

Efficacy of the virtual cone method using fixed small multi-leaf collimator field for stereotactic radiosurgery

ABSTRACT

Variation of dosimetric parameters in photon fields $< 2 \times 2 \text{ cm}^2$ has created research questions when using small-field virtual cone with variable multi-leaf collimator (MLC) fields. We have evaluated the efficacy of the virtual cone method using a fixed small MLC field for stereotactic radiosurgery (SRS) of small targets. The fixed virtual cone (fVC) was characterized by 0.5 cm x 0.5 cm high-definition MLC field of 10 MV FFF beam defined at 100 cm SAD, while jaws were positioned at 1.5 cm x 1.5 cm. A spherical dose distribution equivalent to 5 mm physical cone was generated by using 10–14 non-coplanar arcs. The dosimetric accuracy was validated from 10 retrospective treatment plans (trigeminal neuralgia) using the SRS MapCHECK (Sun Nuclear Corporation, FL) and EBT3 (Ashland Inc., NJ) film based on absolute dose measurements, including the field-by-field study (n = 130 fields) with 6 MV and 10 MV FFF beams. The dosimetric (field output factors, dose/MU) uncertainties in the field defining fVC, caused by a minute (± 0.5 – 1.0 mm) leaf shift, were examined from the Eclipse treatment planning system, SRS diode (PTW 60018) measurements, and Monte Carlo (MC) simulations. Results will be discussed.