

Purpose: To examine characteristics of electron beams collimated by an electron multileaf collimator (eMLC) for modulated electron radiotherapy (MERT).

Method and Materials: An eMLC, which has 25 pairs of Tungsten leaves with 2 cm of thickness and 0.6 cm width, was made and can be attached to a medical LINAC. In this work, measurements using films and ion chamber were performed to investigate electron beam characteristics with eMLC. The source surface distance is 70 cm, at which the distance between the bottom of eMLC and the phantom surface is 5.5 cm. The beam characteristics, such as leakage and transmission, spatial resolution, beam abutment, beam penumbra and percentage depth dose (PDD) were evaluated. Except that the PDDs were measured in water, all other measurements were conducted in a solid water phantom.

Results: Leakage and transmission increases from 0.24% to 3% as the electron energy increases from 6 MeV to 20 MeV. The shape of one leaf can be fairly distinguished while that of 2 or 3 leaves can be clearly seen in the dose profile on the phantom surface. The difference between an abutting field and a single field is obvious on the phantom surface but tends to diminish at the treatment depth. The beam penumbra is of a comparable quality with that shaped by an electron cutout, and in general, it decreases with the increase of energy and increases with the increase of the depth. The therapeutic range and the bremsstrahlung magnitude obtained from the measured PDDs with eMLC are similar to the electron beams shaped by an electron applicator and cutout.

Conclusions: Characteristics of the electron beams collimated by eMLC with a thin air gap (about 5.5 cm) is investigated. Acknowledging these characteristics is essential for optimizing treatment plans of the MERT.