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Patient Specific Quality Assurance for Lung Cancer Patients: A comparative study between fixed (DMLC) and rotating gantry (VMAT)

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Background

Lung cancer irradiation with IMRT and VMAT is challenging due to tumor heterogeneity and dose delivery complexity. Plan verification is crucial to optimize treatment. This study compares Central Axis (CAX) and Dose Maximum (DMAX) values between Quality Assurance methods for rotating (VMAT) and constant (DMLC) gantry techniques.

Materials & Methods

25 patients (14 men-56%, 11 women-44%) were selected for this study. Two Quality Assurance (QA) plans-one for constant and one for rotating gantry-were created using Monaco TPS ver. 5.11.03. Dose distribution was recorded with the MatriXX ImRT detector (IBA Dosimetry) on an AXESSE linear accelerator (Elekta). Gamma Analysis (3%/3mm) was performed, and Gamma Pass Rates for CAX and DMAX were recorded. Statistical analysis was conducted using IBM SPSS ver. 26.0.

Results

Mean (SD) CAX values for DMLC and VMAT were 96.8% (3.3%) and 95.5% (3.5%) respectively. The corresponding values for DMAX were 96.4% (2.3%) and 96.7% (2.5%). Paired samples t-test revealed a statistically significant difference in CAX (p=0.002) between the two setups, but not in DMAX (p=0.446). Bland-Altman analysis showed a bias of 1.38% in CAX and of 0.38% in DMAX between the two setups.

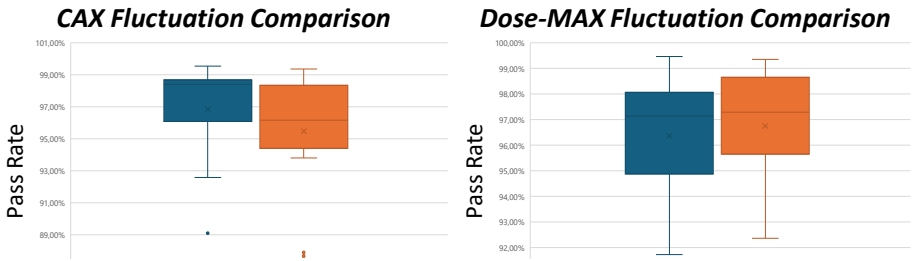

Figure 1: The fluctuation of values for a) CAX and b) DMAX for constant gantry at 0º (blue) and for rotating arcuate Gantry (orange)

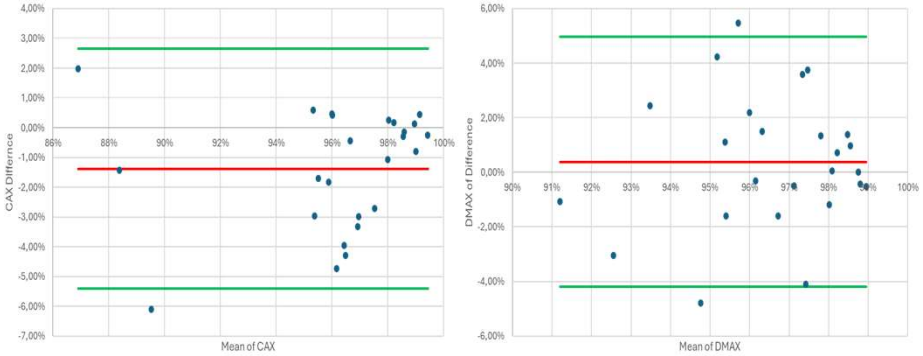

Figure 2: Bland-Altman plots for CAX (left) and DMAX (right)

Conclusion

Statistical analysis shows that CAX is more sensitive to gantry rotation, while DMAX remains consistent. The two QA methods are not interchangeable, so each department must choose its own appropriate technique.