Introducing: 2D Strain imaging using speckle-tracking is a method allowing simultaneous analysis of myocardial strain in both the radial and circumferential directions. The values of strain and strain-rate of left ventricular (LV) segments using this technique pre and post CRT have not been reported. We compared the values before and after implantation of CRT.

**Methods:** Eighteen subjects who underwent successful CRT implantation were included in our study. Patients were evaluated after insertion of the device (6MWT). NYHA class and Minnesota QOL score were used as markers of response. Images were acquired using a Vivid 7 (GE Vingmed) ultrasound system and analyzed offline using dedicated 2D strain software. A parasternal short-axis view at papillary muscle level was used to assess circumferential (CS) and radial (RS) strain. The value of peak strain and both systolic and diastolic strain rates (SRs SRe) were measured in six segments of the LV (septal, lateral, inferior, anterior, anteroseptum and posterior segments).

**Results:** Mean values following CRT increased by 24% for CS (p<0.05) and 25% for RS (p<0.05), non-significant changes were seen with SR. Mean NYHA class was reduced by 0.5 and 13/18 patients significantly improved their QOL score. 14 of the 18 (78%) patients improved their 6MWT by >30 m. The mean CS improvement following CRT showed the strongest correlation with improvement in 6MWT (AUC 0.839, p=0.044). Using a cut-off value of >0.1 for improvement in mean CS, ROC curves predicted an improvement in 6MWT with 93% sensitivity and 75% specificity.

**Conclusion:** This technique demonstrates that CRT has a positive effect on Radial and Circumferential Strain. CS correlates well with clinical response and is a valuable echocardiographic measure of response to CRT.

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**Does real-time 3D echocardiography demonstrate a causative role for inter-papillary dyssynchrony in functional mitral regurgitation in severe heart failure?**

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**Background:** Recent evidence suggests that dyssynchronous papillary muscle activation may be a contributing factor in functional mitral regurgitation (FMR), which occurs in up to 30% of patients with severe heart failure.

**Aims:** Using real-time 3D echocardiography (RT3DE), we evaluated the contribution of dyssynchronous inter-papillary contraction to FMR improvement after CRT.

**Methods:** Thirty consecutive patients (23 male, ejection fraction 21±7%) undergoing CRT with at least mild FMR were studied. FMR severity was assessed semi-quantitatively as regurgitant jet/left atrial area ratio (JA/LAA). RT3DE was used to evaluate left ventricular (LV) volumes, ejection fraction, and indices of global and regional intraventricular dyssynchrony, derived from the standard deviation, corrected for R-R interval, of time to minimum volume of each segment of the standard 16-segment LV model. Measurements were made at baseline pre-implant and at 6 months follow-up.

**Results:** Seventeen patients (ischaemic aetiology, n=8.47%) showed a response to CRT, with evidence of LV reverse remodelling. LV end-systolic volume reduction 155±76 ml to 96±58 ml; p=0.0001) and improvement in ejection fraction (20±6% to 34±11%; p<0.0001). There was no difference in CRT response between the ischaemic and non-ischaemic patients (p=0.9). Mitral regurgitation was also significantly reduced in these patients, JA/LAA ratio (18±16% to 6±9%; p=0.006). Responders showed a reduction in 3D-derived assessment of global dysynchrony (14.3±5.3% to 7.5±4%; p<0.0001). There was no significant correlation between FMR reduction and the degree of LV end-systolic reduction or global dysynchrony. In the remaining 13 patients, in whom there was a non-response to CRT (LV end-systolic volumes 163±63 ml to 174±59 ml; p=0.2; LV ejection fraction 22±6% to 22±7%; p=0.8), there was no reduction in global dysynchrony, (12±6% to 10.6±6%; p=0.1), nor improvement in FMR (17±15 to 25±13; p=0.1). In both responders and non-responders, there was no difference in inter-papillary activation delay times after CRT (96±89 ms vs 100±107 ms respectively; p=0.8). In addition, no correlation between improvement in regional dysynchrony in the mid LV at papillary muscle insertion sites and the degree of FMR improvement was noted in the responder group (r=-0.04, p=0.8).

**Conclusion:** Cardiac resynchronisation therapy significantly reduces FMR. Regional dysynchrony involving the papillary muscle insertion sites however, is not a determinant of FMR reduction in CRT at 6 months follow-up.