

# Evaluation of the effectiveness of slice selective gradient reversal technique in diffusion weighted imaging of the female pelvis at 3T MR imaging

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## Purpose

Diffusion weighted images (DWI) require robust fat suppression. Slice selective gradient reversal (SSGR) is one of the fat suppression techniques [1]. SSGR gives little benefit at 1.5T, however, it would be effective at higher magnetic field strength [2, 3]. Therefore, the purpose of this study is to know whether SSGR influences the ADC values and imaging quality of 3T DWI of the female pelvis.

## Materials and methods

This retrospective study was approved by the institutional review board, and informed consent was waived. Thirty-one women (mean age, 50.4 years; range, 20-85 years) clinically suspected having gynecological diseases were included in the study. Axial and sagittal T1-, T2-weighted images, and axial single shot EPI-DWI (b=1000, and 0) were obtained with a 3T unit (Achieva, Philips Healthcare) using a cardiac 32ch coil. The parameters of DWI were: TR/TE=5546/55msec, FOV 350mm, matrix 256×256, 5mm slice thickness with no slice gap, and SENSE reduction factor 3. For fat suppression technique, two imaging sets of DWI were obtained; (1) SPAIR (spectral attenuated with inversion recovery) only, which is included in our routine protocol, and (2) both SSGR and SPAIR. For quantitative assessment, ADC value was calculated using oval region of interest (ROI) placed on uterine structures (endometrium and myometrium), iliac bone marrow, internal obturator muscle, gluteus maximus muscle, and pelvic tumors, if any. For qualitative assessment, two radiologists independently scored the strength of artifacts (ghosting and chemical shift artifact (CSA)) as 1:strong, 2:moderate, and 3:weak. They also scored the conspicuity of right and left ovary, and uterine layers of corpus and cervix as : 1.poor, 2.fair, and 3.good. ADC values and qualitative scores were statistically analyzed by using the paired t test and Wilcoxon signed rank test, respectively.

## Results

SPAIR+SSGR images provided significantly lower ADC values than SPAIR only images in internal obturator muscle ( $1.42 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$  vs.  $1.51 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ,  $p < .0001$ ) gluteus maximus muscle ( $1.54 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$  vs.  $1.63 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ,  $p < .0001$ ), and pelvic tumors including leiomyoma, adenomyosis, and cervical carcinoma ( $1.15 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$  vs.  $1.17 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ,  $p = .033$ ). There was statistically no significant difference in ADC of endometrium and myometrium. Significant differences of qualitative scores were seen in the assessment of artifacts. SPAIR+SSGR images apparently reduced ghosting (2.8 vs. 1.6,  $p < .0001$ ), however, increased CSA (1.9 vs 2.3;  $p < .0001$ ). There was statistically no significant difference in qualitative scores of the conspicuity of ovaries and uterine structures.

## Conclusion

SSGR influenced the ADC values of pelvic muscles, and tumors including benign and malignant. Therefore, we should notice the reproducibility of ADC is not always promising. SSGR is a robust fat suppression technique that could improve ghosting, and we consider CSA becomes eye-catching under that condition.

## References

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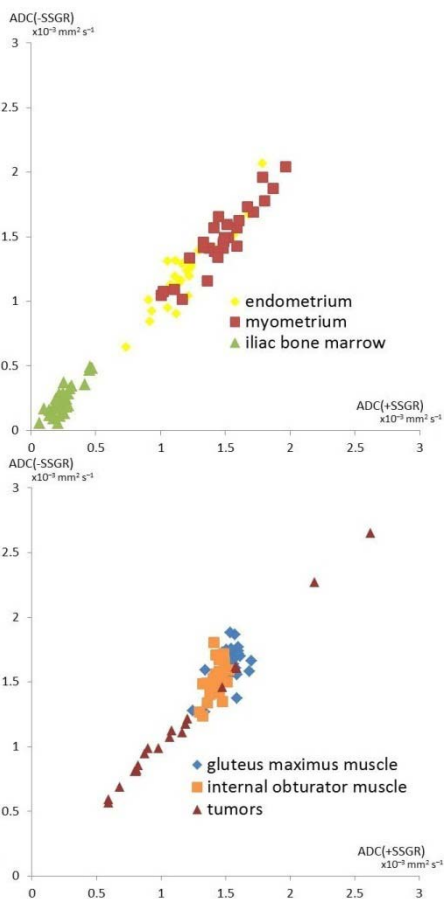


Figure. Comparison of ADC values between SPAIR only and SPAIR+SSGR