

AbstractID: 4790 Title: A Study of Effectiveness of Stereotactic Head Frame Distortion on the Gamma Knife Automatic Positioning System by Stress of Screw Fixation

During routine Gamma Knife radiosurgery procedure, it was noted that the Automatic Positioning System (APS) (Elekta Inc) did not always function as expected for some patients. This caused the plans to be readjusted for use of trunnions which greatly lengthens the treatment time in most cases. After investigation of those repeated APS operation failures, the reliability of APS was extensively tested by performing a series of measurements to determine head frame distortion. Measurements on a fabricated hard wood phantom using a range of torques (2-20 in·lbs) were applied to screws which fastened the head frame into the skull of the patients for Gamma knife treatment. The ability for the Leksell frame to lock into APS was used as the endpoint to determine whether the APS would operate clinically. A calibrated digital torque wrench was applied in those measurements. The magnitude of the distortion on the head frame has been measured by using calipers between the two frame members (Z-bars) which are attached to the sides of head frame bi-laterally. In the clinical application, the acceptable torque upper limit was 15 in·lbs which was the maximum applied to the screws in 26 clinical cases and has been used to predict the success application of the phantom measurements. For 14 Gamma Knife cases, if a frame displacement was greater than 1.5 mm, the APS would not operate. If frame displacements under 1.5 mm, the APS operated in 12 cases. A linear correlation coefficient (r^2) was found to be 0.94 for the fitting of the data to a line.