

Purpose: Fixed Circular Collimator employed in cardiovascular angiography system with flat panel detector was developed to reduce radiation dose to both patient and cardiologist in coronary intervention. This study was designed to assess the radiation dose reduction using this new collimator.

Method and Materials: This new collimator makes the radiation field circular and has tapered aluminum to reduce radiation dose at peripheral field.

1. Entrance air kerma with backscatter (patient) and personnel dose equivalent (Hp) to cardiologist (scattered radiation dose) were measured to verify the radiation dose reduction using fixed circular collimator under a fixed geometric arrangement. The PMMA phantom was employed to simulate the patient thickness varying from 1.0 cm to 35.0 cm in increments of 1.0 cm. Upon completion of the data acquisition, entrance air kerma and Hp to cardiologist were plotted against the phantom thickness.

2. Entrance skin regions (patient) were imaged to verify the overlap region reduction under ten routine angulations (RAO30, RAO10-CAU30, RAO30-CAU30, RAO30-CRA30, LAO10-CRA30, LAO20-CRA30, LAO30-CRA30, LAO45-CRA30, LAO45, and LAO45-CAU30). All tabletop position for every angulations were set up to image the heart center of chest phantom, subsequently, chest phantom was replaced by computed radiography and irradiated 1 sec.

Results: Entrance air kerma and Hp to cardiologist were reduced by 8.0 % and 47.6 %, respectively. On the other hand, the overlapping region of skin was also reduced considerably.

Conclusions: Due to the use of fixed circular collimator, entrance air kerma, the overlap region of exposed skin and Hp to cardiologist were decreased concurrently. It was considered that the use of fixed circular collimator makes the lower density of backscatter and region of interest optimize. Therefore, rectangular images should be reconsidered for safer coronary intervention. Although this study doesn't include image quality evaluation, cardiologists adopt this new collimator in clinical study currently.