Oxygen Imaging of Common Biomaterials

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Purpose/Objectives: The purpose of this study is to probe the compatibility of electron paramagnetic resonance oxygen imaging (EPROI) with commonly used biomaterials. EPROI is an emerging absolute oxygen mapping technology based on magnetic resonance principles. EPROI measures partial oxygen pressure (pO_2) of tissues/animal with the precision of 1-3 torr within 1-10 minutes with 0.5-1 mm spatial resolution. The oxygen maps obtained using EPROI can provide valuable information to improve the therapeutic outcome in regenerative medicine. EPROI has been tested extensively in animal models for tumor drug assessment, chemotherapy, immunotherapy assessment, and radiation treatment. However, its use in artificial tissues and cell encapsulation devices is relatively new.

Methodology: EPROI experiments were performed on commonly used acellular biomaterials, such as agar, vitro-gel, collagen, chitosan, PLGA and gelatin etc. Trityl, OX063-D24 was used as a spin probe to obtain oxygen maps of these biomaterials during the cycle of deoxygenation with N2 bubbling. Calibration of the spin probe relaxation in the biomaterials allows to derive quantitative oxygen maps.

Results: We demonstrate that EPROI is compatible with commonly used biomaterials. We demonstrate the possibility of obtaining high resolution (0.5 mm) pO_2 maps of these biomaterials at different pO2 and physiologic temperatures.

Conclusion/Significance: Oxygen is an essential physiological parameter and oxygenation may carry diagnostic and prognostic information for artificial tissue development. The pO_2 maps of the regenerative medicine devices may act as an essential feedback to control the implantation and performance of therapeutic devices.