

## Observer Evaluation of 3D MR DSA Preview Images

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### KEYWORDS:

*MR Physics, MR Reconstruction Algorithms, MR Vascular Studies*

### PURPOSE:

To evaluate the use of preview images in time-resolved 3D MRA. Preview images are not intended for diagnosis but to identify images for a subsequent full reconstruction, thus reducing overall time-to-display. They should be rapidly generated, yet of sufficient quality to verify exam success and to select time frames.

### METHOD/MATERIALS:

Reconstruction of 4D data sets, such as those from 3D MR DSA, is computationally demanding. The process can be accelerated by the use of *preview images*, which are generated from a subset of the acquired data and help to identify the diagnostic time frames. Initial studies indicated, that Fourier projections (reconstruction of a central slice in  $k$ -space) were of insufficient quality in some instances, especially in the presence of high background signals. In this study, 10 consecutive patient exams of the thighs (acq. matrix:  $312 \times 144 \times 24$ , recon. matrix:  $V = 512 \times 384 \times 48$ ) were analyzed. Time series were reconstructed using all data (technique A), Fourier projection (B), and three  $k$ -space subsets. The subsets either contained only contiguous low-frequency information (method I) or low-frequency information in  $k_x$  and  $k_y$  and every  $i$ -th data point in  $k_z$  (II). The three subsets were chosen based on a previous quantitative contrast analysis (C:  $V = 256 \times 192 \times 4$ , method I; D:  $V = 256 \times 192 \times 4$ , II; E:  $V = 128 \times 96 \times 8$ , II). The techniques required only 2.0% (B), 2.4% (C & D), and 1.2% (E) of the operations as compared to the full reconstruction (A). The images were evaluated in a blinded study with each film containing a time series of 12 images. Four observers were asked whether the images were sufficient to determine the success of a scan and if they were suitable to guide the reconstruction. They also identified the peak arterial time frame.

### RESULTS:

There were 40 evaluations for each method (4 observers  $\times$  10 exams). The images were found to determine the technical success of an exam in 40 (A), 34 (B), 38 (C), 40 (D), and 38 (E) cases. For 40 (A), 36 (B), 37 (C), 39 (D), and 40 (E) films the images were identified as sufficient for guidance of the full reconstruction of the 3D MR DSA exam. The mean differences between identified peak arterial frame and measured peak arterial frame were  $0.38 \pm 0.21$  ( $\pm$ std. error, A),  $-0.75 \pm 0.18$  (B),  $0.35 \pm 0.17$  (C),  $0.28 \pm 0.20$  (D), and  $0.58 \pm 0.19$  (E).

### CONCLUSIONS:

Preview images reconstructed with less than 3% of the operations required for a full reconstruction were judged to be adequate to assess technical success and to guide image reconstruction. Techniques C, D and E are superior to technique B. Using these methods, the total reconstruction time can be significantly reduced.