Phased array coils for abdominal and spine imaging

Cecilia Possanzini[1], Marcel Warntjes[1], Tam Nguyen, Patrick Dooms[1], Rob Kleihorst[1], Mark Verheyen[1], Fredy Visser[1]

[1]*Philips Medical Systems, Magnetic Resonance Development, Best, The Netherlands*

INTRODUCTION:

The rapid expansion of parallel imaging is supported by the development of phased-array coils, which allow to achieve an optimized signal to noise ratio (SNR) over a large field of view (FOV). The increasing number of elements allows faster dynamic scans with the consequent reduction of motion artifacts. This is particularly important to scan anatomical areas, as the heart or the abdomen, which are characterized by different types of motions (cardiac, respiratory and peristaltic). In this paper, we present two different approaches to the realization of a multi-element phased array coil: a modular approach for a 32 element coil for abdominal images and a dedicated design for a 20 element spine/posterior body applications.

METHODS AND RESULTS:

A 20 element phased array coil has been built and optimized for Spine/Posterior body application for the Philips Achieva System with freewave at 3.0T. The coil consists of an array of 4x5 elements, with a total anatomical coverage of 80cm along the main magnetic field axis and 50 cm in LR direction. The dimensions of the loop were optimized in order to achieve a penetration depth of 15 cm, necessary for lombal spine applications. The coupling between the elements is reduced by overlapping neighbor elements and using a high impedance preamplifier [1]. There are 12 elements in a coronal FOV of 50x50cm^2. The element distribution allows SENSE acquisition in both left-right and foot-head direction (Fig.1).

A different and faster approach for building a phased-array surface coil is to assemble existing elements. A phased-array surface coil of 32 elements was built in a modular approach for abdominal applications. The coil is made by combining 16 times a 2element Philips Flex-S surface coil. The Flex-S has been chosen for its extreme flexibility, which allows the use in different applications and in combination with other coils. The high impedance preamplifier implemented in the Flex-S elements minimizes the coupling among the elements. The 32 elements were placed in two arrays of 4x4elements, one on the posterior (Fig. 2a) and one on the anterior part (Fig. 2b) and allow covering the desired FOV of 50x50cm^2 with a good SNR (Fig 3).

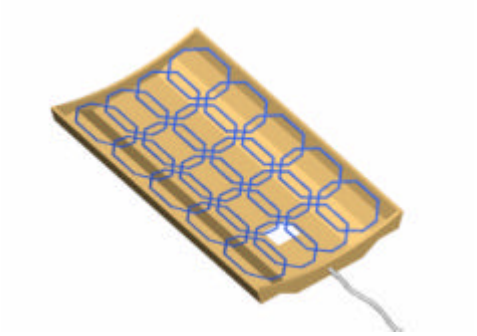

Figure 1: Phased-array Spine/Posterior coil with 20 elements.

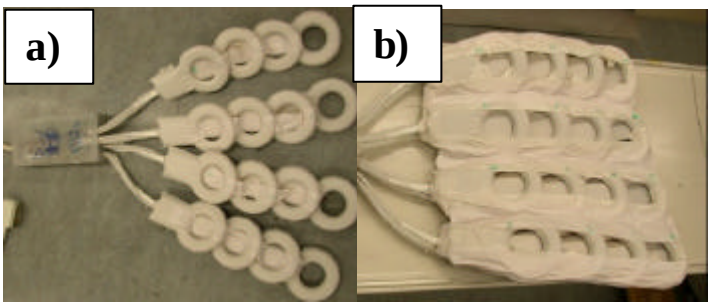

Figure 2: Phased-array coil with 32-elements: posterior (a) and anterior part (b).

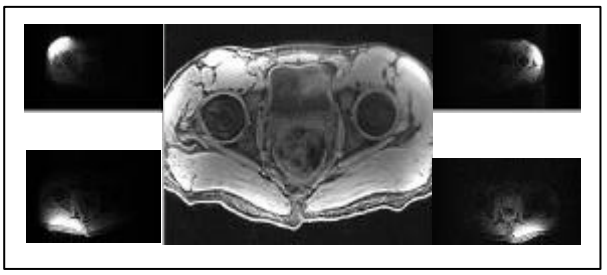

Figure 3: Abdominal image with the modular 32-element coil rebuilt combining the signals form all coils in the array (center). The image is the raw image, without homogeneity correction, i.e. CLEAR. Four single element acquisitions are shown on the sides.

REFERENCES:

[1] Roemer PB, Edelstein WA, Hayes CE, Souza SP, Mueller OM. The NMR phased array. Magn Reson Med 16, pp 192-225, 1990.