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Innovation in Stereotactic
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Improvement of FLASH Electron Beam Characteristics Using an Electron Applicator

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Objectives: Various leading groups are conducting a study to modify a clinical linear accelerator (LINAC) for FLASH therapy. However, previously studies have several problems; i) limited effective area, ii) experiment within the gantry head, iii) non-standard conditions. Although a lot of time and resources are being invested to solve these problems, the limitations of the effective area still require improvement. In this study, we presented the possibility of improving FLASH beam characteristics using a commercially available electron applicator.

Methods: We measured the output and profile with and without an applicator to evaluate its usefulness using an EBT-XD film. The film was placed at the maximum dose (Z_{max}) location within the slab phantoms, and a 10cm×10cm applicator was used; Experimental conditions - SSD 100 cm, dose rate 600 MU/min and exposure time 100ms.

Results: The output result showed as 339.1 and 333.0 Gy/s for without and with applicator respectively, which was confirmed that the applicator did not affect the output. The profile showed Gaussian distribution in without applicator; $W_{50} \varnothing 145.6$ mm, $W_{90} \varnothing 57.6$ mm, $W_{95} \varnothing 37.2$ mm. In with applicator, the overall field showed a rectangular distribution, but the internal distribution showed Gaussian distribution. The flatness showed with and without applicator was 21.8 % and 11.9 %, respectively, which is due to the scattered radiation from the applicator. The symmetry result showed that with and without applicator was 99.7 % and 100.5 %, respectively.

Conclusion(s): In this study, we evaluated the possibility of improving beam characteristics using an applicator. Although, no improvement in effective area, but the possibility of improvement in terms of flatness was confirmed. It is considered that the problem of effective area can be solved by improving flatness through further research on the applicators.



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