Evaluation of a Novel EPID Dosimetry System for Verification of VMAT QA

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JULY 12–16 2020 VIRTUAL JOINT AAPM | COMP MEETING
EASTERN TIME [GMT-4]

INTRODUCTION

EPID dosimetry for routine patient IMRT/VMAT QA is an efficient tool that can be performed in a far shorter time frame than 3D detector based measurements. However, EPID dosimetry has been largely unavailable using the I-View GT detector on Elekta Linacs. We describe a novel, first commercially available system, that can be used to verify VMAT QA using the I-ViewGT detector on Elekta Linacs.

AIM

EPID based dosimetry systems have been largely unavailable for patient dosimetry using the I-ViewGT detector in Elekta Linacs. The purpose of this study is to verify the accuracy of a novel EPID dosimetry system based on a convolution/ superposition algorithm by benchmarking it's performance against a traditional 3D array detector system for VMAT QA.

METHODS

Ten patients with equal mix of 6MV and 10MV beam energies and varying degrees of VMAT plan modulation were randomly chosen for this study. The EPID dosimetry methodology generates a prediction model which reconstructs an SAD level 2D-dose map, at 5 cm depth in water, from the DICOM RT Plan generated by the TPS. The prediction model is compared to a conversion model which is a 2D dose map, related to 5cm depth in water at SAD level, from EPID signal values measured using the amorphous silicon detectors in I-ViewGT. The sensitivity of the EPID dosimetry system to known MLC errors was investigated by applying intentional MLC offsets in both the "in" and "out" directions for each of the leaf banks on the Agility 160 MLC head. Benchmark 3D detector QA was performed using the Delta4 system for comparison.

FORMALISM & RESULTS

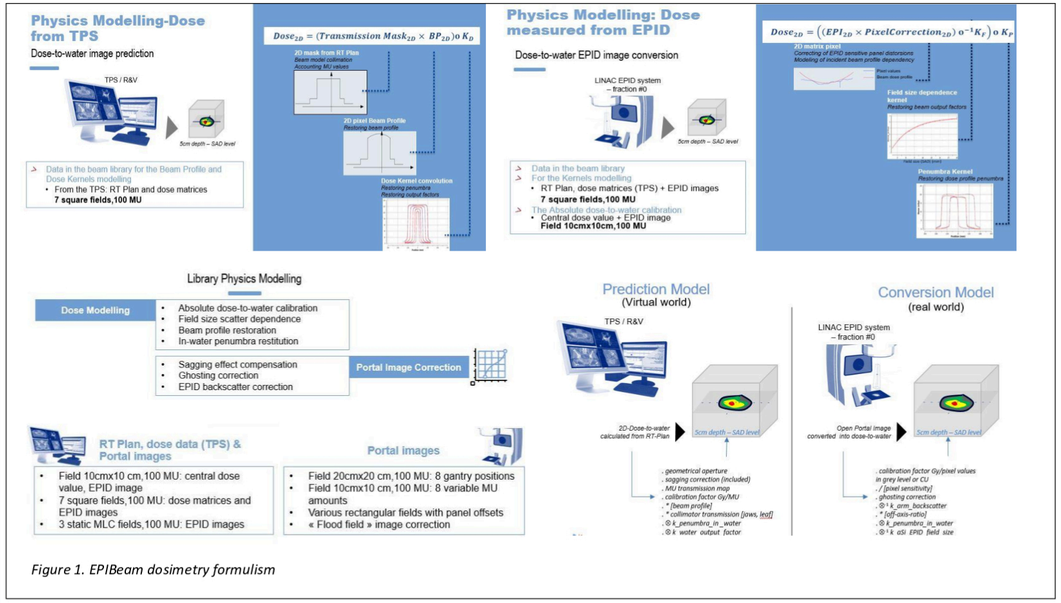

Figure 1. EPIBeam dosimetry formulism

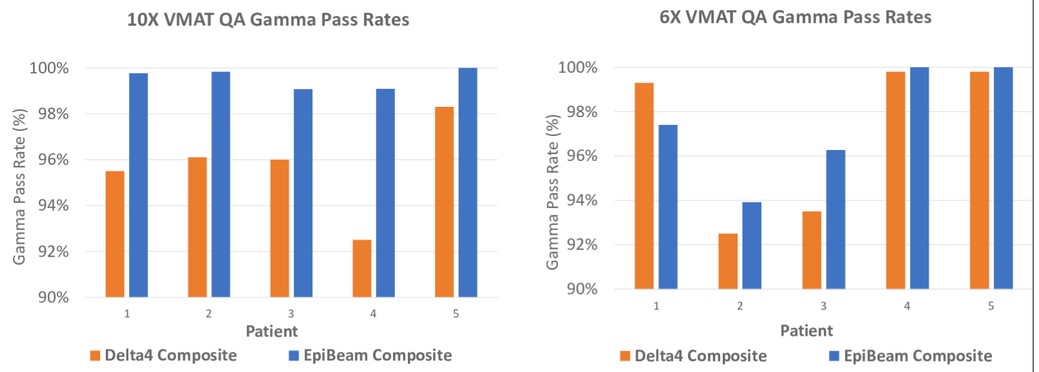

Figure 2. Gamma pass rates comparison using 3% 2mm threshold between Delta 4 and EPIbeam dosimetry for 10 patients without intentional MLC errors.

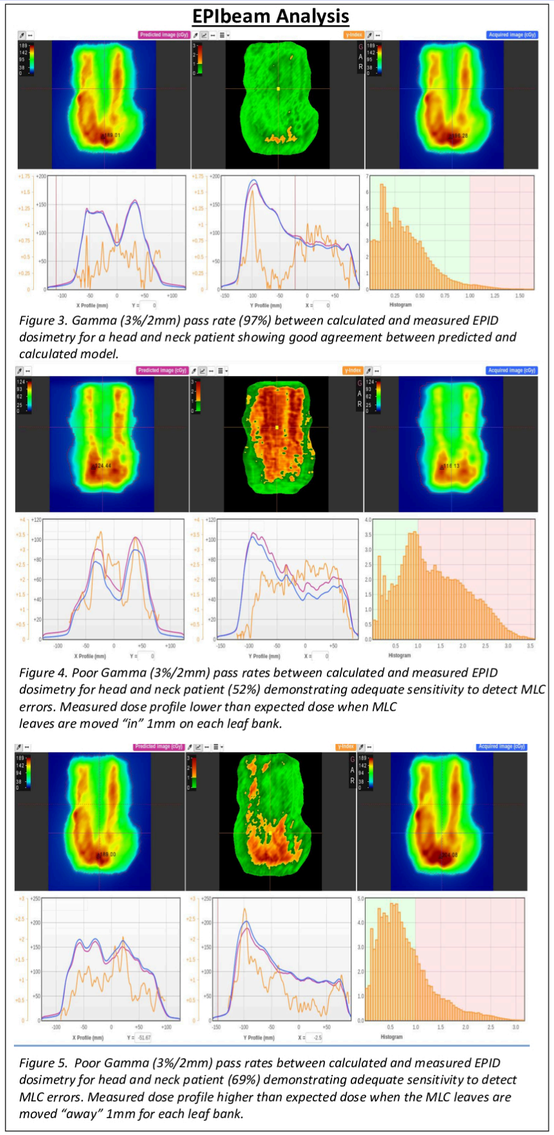

Figure 3. Gamma (3%/2mm) pass rate (97%) between calculated and measured EPID dosimetry for a head and neck patient showing good agreement between predicted and calculated model.

Figure 4. Poor Gamma (3%/2mm) pass rates between calculated and measured EPID dosimetry for head and neck patient (52%) demonstrating adequate sensitivity to detect MLC errors. Measured dose profile lower than expected dose when MLC leaves are moved "in" 1mm on each leaf bank.

Figure 5. Poor Gamma (3%/2mm) pass rates between calculated and measured EPID dosimetry for head and neck patient (69%) demonstrating adequate sensitivity to detect MLC errors. Measured dose profile higher than expected dose when the MLC leaves are moved "away" 1mm for each leaf bank.

CONCLUSIONS

EPID based pretreatment quality assurance can be achieved with the EPIbeam system for fluence verification, and is comparable to traditional 3D detector based QA using the Delta4 system for routine VMAT QA. The system is sensitive to detect MLC errors on the order of 2mm.

ACKNOWLEDGEMENTS

Gloria Di Nardo-Dosisoft

Jeanl Elie-KAFROUNI-Dosisoft

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