AbstractID: 9325 Title: Beam properties and beam modeling of a radiosurgical variable aperture collimator.

Purpose:
The CyberKnife® Robotic Radiosurgery System (Accuray, Inc.) was developed with twelve fixed secondary collimators which deliver circular beams from 5 to 60 mm in diameter at 800 mm SAD. The effective beam diameters vary as actual SADs can range from approximately 650 to 1000 mm depending on the particular treatment. Accuray recently developed the Iris™ Variable Aperture Collimator to improve the ability to use multiple field sizes in a treatment. Tests were performed to compare the beam properties of the Iris Collimator with the fixed collimators.

Method and Materials:
The Iris Collimator consists of two stacked banks of rotationally offset hexagonal apertures. The resulting beam has a 12-sided shape and a field size that can be varied between 5 and 60 mm at 800 mm SAD. The standard (non-Monte Carlo) CyberKnife dose calculation algorithm assumes a circularly symmetric beam model. Beam data acquired with stereotactic diodes was processed to generate average dose profiles that are representative of equivalent circular beams for the Iris Collimator. These beam profiles were uploaded to the treatment planning system and the calculated dose distributions were compared with radiochromic film measurements.

Results:
Gamma histogram film analyses and water phantom measurements show that Iris Collimator beams are substantially equivalent to fixed circular collimator beams with respect to beam quality, collimator transmission and transverse profiles. Maximum leakage dose through the Iris Collimator <0.2%, RMS deviation of the 50% isodose curve from circularity <2%, and the average profile 20-80% penumbra is typically a fraction of a millimeter wider than that of equivalent fixed circular collimator.

Conclusion:
The beam properties of the 12-sided Iris™ Collimator are sufficiently similar to those of the fixed circular collimators that the same beam modeling approach and standard dose calculation algorithm used for fixed collimators can be used with the Iris Collimator.