

GammaPlan[®] - Leksell Gamma Knife[®]

Radiosurgery Treatment Planning Verification

Independent check calculations are always used for teletherapy to minimize treatment errors. Such checks have not been reported for Gamma Knife[®] radiosurgery. This work intends to fill this gap.

Localization: First, the skull is reconstructed using measurements from several locations on the patient's skull. Next, a computer model simplifies the skull as a partial sphere and then calculates its radius and center relative to the center of the head frame.

Dose calculation: An analytical solution is developed for fast ray tracing of the path length for each of the 201 beamlets of the helmet collimator, in contrast to the GammaPlan[®] which uses an iterative interpolation process. The dose rate at the isocenter of a single shot is adjusted for collimator factor and attenuation, with special plugs being taken into account.

Multi-shot treatment: For any arbitrary point, the dose rate is derived from isocenter values by off-axis profile, collimator factor, and relative weighting. This algorithm also accounts for special plugging of individual helmet holes.

Compared to the GammaPlan[®] for spherical phantoms, the calculated dose rates and point doses are within 0.5%. For patients, the dose at any point for multi-shot treatments agrees to within 3% and agrees up to 5% for a single shot treatment. The same accuracy is achieved when plugs are used to block some of the 201 beamlets in order to protect critical anatomical structures.