for each fraction as an additional Quality Control. Our next step will be to study the DF with respect to the gamma analysis outcome of our patient QA.

EP-1723 Validation of EPID dose prediction and conversion models for flattening filter free beams

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Purpose or Objective
Electronic portal imaging devices (EPID) are interesting for pre-treatment quality assurance (QA) because of their high spatial resolution and ease of use. This study evaluated a new dosimetric portal method based on a superposition/convolution algorithm. It was tested for flattening filter free (FFF) photon beams.
Material and Methods
Dosisoft EPIbeam software compares an image prediction generated from the DICOM RT plan and a portal image converted into a dose map at 5 cm depth in water using kernels to account for output factors, field penumbra and arm backscatter. Irradiations were performed with a Varian TrueBeam STx linear accelerator equipped with HD120 MLC and associated with aSi 1000 EPID. Dose prediction from RT plan and EPID image conversion models were assessed in 6 and 10 MV FFF beams by comparing the model to measurements. For output factor measurements, PTW 31010 0.125 cm^3 ion chamber was used for output factors for 2x2 to 20x20 cm^2 field sizes at the isocentre. For clinical plans, prediction and conversion models were assessed with PTW 1000 SRS matrix (pixel resolution between 0.25 and 0.5 cm). Clinical plans were lung (6 MV FFF) and liver (10 MV FFF) stereotactic body radiotherapy plans using dynamic conformal arc technique.
Results
Predicted and converted output factors were within 2% of the measured values for field sizes between 2 and 20 cm^2. For clinical cases, comparison of dose prediction to matrix measurements gave an average gamma passing rate (2%-2.5 mm, global, 10% threshold) of (99.77±0.26)% and (99.98±0.04)% for 6 and 10 MV FFF beams respectively. Comparison of converted EPID image to matrix measurements gave an average gamma passing rate (2%-2.5 mm, global, 10% threshold) of (99.28±0.97)% and (99.98±0.04)% for 6 and 10 MV FFF beams respectively. Both prediction and EPID image conversion model are therefore validated for dynamic conformal arc technique. When the EPID image is used for pre-treatment QA, EPIbeam gave excellent gamma passing rates (2%-2mm, local, 10% threshold): for 6 MV FFF, the average pass rates were (98.79±0.61)% and for 10 MV FFF, the average pass rates were (98.55±0.47)%. Tolerance and action limits were calculated irrespective of the energy and were set to 96% and 87% respectively.
Conclusion
For field sizes between 2 and 20 cm^2, EPIbeam provided a good prediction of the dose in water at 5 cm depth and accurately converted the EPID image into a dose map in water. The software gave consistent results for the studied dynamic conformal arc clinical cases. This work should be extended to study more modulated beams, such as those used in volumetric modulated arctherapy and to study the sensitivity of the method to errors in delivery.

EP-1724 Delivery error sensitivity of an EPID based pre-treatment control for FFF dynamic arc therapy

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Purpose or Objective
EPIbeam is a new algorithm based on a superposition/convolution algorithm and developped for pre-treatment quality control with electronic portal imaging device (EPID). It was tested in this study for dynamic conformal arc therapy with flattening filter free (FFF) photon beams in the context of stereotactic radiotherapy. Its sensitivity to delivery errors was assessed and compared to 3D phantom measurements.
Material and Methods
A Varian TrueBeam STx linear accelerator equipped with HD120 MLC was used for the measurements. EPID images were acquired with Varian aSi 1000 detector and analysed with Dosisoft EPIbeam software. 3D phantom measurements were performed with PTW 1000 SRS array inserted in PTW Octavius 4D phantom. Analysis was performed in PTW Verisoft software. Varian Eclipse treatment planning system (version 13.7 AAA algorithm) was used to calculate the reference dose distribution. EPID and phantom pre-treatment controls were first compared for ten 6 MV FFF lung plans (6.0 to 59.0 cm^3 PTV size) and ten 10 MV FFF liver plans (9.8 to 327.5 cm^3 PTV size).
Delivery error sensitivity was then tested by modifying the initial plans to introduce errors on dose (+1%, 2% and 3%), leaf bank shifts (1 mm and 2 mm), 10 mm central leaf shift, central leaf blockage, gantry rotation (+5° and +15°) as well as collimator rotation (+5° and 15°). For each energy, these errors were introduced for the largest and smallest PTV. Gamma agreement indices (GAI) were calculated with 2% local dose difference, 2 mm distance-to agreement and 10% threshold.
Results
EPIbeam gave gamma index passing rates similar to those with 3D phantom : for 6 MV FFF, the GAI were (98.79±0.61)% for EPIbeam and (99.86±0.26)% for 3D phantom and for 10 MV FFF, the GAI were (98.55±0.47)% and (99.55±0.86)% respectively.
Delivery error sensitivity varied with PTV size but not with energy. For small lesions (6-59 cm^3), EPIbeam is more sensitive to dose errors compared with 3D phantom, spotting errors from 1% difference whereas for the largest lesion (327 cm^3), a 3% difference was necessary. Leaf bank errors had to be at least 2 mm to fail the test with EPIBEAM whereas the 3D phantom test spotted a 1 mm error for small lesions. Central leaf 10 mm shift was spotted for the small lesions but not for the large lesion with both techniques. Leaf blockage was identified as error with both detectors. As expected, EPIbeam was completely insensitive to gantry rotation errors, unlike 3D phantom. EPIbeam is also less sensitive to collimator errors, compared to 3D phantom.
Conclusion
Once the treatment planning system has been validated with 3D phantom measurements, EPID based pre-treatment quality insurance can be achieved with EPIbeam for fluence verification, provided that independent QA of collimator and gantry rotations is performed on a regular basis on the machine.

EP-1725 Two years' experience with Esteya QA

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Purpose or Objective
Esteya® (Elekta AB, Sweden) is used to treat non-melanoma skin cancer. The QA results, since the installation in March 2016, have been reviewed to check the stability of the system.
Material and Methods