AbstractID: 2815 Title: Accuracy of GammaKnife stereotactic space localization as a function of patient alignment during imaging

Purpose: To establish the accuracy of stereotactic space localization for image sets where there is misalignment of the patient's head (stereotactic frame and fiducial box) relative to the CT- or MR- scanner axis.

Method and Materials: Seven 0.5-mm diameter steel spheres separated by 2 cm were rigidly mounted to a string tied tightly at each end to diametrically opposite posts attached to a Leksell stereotactic frame. The steel spheres spanned the entire stereotactic space. A standard CT fiducial box was applied to the frame in the usual clinical manner. A baseline CT scan (1 mm slice thickness) was obtained with the fiducial box perfectly aligned with the scanner axis. After localization of the image set, the (x,y,z) coordinate of the center of each steel sphere was recorded. The frame was then repositioned, re-aligned and re-scanned and the coordinates re-obtained to verify reproducibility. Repeat CT scans with varying fiducial box misalignments up to 20 degrees in the sagittal, coronal, and transverse axes, respectively, were subsequently obtained. After localization, the (x,y,z) coordinates of the steel spheres in each misaligned image set were recorded and compared to the baseline coordinates.

Results: The mean difference between the baseline and the respective coordinates in misaligned geometries was 0.25 mm (σ=0.16 mm). The largest difference (0.87 mm) was found with the greatest misalignment in the coronal plane. These errors are within the accuracy of the image sets.

Conclusions: Accurate localizations were obtained for image sets with misalignments up to 20 degrees relative to the CT- or MR- scanner axis. Patients with very inferior frame placements or concomitant medical conditions that prevent perfect alignment without significant discomfort can be positioned comfortably but rigidly and, despite misalignment with the CT- or MR- imaging axis, the fiducial box will nonetheless afford an accurate localization of the stereotactic space.