Purpose: In stereotactic radiosurgery (SRS), targets in the brain are located in CT or MR images and localized relative to external fiducial. Physicians need accurate assessments of the accuracy with which they can expect to hit targets in order to prescribe appropriate margins. We have developed a new tool which is set up for irradiation in a manner similar to a patient demonstrates the clinical accuracy of the imaging device. No commercial device currently exists which allows measurement of accuracy using both CT and MR planning images.

Methods: The device contains radiosurgical targets visible by both CT and MR, with radiochromic film to capture the delivered dose distribution. The device consists of several thin acrylic plates holding non-ferrous CT fiducial targets which pierce a piece of film. Adjacent to the film are channels filled with copper sulfate solution to provide MR fiducials. The assembly fits inside a water-filled head phantom which can be secured to a SRS system. The phantom is imaged using CT or MR. Targets are determined using the treatment planning software and methods appropriate to the SRS device. Targeting accuracy is determined by measuring distances on the film between dose distribution centers, relative to the pinhole made by the CT fiducials.

Results: Measurements of GK SRS accuracy with 4 mm and 8 mm collimation sizes show sub-millimeter agreement for planned and delivered dose distributions with CT or MR imaging, in agreement with GK SRS manufacturer specifications.

Conclusions: Assessing accuracy of dose delivery for GK or linac SRS can be limited by the use of one imaging modality for patient treatment. This phantom design enables the use of MR-only, CT-only, or MR-CT-combined image-based assessment for GK or linac SRS approaches, providing physicists and radiation oncologists with basic accuracy information that is relevant to patient treatment.