INFLUENCE OF BEAM SPOILER AND AIR GAP ON DOSE DISTRIBUTION IN BUILD-UP REGION FOR X6 MV STATIC FIELD

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INTRODUCTION

Based on CBCT images we noticed that there are several different problems with reproducibility of bolus positioning (E. Dąbrowska, et al., Investigation of reproducibility of bolus position based on kV CBCT imaging, Radiotherapy & Oncology, Journal of the European Society for Radiotherapy and Oncology, Volume 123, Supplement 1, 2017), especially air gap occurrence. The aim of this study was to determine the influence of air gaps between bolus and phantom on dose distribution in build-up region for X6 MV. The novelty of the work is using low density boluses fabricated with 3D printer.

MATERIALS AND METHODS

For Depth dose measurements were perform for X6 MV 10x10 cm^2 open field, generated with Varian CL 2300 C/D. The measurements were carried out with the Markus plane parallel ionization chamber (PTW, 0.055 cm^3 volume), connected to Unidos (PTW) electrometer. The 1 cm thick 3D-printed thermoplastic polyurethane (TPU) cuboids filled with 5%, 10%, 15% and 20% honeycomb structure (thickness of 0.5 g/cm^2, 0.17 g/cm^2, 0.22 g/cm^2) spoilers were used. To generate air gap we used homemade styrofoam frames (Fig. 1). Measurements were performed at a physical depth of 1, 5, 10 and 15 mm for all beam spoilers without air gap and with 10, 20, 30 and 40 mm air gaps, at constant 90 cm SSD.

RESULTS

The results of measurements were presented on graphs (fig. 2, 3). Based on Fig. 2 we can see that beam spoilers increased the dose in build-up region. The bigger is spoiler filling the larger is surface dose. The same dependence we can see in Fig. 3, irrespective of air gap size. Regardless of spoiler percentage filling with honeycomb structure, the larger air gap size the smaller dose on 1 mm depth.

Fig. 1 Homemade styrofoam frames generating air gap with 3D-printed bolus

CONCLUSIONS

Beam spoiler increased the dose in build-up region. The larger thickness of beam spoiler (larger filling) the larger influence on build-up dose. Occurrence of air gaps lowers the surface dose. However, the influence of air gap in the range of 10 - 40 mm is not very pronounced. For bolus with density of 0.22 g/cm^2, regardless of air gap size the dose on 1 mm depth was always larger than 95% of maximum dose. The issue will be investigated for wedged and dynamic fields.

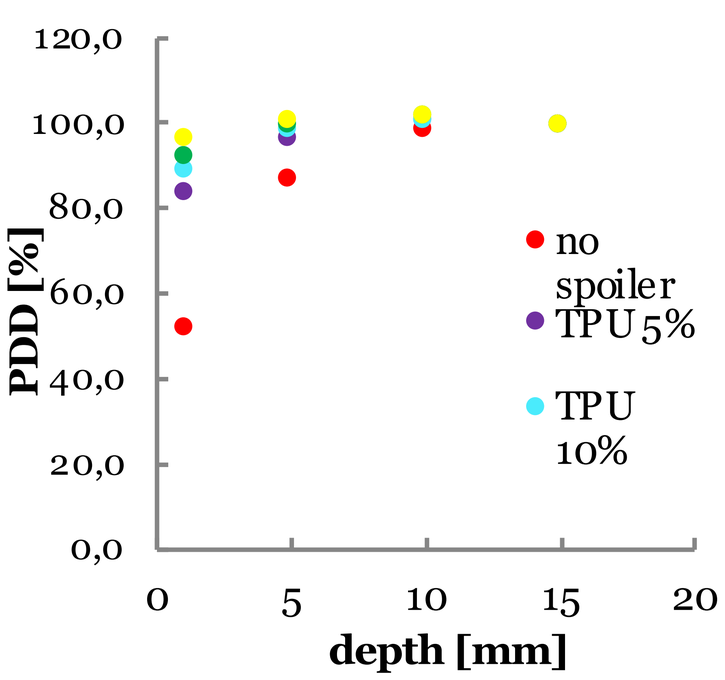

Fig. 2 PDD dependence without air gap for different spoiler filling.

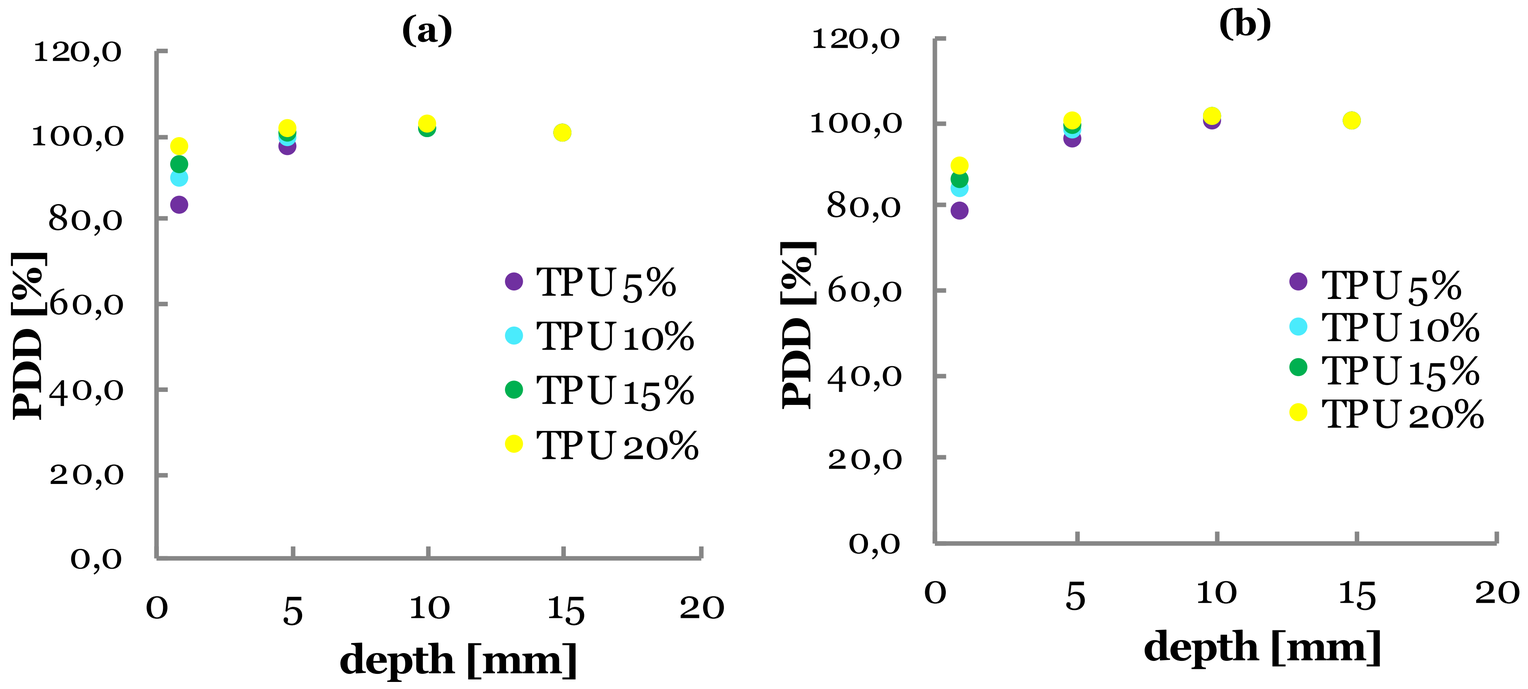

Fig. 3 PDD dependence with 10mm (a) and 40 mm (b) air gap for different spoiler filling.