EP-1392
Validation of total skin electron irradiation technique dosimetry data by Monte Carlo simulation
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Purpose/Objective: Total Skin Electron Irradiation (TSEI) is a complex technique which requires non-standard measurements and dosimetric procedures. At our center, the six-dual-field approach is implemented for this treatment. The purpose of this work is to validate the measured dosimetry data by Monte Carlo (MC) simulations.

Materials and Methods: 6 MeV beam from Elekta Precise linac operated in High-Dose-Rate (HDR) mode is used for TSEI treatments. The EGSnrc code package was used for MC simulation. First, the incident electron beam parameters (energy spectrum, FWHM) were adjusted to match the measured data (PDD and profile) at SSD=100 cm for 40x40 open field. These parameters were then used to calculate dose distributions at the treatment distance of 400 cm. The BEAMnrc code was used to generate the phase-space file in a plane at the exit from the linac head (at the mylar). This file was used in DOSXYZnrc code to calculate PDDs, profiles and output in a water phantom at SSD= 400 cm from a single beam. Optimal gantry angle was determined. Full treatment with 6 dual fields was simulated on the CT-based anthropomorphic phantom. MC calculations were compared with the available set of measurements used in clinical practice.

Results: The results of our Monte Carlo calculations were found to be in general agreement with the measurements, providing a promising tool for further studies of dose distribution calculations in TSEI. For one direct field at the treatment distance, calculated PDD was within 3%/1mm agreement and calculated profile was within 2% agreement with the measurements. The calculated output at the treatment distance was 3% lower than the measured output. The optimal gantry angle providing the best flatness of the surface dose was confirmed to be 17 degrees. Depth doses for the full treatment calculated in the anthropomorphic phantom agreed with the measurements within 3%/1mm.

Conclusions: The measured dosimetry data used for TSEI calculations are validated by MC simulations. This work also indicates that simulations can complement and/or replace extensive experimental measurements needed for commissioning of TSEI technique.

EP-1393
A quick measure equipment characterization for the commissioning of Varian/Ys Enhanced Dynamic Wedges
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Purpose/Objective: For the commissioning as well as for the quality control (QC) of enhanced dynamic wedges (EDW) two devices are commonly used: a system of linear waterproof detectors for relative dosimetry verification, and ionization chambers for the verification of wedge factors. Hereby we study the possibility of executing this process with a quick measure equipment.

Materials and Methods: The PTW StarCheck device is a linear arrangement of small volume ionization chambers (0.053 cc) separated 3 mm (except central chamber and the second chamber) in the left-right and head-feet directions. The manufacturer provides the equipment with a calibration energy Cobalt factor and a calibration matrix which adjusts the gain of the other cameras respect the central chamber. We compared the values obtained with the ionization chamber and StarCheck for energies of 6 MV and 18 MV (measurement conditions: SSD 100 cm and depths 5 cm and 7 cm respectively):

- EDW factors for all angles for the fields: 4x4 cm², 10x10 cm², and 20x20 cm².
- EDW angle obtained with the Schmidt method for all possible combinations of wedge angles and field size.
- Wedge angle independence depending on the orientation of the wedge.

Finally, we evaluated the effect of interrupting the execution of the dynamic wedge by comparing radiation without interruption against the added amount of radiation interrupted for different values of monitor units: 25, 50, 100 and 200.

Results: The StarCheck response linearity is brilliant: linear correlation coefficient of 0.999998 for the reading in the central chamber vs the Farmer camera with readings in the range from 2 to 400 UM. The equivalent depth obtained is 8.9 mm compatible with the value of 8.5 mm supplied by the manufacturer. StarCheck obtained EDW factors are within 0.5% compared to those obtained with the reference Farmer camera for all combinations of energy (6 MV and 18), fields (4x4, 10x10, 20x20 cm²) and wedge angle (10, 15, 20, 25, 30, 45 and 60). The wedge angles measured by StarCheck match, with a maximum difference of 1 degree, those obtained with a Semi-Flex camera in a water phantom for all wedges and fields 10x10 cm² and 20x20 cm². Considerable differences in the angles have been obtained between StarCheck and semi-flex camera for dynamic wedges below 30 degrees and the field 4x4 cm². The interruptions analysis shows that in treatments with EDW with less than 50 UM a disruption can cause an over-dose of approximately 2%, regardless of whether the interruption occurs during static wedge phase or during the movement of the jaw and regardless of the angle wedge.

Conclusions: This study allows us to assure that it is possible to achieve a significant part of the comissioning of EDW with just a quick measurement device.

EP-1394
VMAT patient-specific QA with 2D-array seven29/Octavius system: a retrospective analysis on 1000 patients
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Purpose/Objective: Total Skin Electron Irradiation (TSEI) is a
Purpose/Objective: We retrospectively analyzed our five years experience with patient-specific VMAT QA using the PTW seven29/Octavius system and reported our institutional guidelines and action limits for VMAT delivery.

Materials and Methods: Since June 2009, 1001 patients were treated with Elekta VMAT technique at our institution. Treatment plans were re-grouped according to treatment technique and disease sites: (1) 437 patients with high-modulated complex treatments for head-neck, rectal, endometrial, brain tumours and other sites, all optimized with Masterplan Oncentra TPS with Simultaneous Integrated Boost strategy in dual-arc modality; (2) 248 patients with prostate tumours and (3) 316 patients with bone, liver, lung, abdominal and pelvic metastasis treated with high-dose extracranial stereotactic radiotherapy (SBRT). Group 2/3 plans were optimized with anatomy-based Ergo++ TPS and treated with one arc. The absolute doses were measured utilizing the PTW Seven29 ion-chamber array and the Octavius phantom. VMAT plans were recalculated on phantoms representing the Octavius geometry and density; for each arc the doses were measured both on coronal and sagittal planes, for a total of 2876 measurements (in groups 1 and 2/3, each plan underwent four and two measurements, respectively). Agreement of measured and predicted doses were evaluated using 3%(global)/3mm \( \gamma \)-analysis results for all three groups. For each arc the doses were measured both on coronal and sagittal planes, for a total of 2876 measurements (in groups 1 and 2/3, each plan underwent four and two measurements, respectively). Agreement of measured and predicted doses were evaluated using 3%(global)/3mm \( \gamma \)-analysis. Three scalar metrics were evaluated for each measurement: (a) percentage of points with gamma value less than one \( (P_{\gamma<1}) \), (b) mean gamma \( (\gamma_{mean}) \), and (c) maximum gamma \( (\gamma_{max}) \). Gamma results were evaluated according to treatment technique and disease sites and reported for each arc individually and on a per patient-basis.

Results: Table 1 shows the overall \( \gamma \)-analysis results for all patients with associated confidence limits. \( P_{\gamma<1} \) values significantly depend on plan complexity. For the patients in group (1), average \( P_{\gamma<1} \), \( \gamma_{mean} \) and \( \gamma_{max} \) were 94.8% ± 3.8%, 0.39 ± 0.08 and 1.83 ± 0.55, respectively. These values reached 99.1% ± 1.9%, 0.38 ± 0.08 and 0.99 ± 0.25 values in group (2) and 98.3% ± 2.7%, 0.32 ± 0.09 and 1.13 ± 0.45 values in group (2). On a per-patient basis, our local confidence limits were comparable to those of AAPM TG 119.

Conclusions: This comprehensive study shows that PTW seven29/Octavius system allows a reliable and accurate dosimetric procedure for VMAT QA, benefiting from all the advantages of ionization chamber absolute dosimetry. Despite the increased complexity in VMAT treatments, our local confidence limits were comparable to those of AAPM TG 119.

EP-1395
Evaluation of 3D gamma and DVH based analysis of VMAT: retrospective analyzes of head and neck cases
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Purpose/Objective: VMAT delivers radiation via dynamic multileaf collimator (MLC) motion, and allows for variable dose rates, gantry speed modulation, and collimator rotation. It is, therefore, patient-specific quality assurance (QA) for VMAT plans is important in confirming dose distribution. The COMPASS® system allows for 3D dosimetric quality assurance using MatriXX-specific software and the MatriXX mounted to the gantry with a gantry angle sensor. In this study, the retrospective investigation of the QA results using COMPASS for head and neck (H&N) VMAT cases.

Materials and Methods: VMAT patient plans were delivered to the MatriXX and used to verify the 3D dose distribution calculated by COMPASS. QA results of 65 head and neck patients which were treated in our clinic with TrueBeam/TrueBeamSTX machine consist of the nasopharyngeal, larynx and oral cavity tumors were analyzed. COMPASS system with MatriXX can provide an accurate three-dimensional quantitative analysis of dose delivery. Dose distribution and 3D anatomical site dose differences using DVH were evaluated by comparing the measurements and the treatment planning system (TPS) calculations by using AAA algorithm at the Eclipse TPS. Furthermore, the investigation of the TPS and COMPASS dose calculation based on the Collapse Cone Algorithm was assessed. The COMPASS and the measurement dose distributions agreement was tried obtain with that of a treatment planning system by gamma analysis (criteria; 3 mm/3%) and the volumetric results of the critical organs such as spinalcord was evaluated by average dose value with 3% criteria.

Results: Compass system was very sensitive to the MLC and dose error caused by machine. This system allows to asses 3D anatomical based dose difference between measurement and planning dose. We found that except 5 cases inside the data sets the relative dose differences agreement within the dose volume criteria for spinalcord. All parotid glands dose differences were inside the dose acceptance criteria except a case which shows 4.03%. For all cases, CTV and GTV dose agreement was archived inside the gamma criteria.

Conclusions: The COMPASS system can be expected to be used for traditional QA methods in clinical routine for QA of VMAT plans. The Compass allows anatomical dose distribution evaluation to decide acceptable treatment plan.

EP-1396
Impact of breast shape and lung on in vivo dosimetry in electron boost treatments