Book of Abstracts

INTERCOLM 2018

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International Congress on Optics and Lasers in Medicine (INTERCOLM 2018)

Kemer/Antalya - Turkey

October 9-12, 2018

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INVITED SPEAKERS

Id-02

Photodynamic Therapy (PDT): An Over View

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Abstract: Photodynamic therapy (PDT) involves administration of tumor localizing photosensitizer agent that produces reactive oxygen radicals during light irradiation and ultimately leads to cell death. There are two well-defined mechanisms for generating cytotoxic species: the first mechanism produces free radicals or superoxide ions resulting from hydrogen or electron transfer; second mechanism is singlet oxygen ($^1O_2$) which generated via an energy transfer process that occurs during collision of excited sensitizer with oxygen. Many photosensitizers such as Photofrin, Hypericin, Lutetium Lexaphyrin, Protoporphyrin IX, Rose Bengal, Methylene Blue, … etc., are already known and some of them are used in vivo. The need to search for natural photosensitizers such as some medicinal herbal materials as a drug substitute are recently received new interest. Moreover, nano herbal products such as nanocurcumin is currently used in vitro as a potential photodynamic therapy drug and remains a desirable therapeutic goal. Nano products extracted from herbal is found to be better quantum efficiency, reductions in toxicity and enhancing the killing rate.

Keywords: Photodynamic Therapy; Photosensitizer; Singlet Oxygen.

INVITED SPEAKERS

Id-05

Type I ROS-mediated Therapeutic Enhancement in Concurrent Carboplatin Photodynamic Therapy

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Abstract: Type I (radical formation) and Type II (singlet oygen) reaction can occur simultaneously and the ratio between them depends on the photosensitizer and the nature of substrate molecules, resulting in modulation of three different programmed cell death, e.g. apoptotic, necrotic and authphagic cell death. Photofrin was known to induce cellular signalling typically through $^1O_2$. Since we previously reported complete tumor regression without relapse by concurrent low-dose carboplatin-Photofrin PDT on a number of patients with cervical cancer with successful delivery of babies, the patient number that demonstrated beneficial effects by ccPDT has been increased by 20 up to now with extension of indication to endometrial cancer. This study aims to investigate the molecular mechanism underlying ccPDT with low dose carboplatine plus Photofrin. Three intracellular ROS species ($H_2O_2, OH^{\cdot}, O_2^{\cdot-}$), were masured and compared from a set of HeLa cells loaded with fluorescent oxidant agents and either photofrin or/and carboplatin under photodynamic irradiation of 630 nm-light with a range of dose (0- 5 J) in conjunction with induced cytotoxicities. Photofrin PDT alone did not enhance either hydroxyl radicals or super oxide anion, but a slight enhancement of hydrogen peroxide. A larger enhancement (several factor) of ROS production was observed in a dose-dependent manner from ccPDT in the presence of carboplatin, especially hydroxyl radical and hydrogen peroxide, in conjunction with observation of both necrotic and apoptotic cell death, compared with PDT alone. Carboplatin-mediated Fenton reaction, $2[Pt^{II}]_2 + H_2O_2 \rightarrow [Pt^{2.25}]_4 + OH^- + OH^{\cdot}$, was proposed to explain these results for the dose-dependent enhancement of $OH^{\cdot}$. Our result demonstrates the fertility preservation capacity of ccPDT with biophysical mechanism.

Keywords: ROS; Photodynamic Therapy; Carboplatine; Photofrin.

INVITED SPEAKERS

Id-07

Subthreshold Laser Treatment in Ophthlmology: A New Era

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Abstract: Subthreshold laser treatment is an alternative to the conventional continuous-wave laser for the treatment of retinal and macular diseases. In contrast to the conventional laser, the therapeutic effect of the subthreshold laser is not accompanied by thermal retinal damage. This fact is of particular importance when a treatment near the fovea is required. SML technology can be performed with either 810 nm or 577 nm wavelength lasers. The 577-nm yellow laser light provides maximum absorption by both of oxyhemoglobin and melanin This leads to energy being concentrated in a smaller volume, which in turn allows for a reduction in power and shortened pulse duration Micropulse treatment is applied in indications such as central serous chorioretinopathy (CSC), diabetic macular edema (DME), or macular edema due to retinal vein occlusion (RVO). In this session outlines and discusses the published literature of subthreshold micropulse laser treatment for CSC, DME, and macular edema after RVO.
Keywords: Subthreahold Laser; Diabetic Macular Edema; Retinal Vein Occlusion.

INVITED SPEAKERS

Id-08

Use of Optical Coherence Tomography in the Diagnosis and Prognosis of Neurodegenerative Diseases

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Abstract: Optical Coherence Tomography (OCT) is a relatively new imaging technique which measures the differences in optical properties of different layer tissues. Over the last decade it has also been used in various areas in neurology. It is mainly used in neurology practice for the diagnosis and prediction of the clinical course of neurodegenerative diseases such as multiple sclerosis (MS), Parkinson's disease (PD) and Alzheimer's disease (AD). In a large number of clinical trials, retinal nerve fiber layer (RNFL) and macular thickness have been shown to be useful markers for disease progression and prognosis in MS, PD and AD. In a large number of clinical trials, RNFL and macular thickness have been shown to be useful markers for disease progression and prognosis in MS, PD and AD. However, there is no clear guideline for the use of OCT in the management of neurological diseases yet and therefore the use of OCT technology in the clinical management of neurological patients is limited. In this article, the application of retinal evaluation using OCT technology for the detection of neurodegenerative pathologies such as MS, PD and AD was reviewed.

Keywords: Neurodegenerative Diseases; Neuroimaging; Optical Coherence Tomography.

INVITED SPEAKERS

Id-13

Low-energy Photobiomodulation Therapy in Dentistry

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Abstract: Both clinical and basic research have shown that Low-energy photobiomodulation therapy (LPT) has broad applications in dentistry, specifically in accelerated tooth movement, pain reduction, tissue repair, and bone quality improvement. Commercial LPT products have been used in the clinic. However, the outcomes have been inconsistent or insignificant. The controversies were primarily due to lack of dose control on cells. Consistent and effective treatment requires knowledge of optimal dose to stimulate or inhibit the cells activity, the limit the cells can withstand, and the method to deliver the dose to the cells clinically. The objectives of our studies are to find the optimal dose and develop the dose delivery method. Our approaches include 1) confirming the cell responses to LPT *in-vitro*, which consists of applying well-controlled light in terms of wavelength and power with different doses to bone cells, osteoblast, osteoclast, and osteocyte, respectively and assessing the cell responses in terms of proliferation/differentiation/activities and viability; and 2) developing reliable methods to accurately determine the light intensity at the cross section where cells locate if a light with known intensity and wavelength are applied at the tissue surface. Our results have shown that reaction of the cells to LPT is dose-dependent; optimal dose of specific cell does exist; and the level of dose at the cells in-vivo can be controlled if light transmittances of different tissues are available. The method will enable accurately delivering the dose to the cells, which will maximize the treatment effects and ensure consistent clinical outcomes.

Keywords: Photobiomodulation Therapy; Dentistry; Osteoblast; Osteoclast; Osteocyte.

INVITED SPEAKERS

Id-14

OCT Blood and Lymph Microangiography: Principles and Applications

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Abstract: Functional extensions of optical coherence tomography (OCT) in recent years make it even more useful tool for biomedical diagnostics. One of emerging OCT modalities is the OCT-based angiography. Because OCT signals have specific speckle structure that is very sensitive to positions of scatterers, in particular moving blood erythrocytes, the speckle variance approach (svOCT) becomes one of the most common approach in OCT-angiography (together with temporal speckle decorrelation approach - cmOCT). Alternatively, there are more sensitive to axial flows Doppler-based and hybrid phase-sensitive approaches. Since the hybrid OCT-angiography additionally enables bulk-motion compensation, it opened a possibility to realize real-time OCT angiography with hand-held probe for everyday clinical use. Presently, the overwhelming majority of OCT-based angiography realizations are aimed at visualization of blood microcirculation, although recently increasing attention is paid to possibilities of OCT visualization of lymph circulation. We developed an OCT-based angiography extension to discriminate and visualize the blood and lymph microcirculation separately. It is based on evaluation of three main parameters of the speckles: speckle variance, speckle contrast and speckle-intensity statistics. Unlike approaches that take into account only speckle variability and contrast, additional taking into account the speckle distribution parameters allows one to obviate conventionally used attenuation compensation procedures. Namely, speckle probability density function (PDF) for lymph is preliminary calibrated that makes it possible to discriminate lymph from blood and tissue. The main drawback of this approach is that there is trade-off between the required speckle statistics accumulation and resultant scanning time. Therefore, for preclinical and clinical applications this approach should be tuned individually. The OCT lymphangiography development is supported by the Russian President Grant No MK-3416.2018.2.

Keywords: OCT; Angiography; Lymph; Speckle.

INVITED SPEAKERS

Id-15

Phase-sensitive Optical Coherence Elastography for Mapping Strains and Characterizing Elastic Properties of Biological Tissues

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Abstract: Development of such an extension of optical coherence tomography (OCT) as OCT-based elastography (OCE) for characterization of stiffness properties of biological tissues has been attracting much attention about 20 years since seminal ideas of Schmitt. Although OCE realizations based on excitation of surface or bulk shear waves and evaluation of their velocity using OCT were demonstrated, realization of the initial Schmitt's idea of compressional OCE required over 15 years. In this approach, approximately uniaxial stress in the tissue is created and the resultant strain is visualized using OCT. To this end, initially the use of correlational tracking of scatterers was proposed, although in view of very high variability of speckles in OCT images the correlational approach appeared to be insufficiently accurate. Alternatively, speckle tracking based on phase-sensitive OCT has proven to be much more efficient. Here, we discuss possibilities of mapping strains and quantification of tissue stiffness in compressional OCE with focus on the developed in our group robust methods of strain mapping using comparison of complex-valued OCT B-scans. For many practical biomedical applications and translation of OCE to clinics, realization of strain mapping in manually-operated regime is of key importance. In this context, we demonstrate a realization of compressional OCE in which effective averaging can be made without the need of periodic actuation by auxiliary devices, which is very attractive for usage in manually-operated mode. Advantages of the proposed approach are discussed including possibilities of obtaining quantitative nonlinear stress-strain curves based on application of reference silicone layers, in particular for estimating high-contrast stiffness differences. Possibilities of the developed OCE approach are illustrated using numerical simulations, analytical argumentation and experimental demonstrations with phantoms and real biological tissues.

Keywords: Optical Coherence Tomography; Optical Coherence Elastography; Strain Mapping; Stiffness Mapping.

ALL SUBMISSIONS & TOPICS

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