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Analysis of Clinical Photon Beams in Buildup Region

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INTRODUCTION

The purpose of this study was to improve on the analytical expressions used to describe buildup doses for clinical photon beams . An important consideration in the use of megavoltage photon beams for the treatment of cancer is the amount of surface dose delivered to the patient. The sharp of the depth dose curve in the buildup region, particularly dmax, the depth at which maximum dose is achieved, depends on the field size. The major contributors of buildup region doses are the head structure and the air volume at the extended source to surface distance. The cause of these effects has been controversial. The effect by contaminat electrons to the buildup dose in a water phantom has been calculated and compared to experimental data.

MATERIALS and METHODS

The contribution from factors in the buildup region of a photon beam must be separated for the dose calculation. Their contribution can be extrapolated from the depth dose data by using the depth kerma derived from measured quantities, and the inverse square law for the incident photon beam. The depth dose was measured by using a photon diode (p-type energy compensated Si diode for photon beam) and the radiation field analyzer for square field sizes ranging from 3 to 40 cm per side. The depth dose in the shallow region was also measured for a range of field sizes with a thick acrylic tray, a external wedge, and square Lipowiz's metal blocks on a solid acrylic tray. The depth dose beyond the buildup region was also measured for open and wedge fields to determine parameters. The analysis for the 6 and 10 MV photon beams from a clinical linac was done for source-to-surface distance(SSD) of 100cm. To estmated the effects on the buildup dose the extrapolated techanique has been used.

RESULTS

In our analysis for the 6 and 10MV photon beams from source to surface distance 100cm, the maximum factor of contaminant dose varies from 2% to 16%, for square collimator setting ranging from 5 to 40cm. This value at dmax can reach to 1.1 % and 1.8 % for 6 and 10MV, respectively. Compared with the open beam, the contaminant electron dose increase as a solid tray is used, and its magnitude increases with field size, and reaches to 16% at 40x40cm2 field.

CONCLUSIONS

This contaminant electron dose is almost indepent of the SSD for 6 and 10 MV. Comparing with the open beam, the contaminant electron dose increase when a solid tray is used, and its magnitude increases with field size. The contamin ant electron dose increase slightly for a blocked beam compared with an open beam of the same field size if tray is used in both cases. The contaminant electron dose for the wedged field is less than that for the open field. We have shown that it is not quite significant at large collimator settings and increases slightly for 6 MV photons.