Comparison of Dose Distribution between non-flattening filter based stereotactic mode beam and normal treatment mode beam

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INTRODUCTION

Stereotactic radiosurgery is technique that is used to irradiate small intracranial lesions to a high radiation dose in a single treatment.
The purpose of this study is to evaluate dosimetric aspects of SIEMENS 6MV linear accelerator specially designed adding non-flattening filter based stereotactic mode and normal treatment mode and to compare dose distribution due to the combination of flattnening filter and wedges, and to evaluate implementation of compensator, wedge and other devices and Intensity modulated radiation therapy in sterotactic mode beam.

METHOD

In this experiment, the linear accelerator specially designed by Siemens (non-flattening filter) was used and the head phantom was made to measure dose distribution using the TLD, film and diode. Beam profile between the stereotactic mode and the normal mode was compared using rod-type TLD. The video-densitometer were used to compare beam profile and isodose curve between the stereotactic mode and the normal mode .

Our dosimetric aspects include measurement of depth dose, beam profile, isodose curve for two modes at either single beam or multiple arcs and measurement of wedge factors and beam profiles according to combination of flattening filter and wedges in depth of Dmax, 5cm and 10cm. The measurements were performed with specially designed stereotactic collimator and accessory, and repeated for both stereotactic and normal mode. Dosimetric results in stereotactic and normal modes were compared and evaluated using ion chamber, film

and TLD. Computed isodose curves in two different modes were also compared using our developed computer radiosurgery planning system (CMC Stereo Plan).

RESULT

Dose rates were more than 2 times higher in stereotactic mode than in normal mode. There were no significant differences of beam profiles and isodose curve for both single beam and multiple arcs. There were no significant differences of beam profiles in combination of flattening filter and wedges however, wedge factors in normal mode were slightly higher than stereotactic mode (non flattening filter).

DISCUSSION

Because the collimator size is small in stereotactic radiosurgery, the beam profile and isodose curve, are not different so much, results obtained by stereotactic mode with non-flattening filter and normal mode. Because attenuation is decreased, when removing flattening filter, high dose rate is acquired, as a result treatment time can be reduced. There were no significant differences of beam profiles in treatment field except penumbra widths, which were wider in stereotactic mode than in normal mode and stereotactic mode show shallow dose gradient due to lack of beam hardening.

CONCLUSION

There were no actual differences of dosimetric aspects between stereotactic mode and normal mode , our stereotactic capabilities provide strong benefit of less treatment time, automatic safety set-up, and new function of patient record and verification system compatible with our stereotactic mode.

Stereotactic mode beam can be used with wedge, compensator and other devices which could modify dose distribution.