

Nanothin Fibrin-Heparin Coatings: A Dual-Function Strategy for Thrombosis Prevention and Vascular Implant Integration

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The prevention of thrombosis in artificial vascular implants remains a critical challenge in cardiovascular medicine. Traditional implant surfaces often trigger the coagulation cascade upon contact with blood, leading to thrombus formation and subsequent complications. In response to this issue, we have developed innovative nanothin fibrin-heparin coatings designed to both prevent thrombosis and support the endothelialization of vascular implants.[1] These coatings, with thicknesses in the nanometer range, are inspired by natural biological processes. They function not only as a barrier to platelet activation and inflammation but also as a platform for the controlled release of growth factors. Specifically, the coatings are engineered to bind and release fibroblast growth factor (FGF) and vascular endothelial growth factor (VEGF), which play crucial roles in endothelial cell proliferation and differentiation. In vitro studies using human umbilical vein endothelial cells (HUVECs) demonstrated that these coatings significantly enhance cell viability and promote the formation of mature endothelial structures. The synergistic effect of FGF and VEGF, delivered via the fibrin-heparin matrix, was particularly effective in accelerating endothelialization, a key factor in the long-term success of vascular implants.

Our research highlights the potential of nanothin fibrin-heparin coatings as a dual-function solution for both thrombosis prevention and the promotion of vascular healing. This approach represents a promising advancement in the development of next-generation cardiovascular implants, with the potential to significantly improve patient outcomes.

References

- [1] Johanka Táborská, Zuzana Riedelová, Eduard Brynda, Pavel Májek, Tomáš Riedel. Endothelialization of an ePTFE vessel prosthesis modified with an antithrombogenic fibrin/heparin coating enriched with bound growth factors. *RSC Adv.*, 2021, 11, 5903.

Figure

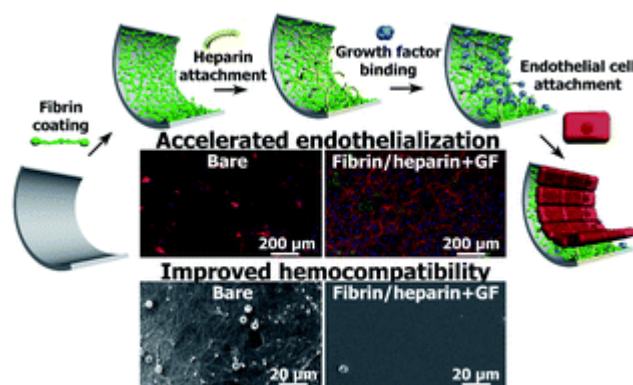


Figure 1. Scheme of a nanothin fibrin-heparin coating and its effect on hemocompatibility and endothelialization

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