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THE STUDY OF VIRTUAL WEDGE BY USING DYNAMIC MULTI-LEAF COLLIMATOR

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Dose uniformity is directly related to tumor control probability (TCP) and normal tissue complication probability (NTCP). An ideal situation is one in which a uniform high dose is focused on the tumor target region and normal tissue surrounding the target volume receives minimal radiation. Dose distribution and uniformity must take into account the irregular contours and density changes within the body, especially the head, neck, and breast. A physical wedge has been used to compensate for irregular contours during traditional treatment, but a physical wedge is limited by its fixed angle and size. In addition, it cannot compensate for two dimensions simultaneously. We have developed a two-dimensional dynamic wedge to overcome these limitations.

A wedge-shaped dose map was calculated for this study. The dose map was transferred to a fluence map in a CadPlan treatment planning program to generate a multileaf motion file. We created 6 dynamic wedges and verified them by phantom measurements. The maximum differences in the beam profiles between the calculated values and the measured values were 1.8%, 1.7%, and -1.8% when measured for wedges at 45 degrees, 15 degrees, and 38 degrees in the X direction, and -2.6% and -2.3% when measured for wedges at 20 and 30 degrees in the Y direction. The differences between the isodose curves for the two-dimensional dynamic wedges were less than 2% and 2mm. Absolute doses also showed good agreement between calculated and measured values in this study such that all differences were less than 3%.

The two-dimensional dynamic wedge developed in this study may be valuable for simulating isodose curves and can be used for CadPlan treatment planning which is currently used in many hospitals.
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