

A PHASED ARRAY HEAD AND NECK APPLICATOR: MEASUREMENTS OF THE SAR DISTRIBUTIONS IN A CYLINDRICAL MUSCLE PHANTOM

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Purpose: In previous theoretical studies we found that a setup consisting of two rings of six antennas, operating at 433MHz, can be used to obtain the desired specific absorption rate (SAR) distributions in the Head and Neck (H&N) region. In the present study we report on the work to verify the SAR distributions that can be obtained and the dynamic SAR steering possibilities by measurements in a cylindrical muscle phantom.

Materials and methods: Using a specially constructed laboratory prototype head-and-neck applicator, including a neck-mimicking cylindrical muscle phantom, we performed SAR measurements by either the electric field (Schottky-diode sheet) or the power-pulse technique (fiberoptic thermometry and infrared thermography). We also measured phase steered SAR distributions in radial and axial directions. All measured distributions were compared with the predictions by a finite-difference time-domain-based electromagnetic simulator. In a next step we build the clinical prototype (HYPERcollar) and measured the SAR distributions in the applicator by infrared thermography.

Results: A central 50% iso-SAR focus of 3.5 cm in diameter and about 10 cm in length was obtained for all investigated settings. Furthermore, this SAR focus could be steered toward the desired location in the radial and axial directions with an accuracy of ~ 0.5 cm. The SAR distributions as measured by all experimental methods were well predicted by the simulations. The SAR measurements within the HYPERcollar show a similar SAR focus in the diameter of the phantom, however due to the finite size of the waterbolus, the length decreases to around 9 cm.

Conclusion: The results of our study have shown that focused heating in the neck is feasible and that this focus can be effectively steered in the radial and axial directions.

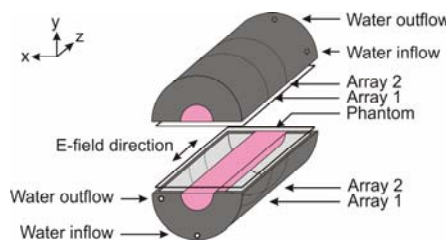


Figure 1: laboratory prototype

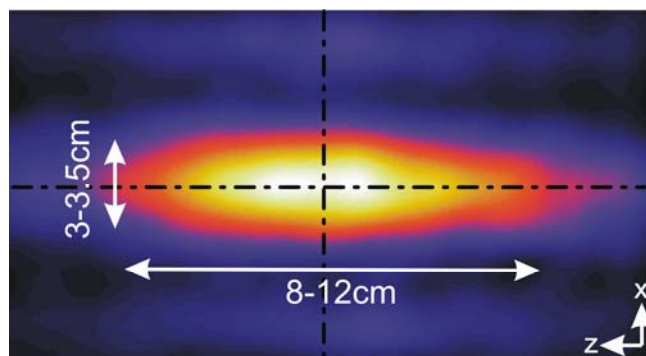


Figure 2: SAR in phantom for central phase settings