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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 (γmax), average gamma (γave), maximum dose difference (DDmax) and the average dose difference (DDave) for various regions of interest using Varian's portal dose prediction (PDP) algorithm.

Methodolgy
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, ton a Varian iX23 with millenium 120 MLC , Brainlab ExacTrac positioning system and 6D Robotics couche was used.

Results:
Our data show that the %GP, γmax and γave 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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