



# Editorial: Dosimetry Study in Photodynamic Therapy for Diagnosis, Precision Treatment and Treatment Evaluation

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## Editorial on the Research Topic

### Dosimetry Study in Photodynamic Therapy for Diagnosis, Precision Treatment and Treatment Evaluation

Photodynamic therapy (PDT) is an ancient therapy that came to the stage of western medicine at the beginning of the twentieth century [1]. The two widely adapted clinical applications for PDT are in dermatology to treat acne [2] and in ophthalmology to treat wet-type age-related macular degeneration [3]. In the past decades, the recent clinical efficacy demonstration of PDT has extended into many more fields, including more cutaneous conditions, infectious diseases, and various cancers at different stages [4], thanks to the dedicated effort of researchers from a variety of backgrounds. Different from lasers used in surgical procedures that utilize a photo-thermal effect, PDT practice uses lower power light, which triggers photochemistry activity at cellular level through interaction with a photosensitizer to cause biological reactions. The advantage of PDT is not only that it is a beneficial addition in the clinic due to the advantages of having minimal side effects, being relatively easy and safe to operate, and being a hardware of low resource demand, but also that it sometimes works when other methods fail. Although it is considered a fairly safe procedure, uncontrolled overdosing or underdosing will compromise the efficacy and hinder the promotion of this modality in clinical treatment. Additionally, with more precision-demanding application, such as during cancer treatments [5], and more sophisticated technology, such as Nano technology [6], predictable and reliable dosimetry protocols are needed to enable the wide clinical adaption of this promising therapy.

The dosimetry of the PDT is mainly influenced by three factors at the targeted tissue: light density (fluence) and total energy dose, photosensitizer concentration, and the local oxygen concentration. This involves knowledge of tissue properties variation and individual differences among patients, which has been gradually built up during the past decades. The whole process can be very complicated since many factors are involved in the treatment planning and monitoring of the dynamic process and efficacy evaluation. Creative direct and (mostly) indirect measurements have been developed to navigate the treatment process [7–9]. Among current methods, it can merely measure the fluorescence intensity [10, 11] or might require the comprehensive measurement of many relevant parameters in the surgical procedure of clinical studies [12]. In practice, most clinical PDT procedures around the world only involve the calculation of drug dose and delivered light dose at the lesion surface. Overall, the dosimetry research of PDT, as a cross-disciplinary subject including physics, chemistry, photobiology, etc., is important to facilitate this promising modality adapted as the mainstream treatment of many diseases.

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Here in this special issue, we would like to present a series of studies on PDT from different perspectives related to dosimetry to demonstrate the promising as well as the complicated aspects of this modality. The topic includes a simulation/calibration study based on the direct/indirect biological response and mathematical models (Pourhajibagher et al.; Spring et al.), a basic animal research to study the cellular dynamic in the PDT process (Wu et al.), the design of a potentially more stable and efficient new photosensitizer (Alberto et al.), and an example of clinical research on Oral Leukoplakia (Han et al.). The goal is to serve as a modest spur to induce more valuable contributions in the inter-disciplinary discussion and to draw more attention to collaboration on the precision management of PDT treatment.

Luckily, for PDT dosimetry, there is a successful example to learn from: the 50 year dosimetry development in Medical

Physics [13]. Besides an effort to get the most accurate calibrations and set the proper clinical protocols, significant amounts of administration work were carried out to ensure the communication and establishment of the correct dosimetry practice in the field. Although there is still a lot to improve for PDT dosimetry in clinical application, it is encouraging to see the leaders in this field have emphasized the importance of dosimetry [14–17]. It is therefore reasonable to believe optimistically that PDT people will overcome all the difficulties, as in the field of medical physics, to make it a great beneficial modality for patients.

## AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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