

Comparative Analysis and Constancy Check of Image Quality Parameters for Three Linear Accelerators Per TG 142 Protocol

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Presentations

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Purpose: To compare image quality parameters and assessing the image stability of three different linear accelerators (linac) for 2D and 3D imaging modalities: planar kV, MV images and cone-beam CT (CBCT).

Methods: QcKv1, QC-3 and Cathpan-600 phantoms were utilized to acquire kV, MV and CBCT images respectively on monthly basis per TG142 QA protocol for over 2 years on 21Ex, NovalisTx and TrueBeam linacs. DICOM images were analyzed with the help of QA analysis software: PIPsPro from Standard Imaging. For planar kV and MV images, planar spatial resolution, contrast to noise ratio (CNR) and noise; for CBCT, HU values were collected and analyzed.

Results: Two years of monthly QA measurements were analyzed for the planar and CBCT images. Values were normalized to the mean and the standard deviations (STD) are presented. For the kV planar radiographic images the STD of spatial resolution for f30, f40, f50, CNR and noise for 21Ex are 0.006, 0.011, 0.013, 0.046, 0.026; Novalis-Tx are 0.009, 0.016, 0.016, 0.067, 0.053 ; TrueBeam are 0.007, 0.005, 0.009, 0.017, 0.016 respectively. For the MV planar radiographic images, the STD of spatial resolution for f30, f40, f50, CNR and noise for 21Ex are 0.009, 0.010, 0.008, 0.023, 0.023; for Novalis-Tx are 0.012, 0.010, 0.008, 0.029, 0.023 and for TrueBeam are 0.010, 0.010, 0.007, 0.022, 0.022 respectively. For the CBCT images, HU constancies of Air, Polystyrene, Teflon, PMP, LDPE and Delrin for 21Ex are 0.014, 0.070, 0.031, 0.053, 0.076, 0.087; for Novalis Tx are 0.019, 0.047, 0.035, 0.059, 0.077, 0.087 and for TrueBeam are 0.011, 0.044, 0.025, 0.044, 0.056, 0.020 respectively.

Conclusion: These Imaging QA results demonstrated that the TrueBeam, performed better in terms of image quality stability for both kV planer and CBCT images as well as EPID MV images, however other two linacs were also satisfied TG142 guidelines.