Optimizing seeding efficiency, reducing delayed culture periods and mimicking native tissue architecture are crucial requirements for the development of seeding procedures in tissue engineering. In vascular applications, the tubular geometry of the grafts further hampers the efficient delivery of cells onto the scaffold. To overcome these limitations, a novel technology based upon the use of magnetic fields is presented in this study: a radial magnetic force drives the cells immediately onto the luminal surface of a tubular scaffold and immobilizes the cells on the substrate’s surface promoting cell attachment. Human smooth muscle cells (SMCs) labeled with CD44 magnetic Dynabeads® were successively seeded onto the luminal surface of a tubular shaped collagen membrane. After 5 h, one additional layer of human umbilical vein endothelial cells (HUVECs) labeled with CD31 magnetic Dynabeads® was seeded onto the luminal SMCs. The co-culture was incubated during 5 days prior to analysis. Cell viability and expression profiles were preserved during the entire seeding process. Histological examination of the constructs highlighted densely packed multilayers of SMCs covered by a monolayer of endothelial cells. SEM inspection confirmed a heterotypic multilayer assembly formed by multiple layers of elongated SMCs covered by a single layer of endothelial cells. Seeding kinetics of HUVECs and SMCs showed over 90% seeding efficiency after 20 and 40 min magnetic exposure.
respectively. Magnetically induced cell seeding provides a valuable tool for rapid seeding procedures of tubular scaffolds while complying with the histological architecture of tissue.

Stichworte: Blood vessels; Endothelium; Tissue engineering; Vascular development; Magnetic tubular cell seeding

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