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Real time control of photobleaching trajectory during photodynamic therapy

J.-B. Tylcz^{1,2}, T. Bastogne^{1,2,3}, A. Bourguignon^{1,2}, S. Pinel^{1,2}, M. Toussaint^{1,2}, C. Frochet⁴, M. Baberi-Heyob^{1,2}

¹Université de Lorraine, CRAN, UMR 7039, Campus Science, BP 70239, 54506 Vandoeuvre-lès-Nancy, France;

²CNRS, CRAN, UMR 7039, France;

³INRIA, BIGS, France;

⁴Université de Lorraine, LRGP, UPR 3349, 1 rue Grandville, 54000 Nancy, France.

Introduction

Obstacles and challenges to the clinical use of the photodynamic therapy (PDT) are numerous: large inter-individual variability, heterogeneity of therapeutic predictability, lack of *in vivo* monitoring concerning the reactive oxygen species (ROS) production, *etc.* All of these factors affect in their ways the therapeutic response of the treatment and can lead to a wild uncertainty on its efficiency.

Objective

To deal with these variability sources, we have designed and developed an innovative technology able to adapt in realtime the width of light impulses during the photodynamic therapy. The first objective is to accurately control the photobleaching trajectory of the photosensitizer during the treatment with a subsequent goal to improve the efficacy and reproducibility of this therapy.

Methods

In this approach, the physician *a priori* defines the expected trajectory to be tracked by the photosensitizer photobleaching during the treatment. The photobleaching state of the PS is regularly measured during the treatment session and is used to change in real-time the illumination signal. This adaptive scheme of the photodynamic therapy has been implemented, tested and validated during *in vitro* tests.

Results

These tests show that controlling the photobleaching trajectory is possible, confirming the technical feasibility of such an approach to deal with inter-individual variabilities in PDT. These results open new perspectives since the illumination signal can be different from a patient to another according to his individual response.

Conclusions

This study has proven its interest by showing promising results in an *in vitro* context, which has to be confirmed by the current *in vivo* experiments. However, it is fair to say that in a near future, the proposed solution could lead, *in fine*, to an optimized and personalized PDT.