Clemson University Research Foundation

Bioprosthetic Heart Valves that Resist Structural Degradation and Stiffening (2013-055)

Crosslinking Chemistry Increases Durability and Endurance of Bioprosthetic Heart Valve Replacements

Market Overview

This treatment stabilizes the connective tissue present in bioprosthetic heart valves to create durable and long-lasting replacement heart valves. There are approximately 300,000 heart valve transplantations performed globally each year and heart valve disorders are diagnosed in approximately four million people. There are major problems with the two heart valve replacement solutions currently available to patients: mechanical and bioprosthetic. Mechanical valves require patients to take lifelong anticoagulants, generally making bioprosthetic valves the preferred approach. Glutaraldhedye is commonly used in bioprosthetic valves to stabilize one component of the connective tissue while the remaining components are not stabilized, causing the valve to lose its native behavior, structurally degrade, and calcify. Clemson University Researchers have developed a treatment which stabilizes all components of the connective tissue in bioprosthetic valves, making the heart valve replacement more durability and resistant to degradation, stiffening, and calcification.

Application

Cardiovascular surgery; heart valve replacement

Stage of Development

In vitro and *in vivo* studies completed

Advantages

- Utilizes crosslinking chemistry to stabilize connective tissue, improving tear resistance and biocompatibility
- Demonstrates significant reducing of calcification in tissue, helping the heart valve to resist structural degradation

Technical Summary

The treatment involves stabilizing the soft connective tissue – glycosaminoglycans (GAGs), elastin, and collagen – resulting in a bioprosthetic heart valve with a structurally stable extracellular matrix. This is done by crosslinking neomycin trisulfate, carbodiimide, and pentagalloyl glucose (NCPC) which allows for the penetration and manipulation of the tissue. *In vivo* studies have demonstrated stabilization and resistance to calcification. The stabilized connective tissue can also exhibit GAG retention over time.

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About the Inventor

Dr. Naren Vyavahare is a Hunter Endowed Chair and Professor in the Department of Bioengineering at Clemson University. He earned his Ph.D. in Chemistry from the University of Pune, India. Prior to joining Clemson, Dr. Vyavahare served as a Research Assistant Professor at the University of Pennsylvania School of Medicine and the University of Michigan. He holds over 15 issued US and foreign patents and several more in patent pending status. His research interests focus on targeted treatments to restore extracellular matrix and tissue function in heart valves, arotic aneurysms, vascular calcification, COPD, and skin disorders.

For More Information

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Application Type	Country	Serial No.	Patent No.	CURF Reference No.	Inventors
Non-Provisional	United States	61/881,611 14/495,067	NA	2013-055	Naren Vyavahare, Hobey Tam