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One-Year Experience with Gyroscopic Radiosurgery Patient Specific Quality Assurance

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Abstract

Objectives: To report on a single-institution experience using a comprehensive PSQA program for ZAP-X SRS consisting of two components: independent dose calculation and absolute planar dose measurements.

Methods: ZapMU is the first independent second MU check software available for ZAP-X developed in-house at Jersey Shore University Medical Center (JSUMC) with Visual Basic 6.0 utilizing modified source code from CKMU, a secondary MU check software popular for CyberKnife. ZapMU dose calculation was assessed using an IROC SRS phantom. Validation of ZapMU software was performed on 10 JSUMC ZAP-X SRS patient treatment plans. Composite beam data for measured OCRs, TPRs, and OFs of ZAP-X units from 10 different institutions were used to recalculate the 10 JSUMC ZAP-X SRS patient treatment plans. A total of 200 ZAP-X SRS patient treatment plans with 374 targets at JSUMC from October 2023 to January 2025 were analyzed with ZapMU. SRS MapCHECK QA phantom (Sun Nuclear Corporation, Melbourne, FL) was used to evaluate all 200 ZAP-X SRS patient plans.

Results: For ZapMU phantom validation, the average isocenter dose percentage difference (Diffiso) was 0% and the average maximum point dose percentage difference (Diffmax) was 0.003 ± 0.004% (range: 0 – 0.01%). For ZapMU measured beam data validation, Diffiso was 0% and Diffmax was 0.5 ± 0.5% (0 – 1.09%). For ZapMU composite beam data validation, Diffiso was 2.2 ± 1.2% (1.25 – 4.54%) and Diffmax was 3.5 ± 1.3% (1.29 – 6.06%). For ZapMU clinical data, the average Diffiso was 0% and the average Diffmax was 0.3 ± 0.3% (0 – 1.46%) for all 200 patients. The average gamma passing rate (GPR) was 98.4 ± 1.7% (91.2 – 100%) for all 200 patients at 10%/2%/1 mm gamma index, with 7 targets failing the ⩾ 95% GPR out of the 374 targets.

Conclusion(s): A PSQA program for ZAP-X SRS consisting of independent dose calculation and absolute planar dose measurements was successfully implemented for 200 patients. Validation of ZapMU dedicated independent dose calculation software for ZAP-X SRS was performed, which is shown to be highly accurate. Utilizing PSQA dose measurement detectors such as SRS MapCHECK may be unnecessary to perform on every single patient for ZAP-X SRS given the high accuracy of the ZAP-X platform.