

## Real Time SSFP: an Alternative Technique for Evaluation of Cardiac Function in Patients with Arrhythmia

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### Introduction

Cine imaging with Steady State Free Precession (SSFP) or True-Fisp is the current method of choice for measuring cardiac function by MRI. Typically this is acquired with a breath held, ECG gated, segmented acquisition over multiple heart beats. Patients with cardiac disease, presenting with arrhythmias present a challenge in obtaining quality diagnostic images. In most cases, images will be degraded by artifacts caused by inconsistent cardiac size, shape and motion during the abnormal heart beats. Although arrhythmia rejection is an option on most scanners, it results in longer scan times, is not 100% reliable in all patients, and incompletely compensates for altered heart size and shape on subsequent heartbeats. Real time imaging with SSFP is a non-ECG gated, non-breath held method resulting in diagnostic quality cine images with no artifact.

### Purpose

To demonstrate real time SSFP as a useful tool in imaging patients with arrhythmia.

### Methods

Patients were scanned with a Siemens Avanto 1.5 T scanner, utilizing an 8 element cardiac array (Nova Medical, Wakefield, MA). Cardiac functional imaging was performed with both segmented and real time SSFP imaging for comparison. Real time imaging was realized by using parallel imaging (TSENSE method) at acceleration rate  $R=4$  and by reducing the spatial and temporal resolution. Using a  $192 \times 80$  matrix, with an echo spacing of 2.7 ms, the temporal resolution was approximately 54 ms. The FOV was 300 by 250 corresponding to an in-plane spatial resolution of  $1.6 \times 3.1 \text{ mm}^2$ . Multiple cardiac cycles were typically acquired.

### Results

A typical short axis SSFP image (Figure 1) obtained with a gated, segmented acquisition demonstrates blurring due to arrhythmia. In the real time image from the same patient (Figure 2), the artifact is eliminated. Real time imaging enabled proper evaluation of cardiac function and measurement of ejection fraction (EF), as compared to conventional SSFP, which was non diagnostic for EF assessment, and allowed only limited evaluation of cardiac function.

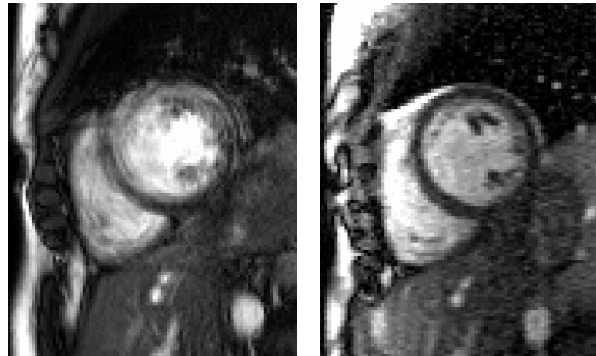


Figure 1

Figure 2

### Conclusion

Real time imaging is a useful technique for imaging patients with arrhythmias. Diagnostic images can be obtained allowing cardiac function to be evaluated in patients that previously would have received non diagnostic studies.