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Comparative Evaluation of Mitral Valve Strain by Deformation Tracking in 3 - Dimensional Echocardiography

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Background:
We compute patient specific strain maps for mitral valve leaflets, by new algorithmic tracking and modeling of mitral valve apparatus (MVA) deformations in 3-dimensional echocardiography.

Methods and Results:
A transesophagual 3-dimensional echocardiography of mitral valve was performed pre- and post-surgery for 10 patients with organic mitral regurgitation, and for 10 normal patients. All regurgitation cases underwent successful surgery by non-resectional dynamic (NRD) mitral valve repair. Mitral annulus and leaflets tagging at Mid- and End Systole enabled the generation of patient specific B-splines MVA models. Dynamic registration of 3D-echocardiographic image data was implemented by innovative computation of diffeomorphic MVA deformations, to compute leaflets strain intensities. Compared to normal, strain intensities were higher for all regurgitation cases, on both anterior and posterior leaflets, and NRD surgery reduced strain in each leaflet to nearly normal values (Fig 1). Figure 2 is an example of strain analysis pre and post mitral valve repair.

Conclusion:
3-dimensional echocardiography enabled the generation of patient specific dynamic modeling of the MVA in 10 controls and 10 organic mitral regurgitation cases (pre - and post - surgery). Strain computation revealed that NRD repair surgery reduced strain intensities for both mitral valve leaflets.

Figure 1

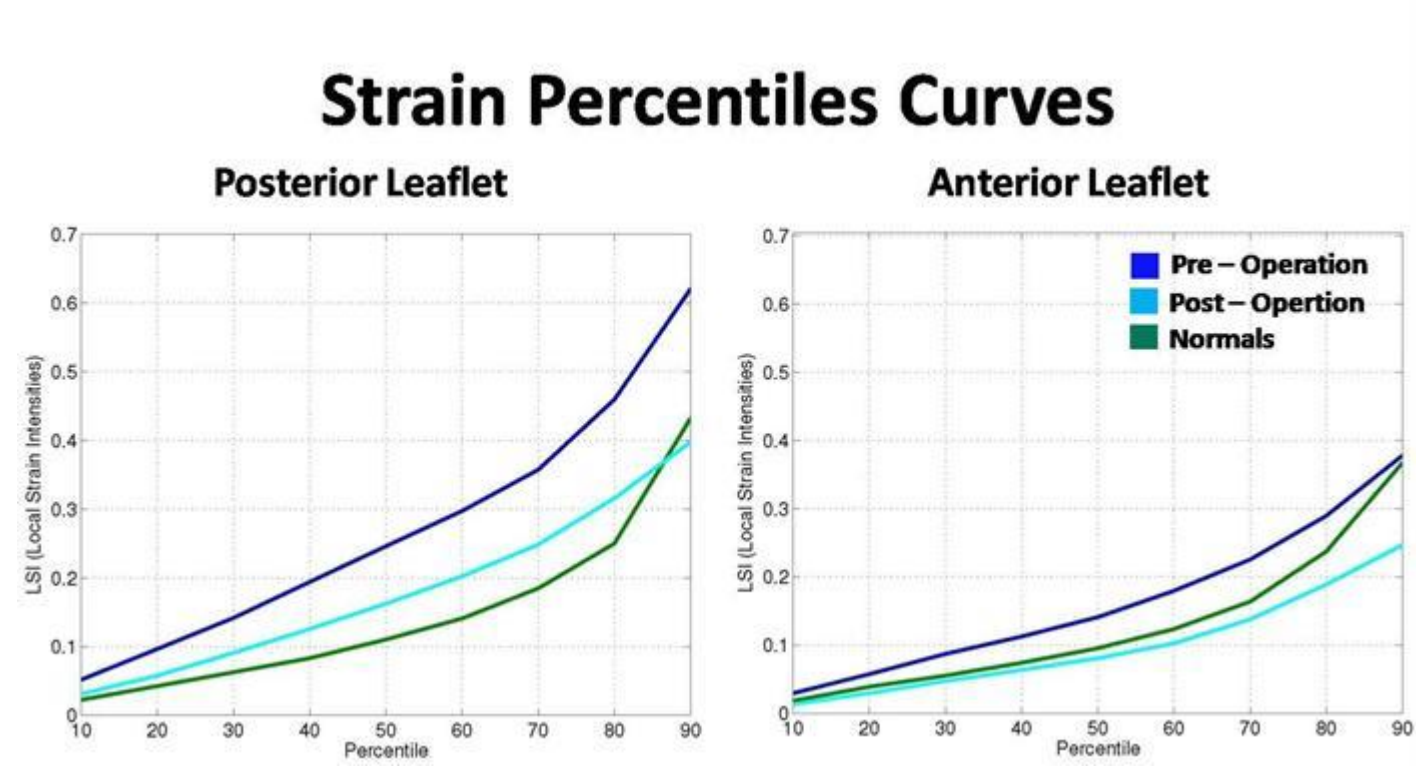
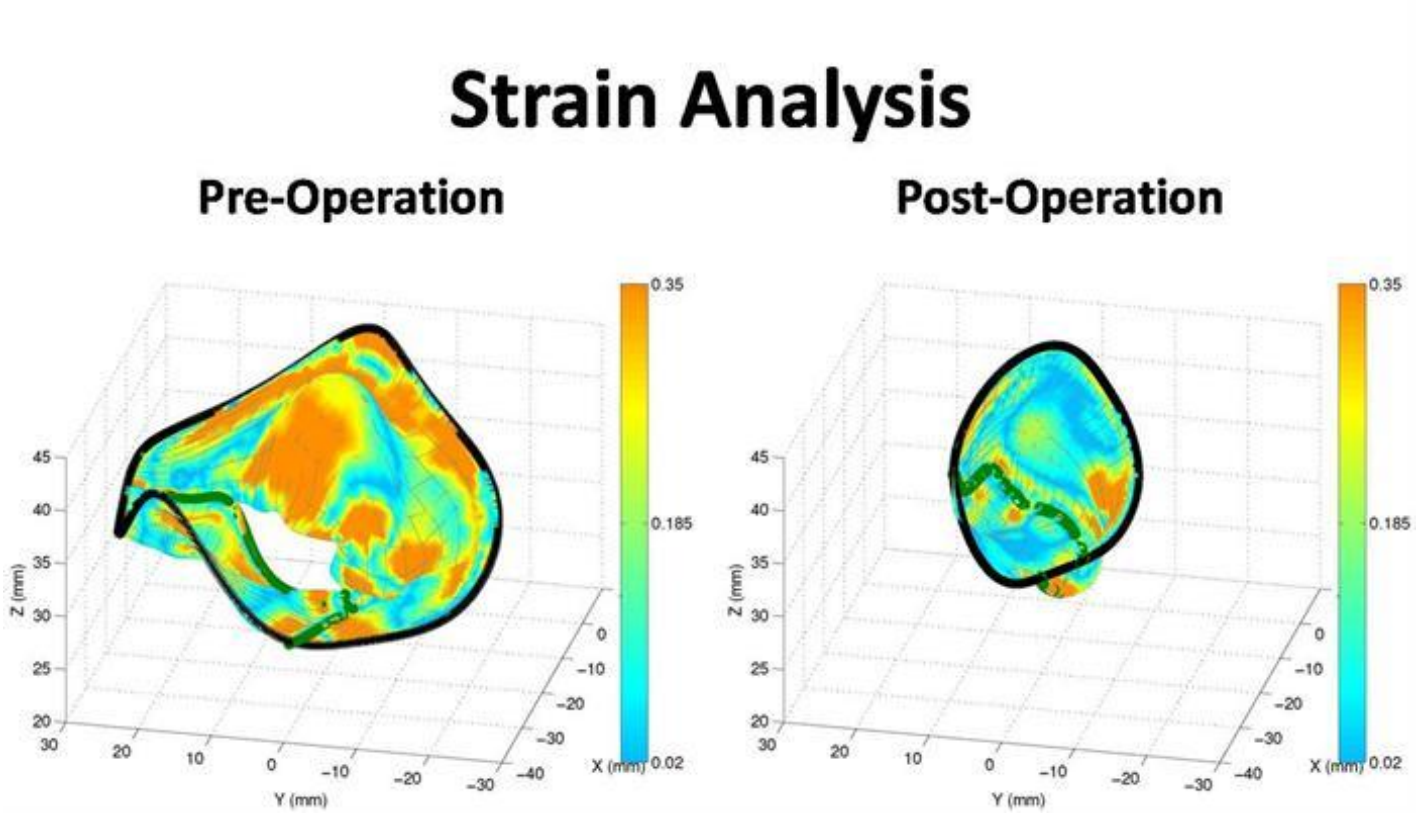


Figure 2


Strain Analysis
Pre-Operation
Post-Operation
Z (mm)
Y (mm)
X (mm)
0.35
0.185
0.02