Sound-induced cell assembly to engineer vascularised tissues - towards patient specific drug evaluation

Anne Géraldine Guex[1], Mauro Alini[1], Tiziano Serra[1]

[1] *AO Research Institute Davos, Switzerland*

Prior to point of care diagnostics and concomitant treatments, efforts in basic research focusing on drug development are urgently needed. In the scope of personalised medicine, in vitro models with patient-specific cells are particularly interesting to evaluate new treatment-options. As a first step towards this, we develop vascular structures within hydrogels which will ultimately permit to engineer vascularised tissues to assess local or systemic drug administration.

Our approach uses acoustic waves that create standing Faraday waves at the hydrogel-air interface, thereby projecting cells into defined patterns by hydrodynamic forces. Specific in this setting is the use of low frequency (< 100 Hz) sound waves, enabling cell manipulation within mili- or centimetre-scaled labware. A cell suspension of human mesenchymal stem cells and endothelial cells within a hydrogel was patterned into concentric rings. Over time, endothelial cells assembled into vascular structures. Lumen formation and sprouting is currently evaluated based on immunofluorescent imaging. In future studies, pro- and anti- angiogenic drugs will be assessed and the model will be complemented with tissue-specific cells. In summary, tight control over pattern formation, combined with a large portfolio of application-tailored hydrogels render sound-induced cell assembly an extremely versatile method to generate in vitro models of high precision for pharmaceutical evaluation.

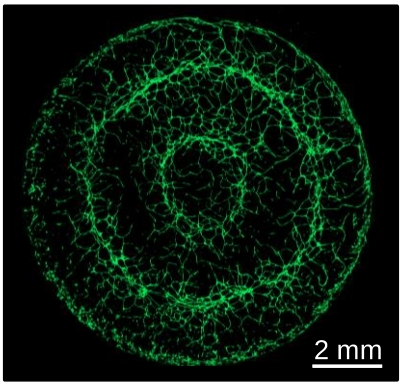

Figure 1 Confocal laser scanning microscope image of engineered vascular structures. Green fluorescent protein (GFP) expressing endothelial cells were assembled into two concentric rings by use of sound waves.