FMRI allows one to identify eloquent cortex in the brain. The integration of cortical activation information into radiotherapy treatment planning may prevent or minimize radiation damage to eloquent cortex.

We studied three brain tumor patients using fMRI to guide stereotactic x-ray beam radiation therapy. A self-paced bilateral finger tapping paradigm was used for two patients. A visual paradigm delivered via MRI-compatible goggles was employed for the third patient. Both paradigms used a 30 sec baseline followed by two 30 sec ON and 30 sec OFF cycles, for a total of 2:30 per scan. The data was acquired using BOLD technique with TR/TE=2000/60, FOV = 24 or 30 cm, matrix size = 64x64, slice thickness = 5 mm, 14 slices, flip angle = 90 on a GE 1.5 Tesla Echospeed Horizon scanner. The raw data set was post-processed and activation maps were generated using software developed in IDL. Activation was demonstrated in eloquent cortex at the precentral gyrus (motor) and medial occipital lobe (visual). The activation maps were downloaded to a treatment planning workstation (Radionics), and 3D activation maps were generated and coregistrated to a 3D CT anatomical data set (512x512 matrix, 2-5 mm slice thickness) using chamfer matching algorithm for treatment planning. Radiotherapy was then designed by the radiation oncologist, neurosurgeon and physicist based on both functional and structural information.

This approach provides the physician with additional information for treatment planning, and may also spare the patient unnecessary radiation exposure to eloquent cortex.