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Functional Performance Of Decellularized Human Heart Valves

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Objectives:
A non-detergent based decellularization paradigm was applied to human pulmonary valves, and showed no change in tissue biomechanics. To assess the processing impact on performance under complex loading, pulsatile flow characterizations were performed under pulmonary valve flow conditions before and after loading through >15 million cycles.

Method:
Six conventional cryopreserved human pulmonary valves (Control) and six decellularized cryopreserved valves (Test) were compared under pulsatile flow and accelerated wear-testing paradigms. Hydrodynamic parameters (ViVitro Systems, Victoria, BC) were collected before and after the accumulation of >15 million accelerated pressure loading cycles at >40 mm Hg (DynaTec-Dalta, Galena, MO) and compared. Comparative gross and histopathologic examinations were also performed.

Results:
Test and control valves showed equivalently low transvalve gradients before and after wear testing, with both populations demonstrating a slight increase in retrograde flow due to post-wear leakage. Gross and histopathologically observed wear was concentrated in the leaflet coaptive margins, with no commissural or hinge-point damage observed.

Conclusions:
Under simulated pulmonary flow and loading conditions, decellularization did not impact the functional integrity of the valve tissues. Functional equivalency was demonstrated between the two valve treatment processes.