

# An 8 channel shoulder coil for high resolution imaging

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**INTRODUCTION** While increasing the number of receiver channels enables higher parallel imaging factor and higher SNR at the surface, more SNR at deep tissues, especially the labrum, area is still desired. In this paper, an 8 channel shoulder coil with high surface SNR and deep tissue SNR is presented by optimizing the loop layout and introducing a dual hinging mechanism.

**METHOD** Shoulder coils can be categorized into two general classes: 1) including a loop going over the top of the shoulder into the armpit, and 2) having loops only surrounding the shoulder from the outside. Figure 1 shows the results of experiments comparing a loop going through the armpit and a loop residing on the lateral side of the patient. Small armpit loops under 55cm in circumference produce greater deep tissue SNR than side loops. However, to practically fit a normal patient population, the armpit loop needs to be 60 – 70cm in circumference, which reduces its deep tissue SNR. Therefore, to have higher SNR in the medial region, we found shoulder coils should not have the armpit loop.

To produce optimal SNR, the coil must maintain a tight fit about the shoulder region. The two-hinge configuration shown in Figure 2 easily adjusts to fit a large variety of shoulder sizes. Three rectangular loops are placed in the each wing. A single loop and a butterfly loop are placed in the center piece and extended into the wings for overlap decoupling with the rectangular loops. This hinge design also maintains tuning and decoupling of the loops to fit a large range of shoulder sizes.

**RESULTS** 1.5T and 3T 8 channel shoulder coils were built and evaluated in comparison with conventional shoulder coils. Figure 3 shows the SNR profile in the anterior-posterior direction normalized at the center of a loaded phantom. The 8-channel coil SNR is 1.2 (1.5T) to 1.3 (3T) times higher than a 4-channel coil at the center. The factor goes up to 2 (both 1.5T and 3T) at the surface region. Images of a normal volunteer are shown in Figures 4 and 5.

**CONCLUSION** 8 channel shoulder coils having a hinge and wing configuration were built and evaluated. Phantom and volunteer studies suggest that the SNR improvement will enable higher resolution or faster acquisitions in shoulder imaging.

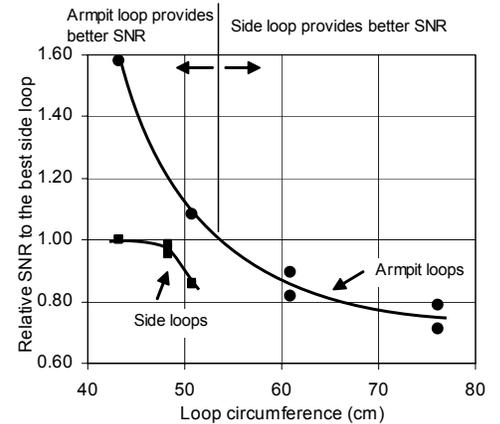


Fig.1. SNR comparison between armpit loops and side loops



Fig.2. The coil fits various size of patients using two hinge lines

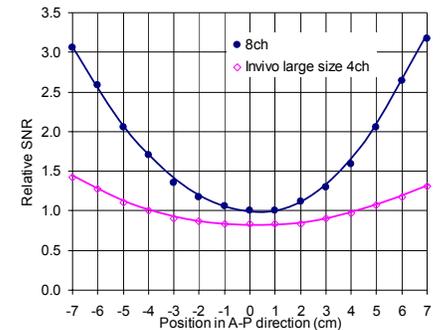


Fig.3. 8-ch coil shows higher SNR than a conventional shoulder coil by factor of 1.2 at the center and 2.0 at the surface (1.5T). SNR was calculated as average signal divided by background noise.



Fig.4. Coronal PD FatSat images at 3T. 8ch coil (left) and Invivo small size 4ch coil (right).

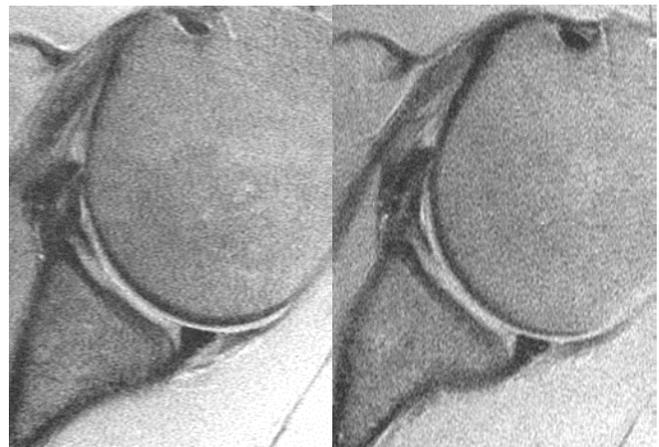


Fig.5. Improved deep tissue SNR from the 8-ch coil using a laterally positioned loop (left) compared to a coil using an armpit loop (right).