Docket #: S21-372

Modular Bioprosthetic Valve design to support customized number of leaflets

Stanford researchers in the Woo Lab have developed a modular bioprosthetic valve that allows for customizable leaflet configurations, ranging from bi- to multi-leaflet designs. These configurations can be tailored to patient-specific needs, including the symmetry and shape of the valve, and can be used in various valve positions. The valve's interchangeable frame or stent comes in multiple shapes to accommodate different patient anatomies and can support chordal attachments for mitral or tricuspid valve replacements. The frame, made from 3D printed biocompatible resin, integrates with components like sewing rings, leak-prevention cloth, wireforms, and leaflets, which can be bioprinted, xenograft, or polymeric. This innovation offers surgeons the ability to customize the valve for each procedure, potentially improving bioprosthetic valve performance and durability, as supported by in silico studies. These findings highlight the significance of customizable valve designs in advancing surgical techniques.

Stage of Development

- Prototypes
- In silico finite element studies

Figure



Figure description: Prototypes of bi-leaflet stent for modular bioprosthetic valve using biocompatible polyurethane RPU70 resin in Carbon 3D printer. (*Image credit: https://doi.org/10.1016/j.xjon.2023.04.007)*

Applications

- Replacement of diseased mitral, aortic, tricuspid, or pulmonary valves

Advantages

- **Customizability** - Surgeons can select from various leaflet configurations and frame shapes
- **Versatility** - The valve can be adapted for different valve positions and supports chordal attachment, making it suitable for mitral or tricuspid valve replacements.
- **Compatibility** - The 3D printed biocompatible resin frame integrates seamlessly with various components
- **Improved Performance and Durability**
- **Enhanced Surgical Flexibility**

Publications

- Pandya, P. K., Park, M. H., Zhu, Y., & Woo, Y. J. (2023). Biomechanical analysis of novel leaflet geometries for bioprosthetic valves. *JTCVS open*, 14, 77–86.

Patents

- Published Application: WO2023219979
- Published Application: 20250064583

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