

Vascularization Strategies in Tissue Engineering: State-of-the-Art Approaches and Challenges

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The need for available organs and tissues for transplantation far exceeds their supply. An alternative to traditional methods is the use of tissue engineering techniques. Increased market demand has accelerated the development of tissue engineering in recent years, and clinical use of grafts created by these methods has become feasible. However, many problems still remain a significant challenge for researchers and physicians. One of them is the vascularization of tissue-engineered grafts, which determines the viability of the tissue, its integration into the recipient and its proper functioning.

Without vascularization, engineered tissues thicker than the diffusion limit experience hypoxia and necrosis. Therefore, modern tissue engineering approaches such as vascularized scaffolds, 3D bioprinting, and the use of signalling molecules to stimulate angiogenesis are used to create complex vascular systems. Despite the progress, significant problems remain in replicating the complexity of the vascular system, compatibility with the recipient's vasculature and large-scale production. To overcome these challenges, it is crucial to conduct more interdisciplinary and clinical research.

This article discusses the importance of tissue engineered vascular systems (TEVS) in clinical practice, their characteristics, manufacturing challenges, and regulatory requirements.