Coregistration of digital photography of the human cortex and cranial magnetic resonance imaging for visualization of subdural electrodes in epilepsy surgery.

OBJECTIVE: To develop a method for the coregistration of digital photographs of the human cortex with head magnetic resonance imaging (MRI) scans for invasive diagnostics and resective neocortical epilepsy surgery. METHODS: Six chronically epileptic patients (two women, four men; mean age, 34 yr; age range, 20-43 yr) underwent preoperative three-dimensional (3D) T1-weighted MRI scans. Digital photographs of the exposed cortex were taken during implantation of subdural grid electrodes. Rendering software (Analyze 3.1; Biomedical Imaging Resource, Mayo Foundation, Rochester, MN) was used to create an MRI-based 3D model of the brain surface. Digital photographs were manually coregistered with the brain surface MRI model using the registration tool in the Analyze software. By matching the digital photograph and the brain surface model, the position of the subdural electrodes was integrated into the coordinate system of the preoperatively acquired 3D MRI dataset. RESULTS: In all patients, the position of the labeled electrode contacts in relation to the cortical anatomy could be visualized on the 3D models of the cortical surface. At the time of resection, the resulting image of the coregistration process provides a realistic view of the cortex and the position of the subdural electrode. CONCLUSION: The
coregistration of digital photographs of the brain cortex with the results of 3D MRI data sets is possible. This allows for identification of anatomic details underlying the subdural grid electrodes and enhances the orientation of the surgeon.