# A simple solution for reducing the dielectric artefact in clinical MR imaging at 3T

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## Introduction

The popularity of commercially available whole body MR scanners operating at higher field strength (3T) is now increasing mainly because of the higher signal to noise ratio it offers over low field strength scanners. This in turn enables the acquisition of images at higher temporal and/or higher spatial resolutions. Images at such resolutions may help in improving the diagnostic accuracy for a wide variety of pathologies. Unfortunately, higher field strength scanners also come with problems such as those related to artefacts. One such issue is the B1-inhomogeneity caused by dielectric effects. Schmitt et al[1] demonstrated the utility of dielectric pads in reducing this artefact in healthy volunteers. The purpose of our work was to demonstrate the efficacy of dielectric pads in improving the homogeneity of RF distribution in patients undergoing MRI scans at 3.0T.

## Methods

Three different dielectric pads were made by filling four litre capacity total parenteral nutrition bags (40 cm X 22 cm x 4cm) with aqueous solutions of Manganese salts. The pads were first tested on uniform doped aqueous phantoms. Fast spin echo T2W (TR/TE 3320/90, FOV 20 x 24cm, slice thickness 4mm, 448x288 matrix), spin echo T1W (TR/TE 500/14 ms, FOV 40 x 30 cm, slice thickness 5mm, 256x192 matrix) and single shot fast spin echo T2W (TR/TE 1800/100 ms, FOV 44 x 33, slice thickness 8mm, 256x256 matrix) sequences were performed on 3T GE scanner (Signa Infinity). Three regions of interest were drawn on the phantoms at different locations for each of the above sequences, signal intensities obtained and their standard deviations calculated. After demonstrating the safety of pads by testing them on two healthy volunteers, three patients with pelvic pathologies were scanned in sagittal and axial planes with and without the pads. As the size of each pad was relatively small, two similar pads were joined together to provide adequate coverage of the abdomen.

## Results

Signal intensities at three different ROIs drawn on the phantoms on three different sequences without and with pads are shown in the table. Experiments on the phantoms showed improved signal intensity and in-plane uniformity with all of the pads compared without using the pads. Figure 1 shows axial and sagittal T2W images of two patients with and without the 20mM MnSO4 pad, clearly demonstrating the improved image quality when the pad is present.

| | | No Pad | MnSO4 20mmol | MnSO4 50mmol | MnCl2 20mmol |
|---|---|---|---|---|---|
| FSE T2W | ROI 1 | 505 | 565 | 798 | 797 |
| | ROI 2 | 423 | 577 | 723 | 750 |
| | ROI 3 | 567 | 643 | 808 | 811 |
| | **S.D.** | **72** | **42** | **46** | **32** |
| SE T1W | ROI 1 | 1835 | 2125 | 2540 | 2606 |
| | ROI 2 | 1898 | 2325 | 2432 | 2460 |
| | ROI 3 | 1630 | 2280 | 2653 | 2769 |
| | **S.D.** | **140** | **105** | **111** | **155** |
| SSFSE T2W | ROI 1 | 751 | 798 | 730 | 736 |
| | ROI 2 | 678 | 770 | 700 | 708 |
| | ROI 3 | 616 | 804 | 702 | 720 |
| | **S.D.** | **68** | **18** | **17** | **14** |

## Conclusions

In our experience, the quantity of fat in the anterior abdominal wall did not influence the dielectric effect. In fact, pathologies such as massive ascites and large pelvic lesions (malignant and benign) seemed to worsen the dielectric effect. In such scenarios it becomes even more important that superior quality images be obtained to make appropriate diagnosis. Patients experienced minimal or no discomfort when pads were used. Pads like ours are quite easy to make and use, and provide a low cost solution of improving B1-homogeneity by reducing the dielectric effect. We are now regularly scanning all our patients with this technique.

## Reference

Schmitt et al (2004) Proc. Intl. Soc. Mag. Reson. Med. 11

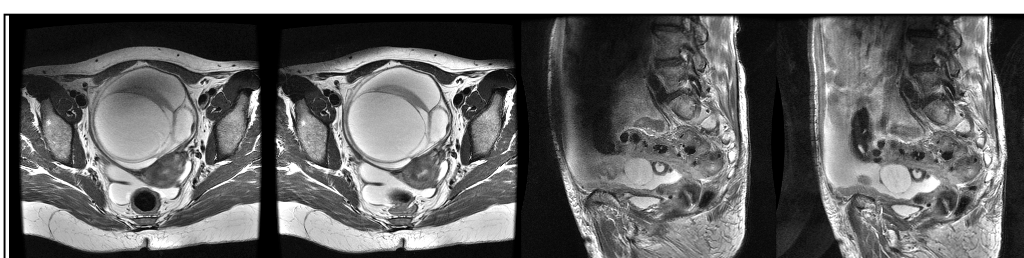

Figure 1. Axial & Sagittal images from two different patients showing improved uniformity when using the 20mM MnSO4 pad (right of each pair) compared to its absence (left).