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STRUCTURAL ANALYSIS OF THE FIRST REMODELING MITRAL MECHANICAL HEART VALVE PROSTHESIS WITH DOUBLE CURVED LEAFLET.

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Current bileaflet mechanical heart valve prosthesis (BHVP) are cylindric with plan leaflet.Recently Kwon studied a cylindric BHVP with curved leaflet to optimize hemodynamic performance. In our study, we describe a saddle shape BHVP with double curved leaflet for mitral valve replacement in order to ensure the remodeling of the mitral annulus, to respect the neighboring regions and to enhance blood flow and reduce frictions. Methods : The remodeling mitral BHVP consists of three parts: the orifice ring with a saddle shape which supports two leaflets, the sewing cuff following the same shape, and the leaflets with a double curved design. Orifice ring and leaflets are made of Si-alloyed pyrolitic carbone (Young's Modulus : 30.5 GPa). Nonlinear structural mechanic analysis for the leaflet of our prosthesis was conducted using a thickness of 0.75 mm (homogenous pression of 500 KPa). Computer-aided engineering systems was used. The geometry of the remodeling mitral BHVP was assessed by SolidWorks software (Dassault Systemes) and exported to Patran MD software (MSC Software) to generate the meshing with Patran MD. The structural analysis was made by Marc Mentat Software (MSC Software). Results : The structural deformation resulting from the analysis showed that the Maximum deflection is 11.5 10-7 m. The distribution of the deflection is maximal at the 3rd quarter of the central part of the leaflet. From the structural analysis of the leaflet the maximum Von Mises stress is 142 MPa. The Von Mises stress distribution is maximal at two points : at the 1st and the 4th quarter of the central part of the leaflet. Conclusion : The structural analysis of the remodeling mitral BHVP showed reduced both stress and deflection comparing to other prosthesis. Further fluid flow studies through this mechanical prosthesis and motion dynamics are necessary to confirm its benefits.