Scanning electron microscopy studies on in-vitro generated smooth muscle component for gastro-intestinal tissue engineering

Kristina Kofler[1], Gerd Leitinger[2], Herwig Ainödhofer[1], and Amulya K. Saxena[1]

1. Medical University of Graz, Department of Pediatric Surgery, Auenbruggerplatz 34, 8036 Graz, Austria
2. Medical University of Graz, Core Facility Ultrastructure Analysis, Center for Medical Research, Stiftingtalstraße 24, 8036 Graz, Austria

kristina.kofler@medunigraz.at
Keywords: smooth muscle, tissue engineering, gastrointestinal structures, scaffold

Aim of the study:

Smooth muscle (SM) tissue components are necessary in the tissue engineering of gastrointestinal structures when the hybrid approach is opted. The presence of SM tissue enables constructs to retain their shape after expansion. The aim of this study was to engineer SM tissue using collagen scaffolds.

Methods:

SM cells were obtained from rat aorta of 20 Sprague Dawley female rats with an average weight of 150g using an explant technique. Briefly, the cells cultured from the explants were passaged once before seeding on collagen sponges (13mm diameter x 3mm thick) using the drop-in seeding technique at a density of 500,000cells/scaffold. The constructs were maintained in-vitro culture for 8 weeks and were removed at weekly intervals to determine the viability of cells as well as to study the generation of tissue using scanning electron microscopy and histological investigations.

Main results:

Viability of SM cells on scaffold could be confirmed up to 8 weeks in culture. Tissue organization resulting from the proliferation, differentiation as well as extracellular matrix secretion could also be demonstrated using scanning electron microscopy. SM tissue engineered demonstrated the formation of strands, the viability of which were confirmed using α-SM Actin immunohistochemical staining.

Conclusion:

The cultivation of SM tissue in-vitro demonstrates the possibility of generating the SM tissue component for the hybrid approach to gastrointestinal tissue engineering. The in-vitro generation of SM tissue permits the assembly of components before in-situ or in-vivo tissue engineering; and has added advantages for the hybrid multicellular layered organ engineering approach.

M.A. Pabst, G. Zellnig (Eds.): MC2009, Vol. 2: Life Sciences,
DOI: 10.3217/978-3-85125-062-6-273, © Verlag der TU Graz 2009

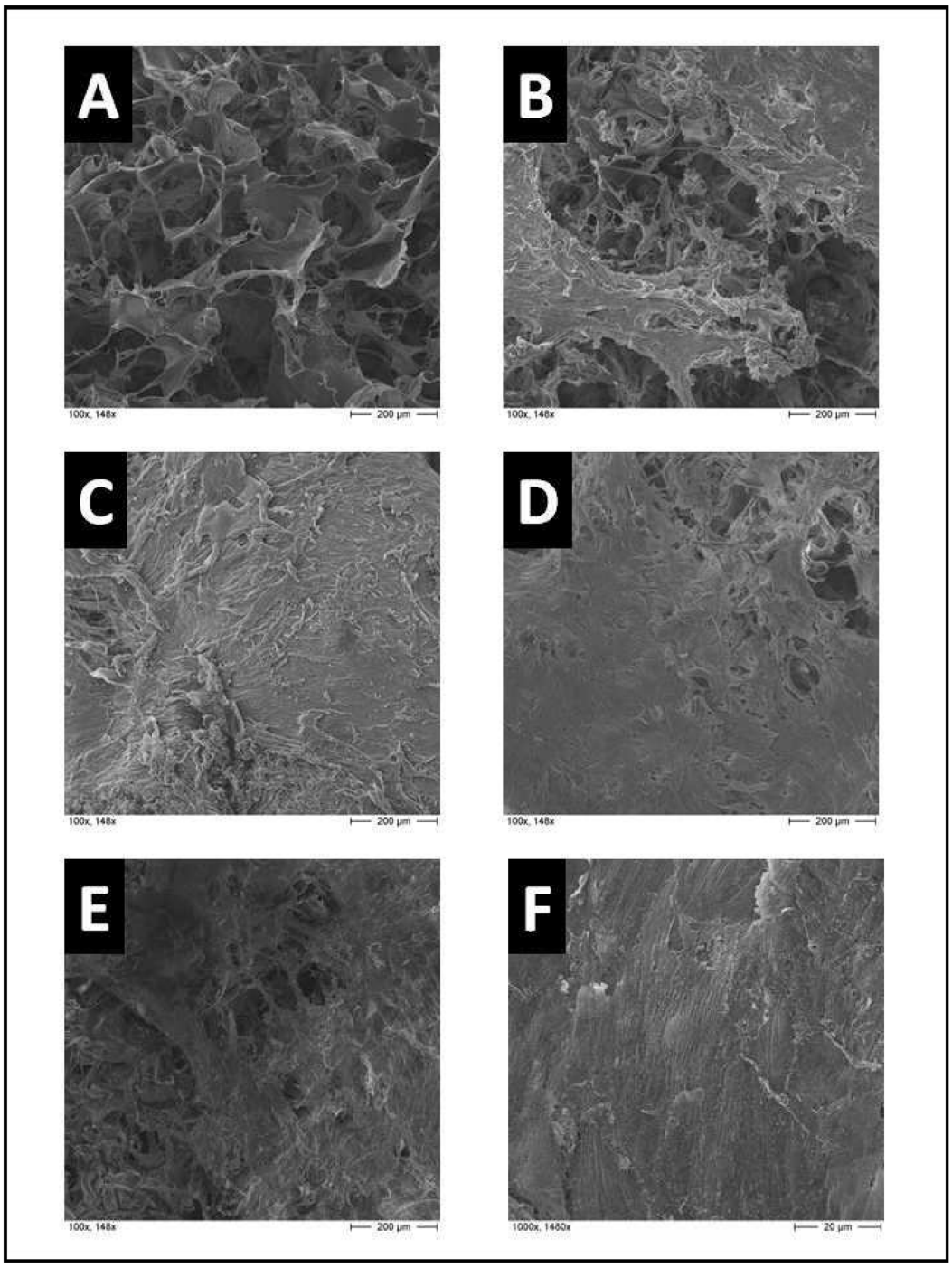

Figure 1. Scanning electron micrographs of bovine collagen scaffold cross sections seeded with smooth muscle cells: A- Native collagen 3-dimensional structure, B-After 14 days of cell culture, cell attachment and organization in groups is evident, C (28 days), D- (42 days) and E (56 days) demonstrate the dense coverage of the scaffold area with smooth muscle cells and extracellular matrix after prolonged culture. F-Magnified view of smooth muscle confluence with nucleus and oriented myofibril architecture after 56 days in culture.

M.A. Pabst, G. Zellnig (Eds.): MC2009, Vol. 2: Life Sciences,
DOI: 10.3217/978-3-85125-062-6-273, © Verlag der TU Graz 2009