonstrated lower pain levels throughout all sessions (around 5 points less). Regarding hair thickness, both groups showed significant reductions (from 0,184±0,006 to 0,064±0,007 in IPL treated side and from 0,178±0,007 to 0,057±0,007 in diode laser). For hair count, both treatments were effective in reducing the amount of hair, with no statistical difference between groups and an averaged reduction of 68% after four sessions. CONCLUSION: Both treatments were effective in reducing hair in terms of quantity and thickness. IPL proved to be more comfortable, with lower pain levels.

Key words: Hair Removal; Diode Laser; Photoepilation; Intense Pulsed Light.

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

71

Evaluation of Photobiomodulation and Dosimetry in Inflammatory Modulation in Experimental Models of Colitis.

Souza V (1), Marcos RL (2)

e-mail de correspondência: vanessacuidador@gmail.com

(2) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction:Photobiomodulation (PBM), also known as low-level light therapy, has emerged as a promising therapeutic alternative or adjunct in the treatment of intestinal diseases. Inflammatory bowel diseases (IBD) are chronic, multifactorial conditions characterized by dysfunction of the intestinal mucosa and a compromised immune response. Ulcerative colitis (UC) is one of the chronic inflammatory diseases of the intestine and rectum that is challenging to treat, with currently available therapies being expensive and often ineffective. In situations of intestinal tissue injury, it is observed that microorganisms translocate to the intestine, recruiting inflammatory cells to the site of injury. Treating UC is difficult, and new therapies are needed. PBM stands out as a non-invasive technology with no side effects; however, there is a need in the literature to develop clinical research to establish the safety of this method.Objective:** This study conducted a critical analysis of the works related to photobiomodulation and dosimetry in inflammatory modulation in experimental models of colitis. To achieve this, we analyzed dosimetric parameters and levels of pro- and anti-inflammatory mediators in the intestinal mucosa.Methods:A critical analysis of studies published in MEDLINE via PubMed and SCOPUS was conducted, covering the period from 1990 to 2024. A total of 72 studies were selected, of which 9 focused on IBD.Results: The results of the selected studies demonstrated that light in PBM attenuated the inflammatory process, preventing the increase in levels of IL-1β and IL-6, and accelerated their resolution, significantly increasing levels of IFN-γ and TGF-β, while reducing inflammatory infiltrate and ulcerations of the intestinal mucosa, demonstrating protective actions on the epithelial barrier. The most frequent studies found in this review were conducted in Brazil, using wavelengths of 660 nm.Conclusions:Thus, PBM treatment promotes structural protection and modulates the inflammatory response of colitis, constituting a potential non-invasive and low-cost combined therapy to help patients achieve disease remission. The need to develop studies with a detailed description of dosimetric parameters is emphasized, in order to replicate them, establishing the safety of results in relation to dosimetry and facilitating the transition from preclinical to clinical studies.

Key words: Ulcerative colitis; Photobiomodulation; Light emitting diode; cytokines; Inflammatory bowel diseases;

Study type: Revisão (Review)

72

Effect of Preventive or Therapeutic Vascular photobiomodulatiom (VPBM) on Muscle Cross-Sectional Area During Regeneration Following Acute Injury.

Silva AS (1) Malavazzi TCS (2,3), Silva RLO(2), Gomes KS (1), Lauand DCK (1), Rodrigues MFSD(2), Bussadori SK (1,2), Fernandes KPS (2), Mesquita-Ferrari RA (1,2)

e-mail de correspondência: aline.sp.br@gmail.com

(1) Postgraduate Program in Rehabilitation Sciences, Nove de Julho University (UNINOVE)

(2) Postgraduate Program in Medicine-Biophotonics, Nove de Julho University (UNINOVE)

(3) Department of Oral Pathology, Dental School, Universidade de Sao Paulo (USP)

Abstract

Background: Skeletal striated muscle is widely required for its functional capacity for movement, protection, and maintenance of posture, which makes it susceptible to injuries. Photobiomodulation Therapy (PBM) gained prominence due to its benefits in muscle repair and regeneration, especially when applied directly to the injury site (LPBM). However, Vascular Photobiomodulation (VPBM) has shown promising effects on tissue repair and has therefore been investigated. Aim: The objective of this study was to evaluate the effects of preventive or therapeutic vascular photobiomodulation (VPBM) on the muscle cross-sectional area during the regeneration process following acute injury. Methods: Animals (n= 40) were randomly divided into 4 groups: Control (n=5), Injury (n=5), Prior VPBM + Injury (n=5) and Injury + Post VPBM (n=5). Treated groups were irradiated with an AlGaAs diode laser (780 nm, 40 mW, 0.04 cm^2, 3.2 J, 80 s) over the caudal artery. A cryolesion was performed on the tibialis anterior (TA) muscle using a cooled metal bar and animals were euthanized at 7-days post-injury. TA muscle samples were collected, sectioned transversely at 4 µm, and stained with Hematoxylin and Eosin (H&E). ImageJ software assessed muscle cross-sectional area (CSA) using the freehand selection tool. A magnification of 200x was applied to obtain five fields per slide, evaluating five animals per group, totaling 100 fibers per area, and calculating the mean per slide. Results: There was a significant increase in the cross-sectional area (CSA) in the groups that received both VPBM, applied before and after injury, compared to the injury no irradiated after 7 days . The injury group and prior VPBM group showed a decrease compared to the control group Conclusion: In conclusion, the findings of this study indicate that VPBM was able to induced an increase in the muscle cross-sectional area (CSA) after 7 days with no difference between the groups treated before or after acute muscle injury.

Key words: Keywords- Vascular photobiomodulation, modified ILIB, muscle repair, muscle injury, cross-sectional area (CSA).

Study type: Estudo experimental em animais (Experimental study in animals)

73

Effect of vascular photobiomodulation on M1 macrophage recruitment during muscle regeneration in an acute injury model.

Silva, RLO (1), Silva, AS(2), Malavazzi, TCS(1), Caprioli, B(1), Rodrigues, MFSD (1), Horliana, ACRT (1), Fernandes, KPS(1), Mesquita-Ferrari, RA(2)

e-mail de correspondência: raquel.lira.ortiz@uni9.edu.br

(1) Programa de Pós-graduação em Medicina Biofotônica; Universidade Nove de Julho
(2) Programa de Pós-graduação em Ciências da Reabilitação; Universidade Nove de Julho

Abstract

INTRODUCTION: Muscle injuries significantly limit function and cause discomfort, being more frequent in high-performance athletes. During a muscle injury, an inflammatory response is triggered, involving the activation of satellite cells and the mobilization of leukocytes, mainly neutrophils and macrophages, through the signaling of pro-inflammatory mediators. However, an imbalance in this process can lead to muscle fibrosis, resulting in morphological changes and functional loss. Photobiomodulation, applied either locally (LPBM) or vascularly (VPBM), has been shown to regulate the inflammatory response, increase vascularization, and reduce myonecrosis in both preventive and/or therapeutic interventions. OBJECTIVE: This study study aimed to investigate the impact of VPBM on the recruitment of M1 phenotype macrophages (CD68+) in an experimental model of acute muscle injury. METHODOLOGY: A total of 30 male Wistar rats, 12 weeks old, were used, divided into experimental groups: G1 – Injury without PBM n=10); G2 – preventive VPBM following by injury (n=10); G3 - injury + VPBM (n=10). PBMV was applied specifically over the vein/artery at the base of the animals' tails (780 nm, 40mW, 80s, and 3.2J). The acute muscle injury was induced by applying a metal bar cooled in liquid nitrogen twice to ventral region of the tibialis anterior muscle. Euthanasia was performed at 1, and 7 days after cryoinjury. The tibialis anterior muscle was collected for analysis of M1 CD68+ macrophages by immunohistochemistry. RESULTS: The Control and No Cryoinjury + PBMV groups were excluded from statistical analysis due to the absence of inflammatory cells in the histological sections. On day 1, a significant increase in the number of CD68+ cells was observed in the PBMV Pre-treatment + Injury group compared to the Injury and Post-injury PBMV groups ($p < 0.0001$). By day 7, there was a notable reduction in CD68+ cells in both the PBMV Pre-injury group ($p < 0.005$) and the Post-injury PBMV group ($p < 0.0001$) compared to the Injury group. CONCLUSION: VPBM was able to modulate the recruitment of CD68+ macrophages, characteristic of the M1 profile, suggesting its pivotal role in regulating the pro-inflammatory response during muscle repair.

Key words: Vascular Photobiomodulation, Muscle repair, Cryolesion, Macrophages, Low-Level Light Therapy

Study type: Estudo experimental em animais (Experimental study in animals)

74

Treatment of facial asymmetry with Photobiomodulation: case report

Leite SHA (1), Ferreira ACD (1), Gonçalves RIS (1), Silva FA (1), Inácio MSC (1), Silva ARJ (1), Costa DR (1), Catão MHCV (1).

e-mail de correspondência: sofiahilueyleite@gmail.com

(1) Universidade Estadual da Paraíba

Abstract

INTRODUCTION. Bell's palsy is an idiopathic peripheral nerve disease related to the facial nerve. It has a sudden onset and no apparent cause and affects the innervation of the muscles responsible for facial expressions, resulting in moderate to severe unilateral facial asymmetry. Facial paralysis usually improves in a short time, however, nerve recovery may not be complete and, therefore, alternative therapies may be useful. Among the alternative therapies, photobiomodulation stands out, which consists of a beam of monochromatic light, in the red and/or infrared spectrum, directed at a tissue in order to promote biological changes. In damage to the nervous system, it acts on the regeneration of the injured nervous tissue. OBJECTIVE: To report a case of Bell's palsy in which treatment with photobiomodulation therapy was performed in order to accelerate the components of the damaged nervous tissue of the facial nerve. CLINICAL CASE: A 56-year-old man was diagnosed with recent Bell's palsy on the right side, presenting grade 3 on the House-Brackmann scale with evident mouth deviation and difficulty closing the eye. The treatment protocol was prescribed photobiomodulation with infrared light twice a week. An irradiation dose of 3 J/cm2, wavelength of 808nm, power of 100mW, punctually, continuous mode, with a duration of 30 seconds per point, totaling 24 irradiated points along the path of the facial nerve. RESULTS: The results demonstrated a significant improvement in muscle functionality in the second week, and a complete improvement after the fifth application, with House-Brackmann classification 1, facial symmetry and normal function. CONCLUSION: Infrared photobiomodulation in the parameters used for an effective, non-invasive treatment in this case of Bell's palsy promoted the restoration of facial symmetry and movement after therapy.

Key words: Photobiomodulation, Bell Palsy, Facial Asymmetry.
Study type: Relato de caso/Serie de casos (Case report/Case series)

75

PHOTOBIOMODULATION THERAPY IN REDUCING THE INFLAMMATORY PROCESS AND PAIN IN A MODEL OF INDUCED RHEUMATOID

Tavares PV (1), Santos SA (2), Romano-Neto O (3), Mello DC (4), Marcos RL(5)

e-mail de correspondência: patriciavtavares@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Rheumatoid Arthritis (RA) is classified as a chronic inflammatory and autoimmune disease that can progress slowly or quickly, but it is always in a degenerative manner, affecting the synovial joints, destroying bones and cartilage irreversibly. In vivo experiments using local photobiomodulation (PBML) have shown satisfactory results. However, to date, there are not many studies using or comparing it to systemic photobiomodulation (PBMS), also known as vascular. Objective: To compare the effects of PBML therapy and PBMS therapy in an "in vivo" sampling, in a experimental model of rheumatoid arthritis induced by Type II collagen, evaluating the resistance of the cartilage from the analysis of mechanical properties in addition to pain control, through mechanical allodynia tests. Method: Elderly male Wistar rats were used and divided into 4 groups of N=7: CTL (Control), NT (Untreated Rheumatoid Arthritis), and the treated groups, RA+PBML (Rheumatoid Arthritis treated with Local Photobiomodulation) and RA+PBMS (Rheumatoid Arthritis treated with Systemic Photobiomodulation). The animals were induced following the parameters of a previous study using Type II Collagen with Freud's adjuvant, receiving two caudal intradermal injections of the disease-inducing solution on days 1 and 8, and a local induction of the same solution in the joints of both knees on day 22. The irradiation parameters used in the treated groups were PBML (808nm; 4J; 100mW) and PBMS (808nm; 15J; 100mW), initiated immediately after the last induction. Euthanasia was performed on day 46 after the first induction. Pre- and post-induction allodynia tests were compared, and cartilage and blood samples were collected for histological, functional, and biochemical analyses. Results: Worsening of mechanical allodynia was observed for the NT group compared to the treated groups (PBML and PBMS). In the biomechanical analysis, there was a reduction in Fmax and Dmax compared to the CTL group, with an improvement in Dmax compared to NT in the treated groups (PBML and PBMS).

Key words: Keywords: Photobiomodulation, Rheumatoid Arthritis, Cartilage, Inflammatory Process, Mechanical Properties.

Study type: Estudo experimental em animais (Experimental study in animals)

76

The photobiomodulation induced by low-power red laser and UVA-LED reduces reactive oxygen species levels in MCF-7 breast cancer cells

Dobao ACC (1), Siqueira PB (1), Mourão MEB (1), da Fonseca AS (2), Pires BRB (1), Rodrigues MMS (1), Mencalha AL (1)

e-mail de correspondência: anaclaradobao10@gmail.com

(1) Universidade do Estado do Rio de Janeiro, Laboratório de Biologia do Câncer

Abstract

Background: Breast cancer (BC) is the most frequent cancer among women, and it is responsible for high mortality rates. Non-ionizing radiation emitted by low-power lasers and LEDs (light-emitting diodes) can induce photobiomodulation (PBM), which is the basis of phototherapy. It is a non-pharmacological treatment suggested for therapeutic purposes such as wound healing and pain relief. However, the effects of PBM on BC cells are still unclear. Aims: This study aimed to evaluate the effects of PBM induced by a low-power red laser and an ultraviolet A LED on the viability, proliferation, cell death, and reactive oxygen species (ROS) levels in MCF-7 BC cells. Methods: MCF-7 cells were irradiated with a low-power red laser (660 nm, 5.3, 10.6, and 21.2 J/cm²) and UVA-LED (390 nm, 1.5, 3.0, and 6.0 J/cm²), alone or simultaneously. A WST-1 assay was performed to evaluate cell viability in 24, 48, and 72h after irradiation, and a colony formation assay to evaluate cell proliferation. Through flow cytometry cell death levels were measured by Annexin V-FITC/7-AAD staining to evaluate necrosis, apoptosis and, late apoptosis, and ROS levels were measured by H2DCFDA staining to evaluate oxidative stress. Results: Exposure to low-power red laser and ultraviolet A LED, alone or simultaneously, did not significantly alter the MCF-7 BC cell viability, as well as in cell death. However, there was a significant decrease in proliferation of cells irradiated with a low-power red laser (660 nm, 21.2 J/cm²) compared with non-irradiated cells. Moreover, the irradiation of cells with a low-power red laser (660 nm, 21.2 J/cm²) and UVA-LED (390 nm, 6.0 J/cm²) alone and simultaneously significantly decreased the ROS levels compared with non-irradiated cells. Conclusion: Our findings suggest that the photobiomodulation induced by irradiation with low-power red laser and ultraviolet A LED does not alter cell viability and cell death. Nevertheless, the irradiation with a low-power red laser (660 nm, 21.2 J/cm²) decreased the proliferation of MCF-7 compared to the non-irradiated cells. Low-power red laser (660 nm, 21.2 J/cm²) also reduced the ROS levels as well as UVA-LED (390 nm, 6.0 J/cm²) alone and simultaneously in comparison with non-irradiated cells.

Key words: breast cancer, light-emitting diode, photobiomodulation, red laser, ultraviolet A radiation

Study type: Estudo experimental em in vitro (Experimental study in vitro)

78

EFFECT OF PHOTOBIOMODULATION THERAPY IN AN EXPERIMENTAL MODEL OF ASTHMA-COPD OVERLAP

Santana KG (1), Ligeiro de Oliveira A (1)

e-mail de correspondência: kelly.gsantana@uni9.edu.br

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction: Asthma and Chronic Obstructive Pulmonary Disease (COPD) are pathologies triggered by different mechanisms, with distinct characteristics and symptoms of airway inflammation and obstruction. It has been demonstrated that patients can exhibit features of both asthma and COPD, which is termed Asthma-COPD Overlap (ACO). The pathophysiology of ACO is not well defined, and we observe alterations in the levels of cytokines and chemokines involved in both asthma and COPD. Photobiomodulation (PBM) has been used in the treatment of various pathologies, where the interaction of light with tissues leads to the modulation of biological functions and anti-inflammatory effects. Previous studies evaluating the effect of PBM on COPD demonstrated a reduction in the levels of pro-inflammatory cytokines with a Th2 profile (IL-4, IL-5, and IL-13) and an increase in IL-10. Furthermore, a reduction in inflammation was observed in an experimental model of asthma with PBM. Objective: We aim to evaluate the effect of laser therapy in an experimental model of ACO with PBM. Methodology: BALB/c mice were subjected to the ACO induction protocol with the administration of House Dust Mite extract (asthma induction) and cigarette smoke extract (COPD induction), irradiated with 660 nm LASER to evaluate: 1) pulmonary inflammation in bronchoalveolar lavage fluid (BALF) through total and differential cell counts; 2) the levels of cytokines with Th1, Th2, Th17 profiles and nitric oxide in BALF; 3) airway remodeling by histology; 4) lung mechanics; 5) ATP levels in the lung. Results: FBM therapy reduced the number of inflammatory cells in BALF of the ACO+Local FBM group compared to the ACO group, with an increase in IL-10 levels and a reduction in IFN-γ. On the other hand, we observed an increase in inflammatory cells in the BALF of the ACO+Vascular FBM group compared to the ACO group, with na increase of both IL-10 and IFN-γ. There was no difference in IL-5 secretion. These findings support our hypothesis that local FBM can reduce inflammation in ACO, offering a potential therapeutic alternative without adverse side effects.

Key words: Asthma-COPD Overlap; Pulmonary Inflammation; Photobiomodulation
Study type: Estudo experimental em animais (Experimental study in animals)

79

In vitro evaluation of the optimized protocol of Antimicrobial Photodynamic Therapy (aPDT) on Staphylococcus aureus

Ferreira BS (1), Rodrigues VS (1), Bezerra DT (1), Duran CCG (1), Bussadori SK (1), Fernandes KPS (1), Prates RA (1), Suguimoto ESA (1), Horliana ACRT (1)

e-mail de correspondência: ferreira.bruno@uni9.edu.br

(2) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Introduction: Staphylococcus aureus is a Gram-positive bacterium frequently associated with severe infections, particularly in immunocompromised individuals, such as hemodialysis patients, due to the use of catheters and other invasive devices. The growing concern over bacterial resistance has made these infections increasingly difficult to treat, creating an urgent need for alternative therapeutic strategies. Antimicrobial Photodynamic Therapy (aPDT) has emerged as a promising approach, utilizing the activation of a photosensitizer by light to generate reactive oxygen species that effectively eliminate pathogens without inducing resistance. Objective: This study aims to investigate the in vitro dynamic of bacterial inactivation with aPDT. Methodology: Bacterial strain S. aureus will be grown on Brain Heart Infusion (BHI) agar at 37°C for 48 hours. After cultivation, an isolated colony will be transferred to BHI broth and incubated at 37°C for 16 hours (overnight). The following day, the culture will be adjusted to an optical density of 600 nm (OD600) and diluted at a ratio of 1:40, then incubated again until it reaches the exponential growth phase. Bacterial biofilm will be cultivated in 96-well plates for treatment with aPDT. The experimental design includes five groups: bacterial control, S. aureus treated with laser only, S. aureus treated with 100 mM methylene blue (MB) without irradiation, and three groups treated by MB with light irradiation for 5,15, and 20 min. The light source will be a red light-emitting diode (LED) (λ = 660 nm), with an irradiance of 400 mW/cm², a radiant dose of 120, 380, and 480 J/cm², and a distance of 3 mm. The bacterial cultures will be treated with methylene blue and incubated in the dark for 5 minutes before irradiation. After treatment, the samples will be diluted, plated on BHI agar, and incubated for 24 hours at 37°C for colony-forming unit (CFU/mL) counting. In parallel, biofilm formation will be assessed with crystal violet staining, and the aPDT treatment will be applied to biofilm cultures in the same way as for planktonic cultures. All experiments will be performed in triplicate, and the results will be statistically analyzed using the Kruskal-Wallis test followed by Dunn's post-test, with $p < 0.05$ considered significant.

Key words: Staphylococcus aureus, antimicrobial photodynamic therapy, methylene blue, bacterial resistance, nasal decolonization

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

80

Vascular photobiomodulation as a therapeutic tool for decompensated asthma in a pediatric patient with Down syndrome

Danielle Peres Costa CORDEIRO(1), Samantha Peixoto PEREIRA(2), Fernando ALZAMORA FILHO(3*)

e-mail de correspondência: samanthapeixoto84@gmail.com

(1). Docente da União Brasileira de Educação Católica, UNILESTE, Departamento de Odontologia, Ipatinga, MG, Brasil

(2). Docente da Universidade Estadual de Santa Cruz, Departamento de Ciências Agrárias e Ambientais, Ilhéus, BA, Brasil

(3) Universidade Nove de Julho Aluno da Pós em Biofotônica: Aplicações das Tecnologias da Luz na Saúde, Campus Vergueiro,SP .

Abstract

Introduction: In the treatment of health conditions, regardless of age group, photobiomodulation has proven effective in the treatment of acute or chronic diseases, given that it modulates the inflammatory process, reducing inflammatory markers, such as pro-inflammatory cytokines and C-reactive protein. The objective of this study is to demonstrate the efficacy of vascular photobiomodulation (FBMV) as a therapeutic adjuvant in a patient with signs of decompensated asthma due to a viral picture of influenza B. Methodology: The application of vascular photobiomodulation in the systemic condition of the patient C.A.M., 6 years old, female, carrier of the genetic condition of trisomy of chromosome 21, with respiratory picture of decompensated asthma, where she was subjected to laser irradiation in the radial artery for 30 min., with the limbs to be irradiated being alternated during the treatment, totaling 30 min/day, for 10 consecutive days. Diode laser (e-lib - DMC) was used, wavelength 660 nm, power of 50 mW, irradiance of 0.86 W/cm2, radiant exposure of 1552 J/cm2. Results: The results of the child's clinical parameters during the 10-day period of therapy with FBMV, show a gradual improvement in dyspnea, reduction in cough and blood saturation by oximeter went from 94% to 96% after the first FBMV session and on the fifth day, saturation was 99%. Data analysis: In the serum examination of C-reactive protein, there was a gradual reduction, with values of: day 1: 47.08 mg/L; day 6: 24.16 mg/L; day 8: 7.03 mg/L and day 10: 2.30 mg/L. The use of vascular FBM in pediatrics has proven to be effective as an adjuvant resource in the treatment of asthma decompensation. Conclusion: Working with FBMV in pediatrics involves knowledge about light, understanding the clinical phase of respiratory diseases in patients with trisomy 21, making it possible to develop a specific protocol for the patient, in addition to being a safe and effective adjuvant therapeutic proposal.

Key words: Lung disease, ILIB, Pediatrics, Trisomy 21.

Study type: Relato de caso/Serie de casos (Case report/Case series)

81

Anti-RSV effect of Photodynamic Therapy (aPDT) with Phthalocyanine for the treatment of Respiratory Syncytial Virus (RSV) infection in vitro:

Donatelli FW(1), Motta (1), Sandra Kalil Bussadori (2,1), Cinthya Cosme Gutierrez Duran (1), Kristianne Porta Santos Fernandes (1), Raquel Agnelli Mesquita Ferrari (1, 2), Anna Carolina Ratto Tempestini Horliana (1)

e-mail de correspondência: clinicadonatelli@gmail.com

(1) Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

Abstract

Acute viral respiratory infections, particularly acute viral bronchiolitis (AVB), are a significant public health concern, primarily caused by the Respiratory Syncytial Virus (RSV), which mainly affects children under five. In 2015, RSV led to over 33 million infections, 3.2 million hospitalizations, and around 60,000 deaths. Elderly and immunocompromised individuals are also at risk. Currently, effective drug treatments for RSV are lacking, with available options primarily supportive. Monoclonal antibodies like Palivizumab show promise but are costly, while ribavirin has limited efficacy and is reserved for high-risk groups. The COVID-19 pandemic temporarily reduced RSV cases, but increased susceptibility has been noted post-restrictions. RSV hospitalizations create significant economic burdens, estimated at €4.82 billion globally in 2017. New therapeutic approaches are necessary for controlling RSV infections and reducing bronchiolitis. Our objecite is to evaluate the anti-RSV activity of aPDT with the anionic derivative of Phthalocyanine (APD) in in vitro models. We are going to isolate circulating wild strains of RSV, subtypes A and B, from hospitalized children with symptoms associated with respiratory tract infection in healthcare institutions, standardize a standard operating protocol for plaque formation assay to titrate the viral stock of RSV , evaluate potential cytotoxic effects in vitro of aPDT with the anionic derivative of Phthalocyanine (APD) in its pure form and in association with nanoparticles in Human Laryngeal Carcinoma Cells (HEp-2 ATCC CCL-23), determine the dosimetry of aPDT as well as the necessary concentration of the compounds to reduce cell viability by 50% (CC50), and evaluate and quantify the antiviral effect of the new therapy by reducing plaque formation in the viral titration assay. The results will be expressed as mean ± standard deviation of three experiments conducted on different days. The data will be analyzed by one-way ANOVA, followed by Tukey's test in the event of significantly different variances. A p-value less than 0.05 will be considered statistically significant. All statistical treatment will be performed using GraphPad Prism 10 (GraphPad®) software.

Key words: Keywords: Photodynamic Therapy. Phthalocyanine. Respiratory Syncytial Virus. In vitro.

Study type: Protocolo Estudo experimental em in vitro (Experimental study in vitro)

82

EVALUATION OF LOW-LEVEL LASER THERAPY IN THE MANAGEMENT OF HYPOSALIVATION IN ELDERLY PATIENTS: A CLINICAL CASE REPORT

Ferreira ACD (1), Leite SHA (1), Gonçalves RIS (1), Costa DRC (1), Silva FA (1), Catão MHCV (1).

e-mail de correspondência: alienycris@hotmail.com

(1) Universidade Estadual da Paraíba, Programa de Pós Graduação em Odontologia

Abstract

INTRODUCTION: Hyposalivation, a condition characterized by reduced salivary flow, is a common problem in the elderly and can negatively impact quality of life, causing difficulties in speech, swallowing, and adaptation to dental prostheses. Low-level laser therapy (LLLT) has emerged as a promising, non-invasive alternative due to its analgesic, anti-inflammatory, and regenerative properties. OBJECTIVE: To evaluate the impact of low-level laser therapy on the treatment of salivary hypofunction in an elderly patient, aiming to improve salivary production through a non-invasive therapy that provides relief from musculoskeletal disorders with its analgesic and anti-inflammatory properties, while also assisting in the repair of damaged nerve fibers. CASE REPORT: An 88-year-old edentulous female patient reported difficulties in speech, swallowing, and adaptation to full dentures, negatively affecting her quality of life. She sought the services of the Laser Therapy Clinic (LIL/UEPB) with a chief complaint of dry mouth sensation for approximately ten years. The diagnosis was suggestive of hyposalivation, evidenced by dry oral mucosa and reduced salivary flow. The treatment consisted of applying low-level laser therapy according to literature protocols: 1 J to the major salivary glands (parotid, submandibular, and sublingual) with 10 seconds per point (808 nm, 100 mW), 0.5 J to the minor salivary glands, except the palatine raphe and gingiva, with 5 seconds (660 nm, 100 mW), and 5 J to the dorsal tongue (660 nm, 100 mW, 50 seconds). The patient received weekly sessions for 12 weeks, resulting in increased salivary production and symptom stabilization after three months. CONCLUSION: Low-level laser therapy proved effective in stimulating salivary flow and improving the sensation of oral moisture, offering a safe and viable alternative for managing hyposalivation in the elderly.

Key words: Low-level laser therapy, hyposalivation, elderly.
Study type: Relato de caso/Serie de casos (Case report/Case series)

83

ACTION OF LIGHT IN MUSCLE REPAIR IN ANIMALS WITH OBESITY: EVALUATION OF THERAPEUTIC BENEFITS

(1) Caprioli, B, (2) Souza, AS., (3) Gomes, KS.,(4) Malavazzi, TCS., (5) Horliana, ACRT., (6) Bussadori SK., (7) Fernandes, KPS., (8) Mesquita-Ferrari, RA.

e-mail de correspondência: brunacaprioli@uni9.edu.br

(1)Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

(2) Universidade Nove de Julho, Programa de Pós Graduação em Ciências da Reabilitação

Abstract

The primary causes of obesity include genetic predisposition, deficiencies in the synthesis and action of leptin or other gastrointestinal hormones, defects in hypothalamic neural systems, impairments in mechanisms controlling energy expenditure, and reduced metabolic energy expenditure and thermogenesis. Additional factors such as social, financial, and cultural influences, along with a sedentary lifestyle and poor diet also contribute to the development of obesity. This condition can increase the risk of muscle injuries, compounding pre-existing risks. photobiomodulation (PBM), used at the local of injury and in a systemic way as vascular PBM is shown positive effects in muscle repair process. Aim: The study aims to assess the effects of Vascular Photobiomodulation (VPBM) and Local Photobiomodulation (LPBM) on the inflammatory response and morphological characteristics of skeletal muscle following acute injury in obese animals. Methods: Male Wistar rats, started on a high-calorie diet at 6 weeks of age, will be used for the study. The animals will be divided into the following experimental groups: G1 – Control (animals fed a high-fat diet (HFD) without cryoinjury and without PBM, n=5); G2 – HFD-fed animals with cryoinjury (n=5); G3 – HFD-fed animals without cryoinjury + preventive VPBM (n=5); G4 – HFD-fed animals with cryoinjury + therapeutic VPBM (n=5). The animals will be weighed weekly, and their food intake will be recorded. Serum glucose levels will be monitored through tail blood sampling, with glucose and insulin sensitivity tests performed. VPBM will be applied over the caudal vein/artery (780 nm, 40 mW, 80 s, 3.2 J) daily for day 1-, 5- and 7-days post-injury groups. The cryoinjury will be induced in the tibialis anterior muscle using a metal bar cooled in liquid nitrogen. Muscle samples will be collected at 1-, 5- and 7-days post-injury, processed, stained with hematoxylin-eosin (H&E), and photographed. Morphological features related to muscle repair, including myonecrosis, inflammatory infiltrate, and blood vessels, were evaluated both quantitatively and qualitatively using the ImageJ cell count software. Data will be analyzed using statistical methods. Quantitative variables, such as muscle cross-sectional area, inflammatory cell counts will be expressed as mean ± standard deviation (SD). Comparisons between groups and periods will be performed using one-way ANOVA 2-way.

Key words: overweight, laser, skeletal muscle, regeneration.
Study type: Protocolo Estudo experimental em animais (Experimental study in animals)

84

EFFECTS OF ERBIUM-YAG LASER IN WOMEN WITH GENITOURINARY SYNDROME OF MENOPAUSE USING ESTROGEN THERAPY: RANDOMIZED, CONTROLLED AND DOUBLE BLIND STUDY

Souza MCCD(1), Chavantes MC(1), Zamuner SR(1), Di Bella ZIKJ(2), Souza SDL(3)

e-mail de correspondência: monicadrago@uni9.edu.br

(1)Postgraduate Program of Biophotonics-Medicine (UNINOVE), São Paulo, Brasil

(2) Universidade Federal de São Paulo, Departamento de Ginecologia;

(2)Pontifícia Universidade Católica de São Paulo, Departamento de Graduação em Medicina

Abstract

Introduction: Chronic, progressive hypoestrogenism, without adequate treatment by the postmenopausal period, affects, significantly, the epithelium of the urogenital system, causing Genitourinary Syndrome of Menopause (GSM). This disorder impacts the quality of life of thousands of women, favoring the emergence of other pathologies, including increasing the risk of gynecological infections from opportunistic microorganisms, due to the increase in vaginal pH, destabilizing the natural immunological vaginal barrier. Therapies with the Erbium:YAG (Er:YAG) 2940nm laser and low-dose topical estrogen therapy have demonstrated safety and efficacy in improving vaginal trophism, thus being crucial for the reestablishment of adequate flora. Objectives: This study proposes to evaluate the effects of the Erbium-YAG laser on women with GSM using isolated topical estrogen therapy, comparing associated therapies. This is a randomized, double-blind clinical study. Methodology: Sixty patients will be recruited and divided into two groups. All will receive low-dose topical estrogen therapy for 14 consecutive days and then twice a week for 16 weeks, in addition of Er: YAG laser every 4 weeks for 3 sessions. In Group 1 (placebo), the laser will be applied in the off mode (Laser-off), while in Group 2, on mode (Laser-on = (9J/cm² and 2Hz on internal region and 6J/cm² and 2Hz on external region). Inclusion eligibility criteria include age between 45 and 70 years, pH >5, non-users of hormone replacement and intimate treatments by the use of energy for 180 days and with moderate symptoms of vaginal atrophy (SCORE>4). The exclusion criteria would be corticosteroid therapy users, for 90 days, altered cytology tests in the last 6 months BMI>=35 kg/m2, We will compare the 2 groups of patients, Pre and 0,8 e 16 weeks post 1st session. The primary variable is the Vaginal Health Index. Secondary variables will be vaginal secretion culture exams, focusing on G. vaginallis and C. Albicans, pH monitoring, and quality of life questionnaires. Data statistical analysis: The Groups will be carried out using the SPSS software, version 22.0. For analytical statistics, the repeated measures ANOVA test and Friedman's test for continuous and categorical data will be employed, respectively. A p-value <0.05 will be considered statistically significant. Satisfactory results will be expected in the use of both therapies, predominantly in Group 2, causing relief of symptoms.

Key words: Genitourinary Syndrome of Menopause (GSM); Erbium-YAG laser (Er:YAG); vaginal atrophy; topical estriol.

Study type: Protocolo clínico ou experimental (Clinical or experimental protocol)

85

Effect of Photobiomodulation and TGF-β1 in Macrophage Proliferation Following Exposure to Bothrops jararacussu snake Venom

David AC (1, 2), Amin M (2), Tang WM (2), Varsani RV (2), Arany PR (2), Zamuner SR (1).

e-mail de correspondência: amandacdavid96@gmail.com

(1) Universidade Nove de Julho, Programa de Pós Graduação em Medicina
(2) University at Buffalo, New York, USA Departments of Oral Biology, Surgery and Biomedical Engineering

Abstract

Botropic envenomations are a significant public health threat in Latin America. The venom of Bothrops jararacussu (BjsV) is highly myotoxic and causes both local and systemic morbidity. While antivenom therapy remains the primary treatment, its efficacy is largely limited to systemic manifestations, leaving local tissue damage largely unaddressed. Delayed or absent administration of antivenom can result in severe local reactions, leading to permanent tissue damage or even limb amputation. Given the severity of these local effects and the limited protection offered by antivenom, alternative or complementary treatments are urgently needed to mitigate local myotoxicity. Photobiomodulation therapy (PBM) has emerged as a promising approach to reduce local tissue damage associated with Bothrops envenomation. PBM has been shown to alleviate myotoxicity, modulate inflammatory responses, and promote muscle regeneration. The present study aims to explore the effects of PBM and TGF-β1 on the proliferation of RAWSEAP macrophage cells after exposure to BjsV. We first performed a dose-response with varying concentrations of BjsV in 48-well plates containing $1x10^4$ cells per well using Alamar blue assay. We observed 75 and 100 µg/ml as the most appropriate doses for subsequent experiments. Next, we examined the role of PBM using a ThorLaser system with parameters (660 nm, 10 mW/cm², 400s, 4 J/cm², 7.6 p.J/cm2, 1.7 Einstein) and (810 nm, 10 mW/cm² 500s, 5 J/cm², 7.5 p.J/cm2 and 1.7 Einstein). We observed PBM treatments with 810 nm significantly (n = 9, p > 0.05) enhanced macrophage survival post-BjsV exposured at 3 and 24 hours. TGF-β1 treatments not demonstrated any synergistic effect with BjsV under any of the tested conditions or time points. To examine the role of TGF-β1 in the PBM rescue, we pre-treated RAW cells post-BjsV exposure with SB431542 (10µM) and performed PBM treatments. We observed that both the 660nm PBM and the 810nm PBM, together with SB431542, also promoted significantly (n = 9, p > 0.05) the macrophage protection and induced proliferation after 24 hours. Ongoing studies are examining the effects of PBM on macrophage migration and phagocytosis. These preliminary findings suggest that PBM, particularly at 810nm, holds potential as a therapeutic intervention to address local inflammation and tissue damage induced by Bothrops venoms.

Key words: Bothrops jararacussu, low-level laser, TGF-β1, inflammation

Study type: Estudo experimental em in vitro (Experimental study in vitro)