
International seminar of
Lasers and Biomedical Photonics
Main Scope: Photodynamic therapy (PDT)
Tehran. October 18th-20th, 2023
with CME Score
Valery V. Tuchin
Head of Chair of Optics and Biophotonics at Saratov State University
Vanderlei Salvador Bagnato
Prof. of Photonics, São Carlos Institute of Physics (IFSC), University of SaoPaulo, Brazil
Jörg Meister
Dept. of Periodontology, Conservative & Preventive Dentistry, Bonn University, Germany
Farahnaz Khalighi Sigaroodi
Medicinal Plants Research Center, Institute of Medicinal Plants, ACECR
Lilian Tan Moriyama
Prof. of Photonics, São Carlos Institute of Physics (IFSC), University of SaoPaulo, Brazil
Sogol Saberi
Laser Research Center of Dentistry, Dentistry Research Institute, TUMS, Tehran, Iran
Khatereh Khorsandi
Assistant prof.of Biochemistry, Department of Photodynamic, MLRC, Yara Institute, ACECR, Postdoctoral Scientist, George Washington University
Ana PAULA Silva
Prof. of Photonics, São Carlos Institute of Physics (IFSC), University of SaoPaulo, Brazil
Farhad Seif
Assistant Prof. of Immunology, Department of Photodynamic, MLRC, Yara institute, ACECR, Tehran, Iran
Parvin Mansouri
Prof. of Dermatology, Medical Laser department, MLRC, Yara institute, ACECR, Tehran, Iran
Reza Fekrazad
Prof. Laser Research Center in Medical Sciences, AJA University of Medical Sciences, Tehran, Iran
Leila Ataie Fashtami
Assistant Prof. of Dermatology, Department of Regenerative Medicine, Royan Institute for Stem Cell Biology & Technology, ACECR, Tehran, Iran
Afshan Shirkavand
Assistant Prof. of Biophotonics, Medical Physics, Department of Photodynamic, MLRC, Yara institute, ACECR, Tehran, Iran
Ezeddin Mohajerani
Prof. of Photonics, Shahid Beheshti University, Laser and Plasma Research Institute
Maryam Sadat Ghoraishi
Research Fellow, Nanotechnology research fellow, Department of Photodynamic, MLRC, Yara Institute, ACECR, Tehran, Iran
Nasim Chiniforush
DDS, PhD, Department of Surgical Sciences and Integrated Diagnostics, University of Genoa, Genoa, Italy.
Seyed Mahdi Tabaie
Associate Prof.of Dermatology, Medical Laser department, MLRC, YARA Institute, ACECR, Tehran, Iran
Parviz Parvin
Prof. of Physics, Department of Energy Engineering and Physics, Amirkabir University of Technology-Tehran Polytechnic
Masoud Habibi
Assistant prof., Head of TUMS branch, ACECR, Department of Photohealing and Regeneration, MLRC, Yara Institute, ACECR, Tehran, Iran
Mohsen Fateh
Research Fellow, Lifestyle Medicine Department, MLRC, Yara Institute, ACECR, Tehran, Iran
Mohammadreza Razzaghi
Professor of Urology, Shahid Beheshti Medical University, Tehran, Iran
Fedora Khatibi Shahidi
Biochemistry, Research fellow, Department of Photodynamic, MLRC, Yara Institute, ACECR, Tehran, Iran
Shamim Fayazmanesh
Former secretary of the working group for supporting knowledge-based companies and new technologies of IFDA
Chairman:
Prof. M.Reza Razzaghi
Scientific Chair:
Prof. Reza Fekrazad
Executive Chair:
Dr. Afshan Shirkavand
Executive board: Dr. Zahra Razzaghi
Ms. Solmaz Zare
ACECR
Medical Laser Research Center
National Lasers in medicine research network
Co operators:

National/international Scientific Committee (Alphabetic):

Collaboration of:

- National Lasers in Medicine Research Network
- Research Center of Laser Applications in Medical Sciences, SBMU
- Photodynamic Department, Medical Laser Research Center, YARA Institute,
- ACECR
- Radiation Sciences Research Center. AjaUMS

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 1

Photodynamic therapy in Brazil: from cancer to microbiological control

V. S. Bagnato*, K. Blanco. C. Kurachi, N. Inada

IFSC-University of São Paulo, São Paulo, Brazil

Email: vander@ifsc.usp.br

ABSTRACT

Photodynamic therapy in Brazil has been an excellent option for skin cancer treatment, cervix and also for the control of infections, especially those resistant to antibiotics. In this presentation we will explain how we have been acting with the development of protocols that today reach a success rate of 95% of tumor elimination as well as the approval of the treatment by the unified public health system. The advantages of using photodynamic therapy for countries with an emerging economy should be discussed. In the microbiological control part, we will explore the problem of bacterial resistance as well as the opportunities created by photodynamic inactivation in different types of infections, including pneumonia. Breaking down bacterial resistance to antibiotics will also be addressed.

Keywords: Photodynamic action, Skin cancer, Cervical cancer, HPV lesions and microbiological control

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 2

aPDT in Combating Oral Pathogens

Nasim Chiniforush*

Department of Surgical Sciences and Integrated Diagnostics, University of Genoa, Genoa, Italy

Email: nasimch2002@yahoo.com

ABSTRACT

The most important aim of dental treatment is to lessen the microbial load. Among diverse antibacterial laser-based approaches, antimicrobial Photodynamic Therapy (aPDT) is strongly considered to be a minimally invasive and safe method. This strategy incorporates special wavelength light to affect a photosensitizer in the presence of oxygen to lead cytotoxic products which lead to cell death. Different sorts of chemical and natural photosensitizers like toluidine blue, methylene blue, indocyanine green, phycocyanin, and curcumin are used. This new method of utilizing aPDT with chemical and natural photosensitizers with potential biological activities can be useful as a supplement to conventional treatment. This lecture aims to assess the anti-bacterial effectiveness of aPDT for oral bacteria.

Keywords: Antimicrobial PDT, Oral, Pathogens

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 3

Photodynamic in Basal Cell Carcinoma

Seyed Mehdi Tabaie*

Associated Professor of Dermatology, Medical Laser Research Center,YARA Institute,ACECR, Tehran,Iran

Email: smtabaie@yahoo.com

ABSTRACT

More than 125 years have passed since the discovery and introduction of photodynamic therapy in medicine. Today, using light-sensitive materials and various light sources, extensive uses for photodynamic therapy have been proposed in the medical field. BCC cancer, the most common skin cancer, is one of the important treatment goals in the field of PDT in dermatology. Of course, limitations such as the thickness and type of tumor, the light source used, and the unwanted side effects of light-sensitive drugs have caused extensive research in the world to remove these obstacles.

Keywords: PDT, Dermatology, BCC, Carcinoma

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 4

Herbal Photosensitizers

Farahnaz Khalighi-Sigaroodi*

Medicinal Plants Research Center, Institute of Medicinal Plants, ACECR, Karaj, Iran

Email: khalighi@imp.ac.ir

ABSTRACT

Herbal photosensitizers for photodynamic therapy (PDT) have reached a noteworthy consideration recently due to their potential as alternative treatment choices for a multitude of abnormalities like cancer. PDT could be a non-invasive therapeutic strategy that utilizes a photosensitizer, light, and tissue oxygen to specifically eliminate abnormal cells or tissues. Traditional photosensitizers used in PDT are often synthetic compounds that can have limitations such as high cost, limited availability, and potential side effects. Herbal photosensitizers offer a promising solution by providing natural alternatives that are readily available, cost-effective, and potentially safer. One example of an herbal photosensitizer is hypericin, derived from Hypericum perforatum. Hypericin has been extensively studied for its photodynamic properties and has shown promising outcomes in the treatment of various cancers. Additionally, hypericin seems to have anti-inflammatory, and antioxidant properties, further enhancing its therapeutic potential. Another herbal photosensitizer is curcumin, derived from Curcuma longa. Curcumin has long been recognized for its anti-inflammatory and anticancer properties. Other herbal photosensitizers such as furanocoumarins, polyacetylenes, thiophenes, polymorphing, alkaloids, anthraquinone, and chlorophyll derivatives from green plants have also shown promise in PDT applications. These natural compounds offer advantages such as low toxicity, biodegradability, and ease of synthesis. However, despite their potential benefits, there are still challenges associated with the use of herbal photosensitizers in PDT. One major challenge is the standardization of the active components within these herbal extracts to ensure consistent therapeutic efficacy. Additionally, further research is needed to optimize their delivery methods and enhance their selectivity towards target cells. In conclusion, herbal photosensitizers hold great promise as alternative options for photodynamic therapy. However, more investigation is required to completely understand their mechanisms of action and optimize their therapeutic potential to harness the full benefits they offer in the field of photodynamic therapy.

Keywords: Herbal photosensitizers, Photodynamic therapy, Hypericin, Curcumin, Cancer

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 5

PDT-Induced Immunomodulation

Farhad Seif*

Department of Photodynamic, Medical Laser Research Center, ACECR, Tehran, Iran

Email: farhad.seif@outlook.com

ABSTRACT

Photodynamic therapy (PDT) could be a cancer treatment that applies photosensitizer materials and light to initiate cell death in tumor cells. Moreover, it can modulate the immune system, leading to augmenting anti-tumor immune responses. The immunomodulatory effect of PDT is thought to be mediated by several mechanisms, including the release of damage-associated molecular patterns (DAMPs) and reactive oxygen species (ROS), activating dendritic cells and T cells, and the inhibition of regulatory T cells (Tregs). PDT-induced immunomodulation can enhance the efficacy of cancer immunotherapy, including checkpoint inhibitors and adoptive T-cell therapy. However, there is still much to be learned about the optimal timing, dosing, and combination therapies for PDT-induced immunomodulation. Studies have shown that PDT-induced immunomodulation can improve anti-tumor immune reactions in some cancers, including melanoma, breast cancer, and lung cancer. PDT can lead to immunogenic cell death, which can promote the uptake of tumor antigens by cells of antigen-presenting (APCs) and activating of T cells. PDT-induced immunomodulation has also been shown to inhibit the activity of Tregs, which are known to suppress anti-tumor immune responses. Furthermore, PDT can activate dendritic cells, which have a vital role in stimulating and regulating immune responses. Although PDT-induced immunomodulation is promising as a cancer treatment strategy, there are still challenges that need to be addressed. For example, the optimal timing and dosing of PDT for other cancer treatments, such as chemotherapy and radiation therapy, is not yet fully understood. In addition, there is a need to identify biomarkers that can predict the response to PDT-induced immunomodulation. In conclusion, PDT-induced immunomodulation is an emerging area of research with promising potential for improving cancer treatment outcomes. However, extensive studies are vital to better understand the mechanisms underlying PDT-Induced Immunomodulation and to develop effective clinical strategies for its application.

Keywords: Photodynamic therapy (PDT), Immunomodulation, Anti-tumor immune response, Cancer treatment

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 6

Biological Mechanisms of Photodynamic Therapy

Mohsen Fateh*

Yara Institute, Medical Laser Research Center, ACECR, Tehran, Iran

Email: fatehmohsen@yahoo.com

ABSTRACT

Photodynamic reactions have many therapeutic and diagnostic applications due to their biological properties. The prominent feature of these reactions is their selective effect in the diagnosis and treatment of malignant and pre-malignant lesions, inactivation of bacteria, and special effects on tissue vascular structure without mutagenic effects. These effects take place through the activation of a photosensitizer by a defined wavelength of visible light by the existence of oxygen. The inactivation of the photosensitizer will be fluorescence properties used in diagnostic procedures and on the other hand by stimulating chemical reactions through intracellular signaling pathways through the induction of reactive oxygen (ROS) or nitrogen species (RNS) by inducing electron or energy transfer. It will have tissue-specific effects from cell growth stimulation, tissue damage repair, and autophagy to apoptosis and necrosis. According to this spectrum, the effects of photodynamic reactions depend on the type of photosensitizer, light dose, incubation period of the photosensitizer and the characteristics of the target cell can induce various biological effects in the tissue and thus show many clinical and paraclinical applications.

Keywords: Photodynamic reaction, Biological effect, ROS, RNS

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 7

Photosensitizers: An overview

Fedora Khatibi Shahidi*

Department of Photodynamic, Medical Laser Research Center, Yara Institute, ACECR

Email: fkhatibish@gmail.com

ABSTRACT

One of the three vital components of photodynamic therapy, other than light and oxygen, with photosensitizers. Dyes are characterized as substances with light absorption at a particular optical window, running photochemophysical reactions. As in each group of drugs, photosensitizer can be classified as high chemical purity grade, being stable at normal temperature, photosensitive effect by light, and high photochemical reactivity; the peak light absorption might happen at 600 - 800 nm wavelength, absorption minimum in the spectrum from 400 nm to 600 nm, while it should not overlap the absorption range of other tissue components (including endogenous dyes such as melatonin, hemoglobin or oxyhemoglobin), minimal cytotoxicity in the dark, easy tissues solubility, high selectivity for neoplastic lesions, inexpensive and simple accessibility. Hematoporphyrin derivative (HpD) as the first photosensitizer (PS) was a water-soluble mixture of porphyrins, and a more purified preparation later became known as Photofrin. The most effectual PSs are relatively hydrophobic materials with sharp diffusion into tumor cells and intracellular components such as mitochondria and endoplasmic reticulum (ER). Most of the PSs used in the cancer field are based on the tetrapyrrole backbone, a structure similar to that included in the protoporphyrin in hemoglobin. Since the light penetration into tissue deep with wavelength, agents with strong absorbance in the deep red spectral region like chlorins, bacteriochlorins, and phthalocyanines tend to make much more efficient PSs, even though many other factors are also important.

Keywords: Photosensitizers, Photodynamic therapy, Porphyrin, Cancer

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 8

Updates of Clinical Photodynamic Therapy

Reza Fekrazad*

Professor of Dentistry, Head of Radiation Sciences Research Center, AJA University of Medical Sciences, Tehran, Iran

Email: rezafekrazad@gmail.com

ABSTRACT

Photodynamic therapy (PDT) is a medical treatment modality that uses photosensitizing agents, light, and oxygen to create a therapeutic effect. Initially, this therapy was used primarily in the treatment of cutaneous tumors, but recent research has explored the use of this technique in a range of other oncologic and non-oncologic indications. This presentation will cover the latest advances and new horizons in photodynamic therapy.

One of the primary topics to be addressed is the use of PDT in the treatment of various cancer types. Clinical studies have shown that PDT can effectively treat both early and advanced forms of cancer, especially those that are resistant to traditional treatments such as chemotherapy and radiation. In addition, researchers have explored the use of PDT as an adjuvant therapy to increase the effectiveness of other treatment modalities.

Another area of study highlighted in this presentation is the development of new photosensitizing agents that can improve the efficacy and enhance the safety of PDT. Several novel photosensitizing agents have been developed and are now in clinical trials. This congress will provide an update on the most promising of these new agents.

The use of nanotechnology in PDT is another exciting area of research being presented in this lecture. Nanoparticles can effectively deliver the photosensitizer to the target tissue, which can create a more effective therapeutic effect while reducing the potential for side effects.

Finally, the application of PDT beyond oncologic indications will also be discussed and also, and the qualitative improvement of light sources and photosensitizer materials and the specific targeting of tumor cells or microorganisms will be discussed and investigated.

In conclusion, this talk provides the latest findings and insights into the emerging trends and new horizons in photodynamic therapy. It will highlight the recent advances and future opportunities in the use of PDT in various medical disciplines, providing clinicians with a comprehensive perspective on the role of photodynamic therapy in modern healthcare.

Keywords: Cutaneous tumors, Clinical updates, Photodynamic therapy

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 9

Nanotechnology assisted photodynamic therapy

Maryam Sadat Ghorashi*

Department of Photodynamic, Medical Laser Research Center, Yara Institute, ACECR, Tehran, Iran

Email: Maryam.ghorashi@gmail.com

ABSTRACT

Photodynamic therapy (PDT), as a local cancer treatment strategy, manifests great promise compared to chemotherapy and radiotherapy. However, the drawbacks of conventional organic photosensitizers such as hydrophobicity, deficient stability, and poor tumor selectivity have immensely restricted the PDT functionality. Alternatively, nanomaterials with exceptional physicochemical features have emerged to circumvent these shortcomings. Herein, rational architectures of nanoparticles to address the anti-tumor efficiency of PDT via the cancer-targeting property, oxygen furnishing, and combined therapeutic/diagnostic strategies have been discussed.

Keywords: Photodynamic therapy, Nanomaterials, Cancer-specific targeting, Synergistic therapy, Hypoxic tumor

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 10

An Update on Photodynamic Therapy in Wound Healing

Khatereh Khorsandi*

Department of Photodynamic, Medical Laser Research Center, Yara Institute, ACECR, Tehran, Iran

Emails: Khorsandi.kh@ut.ac.ir, Biochem.kh@gmail.com

ABSTRACT

Photodynamic therapy (PDT) is classified as a less invasive modality for treatment that has received significant attention in years as a new therapy for cancer treatment, bacterial resistance, and wound healing. PDT uses photosensitizers (PS) that, after being irradiated by light at a special wavelength, react with the molecular oxygen to generate reactive oxygen species (ROS) in the target tissue. ROS produced during PDT could induce two different pathways. If PDT produces control and low ROS, it can lead to cell proliferation and differentiation. However, excess production of ROS by PDT causes cellular photodamage which is the main mechanism used in cancer treatment. In comparison to routine modalities, PDT shows greater selectivity against tumor cells, due to the use of PS that is preferentially localized in tumor lesions, and the precise light irradiation to these lesions. Antimicrobial photodynamic therapy (aPDT) has shown remarkable activity against bacterial pathogens in both planktonic and biofilm forms. There has been little or no resistance development against antimicrobial photodynamic therapy. In addition, new developments in treatment involve a combination of PDT with other modalities and technologies to make their effectiveness more compatible, and the result more synergistic. Research also shows the development of newly enhanced selective PS for tumors and great potential to overcome bacterial resistance and bacterial biofilm formation for speeding the wound healing process and improving PDT efficacy.

Keywords: PDT, Wound healing, Antimicrobial PDT, Low dose photodynamic therapy, ROS

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 11

Daylight Photodynamic therapy: Past till now

Leila Ataie Fashtami MD[1,2], Afshan Shirkavand PhD[2*]

[1]Department of Regenerative Medicine, Royan institute for cell biology and technology, ACECR, Tehran, Iran
[2]Department of Photodynamic, Medical Laser Research Center, Yara institute, ACECR, Tehran Iran

Email: ataiefash@gmail.com

ABSTRACT

Conventional photodynamic therapy, though proven effective and even first-line treatment for many benign, premalignant, and malignant conditions, suffers from many limitations including pain, limited access to light sources, and sophisticated dosimetry. However, Daylight PDT applies low dose PDT by consuming a lesser amount of photosensitizer, lower power density of sunlight irradiation over several hours, and as a result, is accompanied by less or almost no pain. It is accessible in most geographical regions for most sunny days of the year needing less sophisticated equipment and staff which makes it a more and more popular remedy for various skin conditions. Hereby, we tried to give a history of past and present applications of daylight PDT and its future potential in dermatology.

Keywords: Photodynamic therapy (PDT), Day light, Conventional

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 12

Hybrid laser-activated Phycocyanin/Capecitabine treatment of cancerous MCF7 cells

Sahar Jahdi Abdollahi, Parviz Parvin*, Sara Mayahi, Solaleh Seyedi, Parnian Mohsenian, and Fatemeh Ramezani

Department of Energy Engineering and Physics, Amirkabir University of Technology, Tehran, Iran

Email: parvin@aut.ac.ir

ABSTRACT

Laser-induced fluorescence (LIF) is applied as a recent efficient technique in non-invasive cancer diagnosis. Here, the synergic therapeutic efficacies of the Capecitabine (CAP) chemo drug, photosensitive Phycocyanin (PC), and graphene oxide (GO) under laser irradiation were investigated. The efficacy of wide CAP concentrations (0.001-10 mg/ml) and PC (0.5-10 mg/ml) in combination with laser on human breast adenocarcinoma (MCF-7) cells were investigated. The effects of 100 mW SHG Nd: YAG laser at 532nm, and GaAs laser with 808 nm (power: 150 mW- 2.2W) were used. Graphene oxide (GO) in concentrations of 2.5-20 ng/ml and thermal characteristics of laser exposure at 808 nm on GO+ fluorophores have been studied. The effects of the bare and light-excited CAP+PC on cell death have been calculated. While the laser light could not hold up the cell proliferation without drug interaction considerably; however, the viability of the treated cells (by a combination of fluorophores) under laser exposure at 808 nm was significantly reduced. The laser at 532 nm excited the fluorescent PC in (CAP+PC) to trigger the photodynamic processes via oxygen generation. Through the in-vitro experiments of laser-induced fluorescence (LIF) spectroscopy of PC+CAP, the PC/CAP concentrations of the maximum fluorescence signal and spectral shifts have been characterized. The synergic effects of the laser exposures and (CAP+PC) treatment at different concentrations were confirmed. Here, laser activation of (CAP+PC) has been found to lessen chemotherapy doses, minimizing adverse effects while inducing malignant cell death. Increasing laser intensity/exposure time enhances therapeutic effectiveness. Combining GO and fluorophores with laser exposure at 808 nm reduces cell survival, offering potential benefits for clinical protocols using laser spectroscopy in adenocarcinoma imaging, diagnosis, and treatment with PC+CAP+GO.

Keywords: Hybrid, Laser-activated, Phycocyanin/Capecitabine, Cancer

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 13

Efficacy of Natural Photosensitizers in Anticancer Photodynamic Therapy

Sogol Saberi[*]

Laser Research Center of Dentistry, Dentistry Research Institute, Tehran University of Medical Sciences, Tehran, Iran.

Email: saberisogol@gmail.com

ABSTRACT

Photodynamic therapy has made it possible to treat many tumors, including oral cancers, especially in pre-cancerous lesions where these treatments cause the least complications by removing a large lesion on the surface. In these treatments, the removal of the lesion is limited to the superficial epithelial layers, and the sub-epithelial collagen and elastin remain intact, causing repair with minimal scarring, resulting in proper tissue appearance and function.

The advantages of using PDT compared to conventional treatment methods, such as surgery, radiotherapy, and chemotherapy, include minimal invasiveness, excellent functional results with improved quality of life, minimal scar after treatment, low treatment cost, simplicity of the technique and the possibility of reproducibility of treatment.

Today, new light-sensitive materials are easily prepared using the synthesis of natural materials such as hema, chlorophyll, and bacteriochlorophyll, which compared to the synthesis of chemical materials, have advantages such as economic and environmental benefits, biological compatibility, better solubility in water, and easier removal from normal tissues. Riboflavin, curcumin, and porphyrins can be mentioned among these substances.

Keywords: Photodynamic Therapy, Photosensitizers, Natural products

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 14

Photodynamic therapy Combined Conventional Therapy in Cancer treatment

Afshan Shirkavand[1*], Ghazale Geraily[2], Leila Ataie Fashtami[3]

[1]PhD, Assistant Professor of Biophotonics, Medical Physics, Department of Photodynamic, Medical Laser Research Center, YARA institute, ACECR, Tehran, Iran
[2]PhD, Associate Professor of Medical Physics, Medical Physics Department, Tehran University of Medical Sciences, Tehran, Iran
[3]MD, Assistant Professor of Dermatology, Department of Regenerative Medicine, Royan Institute for Stem Cell Biology &Technology, ACECR, Tehran, Iran

Email: shirkavand@acecr.ac.ir

ABSTRACT

Cancer as a pathological condition is characterized by the uncontrollable cell proliferation or dysregulation of cell signaling pathways at multiple steps. Conventional cancer treatment is the therapeutic approach to cure or shrink the tumor or stop the progression of cancer using surgery, radiation, medications, and other therapies in the form of primary treatment, adjuvant treatment, or palliative treatment. Photodynamic therapy (PDT) is considered to have impressive therapeutic effects for a variety of cancers using reactive oxygen species (ROS) which induces an immune response. Photodynamic therapy is a medical technology approved for the treatment of various malignant diseases. By combination therapy of malignancies, treatments employ different antitumor mechanisms, at the same time complementary or even synergistic effects can be achieved. A combination treatment regimen aims to increase efficiency and above all complete removal of the tumor using excision survival mechanisms of tumor cells resistant to PDT. In this manner, they become more susceptible to the next PDT tumors and some pre-cancerous and non-cancerous diseases. To date, much data has been published on the combination of PDT with conventional and innovative treatments like radiotherapy, treatment with chemo-drugs, photothermal therapy (PTT), cold plasma therapy, and immunotherapy. This presentation aims to review the research in this area in recent years.

Keywords: Photodynamic Therapy (PDT), Cancer, Treatment, Conventional therapy

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 15

Photo physical aspects of PDT

Ezeddin Mohajerani*

Laser and Plasma Research Institute, Shahid Beheshti University, Tehran, Iran

Email: e-mohajerani@sbu.ac.ir

ABSTRACT

In this talk after a short review of photodynamic therapy and its applications, the main parts and steps of this process will be discussed. The photosensitizer is the main part of the mechanism that is responsible to be collected at unwanted cells such as tumors, and its aspects will be discussed briefly. This substance needs accurate design and synthesis to be sensitive to light, to produce active oxygen after irradiating with light, and more importantly to be absorbed in unwanted cells and not in living cells. The design of such materials needs accurate studies in biology, chemistry, and biochemistry. The main role of physics starts after accessing this substance to study the photophysical processes after material irradiation with light. Based on the situation, choosing the proper light source with the proper wavelength, intensity, duration, and spot size, to make the reaction more specified and effective will be discussed.

Keywords: Photodynamic therapy, Light sources, Light interaction

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 16

Light Dosimetry for PDT

Moriyama, L.T.

São Carlos Institute of Physics, University of São Paulo, São Carlos/SP-Brazil

Email: lili@ifsc.usp.br

ABSTRACT

Photodynamic Therapy (PDT) is a medical approach method based on the interaction between photosensitive agents and light to generate reactive oxygen species to selectively eliminate malignant cells. To optimize PDT effectiveness while minimizing side effects, precise light dosimetry is important. In this talk I will provide an insight into the central role of PDT light dosimetry, elucidating its principles, importance, and practical applications. This presentation commences by laying the foundation of light dosimetry principles, highlighting the critical elements of the light source, the computation of light parameters, and the determination of the therapeutic light dose. The interdependence of these factors in influencing PDT outcomes is emphasized. Furthermore, challenges inherent in light dosimetry, including tissue optical properties and light distribution, are explored, underscoring the necessity for optimized dosimetry strategies, such as Monte Carlo simulations. Studies performed by our group in Brazil are examples of what is possible to do to optimize PDT outcomes. Emerging trends and research focus areas that promise to expand PDT's therapeutic potential and clinical applications are also considered. In conclusion, this presentation highlights the fundamental role of light dosimetry in PDT. Showing that precision, safety, and knowledge concerning light interaction with tissues are essential for the establishment of a personalized PDT dosimetry and hence therapeutic success.

Keywords: Light dosimetry, Photodynamic Therapy, Tissue Optics

http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2024.30

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 17

Prospects for Tissue Optical Clearing in PDT and PTT

Valery V. Tuchin

Saratov State University, Russia
[1]Tomsk State University, Russia
[2]Institute of Precision Mechanics and Control, FRC ‘Saratov Scientific Center of the RAS, Russia
[3]Bach Institute of Biochemistry, FRC ‘Fundamentals of Biotechnology’ of the RAS, Russia.

Email: tuchinvv@mail.ru

ABSTRACT

Motivation and basics of tissue optical clearing (OC) will be presented. Challenges of optical imaging and phototherapy caused by strong light scattering in tissues lead to the development of OC technologies based on controllable and reversible reduction of scattering in tissues. Based on application of isosmotic and hyperosmotic agents so called optical clearing agents (OCA), refractive index matching and dehydration methods are used in ex vivo and in vivo studies of animals and humans. Spectral measurements from deep UV to NIR and OCT NIR imaging of tissues are performed. Creation and reversibility of UV windows in different tissues, including human colorectal and gingival tissue, and rabbit lung tissue are demonstrated. Tag-RFP fluorescence intensity in vivo enhanced imaging of mouse cancer cells of mouse tumor xenografts and its combination with MRI after intravenous injection of gadobutrol is shown. Other examples of the efficiency of OC, such as for in vivo adipose tissue in rats, which is motivated to provide internal organ surgery to avoid dissection of hidden blood vessels; blood in samples to detect optically rare melanoma cells; transillumination imaging of human finger joints for monitoring of rheumatoid arthritis; deep photoinactivation of germs using OCAs, creation of subsurface voids by ultrashort laser pulses; laser treatment of porcine costal cartilage doped by nanoparticles; plasmonic photothermal therapy (PPT) of tumors; PDT of melanotic melanoma, are presented. OC technology seems to merit enhanced multimodal spectroscopy/imaging and PDT/PTT. The effectiveness of medical lasers with definite, wavelengths from deep-UV to IR range can be improved considerably due to this technology.

Keywords: Tissue, Laser, Optical clearing, Imaging, Phototherapy

Journal of Lasers in Medical Sciences

2024; Volume 15: e30

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2024.30

Laser and Bio-Medical Photonics (LBMP 2023)

17-19 September 2023
Tehran, Iran

Received: September 17, 2023 **Accepted:** September 19, 2023 **ePublished:** August 1, 2024

Abstract 18

An Insight into Photodynamic Therapy towards Treating Dermatologic Conditions

Parvin Mansouri[1*], Reza Chalangari[2]

[1]Medical Laser Research Centers, Academic Center of Education - Culture and Research, Tehran University of Medical Sciences, Tehran, Iran
[2]Kassir Dermatology, Dallas, Texas, USA

Email: mansouripr@yahoo.com

ABSTRACT

Photodynamic therapy (PDT) is a non-invasive method for light-based treatment that has gathered prominent interest in the new decades for its effectiveness in treating several pathological diseases. Not only does PDT have prominent treatment results in different dermatological disorders, but it also has cosmetic outcomes and improves the overall appearance of the affected area. PDT mediates its action by generating oxygen species that are involved in immunomodulation, reducing microbial load, wound healing, skin rejuvenation, lightning scarring, etc. The indications of approved, off-label dermatologic are actinic keratosis, Bowen's disease, BCC, prevention/treatment of non-melanoma skin cancers (NMSCs) in organ transplant recipients, field cancerization, acne vulgaris, photo rejuvenation, viral warts, psoriasis, keloids, etc. Even though there are a few challenges, still PDT stands to be a promising strategy with continuous efforts towards maximizing clinical efficacy while being cautious of the side effects.The new applications and latest results of PDT in some skin-related conditions will be presented.

Keywords: Photodynamic Therapy, PDT, Treatment, Dermatology