

Project title: Processing fine yarns using a textile stent graft as an example for "ultra-low profile" catheter systems

Acronym: LowProTex

Partner: Insitut für Textiltechnik der RWTH Aachen University (ITA); Project-accompanying committee consisting of German SMEs and large companies

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Mission Statement

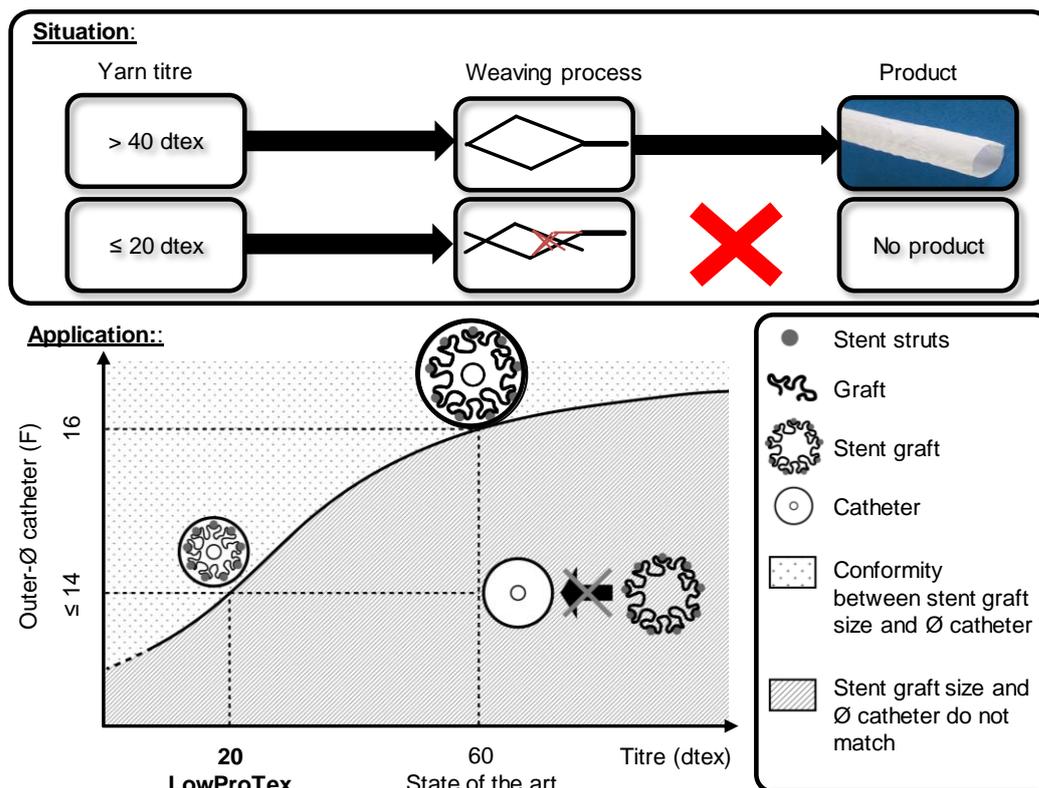


Figure 1: Main figure of the project LowProTex

The minimally invasive therapy of aneurysms of the abdominal aorta (endovascular aortic repair "EVAR") with stent graft systems is a clinically established therapy method nowadays. In this procedure, the folded implant is introduced through a catheter to the aneurysm. The stent graft is then unfolded. A small diameter of the catheter system is decisive for the success of the therapy. The size of the catheter is limited by the thickness of the folded textile implant.

The yarn count in commercial stent grafts is approx. 60 dtex (Multifil.). The system profiles vary between 18 and 24 French (\varnothing 6 -8 mm). As a result of challenging anatomies such as stenosed or strongly angulated access vessels, up to 50% of all patients are unsuitable for the EVAR. Fine medical grade multifilament yarns with a titre of ≤ 20 dtex are commercially available. The current deficit is that such fine multifilament yarns cannot be processed to tubular fabrics. The aim of the project is a stent graft made of a fine PET tubular fabric with a yarn titre ≤ 20 dtex (Multifil.) in order to make EVAR with a thin-walled graft material and consequently smaller introducer system profiles (14 French \leq system profile \leq 18 French) accessible to up to 15% more patients. To this end, the processability of fine yarns in the weaving process will be investigated and made possible by suitable weaving machine modifications and adjustments in weaving preparation under medical-compliant conditions.

Results

As part of the AiF IGF research project "LowProTex - Processing of fine yarns for the production of "ultra-low-profile" stent grafts " (20090N), a very fine tubular fabric was developed for the use as graft material for ultra-low-profile stent graft implants. For the production of these fine tubular fabrics, an innovative modification of the tubular weaving process on a shuttle weaving machine was developed, which reduces the friction between the closely spaced warp yarns in the weaving process. Thus, high-density weaving of fine 20 dtex polyester (Dacron®) and 25 dtex UHMWPE (Dyneema®) multifilament yarns to seamless tubular fabrics was made possible for the first time.

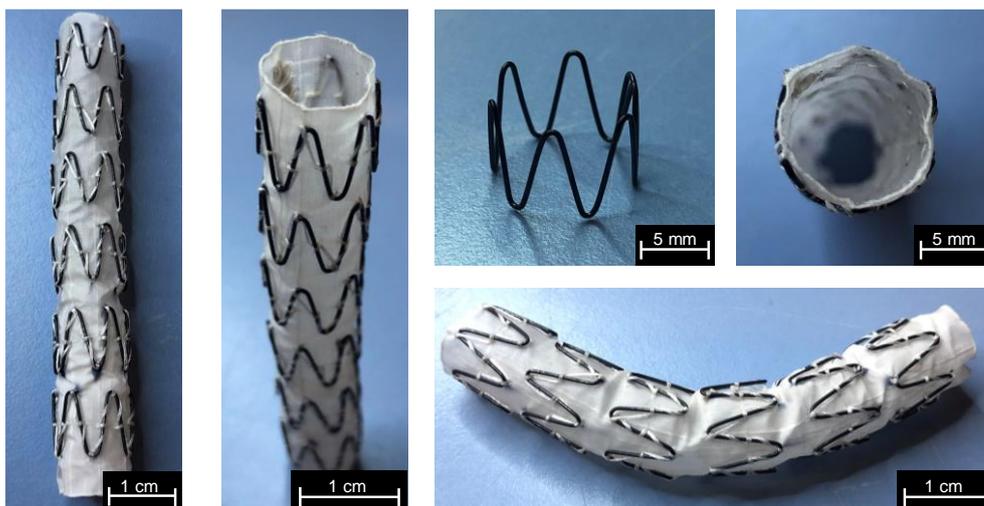


Figure 2: Sample of an "ultra-low-profile" stent graft

The research results show that the new tubular fabrics have up to 55% less wall thickness (with 20 dtex PET) and up to 24% less wall thickness (with 25 dtex UHMWPE) compared to the graft material of commercial textile stent grafts so far. In addition, preliminary investigations regarding water permeability showed that the fine tubular fabrics meet the required low permeability ($< 350 \text{ ml}\cdot\text{cm}^{-2}\cdot\text{min}^{-1}$) at physiological pressure. Given the higher viscosity ($4.5\times$

greater) and the coagulation ability of blood, a lower permeability for blood can be assumed. Thus, the novel tubular fabrics are suitable for the use as graft material of stent graft systems.

Acknowledgement

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