

High resolution imaging of the sacroiliac joints in ankylosing spondylitis patients at 7 Tesla

M. E. Vossen¹, W. M. Teeuwisse¹, M. Reijnierse¹, D. M. van der Heijde², N. B. Smith¹, and A. G. Webb¹

¹Radiology, Leiden University Medical Center, Leiden, Netherlands, ²Rheumatology, Leiden University Medical Center

Introduction. Inflammation of the sacroiliac (SI) joints is one of the earliest hallmarks in patients with ankylosing spondylitis (AS), a chronic rheumatologic inflammatory disorder belonging to the spondyloarthritis (SpA) group [1]. Recently, sacroiliitis on MRI has been included in new classification criteria for axial SpA [2]. In grading sacroiliitis using MR, a differentiation is made between inflammatory changes such as bone marrow edema versus structural changes such as erosions, sclerosis, fatty deposition and ankylosis. However, the distinction between structural changes is difficult at lower field strengths [3]. In this work, we demonstrate that high spatial resolution imaging of the SI joints can be achieved with excellent delineation of the whole SI joint using a 7 T scanner and custom-built RF coils.

Methods. Imaging was performed on a whole body 7T system (Philips Achieva) with subjects positioned head first in supine position. A quadrature transmit surface coil positioned anteriorly and five elements of an eight-channel receive array RF coil configuration [4] placed posteriorly were used to acquire coronal-oblique images with the imaging plane parallel to the SI joint. A multiple slice two-dimensional gradient echo sequence was used: TR/TE 20/7.7 ms, field-of-view 360 x 314 mm, in-plane resolution 0.5 x 0.5 mm, 3 mm slice thickness, 0.3 mm interslice gap, 2 signal averages, 10 slices and a total data acquisition time ~10 minutes. The spatial resolution is significantly increased compared to standard clinical scans on the 3T system. Several fat suppression techniques were explored. Due to specific absorption rate (SAR) limitations, a three-point Dixon method with a delta TE of 0.33 ms was chosen. Figures 1 and 2 show images from both volunteers and patients with various degrees of AS.

Figure 1. High spatial resolution images of a healthy volunteer (left) and a patient (right) with excellent delineation of the SI joints. The SI joints of the patient are irregular and demonstrate numerous cortical erosions (small white arrows) and a large fatty infiltration (thick white arrow).

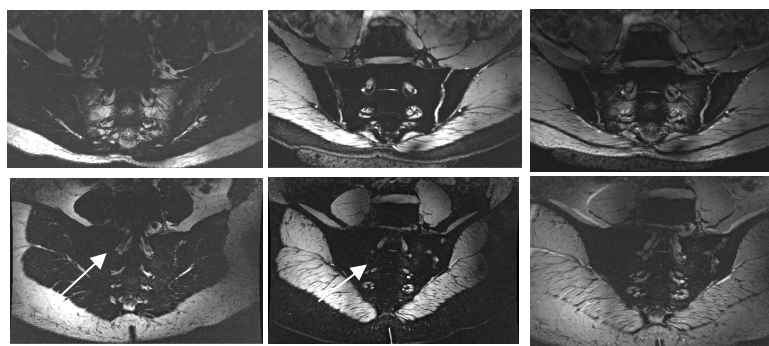
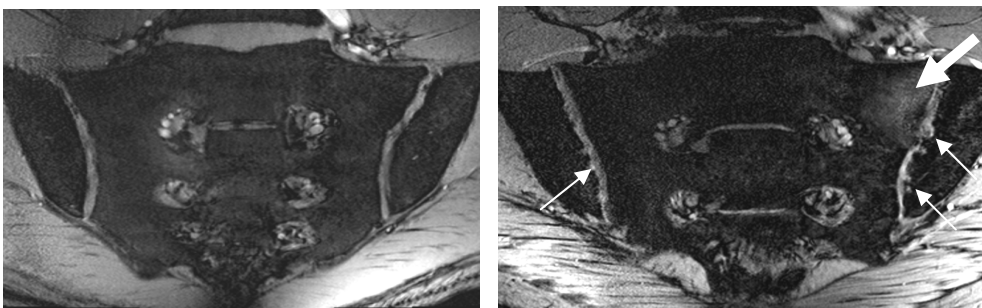


Figure 2.

Images of a healthy volunteer (top) and a patient with AS and long-standing sacroiliitis characterized by ankylosis (bottom, white arrow), demonstrating the Dixon method in the SI joints (left to right: fat, water, (fat+water) image).

Conclusion / discussion. High spatial resolution images of the SI joints can be acquired at 7 Tesla, which may facilitate the distinction of structural changes in sacroiliitis. Water/fat imaging using a three-point Dixon method proved feasible for the imaging of the SI joints at 7 Tesla and can differentiate between fatty infiltration and edema. In one patient with AS erosions and fatty infiltration was demonstrated. In another patient with long-standing sacroiliitis, high contrast images with a very clear differentiation between water (bone marrow edema) and fat (structural lesions) with ankylosis of the SI joints are displayed.

References. [1] J.Sieper et al. *Ann Rheum Dis*, 68, 1-44, 2009. [2] M.Rudwaleit et al. *Ann Rheum Dis*, 68, 777-83, 2009. [3] M.Ostergaard et al. *Best Pract Res Clin Rheumatol*, 24, 637-57, 2010. [4] M.Vossen et al. *J.Magn.Reson.* in press, 2010.