

# Quantitative Apparent Diffusion Coefficient Measurements are a more Repeatable Measure of Sacroiliitis than Visual Scoring

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## Introduction

Visual scoring of short tau inversion recovery (STIR) magnetic resonance images (MRI) is widely used for assessing sacroiliitis<sup>1</sup>. However, current scoring systems contain a number of subjective elements including assessment of depth and brightness of inflammation, and the number of inflamed joint quadrants.

Furthermore, observers can only make binary choices for each joint quadrant. Quantitative apparent diffusion coefficient (ADC) measurements<sup>2</sup> are based on pixel values in the image itself and are therefore intrinsically objective. This study aims to compare the *repeatability*<sup>3</sup> of visual STIR scoring and quantitative ADC measurements.

## Materials and Methods

Ten adolescent patients aged 12-24 with enthesitis-related arthritis (ERA) and ten controls with mechanical back pain underwent conventional MRI and diffusion-weighted MRI. Measurements were performed by two experienced musculoskeletal radiologists with expertise in spondyloarthritis imaging. STIR images were assessed using the Spondyloarthritis Research Consortium of Canada scoring system<sup>1</sup>. Sacroiliac joint apparent diffusion coefficient (ADC) measurements were performed using multiple linear regions-of-interest placed across the sacroiliac joint, as previously described<sup>2</sup> (Figure 1).

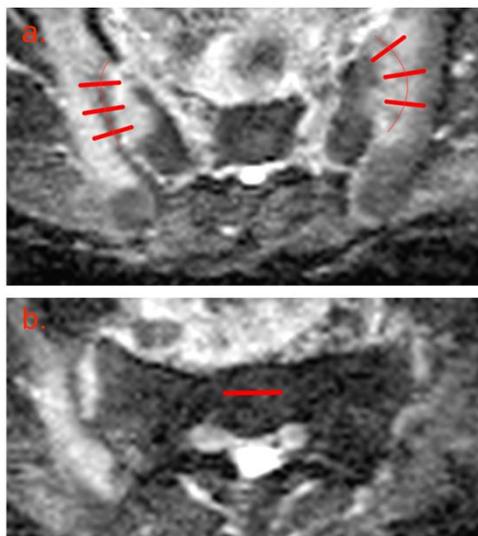


Figure 1 – Placement of regions-of-interest (ROIs) on ADC maps. (a) Three linear ROIs are placed on both sacroiliac joints (thick red lines). The joint itself is shown as a thin red line. (b) A further ROI is placed on interforaminal sacral bone.

## Results

Bland Altman 95% limits of agreement were  $\pm 82 \times 10^{-6} \text{mm}^2/\text{s}$  (**9.9% of the mean**) for quantitative ADC measurements, and  $\pm 6.4$  (**31% of the mean**) for visual STIR scoring. Intraclass correlation coefficients were 0.988 for ADC, and 0.986 for STIR scoring.

## Discussion

These data suggest that quantitative ADC measurements are more repeatable<sup>3</sup> than visual scoring as a measure of inflammation in ERA. DWI can be acquired and analysed more quickly than STIR images, and image analysis requires minimal expertise. Quantitative image analysis techniques may lower the threshold for using imaging biomarker data in the clinic, and could be used to both adults and children with spondyloarthritis. However, joint immaturity may reduce the accuracy of ADC measurements in paediatric/adolescent patients.

## Conclusions

Quantitative ADC measurements are more repeatable than visual STIR scoring as a measure of sacroiliitis.

## References

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3. Sullivan, D. C. *et al.* Metrology Standards for Quantitative Imaging. *Radiology* **277**, 813–825 (2015).