Ex Vivo Biomechanical Analysis of Flexible versus Rigid Annuloplasty Rings in Mitral Valves with Dilated Annulus using a Novel Annular Dilation System

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Background
- Mitral annuloplasty rings are a fundamental component in mitral valve repair.
- They aim to restore annular dimensions to increase leaflet coaptation and prevent annular dilation.
- However, biomechanical evaluations of annuloplasty rings are lacking.

Objective
- We aim to compare flexible and rigid annuloplasty rings using an ex vivo mitral annular dilation model.

Methods
- Porcine mitral valves (n=4) with intercommissural distance of 26-28 mm were mounted in a 3D-printed ex vivo left heart simulator.
- After baseline data collection, the valves were dilated to intercommissural distances of 40-42 mm using a 3D-printed dilator.
- The dilated valves were sewn to an elastic mount.
- Fiber Bragg Grating sensors were anchored to native primary and secondary chordae.

Conclusions
- Both rigid and flexible annuloplasty rings are effective in increasing mitral leaflet coaptation height.
- Rigid rings were possibly more effective in mitral regurgitation reduction and minimizing transmitral leakage energy loss.
- Flexible rings were associated with lower chordal stress post-repair.
- In vivo validation should be performed to enable direct translation to clinical patient care.

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