

*Purpose:*

In radiotherapy, accurate dose determination requires accurate measurements of output factors. The employment of small field size cones in radiosurgery imposes significant challenges for such accurate measurements, since the detector perturbation and its energy dependence, along with the detector size, may introduce significant errors in the output factor determination. This study investigated the impacts on the output factors introduced by the detector perturbation and energy dependence.

*Method and Materials:*

Output factors were measured on a Varian Trilogy™ linear accelerator for various collimator defined small square fields and twelve radiosurgery cones that were shipped with the machine. The measurements were performed by using four different detectors, namely, a pinpoint ion chamber, Koda EDR2 films, a stereotactic diode detector, and a pinpoint diode detector. The energy dependence was also evaluated for the ion chamber and diode detectors.

*Results:*

Both perturbation and energy dependence present non-trivial effects in the determination of the output factors. The impact of detector perturbation was more pronounced for the small fields, while that of energy dependence was evident for all the field sizes investigated. For a cone of 5 mm diameter, the perturbation introduced by using a PinPoint ionization chamber could result in almost 30% reduction in the output factor value. The deviations caused by the energy dependence varied from 3% to 6% depending on field sizes.

*Conclusions:*

The output factor measurements of small fields must not only account for the size of detector but also its perturbation and energy dependence to ensure the measurement accuracy for stereotactic radiosurgery.