Assessment of the dosimetric significance of isocenter shift by means of EPID QA method

In the present work, an EPID based tool for IMRT quality assurance was used to investigate the dosimetric significance of an isocenter shift. The advantage of the present method for QA purposes in IMRT is that not only gamma analysis is available but isodose, profile and DVH analysis can also be used. The MU-EPID software was used to calculate the dose of the measured QA and compare this against the TPS dose calculation in the original CT patient anatomy. Once the dose has been calculated, the isocenter is shifted and a new dose calculation was obtained and compared against the original dose calculation of the plan. Isocenter shifts ranged from 1mm to 5mm were introduced in order to compute the dose based on the EPID based QA images. Once the dose with the isocenter shift was calculated, a dose comparison against the un-shifted plan was performed. In addition, a gamma index analysis was performed between the two plans. Preliminary results comparing the percent dose difference of the shifted plan to the original plan is shown in Figure 1. The graph shows that lateral shift of the isocenter has the maximum impact in the absolute point dose at the isocenter with a maximum percent difference of 4.58%. Anterior-posterior shifts exhibit minimum variation in the dose calculation of the dose at isocenter with an average of 1.69 % dose differences at the isocenter. Figure 2 shows the gamma analysis comparison between the original planned dose and the dose calculated with EPID based QA tool with the introduction of the isocenter shifts. For the gamma analysis, the lateral shift had the minimum impact while anterior-posterior isocenter shift had the greatest impact with a gamma of 89.9% passing with a 3% dose and 3mm distance to agreement criteria. Figure 3 shows the effect of the shift on the DVH analysis when a 1 mm shift of the isocenter is applied in each direction where the shifts have the major impact to the calculation. Deviation of the original QA results is detectable down to a shift that is as small as 1mm based on our results. Preliminary results of the present investigation show the importance of the patient positioning during treatment delivery since very small deviation of the isocenter can have a great impact in the dosimetry of the IMRT plan.