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Splittable wireless resonator array for intraoperative MRI

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Introduction: Intraoperative MRI (iMRI) 1,2 provides real-time imaging during surgery. This is crucial in neurosurgery for precise targeting and complete resection of tumours, reducing the risk of residual tissue and the need for repeat surgeries. For imaging, a radiofrequency (RF) coil must be placed around the head. For effective use in surgery, the top part of the coil should be easily removable, sterile, and sometimes disposable. Standard close-fitting helmet arrays with complex cables are unsuitable. To address this challenge, we test a low cost, cable-free, and splittable wireless resonator array designed specifically for iMRI.
Methods: The coil is a wireless resonator array consisting of two split halves. The top half contains one large loop resonator, while the bottom half includes a four-element, highly decoupled loop array. The bottom half is integrated with the head fixation system and remains stationary throughout the surgical procedure.
MRI was performed on a cylindrical phantom and on the human head to demonstrate the SNR performance. Three scenarios were investigated:(1) the wireless resonator array with the body coil, (2) the wireless resonator array with the 8-channel tilted array, with an acceleration factor of 2 in the AP direction for the human images and (3) a commercial 12-channel head array from Siemens, which served as a baseline for comparison. Data collection and use was approved by the local IRBs. The default body coil was used for RF transmission, with the wireless resonator array detuned or deactivated where applicable.
Results: Compared with the Siemens 12-channel head array, the wireless resonator array demonstrates similar SNR in the top and central areas and approximately 20% higher SNR in the bottom area, whether using the body coil or the local tiled receive array as the primary coil. For parallel imaging, the wireless+ tiled 8-channel array configuration produced lower maximum/average g-factors than the Siemens head array and produced clinically usable images with sufficient coverage of the entire brain.
Discussion and conclusion: In this work, we demonstrated the use of a splittable wireless resonator array for iMRI, in which the top half can be easily removed. The coil provided comparable or better SNR to a commercially available wired coil.
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Reference
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Keyword-1

Intraoperative MRI (iMRI)

Keyword-2

Signal-to-Noise Ratio (SNR)

Keyword-3

RF Coils

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