Purpose: To evaluate the performance of high-intensity flattening-filter-free (FFF) beams in terms of planning efficiency and dosimetric merits for head-and-neck cancers treated with IMRT and VMAT techniques.

Methods: Ten patients with Stage III–IV squamous cell carcinoma of the head and neck were planned with fixed-field IMRT and VMAT using 6MV flattened, 6MV FFF and 10MV FFF beams. Seven equi-spaced fields and two axial arcs were used for IMRT and RapidArc, respectively. Prescription doses to the primary and nodal targets were, respectively, 70 and 54 Gy over 35 fractions. Identical dose constraints are used for IMRT and RapidArc plans. Planning times and plan qualities were assessed for IMRT versus RapidArc with flattened and FFF beams.

Results: Target doses showed moderately better uniformity and conformity in IMRT plans than in RapidArc plans. While IMRT plans also exhibited some superiority in OAR sparing compared to RapidArc, the improvement is not clinically significant for most patients. The mean time for a single planning iteration was 15.7 minutes for IMRT and 55.0 minutes for RapidArc using an Eclipse workstation with 2.27 GHz Dual Quad-Core CPUs. The average MU is 682 for RapidArc and 2636 for IMRT. The average MUs for IMRT plans varied greatly among 6MV flattened, 6MV FFF and 10 MV FFF beams requiring 1513, 2580 and 3816 MU, respectively. In RapidArc plans, however, this variation is less than 20% for the three beams.

Conclusions: Both IMRT and RapidArc produced clinically acceptable treatment plans with flattened and FFF beams for head-and-neck cancers. Fixed-field IMRT plans showed moderate dosimetric advantage over RapidArc plans but required almost four times the MU. Among IMRT plans, FFF beams required 2-3 times the MU of flattened beams.