Technology Opportunity, Ref. No. BS-14/0051

Artificial vascular graft with arterial-like properties

Up to 25 % of patients undergoing cardiovascular/vascular surgery lack suitable bypass material. Our vascular graft technology provides a solution.

Keywords	Vascular graft, bypass, surgery, CABG, small diameter grafts, composite material, cellulose, nitinol, high burst strength
Fields of Use	Cardiac surgery, coronary artery bypass, peripheral vascular surgery, dialysis shunts, emergency surgery and traumatology, congenital surgery
Inventors	Bernhard Winkler, Martin Grapow, Friedrich Eckstein, et al.
Reference	In preparation
Patent	WO 2015/040139

Background

The prevalence of arterial disease is increasing in many countries due to the ageing society and changes in lifestyle and nutrition especially in Asian regions. This trend is of particular importance for atherosclerotic vascular diseases such as coronary and peripheral vascular diseases, the leading causes of death worldwide (according to WHO). Surgical treatment and therapy involves bypass surgery by using either the autologous saphenous vein or the internal mammary artery. Major drawback of venous grafts are occlusion and atherosclerotic changes. 25 % of the patients cannot be provided with suitable autologous bypass material, due to pre-existing diseases or because the bypass material has already been used in previous surgery.

Thus, the demand for artificial vascular replacement material is increasing for both small and large diameter grafts. Existing graft technologies have serious limitations, such as the amount of time to produce them, storage conditions, infections, degradation, thrombosis, foreign body reaction or lack of necessary stability.

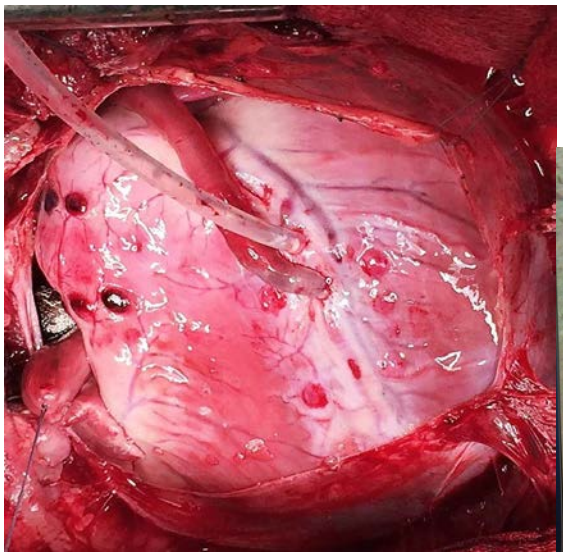
Cases: 400.000 coronary artery bypass grafts (CABG) in the US plus 300.000 in Europe and Asia = 700.000 per year.

Invention

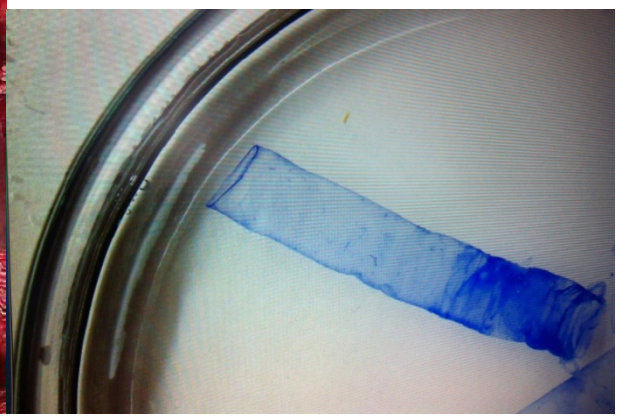
The grafts were designed to avoid all known shortcomings of bio-engineered grafts reported over the last 20 years: Fast production time, simple cheap storage independent from specific conditions, necessary mechanical strength, arterial-like properties.

The invention provides an artificial vascular graft composed of a tubular scaffold structure with a coating on the inner and outer surface and a plurality of grooves in the coating of the inner surface. The graft is designed in such a way that cells, including progenitor cells, can migrate from the periphery to the inner surface and attach to the inner surface to produce an aterial like substitute with layers of smooth muscle cells, endothelial lining and vasa privata resembling a natural artery.

We have established the graft technology at the laboratory scale and are able to produce grafts reproducibly and with the required mechanical stability. Such grafts have successfully been implanted, demonstrating proof-of-concept in an animal model (pig) of coronary artery bypass surgery evaluated with coronary angiograms, immunostaining, SEM and mechanical testings: (i) the surgical handling was reported as excellent with proper conditions during suturing and needle passing; (ii) dissection or burst was fully absent in all grafts and coronary angiographies showed good results; (iii) the animals recovered fast; (iv) postoperative angiographies showed stable results; (v) histology revealed the desired morphology of cells that migrated in vivo as planned; no seeding step was necessary pre-implantation; (vi) the occurrence of vasa privata similar to a native artery was even more than could ever be expected so far.



Pig heart with graft to LAD



Artificial graft in petri dish.

Contact *Unitectra, Technology Transfer University Basel, Dr. Peter Eckard*
Steinengraben 5, CH-4001 Basel, +41 61 207 18 95 mail@unitectra.ch