properties of electron beam scattering foil free in small fields using mcnpx

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**Back ground:** Electron beam is widely used in the treatment of malignant cancers due to the property of dose deposition as a function of depth. If the treatment of patient surfaces is irregular, we have a dose heterogeneity in the target volume due to the change in the penetration power of the electron beam at a distance from the central axis. Therefore, modulated electron beam radiotherapy (MERT) is recommended, but multi-leaf electron collimators are recommended for electron beam foil, but its use is associated with the photon contamination that the use of scattering foil free electron beam is suggested to solve this problem.

**Aim of the study:** the specificity of 6 MeV electron beam in fields smaller than 10 $cm^{2}$ without scattering foils by Monte Carlo method, code MCNPX2.6.

**Materials and Methods:** In this study, the 2100CD Varian linac was first simulated and after validation, the scattering foils were removed and the depth percentage (PDD) and dose profile curves were examined for 0.5$×$0.5$cm^{2}$ and 10$×$10$cm^{2}$ and the maximum dose range, surface dose and photon contamination were calculated and compared.

**Results:** Our results showed that the absorption dose in the absence of scattering foils is significantly higher and the maximum dose range has increased in field 10$×$10$cm^{2}$ after the scattering foil has been removed, while in 0.5$×$0.5$cm^{2}$ field has become closer to the surface. Surface dose in electron beams scattering foil free increased by 31.93% for 0.5$×$0.5$cm^{2}$ field and 4.04% for 10x10$cm^{2}$ field. photon pollution is reduced in scattering foil removal but the amount of pollution in 0.5$×$0.5$cm^{2}$ field is higher than 10x10$cm^{2}$ field.

 **Conclusions:** By removing the scattering foils in fields smaller than 10$×$10$cm^{2}$, the surface dose is increased and the photon pollution is reduced. Also, due to shrinkage, the dose profile curves of adjacent organs receive lower doses, but it should be noted that the removal of scattering foils will not be efficient for large fields. Foil removal will be effective in treating superficial tumors, but in depth, this amount increases that should be considered.

***Keywords: radiotherapy, electron beam, MCNPX, scattering foil, small fields***

Reference

[1] Connell T. An experimental feasibility study on the use of scattering foil free beams for modulated electron. 3259.

[2] Sung W, Park JI, Kim J, Carlson J, Ye S, Park JM. Monte Carlo simulation for scanning technique with scattering foil free electron beam : A proof of concept study. 2017;1–22.

[3] Eldib A, Jin L, Li J. Investigation of the clinical potential of scattering foil free electron beams. 819.

[4] Bieda MR, Antolak JA, Hogstrom KR. The effect of scattering foil parameters on electron-beam Monte Carlo calculations. 2001;(492):2527–34.

[5] Ye S, Pareek PN, Spencer S, Duan J, Brezovich IA, Ye S, et al. Monte Carlo techniques for scattering foil design and dosimetry in total skin electron irradiations Monte Carlo techniques for scattering foil design and dosimetry in total skin electron irradiations. 2014;1460(2005).