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Evaluation of Radiation Characteristics of Machine without a Flattening Filter in SRS

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Most of the photon radiation therapy units have a very similar structure, composed of a high atomic number target, primary collimator, flattening filter, monitor chamber, and the secondary collimator. Optionally, additional beam modulators like wedges, compensators or multileaf collimators are used to modulate the beam intensity of an open field. In this work a recently developed and in some aspects nonstandard radiotherapy system CyberKnife is investigated. The most important difference is the absence of a flattening filter, which cause the radiation field to be significantly different from that of other treatment units. Because of the mentioned differences relative to a standard radiotherapy machine, the main focus of this paper is on the description of radiation characteristics of machines without a flattening filter. For comparison to other systems, linac-based radiosurgery system (pReference) was performed. All measurements of the radiation characteristics were performed by four different detectors: diode detector, GafChromic EBT film, 0.015 cc and 0.125 cc ionization chamber. Measurements of PDD, beam profiles and relative output factor were in water with a diode detector and also with ion chambers. Beam profiles were also measured with film. Absolute dose was measured with an ion chamber in water. The radiation characteristics of machines without a flattening filter are in several aspects different from characteristics of other treatment units. The PDD of the filtered beam is higher than that of the unfiltered beam at the same OAD. The resulting beam profiles are slightly improved in the penumbra region for the unflattened beam.

Keywords : CyberKnife, Linac-based Radiosurgery, Flattening Filter