

Development, physical properties and clinical applicability of a mechanical Multileaf Collimator for the use in Cobalt-60 radiotherapy

Abstract

According to the Directory of Radiotherapy Centres (DIRAC) there are 2348 Cobalt-60 (Co-60) teletherapy units worldwide, most of them in low and middle income countries, compared to 11046 clinical accelerators. To improve teletherapy with Co-60, a mechanical Multi-Leaf Collimator (MLC) was developed, working with pneumatic pressure and thus independent of electricity supply. Instead of tungsten, brass was used as leaf material to make the mechanical MLC more affordable. The physical properties and clinical applicability of this mechanical MLC are presented here. The leakage strongly depends on the fieldsize of the therapy unit due to scatter effects. The maximum transmission through the leaves measured 2.5 cm from the end-to-end gap, within a field size of 20 cm × 30 cm defined by jaws of the therapy unit at 80 cm SAD, amounts 4.2%, normalized to an open 10 cm × 10 cm field, created by the mechanical MLC. Within a precollimated field size of 12.5 cm × 12.5 cm, the end-to-end leakage is 6.5% normalized to an open 10 cm × 10 cm field as well. This characteristic is clinically acceptable considering the criteria for non-IMRT MLCs of the International Electrotechnical Commission (IEC 60601-2-1). The penumbra for a 10 cm × 10 cm field was measured to be 9.14 mm in plane and 8.38 mm cross plane. The clinical applicability of the designed mechanical MLC was affirmed by measurements relating to all relevant clinical properties such as penumbra, leakage, output factors and field widths. Hence this novel device presents an apt way forward to make radiotherapy with conformal fields possible in low-infrastructure environments, using gantry based Co-60 therapy units.¹