International Seminar of
Lasers and Biomedical Photonics, LBMP 2023

18-20 October 2023, Tehran, Iran
Main Scope: Photodynamic Therapy

Chairman:
Prof. Mohammadreza Razzaghi M.D

Scientific Chair:
Prof. Reza Fekrazad D.D.S, Ph.D.

Executive Chair:
Afshan Shirkavand Ph.D.

Collaboration of:

National Lasers in Medicine Research Network

Research Center of Laser Applications in Medical Sciences, SBMU

Photodynamic Therapy Department of Medical Laser Research Center, YARA Institute, ACECR

Radiation Sciences Research Center. AjaUMS

Wednesday, Oct 18, 2023	
8:30 - 9:00	**Opening Remarks** Prof. Mohammadreza Razzaghi M.D, Prof. Reza Fekrazad D.D.S, PhD Dr. Masoud Habibi M.D, PhD
CHAIRS	***Prof. Ezedin Mohajerani, Dr Mohsen Fateh***
9:00 - 9:30	**Photophysical Aspects PDT** Prof. Ezedin Mohajerani, PhD Professor of Photonics, Laser and Plasma Research Institute,, Shahid Beheshti University
9:30 - 10:00	**Biological Mechanisms of Photodynamic Therapy** Dr Mohsen Fateh, MD, PhD Research Fellow, Medical Laser Research Center, Yara Institute, ACECR
10:00-10:30	**Light Dosimetry in PDT** Dr Lilian Tan Moryama, PhD Professor of Photonics, São Carlos Institute of Physics (IFSC), University of SaoPaulo, Brazil
10:30-11:00	Break
CHAIRS	***Dr Maryam Sadat Ghorashi, Dr. Fedora Khatibi Shahidi***
11:00-11:30	**Photosensitizers: An overview** Fedora Khatibi Shahidi, PhD candidate Department of Photodynamic Therapy, Medical Laser Research Center, Yara Institute, ACECR
11:30-12:00	**Nanotechnology-assisted PDT** Dr Maryam Sadat Ghorashi PhD Department of Photodynamic Therapy, Medical Laser Research Center, Yara Institute, ACECR
12:00 – 13:00	Lunch
CHAIRS	***Dr. Farahnaz Khalighi Sigaroodi, Dr Afshan Shirkavand***
13:00 - 13:30	**Herbal Photosensitizers** Dr. Farahnaz Khalighi Sigaroodi Pharm.D, Ph.D. Medicinal Plants Research Center, Institute of Medicinal, ACECR
13:30 – 14:00	**PDT Combined Conventional Cancer Treatment** Dr Afshan Shirkavand PhD Assistant prof, Department of Photodynamic therapy, Medical Laser Research Center, Yara Institute, ACECR
14:00-14:30	**PDT in Wound Repair** Dr Khatereh Khorsandi PhD Assistant professor, Department of Photodynamic Therapy, Medical Laser Research Center, Yara Institute, ACECR Postdoctoral scientist, George Washington University
14:30-15:00	Q&A

Thursday, Oct 19, 2023

CHAIRS	***Dr. Parvin Mansouri MD, Dr. Leila Ataie Fashtami, Dr. Seyed Mehdi Tabaie***
9:00 – 10:00	**Panel of PDT in dermatology: in cancer & non-cancer** Prof. Parvin Mansouri MD, Professor of Dermatology, Department of Medical Laser, Medical Laser Research Center, Yara institute, ACECR Dr. Leila Ataie Fashtami MD, Assistant Professor of Dermatology, Department of Regenerative Medicine, Royan Institute for Stem Cell Biology & Technology, ACECR Dr. Seyed Mehdi Tabaie MD. Associate Professor of Dermatology, Department of Medical Laser, Medical Laser Research Center, Yara institute, ACECR
10:00-10:30	Break
CHAIRS	***Prof. Reza Fekrazad, Dr. Nasim Chiniforush, Dr. Neda Hakimiha, Dr. Sogol Saberi***
10:30-11:00	**Updates of Clinical Photodynamic Therapy** Prof. Reza Fekrazad DDS,PhD Professor, Radiation Science Research Center, Aja University of Medical Sciences
11:00-11:30	**aPDT in Combating Oral Pathogens** Dr. Nasim Chiniforush DDS, PhD Department of Surgical Sciences and Integrated Diagnostics, University of Genoa, Genoa, Italy
11:30-12:00	**Efficacy of Natural Photosensitizers in Anticancer PDT** Dr. Sogol Saberi DDS, PhD Laser research center of dentistry, Dentistry research institute, Tehran University of Medical Sciences
12:00-13:00	Lunch
CHAIRS	***Dr. Afshan Shirkavand – Dr. Farhad Seif***
13:00 – 13:30:00	**PDT-Induced Immunomodulation** Dr Farhad Seif PhD Assistant prof, Department of Photodynamic Therapy, Medical Laser Research Center, Yara Institute, ACECR
13:30-14:00	**Optical Clearing in PDT and PTT** Valery Tuchin, PhD, Head of Chair of Optics and Biophotonics at Saratov State University, Russia
14:00 – 14:30	**PDT Approach to Eliminate Microorganisms Caused for Onychomycosis** Dr. Ana Paula Silva PhD Faculty member, Photonics, São Carlos Institute of Physics (IFSC), University of SaoPaulo, Brazil
14:30-15:00	Q& A

Friday, Oct 20, 2023

CHAIRS	***Prof. Mohannadreza Razzaghi, Prof. Parviz Parvin, Dr. Fayazmanesh***
9:00 – 9:30	**Photodynamic therapy in Brazil: from cancer to microbiological control** Pro. Vanderlei Bagnato, PhD Professor of Photonics, São Carlos Institute of Physics (IFSC), University of SaoPaulo, Brazil
9:30 - 10:00	**Physical Modeling and Simulation in PDT** Dr Joerge Meister PhD, Dept. of Periodontology, Conservative & Preventive Dentistry, Bonn University, Germany
10:00 -10:30	Break
10:30-11:00	**Laser Activated PDT-Chemotherapy of Breast Cancer: Animal Model** Prof. Parviz Parvin PhD Prof of physics, Department of Physics and Engineering, Amir kabir Technical university
11:00-11:30	**Horizons in PDT in Iran** Prof. Mohannadreza Razzaghi MD Prof of Urology, Laser in Medical sciences Research Center, Shahid Beheshti University of Medical Sciences
11:30-12:00	**Requirements for Approving New Clinical Photosensitizers** Dr. Fayazmanesh Pharm.D., PhD Tehran University of Medical Sciences (TUMS) Former expert of the General Department of Natural, Traditional, and Supplement Products of IFDA
12:00-13:00	**Closing marks**

Prospects for Tissue Optical Clearing in PDT and PTT

Valery V. Tuchin* PhD

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Abstract:

Introduction: 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.

Methods & Materials: 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.

Results: Creation and reversibility of UV windows in different tissues, including human colorectal and gingival tissue, 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 an intravenous injection of gadobutrol are shown. Other examples of efficiency of OC, such as for *in vivo* adipose tissue in rats, which is motivated to provide internal organ surgery with avoiding 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.

Conclusion: OC technology is beneficial for enhanced multimodal spectroscopy/imaging and PDT/PTT treatment. The efficiency of medical lasers working on selected wavelengths in a wide wavelength range from deep-UV to IR range can be improved significantly due to this technology.

Keywords: tissue, laser, optical clearing, imaging, phototherapy

Photodynamic therapy in Brazil: from cancer to microbiological control

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

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Photodynamic therapy in Brazil has been an excellent option for the treatment of skin cancer, 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

Light Dosimetry for PDT

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Introduction: Photodynamic Therapy (PDT) is a promising medical treatment 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. **Methods & Materials:** This presentation commences by laying the foundation of light dosimetry principles, highlighting the critical elements of 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. **Results:** Studies performed by our group in Brazil are examples of what is possible to do for optimizing PDT outcomes. Emerging trends and research focus areas that promise to expand PDT's therapeutic potential and clinical applications are also considered. **Conclusion:** 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

PDT Approach to Eliminate Microorganisms Caused for Onychomycosis

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Daylight Photodynamic therapy: Past, Present and Future

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 therapy, MLRC, Yara institute, ACECR, Tehran Iran

Presenter: Leila Ataie Fashtami

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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 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 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

aPDT in Combating Oral Pathogens

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Abstract:

The main goal in dental treatment is s to eliminate or at least decrease microbial population. Among different antibacterial laser procedures, antimicrobial Photodynamic therapy (aPDT) has gained special attention due to its minimally invasive manner and safety. This technique includes light of a specific wavelength to activate a photosensitizer in the presence of oxygen to produce cytotoxic products which leads to cell death. Various types of chemical and natural photosensitizers like toluidine blue, methylene blue, indocyanine green, phycocyanin, curcumin are used. This new approach of using aPDT with chemical and natural photosensitizers with potential biological activities can be beneficial as an adjunct to conventional therapy. The aim of this lecture is to assess the anti-bacterial efficacy with aPDT against oral bacteria.

Keywords: Antimicrobial Photodynamic therapy, Oral bacteria, chemical photosensitizer, Natural photosensitizer.

Biological Mechanisms of Photodynamic Therapy

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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 specific wavelength of visible light in the presence 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 production 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

Requirements for Approving New Clinical Photosensitizers

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Updates of Clinical Photodynamic Therapy

Reza Fekrazad* DDS, MSc, FLD, FICD

Founder and Head of Radiation Sciences Research Center, AJA University of Medical Sciences, Tehran, Iran (since 2013)

Secretary General of World Association for Photobiomodulation and Laser Therapy-WALT (2016-2020)

Past - President of Iranian Medical Laser Association (2012-2023)

Founder and director of International Network for Photo Medicine and Photo Dynamic Therapy (INPMPDT), Universal Scientific Education and Research, Network (USERN), Tehran, Iran (since 2015)

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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 at 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 at 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, the qualitative improvement of light sources and photosensitizers materials and the specific targeting of tumor cells or microorganisms were discussed and investigated.

In conclusion, this talk provides 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.

Nanotechnology assisted photodynamic therapy

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Abstract: Photodynamic therapy (PDT), as a non-invasive local cancer therapeutic technique manifests great promise compared to chemotherapy and radiotherapy. Although, 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 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

Herbal Photosensitizers

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Abstract:

Herbal photosensitizers for photodynamic therapy (PDT) have gained significant attention in recent years due to their potential as alternative treatment options for various diseases, including cancer. PDT is a non-invasive therapeutic approach that involves the use of a photosensitizer, light, and oxygen to selectively destroy 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 results in the treatment of various cancers. Additionally, hypericin has been found to possess 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, tolyporphins, alkaloid, anthraquinones 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 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 research is needed to fully understand their mechanisms of action and optimize their therapeutic potential in order to harness the full benefits they offer in the field of photodynamic therapy.

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

Photosensitizers: An overview

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Abstract: One of the three crucial elements of photodynamic therapy, apart from light and oxygen, is the presence of photosensitizers. These dyes are defined as substances capable of absorbing light with a specific wavelength, triggering photochemical or photophysical reactions. As in each group of drugs, photosensitizer can be distinguished by: high chemical purity grade, stability at room temperature, photosensitive effect only in the presence of a typical wavelength, and high photochemical reactivity; the maximum absorption of light should be at wavelengths from 600 nm to 800 nm, absorption minimum in the spectrum from 400 nm to 600 nm, the absorption bands should not overlap the absorption band of other substances in the body(including endogenous dyes such as melatonin, hemoglobin or oxyhemoglobin), minimal cytotoxicity in the dark, easy solubility in the tissues of the body, high selectivity for neoplastic tissues, inexpensive and straightforward synthesis and easy availability. hematoporphyrin derivative (HpD) is the first photosensitizer (PS) introduced by Dougherty and co-workers. It was a water-soluble mixture of porphyrins, and a more purified preparation later became known as Photofrin. The most effectual PSs are relatively hydrophobic compounds that rapidly diffuse into tumor cells and localize in intracellular membrane structures such as mitochondria and endoplasmic reticulum (ER). Most of the PSs used in cancer therapy are based on the tetrapyrrole backbone, a structure similar to that included in the protoporphyrin prosthetic group contained in hemoglobin. Since the penetration of light into tissue expansions with wavelength, agents with strong absorbance in the deep red spectral region like s 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

An Update on Photodynamic Therapy in Wound Healing

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Photodynamic therapy (PDT) is a minimally invasive therapeutic modality that has gained great attention in the past years as a new therapy for cancer treatment, bacterial resistance and wound healing. PDT uses photosensitizers (PS) that, after being excited by light at a specific wavelength, react with the molecular oxygen to create 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 photo damage which is the main mechanism used in cancer treatment. Compared to conventional therapeutic modalities, PDT presents greater selectivity against tumor cells, due to the use of photosensitizers that are preferably localized in tumor lesions, and the precise light irradiation of 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. Furthermore, recent developments in therapies that involve PDT in combination with chemotherapy, photothermal hyperthermia therapy, magnetic hyperthermia therapy, antibiotic chemotherapy, cold atmospheric pressure plasma therapy and using nanotechnology have shown additive and synergistic enhancement of its efficacy. The future path on the research of new photosensitizers with enhanced tumor selectivity and great potential to overcome the bacterial resistance associated with bacterial biofilm formation and finally accelerating wound healing process, featuring the improvement of PDT effectiveness, has been addressed in our research.

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

Photodynamic therapy in Dermatology

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Physical Modeling and Simulation in PDT

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Photophysical Aspects PDT

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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 as the main part of the mechanism which 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 important to be absorbed in unwanted cells and not in living cells. 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 photo physical processes after material irradiation with light. Based on the situation, choosing the proper light source with proper wavelength, intensity, duration, spot size, to make the reaction more specified and effective will be discussed.

Keywords: Photodynamic therapy, Light sources, Light interaction

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

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*Presenter: Prof. Parviz Parvin

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Abstract: Laser-induced fluorescence has recently been used as an efficient technique in cancer diagnosis and non-invasive treatment. Here, the synergic therapeutic efficacies of the Capecitabine (CAP) chemo drug, photosensitive Phycocyanin (PC), and graphene oxide (GO) under laser irradiation were investigated. The therapeutic efficacies of diverse concentrations of CAP (0.001-10 mg/ml) and PC (0.5-10 mg/ml) alone and with laser irradiation on human breast adenocarcinoma (MCF-7) cells were examined. The interactional effects of 100 mW SHG Nd: YAG laser at 532nm and GaAs laser at 808 nm ranging power of 150 mW- 2.2W were considered. The contribution of graphene oxide (GO) in biocompatible 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 laser-excited CAP+PC on cell mortality have been obtained. Despite the laser irradiation could not hold up the cell proliferation in the absence of 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 demonstrated to reduce chemotherapy doses, minimizing side effects and promoting minimally invasive treatment while inducing malignant cell mortality. 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.

Horizons in PDT in Iran

Prof. Mohannadreza Razaghi* MD

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Efficacy of Natural Photosensitizers in Anticancer Photodynamic Therapy

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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

PDT-Induced Immunomodulation

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Abstract:

Photodynamic therapy (PDT) is a cancer treatment that uses photosensitizers and light to induce cell death in tumor cells. It can also modulate the immune system, leading to augment 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), the activation of 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 enhance anti-tumor immune responses in various types of cancer, including melanoma, breast cancer, and lung cancer. PDT can induce immunogenic cell death, which can promote the uptake of tumor antigens by antigen-presenting cells (APCs) and subsequent activation 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 play a critical role in initiating 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 in relation to 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, further studies are needed to fully 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

Photodynamic therapy Combined Conventional Therapy in Cancer treatment

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Abstract:

Cancer is a pathological condition characterized by the uncontrollable cell proliferation, or dysregulation of cell signaling pathways at multiple steps. Conventional cancer treatment is the therapeutic approaches to cure or shrink the tumor, or stop the progression of a cancer using of surgery, radiation, medications and other therapies in 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. 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 such as radiotherapy, chemotherapy, immunotherapy, photothermal therapy (PTT) and cold plasma therapy. The goal of this presentation is to review the researches in this area in recent years.

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

Photodynamic in Basal Cell Carcinoma

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Abstract: More than 125 years have passed since the discovery and introduction of photodynamic therapy in the field of medicine. Today, by using light-sensitive materials and various light sources, extensive uses for photodynamic therapy have been proposed in the medical field, and BCC cancer, as 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, the unwanted side effects of light-sensitive drugs have caused extensive research in the world to remove these obstacles.

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Keywords: PDT, Dermatology, BCC, Carcinoma