Scientific Paper:

Experimental Dermatology (2019)00, 1-3

Imaging of pH and pO_2 gives insight in molecular processes of irradiated cells

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Abstract:

One of the major challenges in radiation therapy is the interference with tissue repair processes due to hypoxic characteristics and pH dysregulation. In this study, we present dual imaging of pH and oxygenation *in vitro* based on luminescent biocompatible sensor foils that allow studying the effects of irradiation on different cell types in culture. Different sensitivities of fibroblasts and oral squamous carcinoma cells were observed by complementing oxygen and pH differences with proliferation assays. This study highlights especially the distinct role of oxygen after irradiation and the difference in proliferation processes of irradiated normal dermal cells in contrast to irradiated tumor cells.
Background
Radiation therapy is a common treatment in head and neck cancer. However, irradiated areas often show interference with wound repair processes. Here, chronic wounds show hypoxic characteristics. However, sufficient oxygenation is mandatory for essential molecular healing processes like cell proliferation and protein synthesis. Additionally, regulation of pH plays an important role in tissue repair and in tumor growth and is therefore precisely regulated. Thus, regulation of pH in tissue deteriorations has a major impact on cell turnover and migration as well as on the metabolic activity of cells involved tissue repair.
Questions Addressed
Studying pH and oxygen consumption of irradiated cancer cells and normal dermal cells like fibroblasts may give a more detailed view of both tumor development and tissue regeneration. Up to now, evaluation of pathogenesis relies on wound observation; pH and oxygen consumption have not been taken into account. Using a newly developed luminescence-based sensor imaging system, it is now possible to measure pH and pO_2 directly in close proximity of cell layers. The acquisition of these parameters may facilitate a complex and comprehensive description of the healing progress directly in tissue and may enable a better wound management.

Keywords: Dual imaging, oxygenation, radiation therapy, sensors, wound healing