

## 2D Wall Motion Tracking - A Powerful Analysis Tool in the Cardiovascular Package for the Aplio Series

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### Clinical purpose and background

Toshiba Medical Systems enjoys a high reputation in the field of echocardiography by successfully exploring speckle tracking technology for cardiovascular applications. As an industry leader Toshiba introduced the first commercially available 3D Wall Motion Tracking (WMT) on its Artida premium class echocardiography system. Recently 2D WMT was presented as part of the cardiovascular package on the new Aplio series for advanced cardiology applications.

Based on 2D raw data speckle samples, the motion of the myocardium is tracked throughout the cardiac cycle.

The samples provide thousands of 2D displacement vectors which are automatically grouped within standard segments to generate dynamic information from the myocardial structures such as velocity, strain, and strain rate (Fig. 1, 2).

### Basic features

WMT is available for all apical views and three short axis views, thus the motion of each segment of the left ventricle can be analyzed in two directions.

Since 2D WMT is applied on 2D Cine Clips, high-frame rate raw data can be acquired for the assessment of velocity and strain rate parameters, in particular.

### Easy to use

The workflow of the WMT analysis is very easy. Following full manual outlining of the myocardial border at end diastole, automatic contour tracking (ACT) is added. Only three markers have to be set: two are placed at the mitral valve ring and the third at the apex. The software will immediately and accurately track the myocardium.

### Speckle tracking and standardization

Toshiba is aware of the importance of standardization of strain parameters from different manufacturers of ultrasound systems and actively supports the Joint Taskforce of the American Society of Echocardiography (ASE) and the European Association

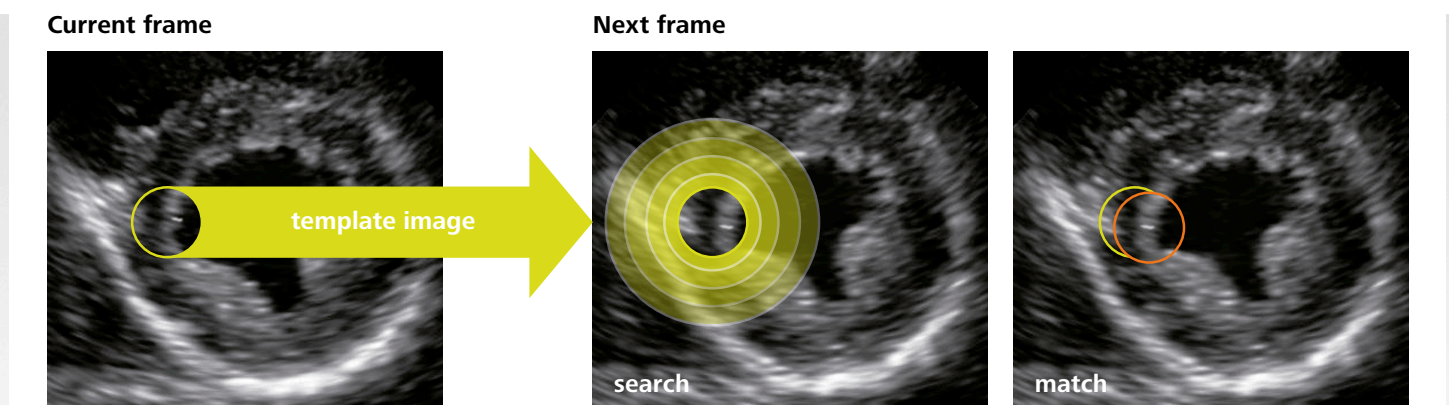


Fig. 1: Speckles are identified in each frame by means of pattern recognition. In the adjacent frame the new position of each speckle is determined by an intelligent search-and-match function. The amplitude of movement provides quantitative information about myocardial wall motion.

of Echocardiography (EAE) to achieve this standardization. The first steps have already been taken.

**Comprehensive measurements**

In addition to the standard definition of the ASE-EAE of global longitudinal and circumferential strain, the Aplio analyses several further parameters of the dynamics of the myocardium.

**Advanced features**

One of the special features of WMT is the individual presentation of strain from the inner myocardial layer (defined as the “standard” for longitudinal and circumferential strain according to the ASE-EAE Taskforce) as well as from mid- myocardial and from outer myocardial layers to gain layer-specific information of the myocardial motion and

thickening (Fig. 4). In addition, WMT offers parametric presentations of left ventricle motion timing to support the assessment of dyssynchrony in patients with LBBB and of patients undergoing CRT (Fig. 3).

**LV function: quick quantitative assessment**

The WMT package provides comprehensive

Parameters that currently can be measured with WMT:

	Displacement	Velocity	Strain	Strain Rate	Rotation	Rotation Rate
<b>Apical View</b>						
Longitudinal	•	•	•	•		
Transversal	•	•	•	•		
<b>Parasternal View</b>						
Circumferential	•	•	•	•		
Radial	•	•	•	•	•	•
<b>Dyssynchrony (Time To Peak)</b>	•		•			

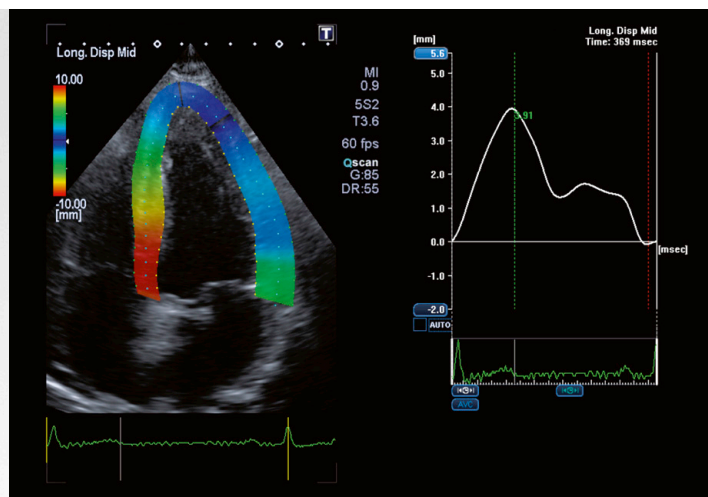


Fig. 2: Example of the global displacement curve of the left ventricle based on six segments.

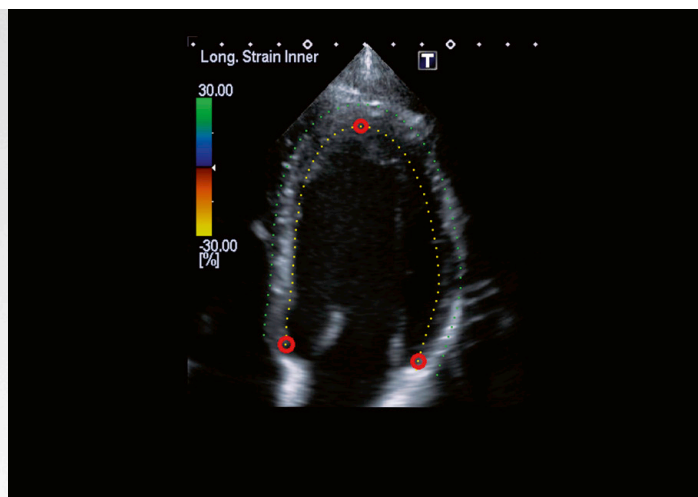


Fig. 3: Three points need to be set by the user of the LV at end diastole to define the initial contour for WMT.

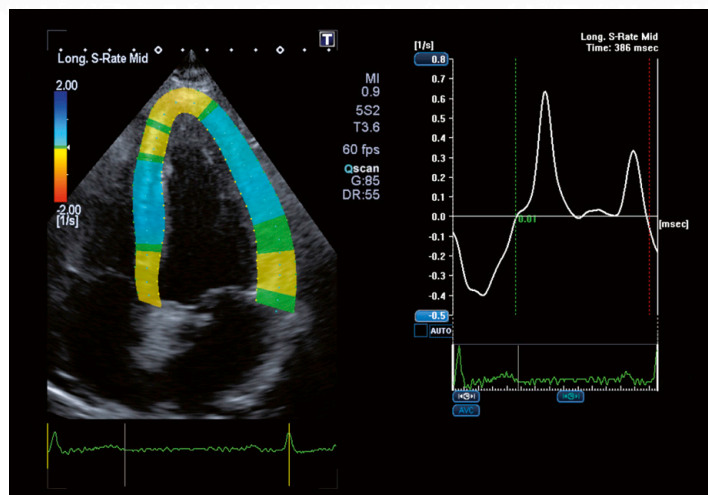


Fig. 4: Global six segments averaged strain rate curve of the LV.

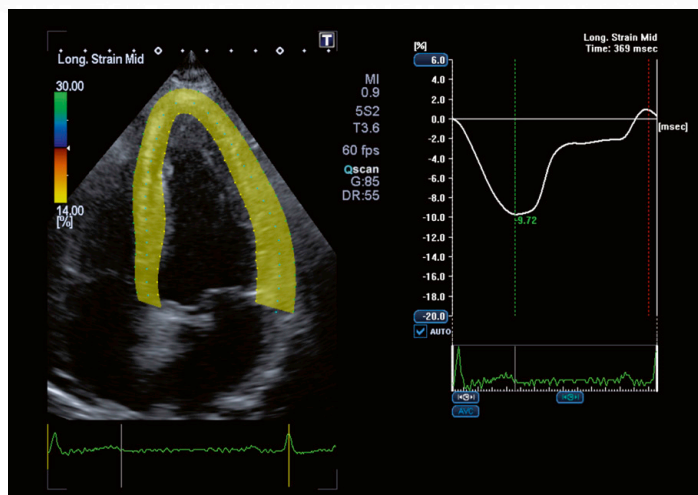


Fig. 5: Averaged global longitudinal strain of six segments at mid-myocardium.

quantitative information about global and regional LV function. In addition to the global and regional displacement, velocity, strain, and strain rate curves the left ventricle volume change and ejection fraction are calculated. Thus the main clinical values are immediately available.

**Volume information:**

- End diastolic volume
- End systolic volume
- Ejection fraction
- LV mass
- Volume curve
- LV mass curve

**Off-line analysis**

The WMT analysis can also be performed off-line based on DICOM files containing raw data clips sent to an UltraExtend™ workstation.

Clinical data courtesy of:  
 Prof. Dr. H-J. Nesser  
 Dr. R Steringer-Mascherbauer  
 Elisabethinen Hospital, Linz, Austria

**References**

**1. Next-generation wall motion analysis techniques in Artida**

Hiroyuki Ohuchi, Yasuhiko Abe, Shinichi Hashimoto  
 White Paper Toshiba Medical Review TMR-0903-1

**2. Two and three dimensional wall motion analysis**

Abe Y, Ohichi H, Kawagishi T,  
 White Paper Toshiba Medical Review TMR 0805-1

**3. Dyssynchrony by speckle-tracking echocardiography and response to cardiac resynchronization therapy: results of the**

**Speckle Tracking and Resynchronization (STAR) study**

Hidekazu Tanaka<sup>1</sup>, Hans-Joachim Nesser<sup>2</sup>, Thomas Buck<sup>3</sup>, Olusegun Oyenuga<sup>1</sup>, Alexander R. Janosi<sup>3</sup>, Siegmund Winter<sup>2</sup>, Samir Saba<sup>1</sup>, and John Gorcsan III<sup>1\*</sup>  
 European Heart Journal ( Fast Track )  
 doi:10.1093/eurheartj/ehq213

**4. Validation of intramural strain with a newly developed 2-dimensional speckle tracking system**

Ishizu T, Tsukuba University, Japan  
 ACC 2009, 1018-244

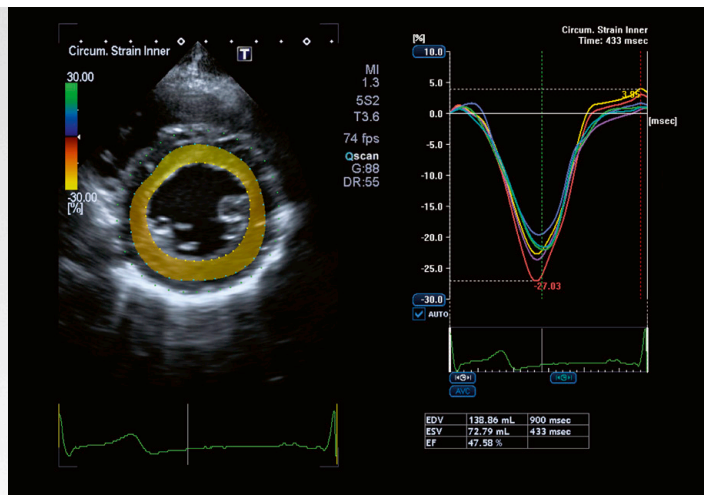


Fig. 6: Example of circumferential strain of the endocardial (inner) layer where the highest strain values are detected.

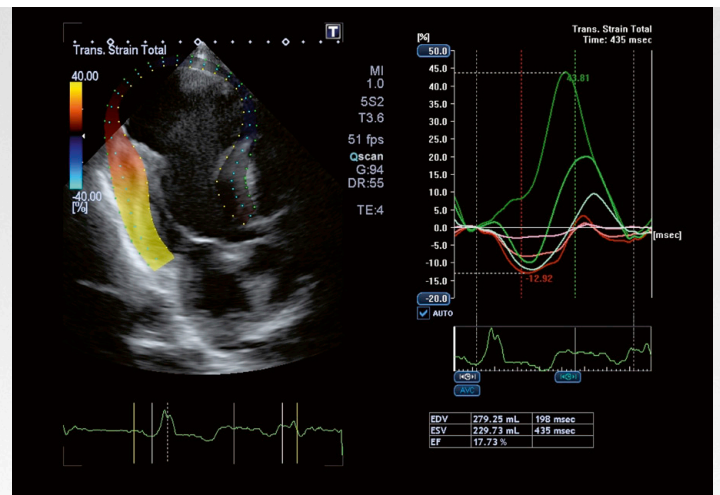


Fig. 7: Example of transversal strain in case of anterior infarction. Note the dyskinetic negative red curve on the right which corresponds to the anterior segments (dark area in the image on the left side). The high strain peak of the basal posterior wall (green curve) corresponds to the bright yellow area in the image on the left.

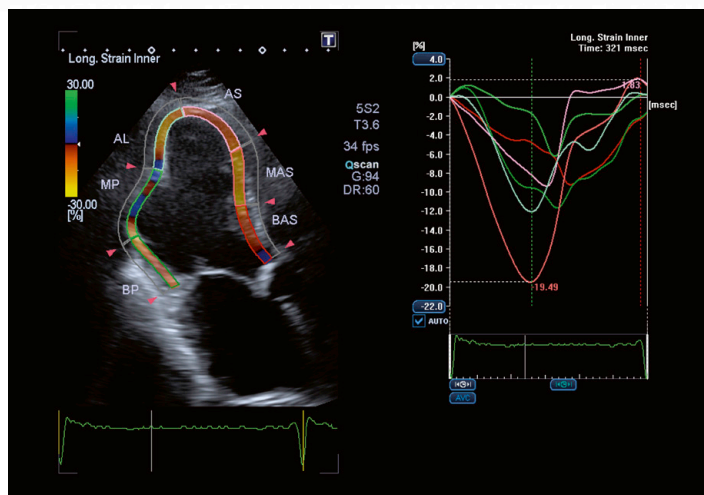


Fig. 8: Regional strain analysis in postero-lateral infarction: Apical long axis view shows normal contraction of the anterior wall segments with the red and orange color. The posterior wall segments (green) show a typical low systolic longitudinal strain value of the inner myocardial layer with a delayed peak in early diastole in the postero-lateral infarcted zone.

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