

In Vivo Characterization of Bioprinted Capillaries

Maria Yanez, Julio E. Rincon, and Thomas Boland, The University of Texas at El Paso (USA)

We present two studies that assessed vascularization of implanted bioprinted grafts. The first study involves bioprinted vascular networks build into skin grafts. A modified inkjet printer allowed depositing human microvascular endothelial cells into fibrin networked channels. Neonatal human dermal fibroblast cells and neonatal human epidermal keratinocytes were manually mixed into a collagen matrix, which sandwiched the networks. A full thickness wound was created at the top of the back of athymic nude mice and the graft covered this wound. As control, a commercial Apligraf dressing was used and as a further control, no treatment was done. Wound contraction with the graft improved by up to 10% when compared with the control groups. Histological analysis showed the neoskin having similar appearance than normal skin. Both layers, dermis and epidermis were present with thicknesses resembling normal skin.

Immunohistochemistry analysis showed the implanted cells were serving as neo-vessels in the regenerated skin. The second study involved sandwiching the vascular networks into subcutaneous adipose grafts. Volume retention was measured over time. Good graft acceptance was found. Immunohistochemistry analysis revealed the presence of new vessels formation involving the implanted cells. Both studies showed that bioprinted vascular capillaries will incorporate into host tissue, either by direct anastomosis or by being recruited by the host and help form neo-vessels. Although the exact mechanism by which this happens remains to be resolved, the findings point to a faster and more complete incorporation of the grafts into the host tissue. This will allow in the future for more functional tissues being constructed, where survival of the implanted cells is paramount.