Purpose:
To propose dose calculation model of tumor-tracking irradiation by gimbals mechanism for MHI-TM2000 (Vero).

Methods:
Our MC simulation for a 6 MV photon beam delivered by the MHI-TM2000 system was performed using EGSnrc. First, the lateral doses (5 x 5 cm2 at 100 mm depth) with pan/tilt rotation were simulated under the SSD of 900 mm. Rotation angles along pan/tilt directions were set in the range of -2.5 to +2.5° at intervals of 0.5°. The corresponding measurements were performed using EDR2 films with water-equivalent phantoms. Differences between simulated and measured doses were calculated. Furthermore, difference of output characteristic without setup error was estimated using the simulated lateral doses under the reference condition at the maximum and minimum rotation angles. Next, the moving phantom was driven at frequency of 0.25 Hz with amplitude of 10 mm along tilt direction. From the infrared marker positions, the corresponding pan/tilt angles were calculated. Time, phantom position by laser displacement gauge, current angle of pan/tilt, and MU were recorded in the log file. A phase space data at any angles was created from the log file and particle data under the MLC. Finally, both stationary X-ray head and tumor-tracking irradiation were simulated under the SSD of 950 mm (4 x 4 cm2 at 50 mm depth). Each of them was compared with the corresponding measurement using EDR2 film.

Results:
The lateral doses within flat region showed agreement of within 1.1% in any angles. The differences between doses at the minimum angle and at the maximum were within 0.5% and 4.5% in flat and penumbra region, respectively. The averaged differences between the simulated and the measured doses with stationary and tumor-tracking irradiation were 1.9%.

Conclusions:
We have developed dose calculation model of tumor-tracking irradiation for MHI-TM2000. This study demonstrated our proposed model has acceptable accuracy.

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