

## Abstract

**Purpose:** To determine the dosimetric properties of flattening filter free (FFF) megavoltage photon beams for a new Varian linear accelerator, Trilogy MX.

**Materials and methods:** A new Varian linac consists of 6, 10 and 15 MV photon beams equipped with flattening filters (WFF), and 6 and 10 MV photon beam free of the flattening filter (FFF). Dosimetric data including depth dose, profiles, output factors, phantom scatter factors, and surface doses operated under the FFF mode were examined. Measurements of leaf transmission, leakage radiation, and off axis beam quality were also performed. Treatment plans using the FFF beams were evaluated to determine differences between WFF and FFF beams.

**Results:** Depth of dose maxima for photon beams with WFF and FFF were compared. It was found that for FFF beams,  $d_{max}$  was shallower. The PDDs for the FFF beams were found to be lower than WFF beams. Surface doses were found to be larger for FFF. The flatness for a  $10 \times 10 \text{ cm}^2$  field is 6.1 % (FFF) versus 2.5 % (WFF) for a 6MV at a depth of 10 cm.  $S_{c,p}$  were found to be higher for FFF beams for field sizes  $< 10 \times 10 \text{ cm}^2$ , but lower otherwise. No significant dose distribution differences were observed between IMRT treatment plans using the FFF or WFF beams.

**Conclusions:** The results indicate that the physical characteristic of the FFF photon beams are not dramatically different from the WFF photon beams, except for uniformity across the field. However, FFF mode does result in a softer beam due to reduced beam hardening. The increased dose rate for FFF beams will reduce treatment time.

**Conflicts of interest:** Research funding from Varian Medical Systems.