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Characterization of endoscopic cell spray for application in tubular organs

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Stem cell therapy at diseased tissue requires high local concentrations of stem cells. State of the art represents the intravenous stem cell transplantation, leading to distribution of cells within the entire body. Increase of cell concentration is exclusively achieved by utilizing tissue homing, i.e. the property of cells to autonomously migrate to afflicted tissue. An innovative approach aims at high local cell concentrations based on a minimal invasive surgery through flexible endoscopy, by spraying the cells directly onto the area of treatment. Thereby, the endoscope's working channel in combination with a commercially available catheter is utilized for injection of the liquid cell suspension and liquid atomization by a coaxial air stream. Within the realms of endoscopy, the device enables local application of cells, but currently no information is available regarding the influence of atomization parameters on cell survival. Therefore, a first-time parametric study on atomization of cell-suspensions has been performed in this study. The mutual interaction of cells and atomization is experimentally analyzed, aiming at correlations between air velocity, droplet sizes and cell survival rates. The influences of catheter flow, atomization and droplet wall interaction on cell survival are quantified and thus the extensional flow during ligament formation is identified as main cell destruction mechanism. On the basis of the present endoscopic configuration, integral cell survival rates above 80% are achieved, offering the opportunity for optimized homogeneous local coating in tubular shaped bodies.

Biography

Malte Bieber has completed his Master of Science in Engineering from RWTH Aachen University and started his PhD in July 2016 at the Institute of Heat and Mass Transfer.

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