

Purpose:

This study presents a comprehensive dosimetric comparison between all the MLC systems that may be used for treatment planning in IMRT and SBRT. The clear clinical benefits of smaller MLC leaf widths, in the presence of IMRT, are questionable we found. We underline the importance of dosimetric benchmarking of IMRT.

Methods:

The RPC H&N and TG-119 phantoms and several clinical cases, were planned successively for NovalisTX (2.5mm), Synergy-BM(4mm), Artiste(5mm), Varian(5mm), and Primus (10mm) within the same planning system and multi-6MV beam arrangements. The Primus was successfully benchmarked against the RPC and the TG-119 phantoms and was used as reference. IMRT was utilized with same optimization parameters for all MLC systems, respectively. The target coverage was evaluated via a conformity index (CI) and the OAR sparing was evaluated from the dose to a “Ring” structure created around the target. Comparisons based on dose distributions, DVHs and gEUD for all plans were performed.

Results:

Surprisingly, we noticed no difference in TV coverage and sparing of OARs. Furthermore, the isodose distributions and DVHs for the RPC and TG-119 phantoms show no major dosimetric gains for the smaller MLC widths, the cord for the RPC phantom received lower doses with the 1cm MLC system (our benchmark reference), for the same TV coverage across the systems. For the clinical cases, all systems gave comparable TV coverage and sparing of the OARs, with the Primus MLC system again, to provide slightly better conformity (lower CI). This better dose conformity is the reason that the dose fall-off within the “Ring” structure is higher, for the Primus system.

Conclusions:

This study is the first that comprehensively compares the majority of today’s MLC systems and has shown no significant indication that smaller MLC widths can lead to optimal plans, when multi-field IMRT techniques are used for planning.