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 EXCHANGE EFFECT/EQUIVALENT SQUARE FIELD

NUANPEN DAMRONGKIJUDOM : THE STUDY OF HEAD-SCATTER
 FACTORS IN OPEN AND WEDGE FIELDS FOR 6 AND 10 MV PHOTON
 BEAMS FROM LINEAR ACCELERATORS. THESIS ADVISORS : RATANA
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Head-scatter factor (S_h) and wedge-head scatter factor ($S_{h(w)}$) are the ratio of the output in air for a given field to a reference field $10 \times 10 \text{ cm}^2$ along the axis of the beam for the open beam and the wedge beam respectively. Those values are important in the calculation of the dose given to the patient.

In this research, the experiments aimed to study the measurement values of S_h and $S_{h(w)}$ for square and rectangular fields. Measurements were taken on a Clinac 2100C and an SL-15 accelerator with 6 and 10 MV photon beams for both open and wedged fields with 0.6 cc ionization chamber covered with the perspex build-up cap. The distance from the source to the center of the chamber was fixed at 180 cm. The results showed that for square fields, S_h and $S_{h(w)}$ were increased as a function of field sizes varied from 4×4 to $20 \times 20 \text{ cm}^2$. When the field sizes were less than $20 \times 20 \text{ cm}^2$, the difference of the head-scatter factor between open and wedged beams for the internal wedge from the SL-15 was 2.0-2.5%, whereas for the external wedge from the Clinac 2100C, the difference was less than 1.0%. It was also found that for rectangular field sizes, when the upper jaws (Y) were larger than the lower jaws (X), the values of S_h and $S_{h(w)}$ were greater than the values in which the lower jaws (X) were larger than the upper jaws (Y). It showed that the Y-collimator contributed greater effect on the head scatter factor than the X-collimator. The higher the values of $|X-Y|$, the larger the percent differences of S_h and $S_{h(w)}$ for the exchange of the X and Y-collimator. The calculation of the S_h and $S_{h(w)}$ of the rectangular fields using the equivalent square formalism was also studied. The side of equivalent square should be obtained with different weights from the modified equivalent square formalism [$S = (k+1)XY/kX+Y$]. Comparison between the measurement and the calculation values of S_h and $S_{h(w)}$ for 6 and 10 MV photon beams on both machines was made. The differences are less than 0.85 % when the k-value is 1.7 for 6 and 10 MV photon beams on a Clinac 2100 C with open and wedged fields. The differences are less than 1.05 % when the k-value is 1.6 for both energy photon beams on a SL-15 with open and wedged fields. The difference is markedly observed when the simple equivalent square formula ($S = 2XY/X+Y$) and the table of equivalent square (BJR suppl. 17) were employed while the modified equivalent square formalism corrects well for the effect of the field elongation and the collimator-exchange effect for the calculation of an equivalent square field.