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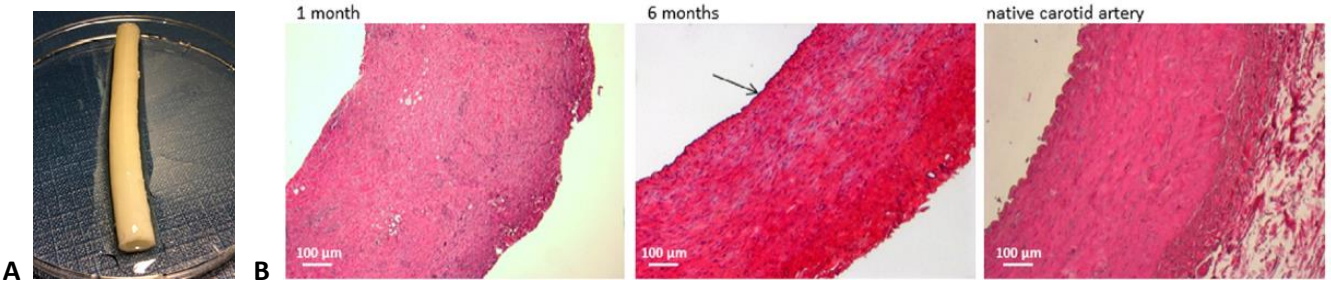
Bioartificial vascular grafts based on a highly compacted acellular fibrin matrix

Keywords: bioartificial graft, vascular graft, acellular, fibrin matrix, tissue engineering

INVENTION NOVELTY

The development of vascular grafts is an ongoing challenge in the field of tissue engineering. Various prerequisites such as biocompatibility, fast availability and sufficient burst strength need to be considered in the development towards a clinical product. The newly developed process for production of acellular bioartificial grafts perfectly addresses the aforementioned requirements and enables the production of highly stable tubular fibrin-based grafts for vascular replacement.



(A) Fibrin tubes with a length of 100 mm were engineered and implanted into sheep for evaluation studies. (B) Histological HE-staining of explanted fibrin grafts visualizes the tissue remodeling process of the explanted fibrin tubes. After 6 month fibrin grafts became most similar to the native carotid. (From: Aper et al., 2016).

VALUE PROPOSITION

Fibrin has been proven to be the most suitable matrix for vascularized tissue constructs due to its biocompatibility and its perfect characteristics for the repopulation with different cell types. However, the lack of stability has substantially limited its clinical application until today. Thus, there is still an unmet need to develop highly stable fibrin-based vascular grafts. The novel production process enables the manufacture of highly stable tubular fibrin segments which can be stored as ready-to-use products for immediate clinical application in vascular surgery.

TECHNOLOGY DESCRIPTION

The largely automated process comprises the precipitation of fibrin from plasma and subsequent compaction of fibrin by centrifugal forces or pressurization which results in a significant increase of biomechanical stability and a burst strength of ≥900 mm of mercury. It is particularly noteworthy that animal studies demonstrated an astonishing structural similarity between implanted fibrin-based vascular grafts and native arteries after only 6 months. Thus, the novel fibrin-based vascular grafts have excellent mechanical characteristics and striking tissue remodeling properties as well. In view of storage conditions, it is important to mention that engineered vascular grafts can be simply stored at room temperature and are available “off the shelf” during surgery.

COMMERCIAL OPPORTUNITY

In-licensing is possible.

DEVELOPMENT STATUS

Engineered vascular grafts have been widely tested *in vitro* and *in vivo* with very promising results.

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PATENT SITUATION

European patents (EP 3319652 B1, EP 3821919 B1) with priority of 2015 have been granted. Further, a US patent (US 11,065,366 B2) has been granted and a US patent application (US 17/346,872) is pending.

FURTHER READING

Aper T, Wilhelmi M, Gebhardt C, Hoeffler K, Benecke N, Hilfiker A, Haverich A. 2016. Novel method for the generation of tissue-engineered vascular grafts based on a highly compacted fibrin matrix. *Acta Biomater*. 29:21-32.

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