

Comparison of an in-house developed treatment planning system, a commercially available system and a BETA-version for linac based radiosurgery

Linac based stereotactic radiosurgery (SRS) has been introduced in our department in 1992 and more than 200 patients have been treated since. An in-house developed algorithm for target localization and dose calculation has been replaced with a commercially available system (BrainSCAN v3.1). Both systems as well as a BETA-version (v3.6) from the same company have been compared, and positional accuracy and dose calculation have been verified experimentally. The full SRS procedure applied to an anthropomorphic phantom has been used as a comprehensive method to assess the uncertainties involved in dose delivery and target positioning. The dose calculation algorithms have been verified against manual calculations and measurements with the anthropomorphic phantom applying ionization chamber, thermoluminescent detectors as well as radiographic film. The image correlation of CT and MRI has also been verified experimentally and mutually compared in clinical situations. Phantom studies have shown that a target, localized by CT, can be irradiated with a positional accuracy of 0.08 cm in any direction with 95 % confidence. Neglecting the influence of dose perturbation when the beam passes through bone tissue or air cavities the calculated dose values obtained from the 3 systems agreed within 1 % (SD: 1 %). The application of a 1 dimensional path length correction for tissue heterogeneity influences the treatment prescription with 4 % on average (SD: 1 %) which is in compliance with the theoretical predictions.