

Performance and stability of an electronic portal imaging device for dosimetry purposes

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Introduction

An electronic portal imaging device (EPID) has been used in our department as a replacement for portal films for intensity modulated radiotherapy (IMRT) quality assurance (QA) [1]. An evaluation of the measurements done until now has been done to evaluate the stability and reproducibility of our EPID.

Material and Methods

Intensity modulated treatment plans were planned on KonRad (Siemens Medical Solutions). All measurements were carried out using a portal dosimetry system (Varian aS500) mounted on a Varian Clinac 2100C/D with a 120 micro-leaves collimator. The energy used for the treatment of the IMRT plans were 6MV and the "step-and-shoot" technique was used.

This EPID has a field of view of $40 \times 30 \text{ cm}^2$ and the measurements were done at a fixed distance of 100 cm from the focal spot [2]. The measurements were done at the depth of maximal dose with a build-up consisting of 8 mm of the inherent water-equivalent build-up plus 7mm thick water equivalent slab placed on the EPID. The EPID greyscale has been normalized to give a value of 1 for 100 monitor units (MU) exposure.

Around twice a month, output measurements were obtained from the images by measuring the greyscale in the middle of the images for a $10 \times 10 \text{ cm}^2$ field. This output was compared to absolute dose measured using an ion chamber (PTW, 31003, 0.3 cm^3) in a water equivalent phantom for a $10 \times 10 \text{ cm}^2$ field.

The linearity of the EPID was verified by measuring the greyscale in the middle of the image for a $10 \times 10 \text{ cm}^2$ field with monitor units varying from 3 to 200.

Results

The mean difference between the output of the EPID and the ion chamber was $-0.01 \pm 0.24 \%$ ranging from -0.44% to $+0.44 \%$. For low MU, the deviation between the EPID and the calculated dose was up to 5% for low MU (3 – 5 MU) and less than 1% for higher MU (75 – 200 MU). The EPID showed a very good linearity with the MU, $R^2 = 0.99997$, for MU ranging from 3 to 200.

Discussion

Pre-treatment verification procedure based on the use of an EPID has been used clinically in our department for more than 18 months. During this time, the stability and the reproducibility of the EPID were assessed and showed very good performance. It is therefore suitable for IMRT QA.

References

- [1] IMRT field verification using a portal dosimetry system, Dreiländertagung 2007, Bern
- [2] Varian Medical System, Reference Guide (PortalVision and Dosimetry), B401988R01D, August 2005.