

Retrospective evaluation of portal dosimetry pre-treatment quality assurance for volumetric-modulated arc therapy (VMAT) and stereotactic radiotherapy (SRT) plans

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Introduction of the study

Electronic portal imaging device (EPID) offers high-resolution digital image that can be used to quantitatively compare a measured and calculated dose distribution that is routinely used for quality assurance (QA) of volumetric-modulated arc therapy (VMAT) and stereotactic radiation therapy (SRT) treatment plans by the evaluation of the gamma index. The aim of this investigation was to evaluate the gamma passing rate (%GP), maximum gamma (γ_{max}), average gamma (γ_{ave}), maximum dose difference (DD_{max}) and the average dose difference (DD_{ave}) for various regions of interest using Varian's portal dose prediction (PDP) algorithm.

Methodology

For this study, SRT and VMAT plans which were already used for patient treatment were retrospectively selected. A total of 310 treatment plans were analyzed in this study (252 VMAT plans and 73 SRT plans). The treatment sites were various, which were brain, head and neck (H&N), prostate and cervix. For VMAT and SRT treatment delivery, on a Varian iX23 with millenium 120 MLC, Brainlab ExacTrac positioning system and 6D Robotics couch was used.

Results:

Our data show that the %GP, γ_{max} and γ_{ave} depend on the gamma calculation method and the acceptance criteria. Higher %GP values were obtained compared with both our current institutional action level and the American Association of Physicists in Medicine Task Group 119 recommendations.

Conclusions:

The results of this study can be used to establish stricter action levels for pre-treatment QA of SRT and VMAT plans. A stricter 3%/3 mm improved gamma criterion with a passing rate of 97% or the 2%/2 mm improved gamma criterion with a passing rate of 95% can be achieved without additional measurements or configurations.

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