Evalutaion of two detector arrays for CDR-CAS-IMAT pretreatment quality assurance

W Bai [1], Y Gao [2], R Zhang [1],*, S Wang [1], Xiaochen Han [1], Weihui Zhang [3], Jingjing Guo [1]
1The Fourth Hospital of Hebei Medical University, Shijiazhuang, Hebei, China,
2Department of Gastroenterology, Hebei General Hospital, Shijiazhuang,China
3Shijin Irrigation District Administration of Hebei Province,China

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INTRODUCTION

For pre-treatment plan verification of advanced treatment techniques such as intensity-modulated arc therapy, a fast and reliable dosimetric device is required.

AIM

Patient-specific pre-treatment plan verification is a necessary prerequisite to advanced treatment techniques such as intensity-modulated arc therapy. Aim of this work is to verify the suitability of two ionization chamber 2D arrays (PTW729 and MatriXX) for pre-treatment CDR-CAS-IMAT plan verification and to compare the results achieved by the two systems.

METHOD

Measurements were performed by PTW729 and I'mRT MatriXX withabuild-up of 5 cm and backscatter of 5cm in the RW3 phantom, respectively. Forty-eight CDR-CAS-IMAT plans elaborated by TPS Elekta Oncentra version 4.1 and delivered by Varian Clinical 23EX Linac (with 6MV) have been used in this study (10 head and neck, 18 esophageal carcinoma and 20 pelvic treatments). The measured dose distributions of coronal and sagittal planes were compared with those from calculation by the planning system for cross verification.The results were evaluated by the absolute and relative doses as well as 3D gamma metric at 3% /3 mm.

RESULTS

Mean gamma pass rate for the I'mRT MatriXX was 92.8% (s.d. 1.3%) for HN plans, 94.8% (s.d. 1.5%) for esophageal carcinoma treatments and 96.2% (s.d. 1.9%) for pelvic plans. Mean gamma pass rate for thePTW729 was 91.4% (s.d.2.6%) for HN plans, 88.6% (s.d. 3.2%) for esophageal carcinoma treatments and 89.3% (s.d. 2.8%) for pelvic plans. Improve measurement resolution by merging two longitudinally shifted measurements showed excellent agreement between measurements and calculations for both dosimetric devices. The passing pixels (pp) averaged over all plans was nearly 100%.

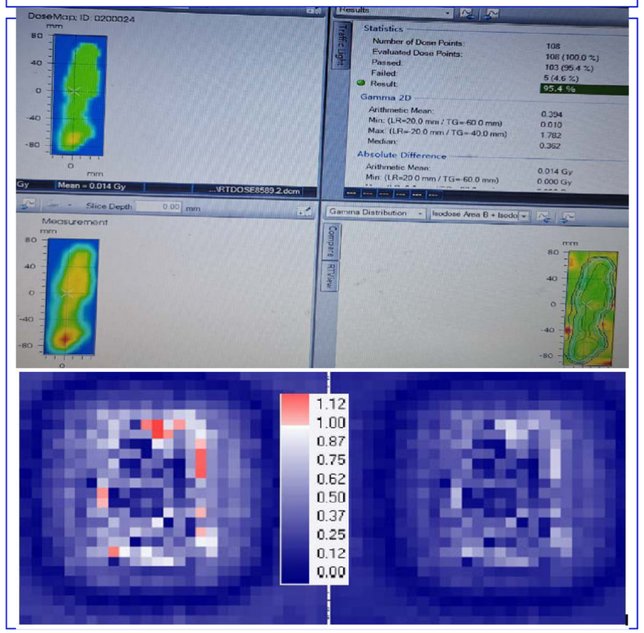

Figure 1. Comparison of gamma maps between computed (Oncentra) and measured dose distribution for γ(3%/3mm). The dose distributions were acquired with PTW729(The Up) and MatriXX(The down) in RW3 phantom.

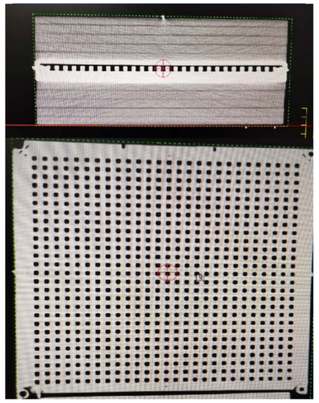

Figure 2. (a) CT of PTW729 in RW3 phantom, in Oncentra TPS.

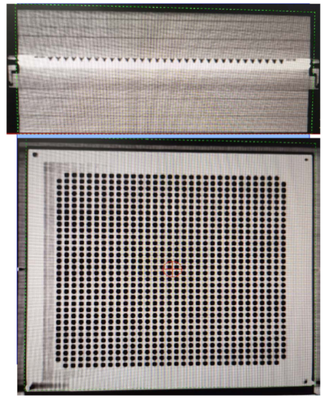

Figure 2. (b) CT of MatriXX in RW3 phantom, in Oncentra TPS.

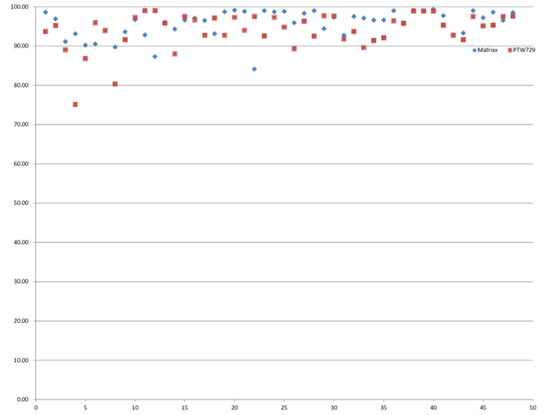

Figure 3. . Improve measurement resolution by merging two longitudinally shifted measurements showed excellent agreement between measurements and calculations for both dosimetric devices. Lists the percentage of passing points for both γ(3%/3mm) .

CONCLUSIONS

Both investigated systems achieves the goal of an efficient and accurate dosimetry validation method suitable for CDR-CAS-IMAT pre-treatment quality assurance and found to be reliable to measure both absolute dose and relative dose distributions, simultaneously, but I'mRT MatriXX outperformed its predecessor PTW729 because of the higher spatial resolution of the dosimeters.

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CONTACT INFORMATION

zrh_205.com@163.com