**Results:** The known offsets were compared to the values of the kV-kV match and the CBCT match. The kV-kV alignment differed from the known offset by a magnitude of 1.8 ± 0.7 mm averaged over 25 measurements. The same comparison using CBCT revealed a difference magnitude of 1.6 ± 0.6 mm. Evaluation of kV-kV and CBCT offsets showed that the systems differed in their determined shifts by a magnitude of 1.2 ± 0.5 mm.

**Conclusions:** Based on our evaluation, neither kV radiographs nor CBCT proved to be more accurate than the other in detecting known offsets. Both systems differed from the known offset by a magnitude greater than 1.0 mm. This may be in part due to the fact that they lack the ability to calculate sub-millimeter offsets and that the initial phantom position was not established with sub-millimeter accuracy. Further studies will establish the initial position of the phantom with sub-millimeter accuracy using a Winston-Lutz procedure.

Author Disclosure: T. Ogunleye, None; I. Crocker, None; E. Elder, None.

## 2952 A Dosimetric Study Comparing Different Strategies to De-escalate the Dose for Tonsillar Cancer

Y. Le, G. Sanguineti, T. McNutt

*The Johns Hopkins University, Baltimore, MD*

**Purpose/Objective(s):** To explore the relative benefit on organs at risk (OAR) sparing by 3 strategies (S) (and their combinations) of dose de-escalation for intermediate stage tonsillar cancer.

**Materials/Methods:** Nine patients with intermediate stage (T1-2N0-2) tonsillar cancer were selected. Compared to a reference (ref) whole-field IMRT plan addressing the primary tumor and the whole neck (3 dose levels, CTV 1, 2, 3 to 70, 63 and 58.1 Gy in 35 fxs/7 wks, 5 mm expansion to PTVs), 3 main S of dose de-escalation and their combinations were compared: S1. dose prescription (Px) reduction to PTV1 from 70 to 63 Gy; S2. dose Px reduction to the portions of PTV1 and PTV3 that overlap with main OARs from 70 to 63 Gy and 58.1 to 50.75 Gy, respectively, while unchanging the Px dose to CTV1 and CTV3; S3. dose Px reduction from 58.1 to 50.75 Gy to the portion of PTV3 far from macroscopic disease (*i.e.,* lower neck); S1 + S3; S2 + S3. All plans had same beam arrangements and were isoeffective to PTV (or CTV when appropriate) coverage. DVH for PTVs and 18 OARs were extracted for each patient/plan and compared at various dose intervals by Wilcoxon Matched-Pairs test.

**Results:** Compared to ref, for 6 OARs (mandible, larynx, ipsilateral parotid, ipsi masticatory mm, sup constrictor m, mucosa) S2 provides a statistically significant average maximum absolute reduction of $\approx$10% in the volume that receives at least 50-60 Gy (V50-60); for the mid constrictor m this is 35% at V60. For all these structures, S1 provides some statistically small ($\approx$3%) additional sparing over S2 in the 65-70 Gy interval, except for sup constrictor which is $>$10%. Other OARs (contra parotid, bil inner ears, contra masticatory mm, bil TMJs) show a similar benefit from S2 as above, without further advantage from S1. Moreover, all mentioned OARs do not benefit from S3 alone or in combination with S1-2.

S3 provides an average maximum improvement of $\approx$63% and $\approx$90% for ipsi/contra brachial plexus at 55 Gy, respectively, over ref.

Finally, for 4 OARs (inf constrictor, cricopharyngeus m, esophagus, thyroid gl) both S2 and S3 provide a 15-60% reduction of V45-60 over ref, though the absolute benefit appears greater for S3 over S2; moreover, the combination of S2 and S3 does not appear to provide further advantage over S3 alone. Compared to ref, PTV coverage reduction with S2 is $\approx$5% at V70 and $\approx$7% at V58.1 for PTV1 and PTV3, respectively.

**Conclusions:** Different strategies have different impact on different organs; the 'spatial' cooperation of S2+S3 appears a reasonable dose de-escalation strategy: S3 is preferable for OARs in the mid/lower neck, while S2 in the upper neck. S1 seems necessary only for the superior constrictor m.

Author Disclosure: Y. Le, None; G. Sanguineti, None; T. McNutt, None.

## 2953 RapidArc vs. IMRT Planning: A Comparative Study with Dosimetric Validation for Head and Neck, Glioma and Pancreas Cancer

W. F. A. R. Verbakel, S. Senan, F. J. Lagerwaard, D. Hoffmans, B. J. Slotman, J. P. Cuijpers

*VUMC, Amsterdam MB, The Netherlands*

**Purpose/Objective(s):** RapidArc (RA) is a novel approach for delivering intensity modulated single arc therapy in less than 2 minutes, while achieving dose distributions comparable to current IMRT. We compared RA plans with IMRT for 11 cases and validated the delivery of RA plans by performing dosimetry for 6 of the plans.

**Materials/Methods:** Clinically acceptable single RA plans were generated with a pre-clinical version (8.2.16) for a single case of high grade glioma and pancreas cancer and for 9 advanced Head & Neck (HN) cancer cases with 2 dose levels. All HN plans were re-optimized by means of a ''base dose plan'', resulting in a final plan consisting of 2 RA arcs. Dose homogeneity in PTV and sparing of organs at risk (OAR) of all RA plans were compared with clinical 7-field sliding window IMRT plans (Eclipse 8.1.14). Four of the HN plans, the glioma and pancreas plans were delivered with a Varian Linac and measured in a solid water phantom for 5 coronal planes, 2 cm separated, using double Gafchromic EBT films. Plans were also measured using ionization chamber arrays (MatriXX). Measured and calculated dose distributions were compared using 2D gamma evaluation with limits of 2 mm and 3.5% (of typical PTV dose in phantom).

**Results:** All 30 film measurements showed high agreement with calculations, with a mean gamma of 0.31 and on average 1.9% (maximum 7.6%) of the film surface exceeding a gamma of 1.0. Relatively strong spatial dose modulations could be measured, in the PTV within the 95-107% dose range, which were not completely predicted by calculations. MatriXX measurements corresponded better with dose calculations than film measurements, which may be due to the limited resolution of 7.6 mm of MatriXX. RA plans achieved similar or lower average dose to OAR than IMRT, though for the HN cases, CI was slightly worse for the RA plans (PTV: 1.14 ± 0.09 vs. 1.22 ± 0.04), and dose in PTV was less homogeneous for single RA. All plans based on two arcs resulted in excellent PTV homogeneity, which was even better than for IMRT: the average relative volume of the elective PTV receiving more than 107% of its prescribed dose was 5.8%, 14.5% and 1.9%, respectively, for the IMRT, single RA and double