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Assessment of B_0 shimming routines for cervical spinal cord MRI at 7 Tesla

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7T MRI shows great potential for precise imaging of the spinal cord, offering higher resolution and signal-to-noise ratio compared to conventional clinical MR systems. However, increased field strength amplifies field inhomogeneities from magnetic susceptibility differences, potentially degrading diagnostic quality of the images. Shimming is a method to homogenize the magnetic field by sending variable currents through integrated shim coils. Different methods exist to calculate these currents, influenced by parameters such as volume of interest (shim volume). The optimal shimming routine for 7T MRI of the cervical spinal cord is however unclear.

Imaging of the cervical spinal cord was performed on five healthy volunteers on a 7T Terra System (Siemens Healthineers), with a 1Tx, 24Rx cervical coil. Shimming was performed with vendor-provided algorithms. The effect of shim volume, method of shimming, and number of shim iterations was quantitatively assessed on sagittal B0 field maps covering the full cervical spine, alongside axial multi-echo gradient echo and echo-planar imaging acquisitions centered on C3 and C6.

The vendor-provided Siemens Brain with shim volume enclosing the cervical spinal cord was used as a reference routine for comparison. This narrow shim volume yielded better shim quality than a shim volume covering the entire neck. A reduced shim volume targeting regions around C3/C6 yielded minimal improvements within the volume, while exacerbating field distortion outside. One shim iteration yielded equally good shim quality as three iterations. More advanced shimming methods yielded no further improvement. In conclusion, one iteration of the reference routine provided the most optimal shim.

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