Regional Changes in Leaflet Coaptation Geometry Following Reduction Annuloplasty in Patients with Functional Mitral Regurgitation

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Introduction & Methods

- Reduction annuloplasty (RA) for functional mitral regurgitation (FMR) improves leaflet coaptation, but effects on regional geometry have not been well defined.
- 16 patients with severe FMR underwent RA with a semirigid device. Intraoperative 3DTEE was taken pre & post repair.
- Offline analysis assessed coaptation zone geometry in 3 regions; differences were quantified with RMANOVA.

Patient Characteristics

	Value
Age (years)	63.8 (range: 50-84)
Male Gender (n)	14 (88%)
Ischemic Etiology (n)	8 (50%)
Concomitant CABG (n)	5 (31%)
Concomitant TVR (n)	3 (19%)
Annuloplasty Size (Mean±SD)	27.0 ± 2.53

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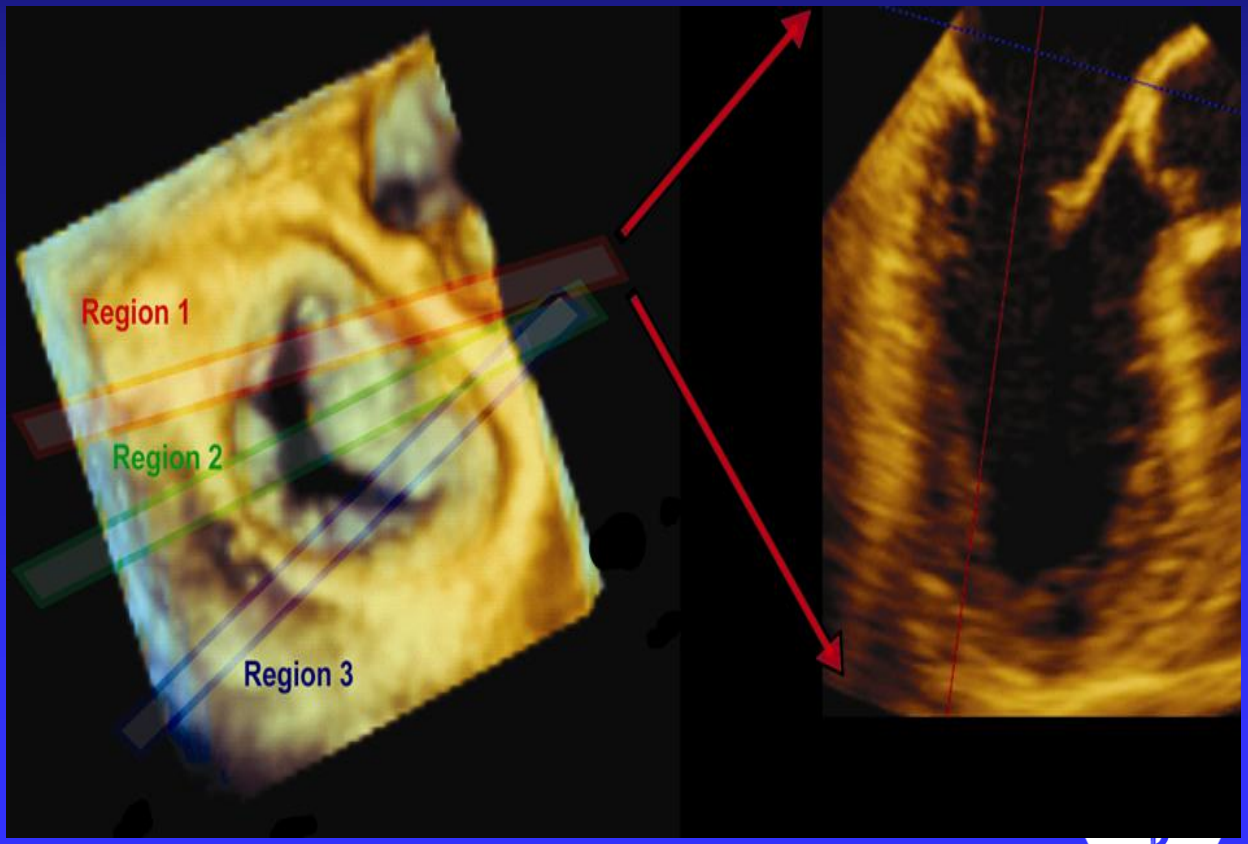
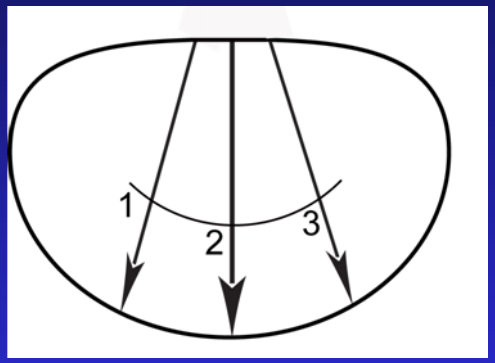
Coaptation Zone Analysis

- Measurements were performed in three planes (regions) orthogonal to the annulus, transecting the posterior leaflet scallops.

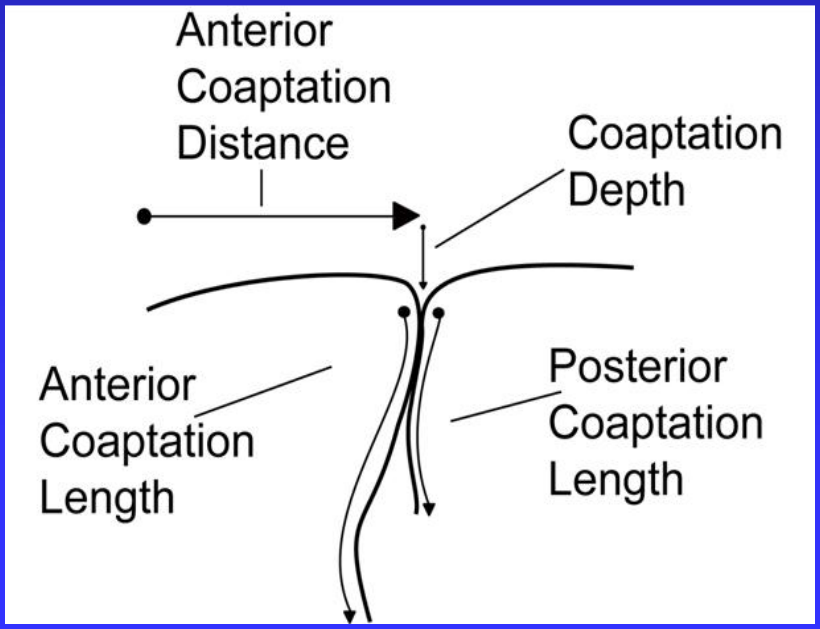


Schematic Representation of Coaptation Measurements

Diastolic Measurements:
- Septo-lateral annular dimension
- Anterior Leaflet Length
- Posterior Leaflet Length



Systolic Measurements:
- Anterior Coaptation Distance
- Coaptation Depth
- Anterior Coaptation Length
- Posterior Coaptation Length



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Regional Mitral Valve Geometry Pre versus Post Reduction Annuloplasty for FMR

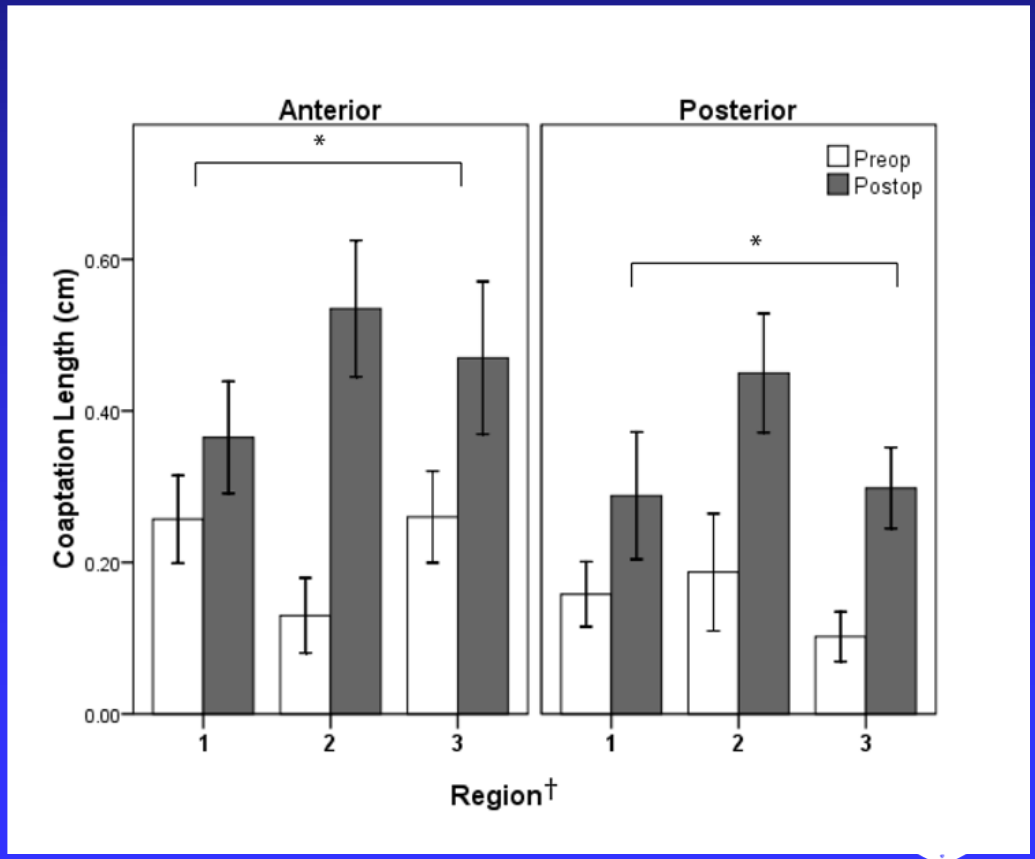
	Region 1: *Pre vs Post*	Region 2: *Pre vs Post*	Region 3: *Pre vs Post*
Septo-Lateral Annular Dimension	31.4±8.0 vs 20.2±5.5*	34.7±5.9 vs 22.0±5.5*	30.3±5.9 vs 19.8±4.9*
Coaptation Distance	19.9±6.1 vs 15.7±4.6*	23.3±5.9 vs 15.9±4.7*	18.4±5.5 vs 14.5±4.4*
Coaptation Depth	7.2±2.6 vs 6.4±2.6**	8.2±3.3 vs 6.7±2.6**	6.5±2.5 vs 6.3±2.1**
Anterior Leaflet Coaptation Length†	3.6±2.1 vs 4.3±2.2*	2.9±2.6 vs 5.5 ±2.5*	3.6±2.2 vs 4.8±2.6*
Posterior Leaflet Coaptation Length	2.2±1.6 vs 2.9±2.1*	2.6±2.4 vs 4.0±2.1*	1.8±1.4 vs 2.9±1.3*

Measurements in millimeters.
RMANOVA: Effect of RA on all regions: *p<0.01, **p=0.08.
Effect of region on coaptation length by RA: †p=0.01.

Effects of Reduction Annuloplasty

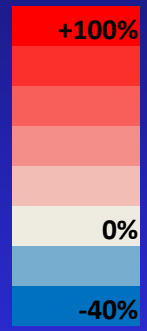
- Reduction annuloplasty was associated with increased leaflet coaptation lengths in all regions (*p<0.01).

- Increased anterior coaptation length was non-uniform between regions, with the greatest increase in *Region 2* as assessed by RMANOVA (†p=0.01).



Absolute and Relative Changes in Mitral Valve Geometry Pre versus Post Reduction Annuloplasty for FMR

	Region 1 (mm)	Region 2 (mm)	Region 3 (mm)
Septo-Lateral Annular Dimension *	-11.2 (-35.7%)	-12.7 (-36.6%)	-10.5 (-34.7%)
Coaptation Distance *	-4.2 (-21.1%)	-7.4 (-31.8%)	-3.9 (-21.2%)
Coaptation Depth **	-0.8 (-11.1%)	-1.5 (-18.3%)	-0.2 (-3.1%)
Anterior Leaflet Coaptation Length†	0.7 (19.4%)	2.6 (89.7%)	1.2 (33.3%)
Posterior Leaflet Coaptation Length *	0.7 (31.8%)	1.4 (53.8%)	1.1 (61.1%)



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Effect of region on coaptation length by RA: †p=0.01.

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Ventricular Measurements

	Pre-op (Mean±SD)	Post-op (Mean±SD)	p-value
MR Severity (1-4+)	3.8±0.5	0.1±0.4	<0.001
Ejection Fraction (%)	34.5±18.1%	27.8±5.4%	0.33
LVEDD (cm)	4.82±0.71cm	4.41±0.66cm	0.03
LVESD (cm)	4.09±0.79cm	4.05±0.65cm	0.29

- RA for FMR significantly reduced the grade of FMR from 3.8 to 0.1 (scale 0-4).

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Conclusions

- RA in FMR produces varying changes in coaptation zones:
  - Leaflet coaptation lengths increased in all regions.
  - This increase varies by region, with region 2 showing the greatest increase.
  - Annular septo-lateral dimension and coaptation distance decreased significantly in all regions.

- Regional analysis of mitral valve coaptation creates a mathematical framework to better understand the mechanisms of surgical success/failure of RA for FMR.