

AbstractID: 7235 Title: Impact of the isocenter shift as a function of couch and gantry angles on the stereotactic radiosurgery (SRS) dose

Purpose:

The most important component of the pre-treatment QA for radiosurgery is the verification of the target position in the beam. There are some generally accepted rules for the alignment test, e.g., the positioning differences should be within 1 mm or better. However, the impact on delivered dose of the shift in different directions during gantry and couch rotation may not be the same. Detailed investigations are desired to find out the relationship between the shift functions and the final dose distributions.

Method and materials:

In this study, the impact on the delivered dose was evaluated by Monte Carlo simulations using an EGS4-based code MCSIM. The code was modified for arc therapy so that it can be used to do patient dose calculation for any given arc range and couch angle. A two-step investigation has been carried out in this research. First, several assumed meaningful shift functions of gantry and couch movement were implemented into the Monte Carlo simulation to find out the dose impact from each component. Then actual shift functions based on measurements were used to evaluate the dose change due to the isocenter uncertainties for a real machine. A SRS plan for a brain tumor (9 arcs with a 10 mm cone) was used in these simulations.

Results and conclusions:

Based on the results from the assumed shift functions and the measured shift functions, we found that the isodose line shift is generally less than 0.5 mm on our Trilogy and Primart, which is much smaller than the isocenter uncertainties. Also big differences were mainly found in the high dose region (>90% of the maximum dose). The isodose line shift at the typical dose prescription level, e.g., 70% or 80%, has been reduced to 0.2~0.3 mm, which is comparable to the imaging uncertainties.