Conclusions: Performing patient-specific QA for VMAT plan by using MapCHECK with IMF tool shows the result of agreement between Eclipse plan and measurement comparable with using ArcCHECK 3D diode array.

EP-1175

The matter of IMRT plan QA using gamma pass rate

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Purpose/Objective: The purpose of this work is to determine the statistical correlation between 2D IMRT QA passing rates and several clinically relevant, anatomy-based dose errors for per patient IMRTQA.
Materials and Methods: Thirty patients which performed QA of the treatment plan of the VMAT(VARIAN MedicalSystems, USA) with prostate cancer in the past were examined. Each planned with 10 MV linear accelerators (Novalis-Tx; Brain LAB) using a commercial treatment planning system (ECLIPSE; VARIAN Medical Systems, USA) and VMAT. In this study was compared with 2D or volume gamma pass rate and Dose Volume Histogram (DVH), and absolute dose. 2D gamma pass rate analysis was measured by 2D pixel ion-chamber (MatriXX; IBA, Germany). Volume gamma pass rate and DVH were computed by COMPASS MatriXX systems(IBA, Germany). The dose response data measured by the MatriXX(IBA, Germany) was imported to the COMPASS MatriXX systems, and volume gamma and DVH were calculated. The COMPASS MatriXX systems can perform only dose calculation by using imported DICOM plan data and dose response. As for the absorbed dose was compared with 0.6ml Farmer type ion-chamber and COMPASS MatriXX systems. An absorbed dose was compared with mean dose of the same area volume as the area volume measured by ion-chamber of the IMRT phantom, and correlation was investigated.
Results: A variation of 2D gamma pass rate was larger than volume gamma. As a result of performing comparison of 2D gamma pass rate and DVH, absorbed dose error was less than 5% in DVH when 2D gamma pass rate was more than 95% of PTV. However,even if the rectum and bladder were more than 95% gamma pass rate, there was dose error more than 5% in 40% of all measured data. There were correlated with absolute dose measured by 0.6ml ion-chamber and computed by the COMPASS MatriXX systems (p<0.01).
Conclusions: Although IMRT Plan QA by means of 2D or volume gamma pass rate were suitable as objective rating of distribution, it was suggested that these were not suitable as clinical assessment of IMRT Plan.

EP-1176

Three years of VMAT patient quality assurance with the PTW seven29 ionization chamber array and Octavius phantom

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Purpose/Objective: The introduction of VMAT in clinical routine can be limited for the complexity and time needed in pre-treatment verification, decreasing the number of patients that could benefit. A fast and reliable dosimetric device is then required. Since 2009, over 400 patients have been treated with Volumetric modulated arc therapy (VMAT) at Fondazione di Ricerca e Cura 'Giovanni Paolo II' of Campobasso, Italy. In this study we present the three-years results of our patient specific QA program using the PTW seven29/Octavius system and our institutional guidelines for VMAT delivery.
Materials and Methods: From June 2009 to October 2012, 410 patients were treated with VMAT technique at our institution using Elekta linacs and Oncentra Masterplan TPS. Patients were divided in three groups: (1) 125 patients with high-modulated complex treatments for head-neck, rectal, endometrial and brain tumours, all treated with Simultaneous Integrated Boost strategy using two arcs; (2) 140 patients with prostate and vaginal tumours and (3) 145 patients undergone to radiosurgery or extracranial stereotactic techniques for bone, liver, lung, abdominal and pelvic metastasis, treated by 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 1070 measurements. Agreement of measured and predicted doses were evaluated using gamma index set at 3%/3mm. Three scalar metrics were evaluated for each measurement: (a) percentage of points with gamma value less than one ($P_{\gamma<1}$), (b) mean gamma (γ_{mean}), and (c) maximum gamma (γ_{max}). Dose measurements at isocenter point were extracted by the seven29 central 0.125 cc ion chamber.
Results: $P_{\gamma<1}$, γ_{mean} and γ_{max} averaged over all treatment sites were 96.8% ± 3.0%, 0.37 ± 0.08 and 1.58 ± 0.70, respectively. For the patients in group (1), $P_{\gamma<1}$, γ_{mean} and γ_{max} were 95.7% ± 3.0%, 0.39 ± 0.08 and 1.90 ± 0.62, respectively. These values reached 98.2% ± 3.3%, 0.35 ± 0.09 and 1.13 ± 0.61 values in group (2) and 98.3% ± 2.3%, 0.31 ± 0.08 and 1.24 ± 0.70 values in group (3). Our local confidence limits for $P_{\gamma<1}$ were determined to be 9.1% over all treatment sites, and 10.2%, 8.1%, and 6.2%, for patients in group 1, 2 and 3, respectively. Mean values and SD of ion-chamber differences between isocenter measured and calculated doses were -0.4% ± 2.8%, -0.7% ± 1.6% and 0.5% ± 2.0% for group 1, 2, and 3, respectively, supplying our local confidence limit of 5.9%, 3.8% and 4.4%.
Conclusions: The PTW seven29/Octavius system allows a fast and accurate dosimetric procedure for VMAT pre-treatment verification, 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-1177

Designing, coding and implementing a software solution for daily output QA using an Electronic Portal Imaging Device

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Purpose/Objective: In the field of radiotherapy (RT) vast resources are being used on quality assurance (QA) to ensure the most precise treatment delivery. One important parameter to control and monitor is the dosimetric output from the linear accelerator. In recent years at this institute, this has been done by weekly output measurements with an ion chamber in a Perspex phantom. These measurements have been supplemented by daily output measurements using LINACHECK from PTW. However, modern linear accelerators allows for such measurements using the onboard Electronic Portal Imaging Device (EPID). The purpose of this study has been to design, code and implement a software solution for measuring and evaluating the daily output on the Varian iX and Truebeam accelerators using the EPID.
Materials and Methods: Daily warm-up and output measurement test patients were created for each accelerator. These consisted of four fields: two warm-up fields (25 x 25 cm^2, 400 MU, 6 and 15 MV) and two output measurement fields (25 x 25 cm^2, 100 MU, 6 and 15 MV) with the EPID positioned at SID = 100 cm and the measurements carried out by integrating dose over time. To collect reference data and allow for dosimetrically equivalent measurements, the output of all accelerators was measured and adjusted in water to within ± 0.3 % of reference values. Afterwards the integrated image mode of the EPID was calibrated for the clinical used D/R, followed by a dosimetric calibration using a 10x10 cm^2 field and 100 MU. Reference data was then collected using the test patients. All data was exported from the TPS as DICOM files. An algorithm for sorting measurements, calculating output, beam quality, symmetry and plotting in- and cross-line profiles was created using MATLAB. For easy accessibility and quick handling a graphical user interface (GUI) was also coded using the MATLAB GUI editor. Finally the algorithm and GUI were compiled to an executable, allowing the software to run independently of a MATLAB installation using the MATLAB Compiler Runtime (MCR). Several versions of the software was designed, compiled and deployed each targeting a specific personal group with different requirements. All measurements and results were saved to MATLAB data files for storage and easy accessibility.
Results: A lot of energy was used in the design phase of this project which clearly paid out in implementation and evaluation phase, where only minor issues related to the software arose, being primarily coding errors related to e.g. saving data. As a result of this several new versions with error corrections or minor functionality tweaks were deployed over the first months of implementation.
Conclusions: Using MATLAB for creating software to interact with data measured using the EPID exported via DICOM has proven itself possible, easy and reliable. Making in-house software gives the benefits of a highly customizable system alongside complete knowledge and control over algorithms and data handling.

EP-1178