ABSTRACT

Glioblastoma is the most aggressive primary brain tumour, characterized by poor prognosis and high mortality. Intensity Modulated Radiation Therapy (IMRT) plays a crucial role in improving treatment precision by delivering optimal dose to the target while minimizing exposure to surrounding healthy tissues. The use of Flattening Filter Free (FFF) beams at 6 MV has emerged as an alternative to conventional flattened beams (FF), offering potential advantages in reducing radiation scatter. This study aimed to evaluate and compare dose fall-off characteristics between 6 MV FFF and 6 MV FF beams in IMRT planning for glioblastoma cases. A total of 10 treatment plans from patients with right-lobe glioblastoma were analysed using a Treatment Planning System. Target evaluation was performed according to ICRU Report 83 recommendations, while dose distribution was assessed using Gradient Index (GI), Conformity Index (CI), and Homogeneity Index (HI). Organ at risk (OAR) evaluation followed QUANTEC and RTOG guidelines. Statistical analysis was conducted using paired t-test. The results demonstrated that both techniques met clinical criteria. However, FF beams exhibited significantly lower GI values ($p < 0.05$), indicating a sharper dose fall-off. In addition, FF showed significantly better CI and HI values ($p < 0.05$), reflecting more conformal and homogeneous dose distributions. Improved OAR sparing was observed in the brainstem and right optic nerve with FF beams, while no significant difference was found in Monitor Unit (MU) ($p > 0.05$). In conclusion, although FFF beams offer theoretical advantages, FF beams demonstrated superior dosimetry performance in IMRT planning for glioblastoma. These findings highlight that treatment plan quality is more strongly influenced by optimization strategies than by beam characteristics.

Keywords: *glioblastoma, IMRT, Flattening Filter Free, flattened beam, dose fall-off, Gradient Index.*