

REVIEW ARTICLES

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Tissue engineering of heart valves – challenges and opportunities

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Abstract

Background: Heart valve disease is a clinically serious condition. The replacement of damaged valves practiced since the 1950's is the ultimate treatment for end-stage heart failure caused by severe valve dysfunction. The choice of adequate prosthesis is challenging. Unfortunately, the treatment options available today do not satisfy completely physicians and scientists' needs. Mechanical valves require long-term anticoagulation therapy because of poor hemocompatibility. Biological substitutes have better hemodynamics, but need replacement in ~ 10 years due to calcification and degeneration. In order to overcome the shortcomings of current treatment options many researches are motivated to fabricate a functional, living heart valve replacement by tissue engineering.

Conclusions: Tissue engineering is a promising approach that may lead novel constructs that will satisfy the need and overcome the limitations of current valve prosthetics. Scaffolds, fabricated from synthetic or biological materials, do not require donor tissue, but have struggled to recreate the macro- and micro valve anatomy and mechanical properties of native valve. Decellularized cardiovascular grafts have the opportunity to improve patients care by reducing the risk of sensitization to donor antigens, calcify and stenosis and providing with a good graft that will grow (especially important in children). In this way the emotional and financial drain on the patient and family of enduring multiple surgeries may be significantly minimized. The choice of decellularization method can be rational if mechanism of action is contemplated and clearly understood.

Key words: tissue engineering of heart valve, decellularized scaffolds, hybrid starter matrices.