

Fractionated E2E Test Validation for Multi-fraction SRS/SBRT in Four Different CyberKnife Models

Berat Aral ¹, Kaan Oysul ², Sait Sirin ³, ESRA KUCUKMORKOC ⁴, Nadir Kucuk ⁵, Hatice Tataroğlu ⁶, Fatih Inci ⁷, Busra Cakir ⁷, Ilkay Ordualtundag ⁷, Zerrin Gani ⁷

1. Medical Physics, Medicana International Ankara Hospital 2. Cyberknife Radiosurgery and Advanced Radiotherapy Technologies Center, Medicana International Hospital, Ankara, TUR 3. CyberKnife Radiosurgery Center, Medicana International Ankara Hospital 4. Radiation Oncology, Medipol Istanbul University, Turkey 5. Anadolu Medical Center 6. Radiation Oncology, Samsun Education and Research Hospital 7. Radiation Oncology, Dr Abdurrahman Yurtarslan Ankara Oncology Education and Research Hospital

✉ **Corresponding author:** Berat Aral, beratara@gmail.com

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Abstract

Objectives: End to end test is a QA test designed to measure total accuracy of the system including localization, mechanical targeting, and planning errors for different tracking methods. According to report of AAPM TG135 irradiation is done in one fraction. In our previous study, performed with single cyberknife installed in our department, we found that fractionation can affect E2E test results. The aim of this study is to validate the fractionation effect on E2E test results in four different cyberknife models.

Methods: E2E tests were done according to report of AAPM TG 135 in 1 fraction and also repeated in 3 and 5 fractions by dividing the same total irradiation dose. Fractionated irradiation was done consecutively and without any phantom or couch movement. All E2E test films were scanned and measured. We performed this procedure in four different CyberKnife models, which are Cyberknife #1: G4 1000MU SLH iris II ready (robot modelkr210), Cyberknife #2: G4 1000MU SLH iris II (robot modelkr240), Cyberknife #3: G4 800 MU SLH with brass water fittings (robot modelkr240), and Cyberknife #4: M6 1000MU incise II ready (robot modelkr300). The results were compared for each Cyberknife model.

Results: The errors measured for 1, 3 and 5 fractions for 6D Skull tracking were 0.45, 0.92 and 1.01 in Cyberknife #1, 0.35, 0.27 and 0.83 in Cyberknife #2, 0.28, 0.22 and 0.33 in Cyberknife #3 and 0.42, 0.42 and 0.45 in Cyberknife #4 respectively. For X-Sight Spine tracking errors were 0.77, 0.77 and 0.83 in Cyberknife #1, 0.61, 0.81 and 0.74 in Cyberknife #2, 0.59, 0.83 and 0.69 in Cyberknife #3 and 0.25, 0.26 and 0.76 in Cyberknife #4 respectively. And for fiducial tracking errors were 0.36, 0.81 and 0.96 in Cyberknife #1, 0.36, 0.37 and 0.45 in Cyberknife #2, 0.49, 0.51 and 0.38 in Cyberknife #3 and 0.56, 0.68 and 1.36 in Cyberknife #4 respectively.

Conclusions: E2E test is routinely done in one fraction according to report of AAPM TG 135. This study revealed differences in 1, 3 and 5 fractions in four different cyberknife models. E2E test may also be done in fractionated setting for quality assurance.

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Abstract

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