ΕΘΝΙΚΟΝ & ΚΑΠΟΔΙΣΤΡΙΑΚΟΝ ΠΑΝΕΠΙΣΤΗΜΙΟΝ ΑΘΗΝΩΝ
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Impact of (virtual) set-up errors on DVH dose results in IMRT plans for head-neck cancer

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Purpose

The aim of this study is to evaluate the impact of isocenter shift in three directions (lateral, longitudinal and vertical) on DVH results in IMRT plans for head and neck cancer treatment, in order to simulate possible set-up errors and its effects on treatment outcome.

Method

- Ten (10) step and shoot IMRT plans were created on the Oncentra TPS for head and neck cancer to be delivered on a 6MV Siemens ONCOR linac.

- Three PTVs were outlined with prescribed dose of 54Gy (PTV54), 59.4Gy (PTV59.4) and 70Gy (PTV70) in 33 fractions according to RTOG 0615 protocol.

Method

- Each treatment plan was recalculated for isocenter shift of ±3mm in all directions (lateral, vertical, longitudinal).
- DVHs were regenerated for PTVs and critical structures (spinal cord, brainstem, parotids) for all shifted plans.

Results

DVH results for **standard plan** (mean values from 10 plans) for PTVs

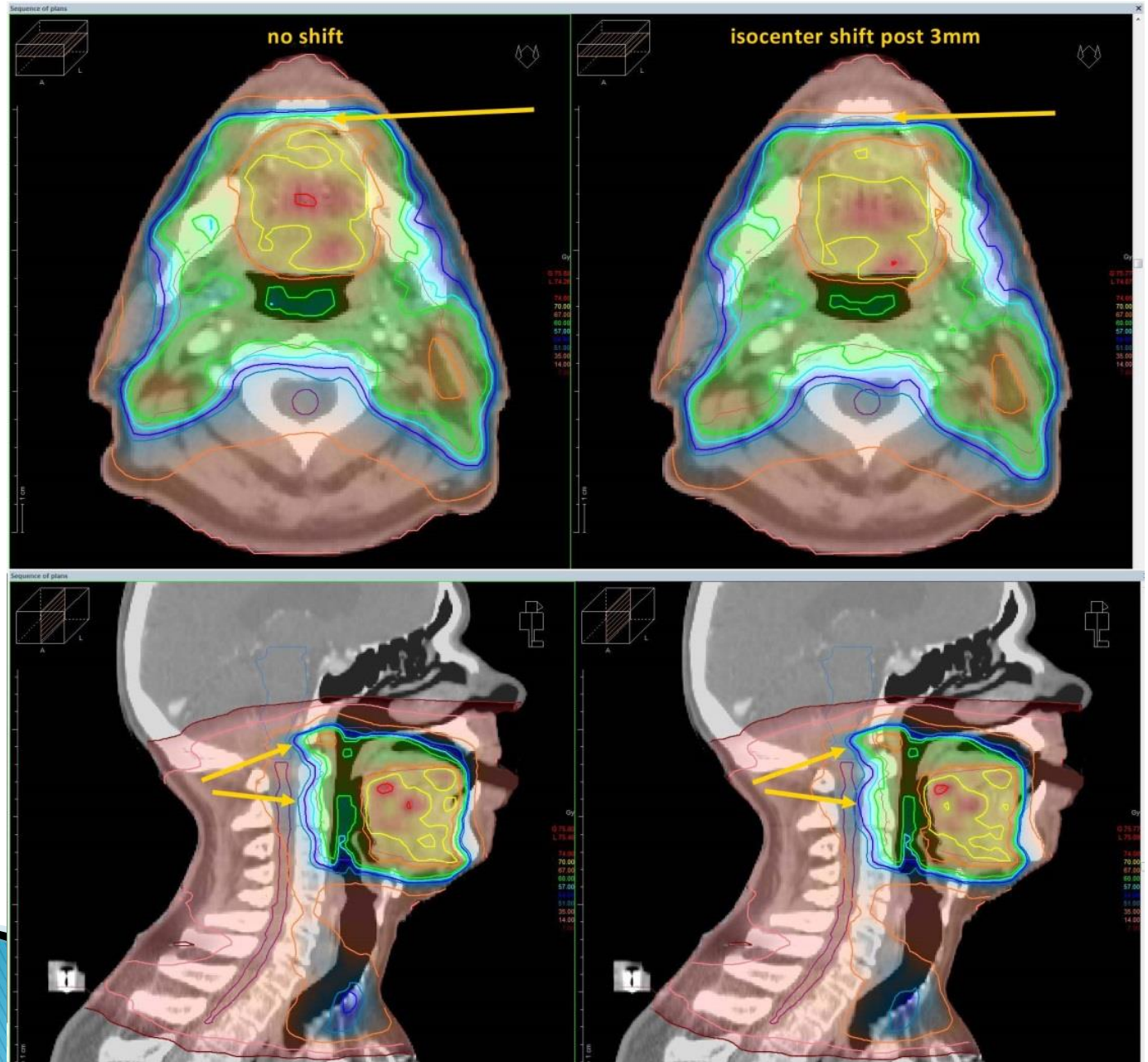
DVH results	V51,3 (PTV 54) (%)	V57 (PTV59,4) (%)	V66,5 (PTV70) (%)
Mean value	95.3	93.5	95.3
Max	*96,5*	*94,5*	*97,3*
Min	*93,8*	*92,7*	*94,1*
SD	1.3	0.9	1.8

Results

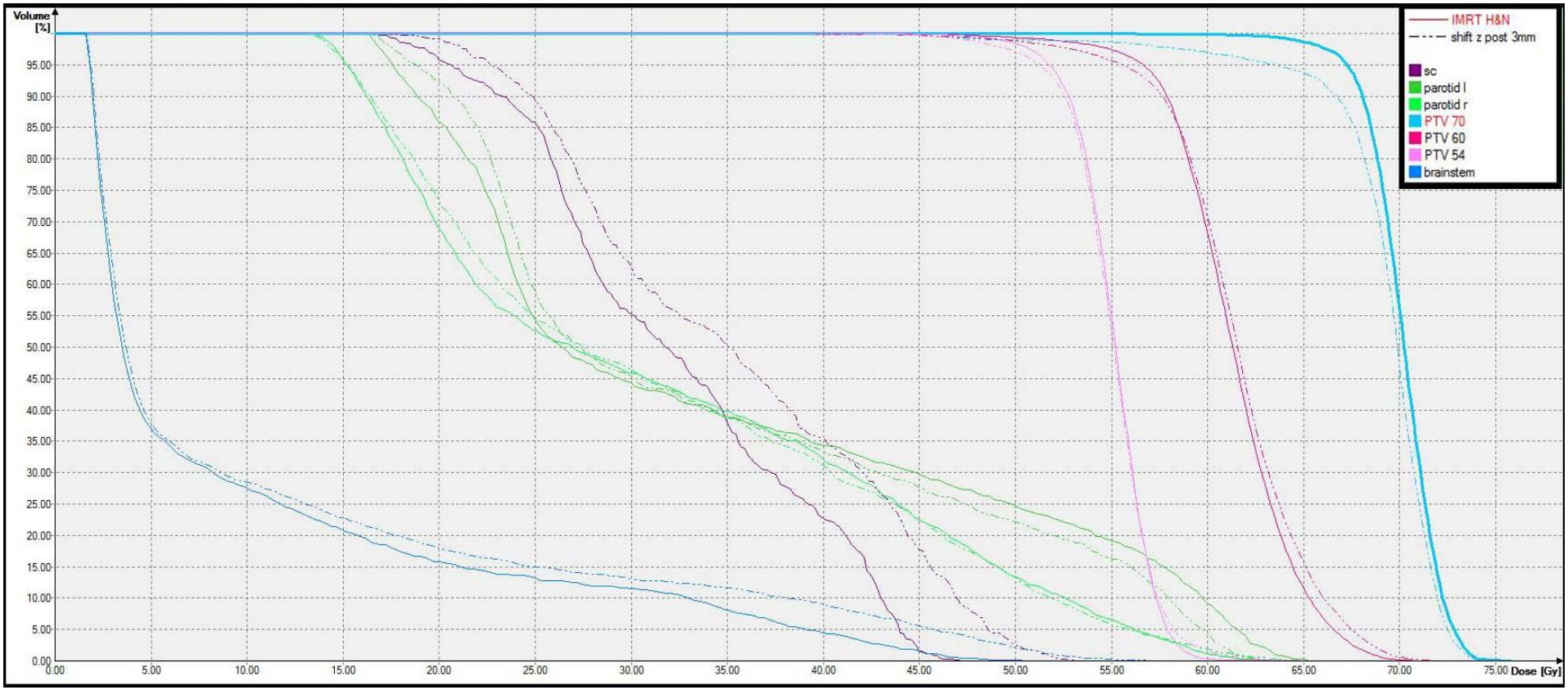
DVH results for **standard plan** (mean values from 10 plans) for critical structures

DVH results	D2 (spinal cord) (Gy)	D2 (brainstem) (Gy)	D50 (left parotid) (Gy)	D50 (right parotid) (Gy)
Mean value	42.0	42.6	26.4	27.0
Max	*45*	*44,2*	*27,5*	*28,2*
Min	*41,2*	*40,1*	*25,1*	*25,7*
SD	2.1	1.1	1.2	1.3

Dose comparison between standard and shifted plans (example case)



DVH comparison between standard and shifted plans (example case)



Results

- Greatest deviations for **shifted plans (±3mm)**

Structure	DVH value	Max Deviation (%)	Direction
PTV 70	V66,5	5 ↓	Vertical
PTV 59,4	V59,4	8 ↓	Longitudinal
PTV 50	V51,3	5 ↓	Vertical
Spinal cord	D2	11 ↑	Vertical (post)
Brainstem	D2	11 ↑	Vertical (post)
Parotid R	D50	13 ↑	Lateral (right)
Parotid L	D50	13 ↑	Lateral (left)

Conclusions

- In this study, isocenter shift of ±3mm reveals significant deviations of calculated DVH parameters. Such possible set-up errors could result in non-adequate PTV coverage and in dose values for critical structures outside of compliance criteria.
- These results indicate the importance of daily IGRT and subsequent daily patient setup correction for efficient IMRT treatment outcome.