

EFFECT OF THE AIR GAP BETWEEN THE SKIN SURFACE AND BOLUS MATERIAL ON THE RELATIVE SURFACE DOSE IN ELECTRON BEAM THERAPY

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Purpose: The existence of an air gap between the bolus material and the skin surface is often encountered in electron beam therapy. This study investigated the perturbation effect of air gaps under bolus material on the surface dose.

Materials and Methods: The surface dose was measured for air gaps from a distance of 0.0 cm to 2.0 cm using 6, 9, 12, 16 and 20 MeV electron beams and various available cone sizes from 6x6, 10x10, and 20x20 cm² on a linear accelerator.

Results: In the case of 6x6 cm² cone size with different thickness of boluses and electron energy, the relative surface dose decreased from 100% to 85.2% as the air gap was increased. In 10x10 cm² cone size the relative surface dose decreased from 100% to 93.7%. In 20x20 cm² cone size the relative surface dose decreased from 100% to 97.1%.

Conclusions: These measurements showed that there was a tendency of relatively decreasing surface dose by lower electron energies, smaller field sizes, larger air gaps, and thicker boluses. It is necessary to correct the problem with individual dosimetry.

[Therapeut Radiol Oncol 1997; 4: 211-214]

Key words: Electron beam therapy, Air gap, Bolus

INTRODUCTION

Tissue-equivalent bolus is sometimes used in electron beam therapy to (1)increase the surface dose, (2)decrease the penetration depth of the electrons in parts of the field and (3)flatten the irregular surface as a compensator [3,4]. The bolus was usually put directly on the skin surface. Due to the irregular contours of the body shapes, the bolus cannot always be perfectly contacted with the skin surface, leaving an air gap between the skin and bolus. This study investigated the influence of the air gaps on the

relative surface dose in the electron beam therapy.

MATERIALS AND METHODS

Different situations were designed to evaluate the surface dose perturbations by varying the air gaps with different field sizes, beam energies, and boluses. The tissue-equivalent polystyrene with thickness of 0.5 and 1.0 cm were chosen as the bolus materials due to the similarity of electron densities of polystyrene and the soft tissues [1,5]. The various electron