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Cold Plasma Combination Photodynamic Therapy for Biomedical Therapy

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ABSTRACT

Introduction: Cold atmospheric plasma (CAP) has recently emerged as a novel approach for cancer treatment as well as photodynamic therapy (PDT). The produced ionized gas (such as helium) generates unique combinations of reactive oxygen and nitrogen species (RONS). Over a decade ago, these plasmas, started to be explored for medical therapy, yet at that time, there was limited research on the mechanistic redox chemistry or biomedical implications of this topic.

Materials and Methods: The effectiveness of these two techniques, both separately and in combination, has been examined. The study analyzed the cell-killing rates among different study groups (i.e., control, CAP, PDT, and the combined technique (PDT and CAP) on cancerous human cells.

Results and Discussion: The results from treating cancer cells with CAP are promising. Due to the potential of this technique, it is essential to establish a mechanistic link between plasma physics (how and which plasma-derived ROS are produced) and therapy (what is the medical benefit). Additionally, the combination treatment of PDT and CAP showed enhanced effects compared to either PDT or CAP used alone.

Conclusion: The combined technique appears to be a promising method for treating cancerous cells, which are accessible to both light and CAP (e.g. skin cells). Moreover, applying a photosensitizer (e.g. ALA) before CAP therapy could enhance the overall treatment process.

Keywords: Cancer, Cold plasma, Photodynamic therapy, Redox, ROS

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