Perspective
Volume 13:11, 2022

Journal of
Tissue Science and Engineering

ISSN: 2157-7552

Open Access

The Search for a Durable Bioengineered Tissue for the Treatment of Valvular Heart Disease

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Introduction

In regenerative medicine, tissue engineering has the potential to be used to create organs with intricate functions as well as structural tissues. Focuses on tissue engineering of heart valves, a goal that requires a unique combination of technological, biological, and technical obstacles [1]. We emphasize fundamental ideas, methods, and concepts, as well as recent advancements and ongoing issues. We begin by examining normal heart valve functional anatomy, biomechanics, development, maturation, remodelling, and injury response as a foundation for comprehending the enabling scientific principles.

Description

In order to achieve the goal of engineered tissue heart cell seeding of biodegradable synthetic scaffolds, cell seeding of processed tissue scaffolds, and repopulation of implanted substrates by circulating endogenous cells without first performing in vitro cell seeding are the three approaches that we investigate. Finally, we look at the issues that exist in the field and offer suggestions for future preclinical and translational clinical studies that will be required to address significant regulatory concerns regarding the safety and effectiveness of heart valve tissue engineering and regenerative techniques. Biodegradable polymers and other scaffolds, cellular engineering, and tissue engineering are all areas in which further success and eventual human benefit will depend, even though some progress has been made toward the goal of developing a therapeutically viable tissue-created heart valve [2].

Techniques and procedures for manipulating the extracellular matrix in order to describe and possibly non-invasively measure the rate and quality of tissue remodelling and healing [3]. Circulating stem cells, biodegradable scaffolds, decellularized scaffolds, engineered tissue heart valves, and heart valve remodelling. The heart and other components of the cardiovascular system, as well as the liver, kidney, and pancreas, are just a few of the complex organs for which tissue engineering has the potential to be used in regenerative medicine. However, there are significant shortages of donor tissues, serious transplant-related complications, limitations to existing prosthetic devices and conventional surgical approaches. Cardiovascular tissue engineering has primarily focused on blood vessels, myocardium, and heart valves [4].

The Ross procedure, which replaces diseased valves with mechanical prosthetics or tissue valves like porcine aortic valve, bovine pericardial xenograft, cadaveric allograft, or pulmonary-to-aortic autograft valves, has improved adult survival and quality of life. However, there are drawbacks to each of these valve types. Bio prosthetic valves, on the other hand, do not require anticoagulation to control thromboembolism. The expected benefits of a tissue heart valve are nonthrombogenicity, resistance to infection, and cellular viability. Comparisons and summaries of conventional and tissue-engineered heart valve replacement design criteria are presented [5].

Conclusion

The most pressing need for technology for heart valve tissue engineering and regeneration is in the young adult and pediatric populations, where the outcomes of valve replacement are less favorable than in older people. Since a valve replacement's inability to expand with an individual's growth necessitates repetitive procedures, the promise of growth, repair, and remodelling as a child receiver matures is extremely exciting. Only autografts, like valves that are moved from the pulmonary to the aortic position on an individual, are currently possible. However, the technique is technically complicated, dangerous, and only useful for a small number of patients, and produces results that aren't certain, like whether the grafts would grow in proportion to the growth of the recipients.

Acknowledgement

None.

Conflict of Interest

None.

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Received: 02 November, 2022; Manuscript No. JTSE-23-86579; **Editor Assigned:** 05 November, 2022; PreQC No. P-86579; **Reviewed:** 16 November, 2022; QC No. Q-86579; **Revised:** 22 November, 2022, Manuscript No. R-86579; **Published:** 29 November, 2022, DOI: 10.37421/2157-7552.2022.13.309

How to cite this article: Keynes, Walter. "The Search for a Durable Bioengineered Tissue for the Treatment of Valvular Heart Disease." *J Tiss Sci Eng* 13 (2022): 309.