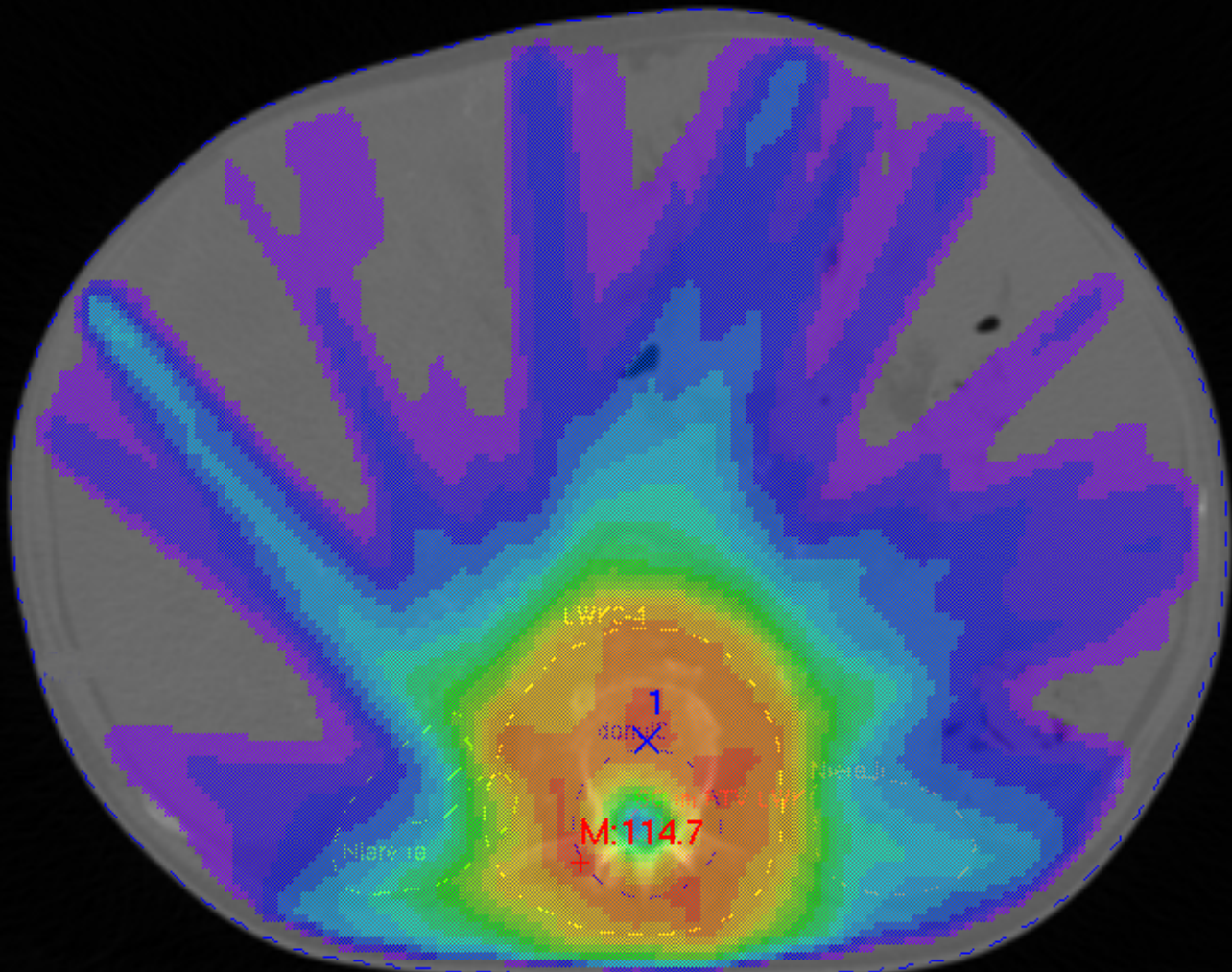


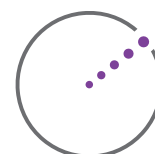
## VMAT vs. established treatment techniques for re-irradiation of spinal metastases



INSTITUTION: **Department of Radiation Oncology, University Medical Center Mannheim**

PURPOSE: Using 3D conformal radiation therapy (3D-RT) for the reirradiation of spinal metastases leads to high dose exposure of the spinal cord (SC) which can cause myelopathy. Intensity modulated radiation therapy (IMRT) can reduce dose to the SC while requiring longer treatment times. We analyzed the potential of volumetric modulated arc therapy (VMAT) to reduce treatment time and number of monitor units for this target volume.

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# VMAT vs. established treatment techniques for re-irradiation of spinal metastases

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## Material and methods

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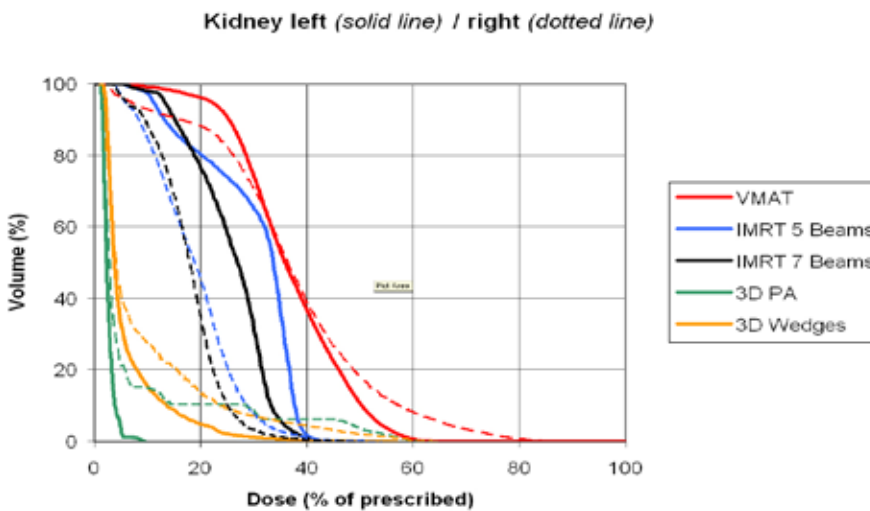
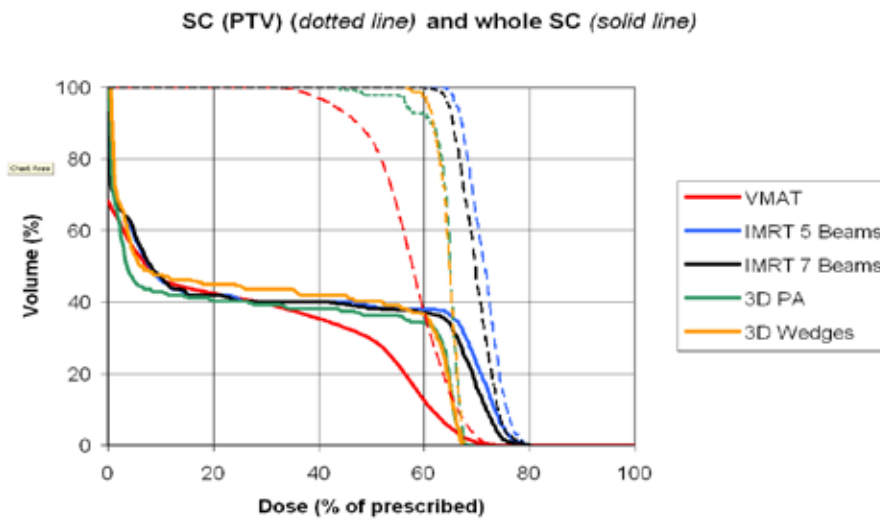
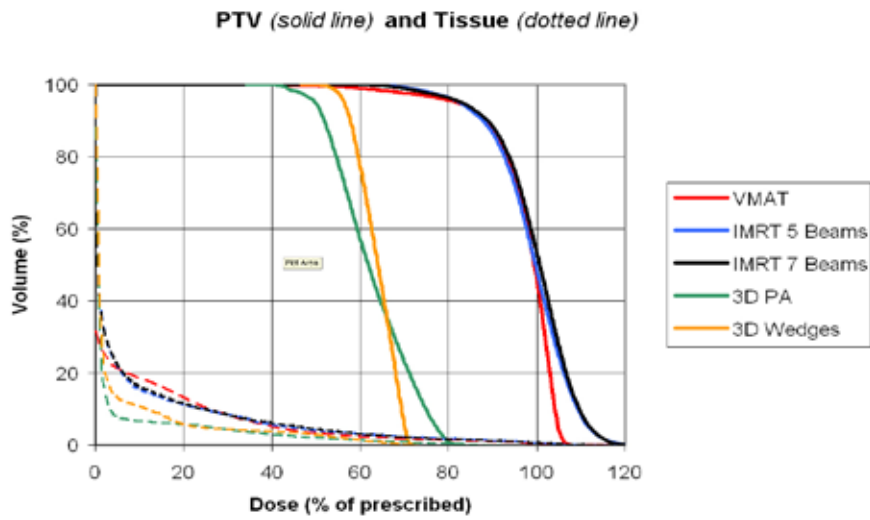
The study was based on five patients with vertebral column metastases. The PTV encompassed the macroscopic tumor excluding SC or medullary cone, respectively. The target dose for the PTV was 40Gy and median SC dose was intended to be 24 – 26Gy or less. We compared a posterior-anterior (PA) static field technique, a two-field-wedge technique (W) (Masterplan, Theranostic, normalized to 26Gy to 50% of SC), a 5- and 7-beam IMRT (Hyperion, University of Tübingen, normalized to 100% volume to 50% dose in PTV) with VMAT (ERGO++, Elekta, 2 rotations, normalized as for IMRT). The following metrics were analysed: conformity index (CI), homogeneity index (HI40), dose volume histograms (DVH), treatment delivery time (T) and monitor units (MU).

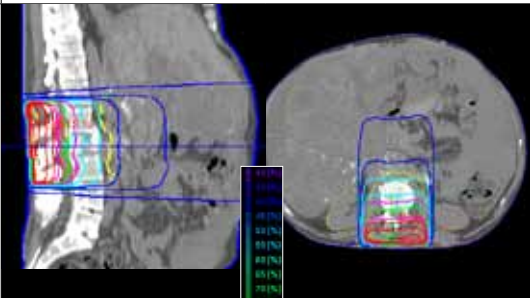
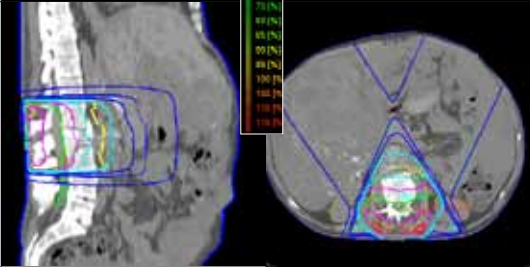
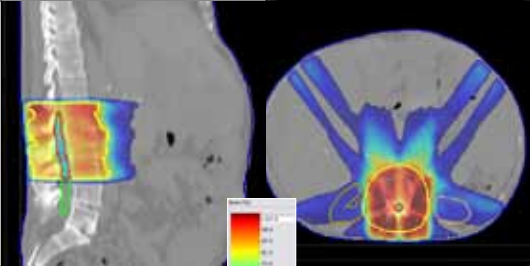
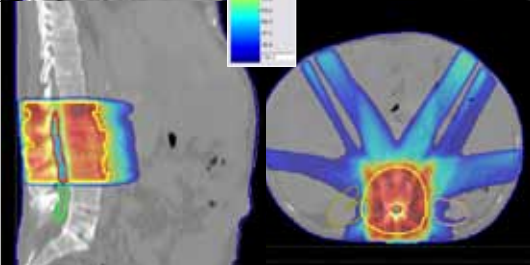
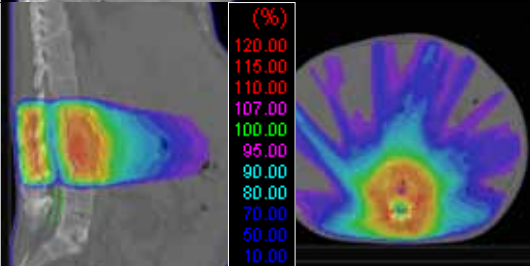
## Results

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PTV coverage taking SC radiation tolerance into consideration was insufficient with 3D-RT in contrast to IMRT and VMAT. The IMRT approach provided excellent results but has the longest treatment time (~10 min). VMAT produced similar dose distributions to IMRT with treatment times of less than 4 minutes. CI and HI40 for 3D-CRT are not comparable because of the different normalization when compared to IMRT/VMAT. Homogeneity is better for VMAT than for IMRT, however conformity for IMRT is better than for VMAT with better spinal cord sparing. Treatment times for VMAT were reduced by 50% in comparison with IMRT. Regarding the PTV, the volume encompassed by the 95% isodose line (C95%PD) was similar between IMRT and VMAT.

DVHs for one selected patient



	DD	HI	CI	MU	Time	C <sub>95%</sub> PD	SC
3D-PA		-	-	240 ±21	25 sec	47.9 ±9.89%	26.11 ±32Gy
3D-wedge		-	-	553 ±137	98 sec	55.3 ±1.93%	25.98 ±0.07Gy
IMRT 5B		1.18 ±0.62	1.74 ±0.32	861 ±152	413 sec	83.99 ±2.59%	26.98 ±0.94Gy
IMRT 7B		1.17 ±0.62	1.85 ±0.21	908 ±99	589 sec	83.98 ±2.15%	26.53 ±1.38Gy
VMAT		1.08 ±0.57	2.13 ±0.36	793 ±45	195 sec	83.82 ±2.69	23.47 ±2.2Gy

## Conclusion

For this PTV paradigm VMAT produces high quality treatment plans with similar homogeneity and conformity to step-and-shoot IMRT and short treatment times (50% of IMRT) and lower monitor units.

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