**Introduction**

We evaluate three commercially available treatment planning systems (TPS) for intensity modulated arc therapy (IMAT) with regard to the optimization and dose calculation algorithm and the plan outcome.

**Methods and Materials**

**Patient Cases**

* re-optimization and re-planning of 25 clinical accepted RA plans (cRA)
* prostate/prostatic fossa, up to 2 levels (n=9), head and neck (HnN), up to 3 levels (n=8), lung (n=4)/upper abdominal PTVs (n=4)
* transfer of PTV(s) / OAR / normalization method = physician’s intent

**Re-Optimization Method**

* independence from plan outcome of cRA
* change of collimator rotation (45°(cRA) → 20°(RA, SA, MoV) or 0 (MoV))
* adaptation of arc length, if necessary
* additional helping structures to model e.g. conformity, if necessary

**LINAC**

* VARIAN Trilogy
* 6MV photons, only
* 120 MLC

**Investigated TPS**

* ECLIPSE RapidArc (RA)
* PINNACLE SmartArc (SA)
* MONACO VMAT (MoV)

**Results**

Apart from four HnN and one lung case, for which MoV yield no competitive plan, all three investigated TPS are capable to calculate reasonable IMAT plans with comparable learning curves (2 to 6 trials) and reasonable calculation times (6 to 225 min., fig. 5).

The largest arc length is found for MoV (886°±191°), as here the arc length is calculated by the TPS itself instead of a user defined and preset plan parameter (cRA: 725°±137°, rRA: 731°±85°, SA: 726°±66°). Accordingly, the number of MU is the highest for MoV (table 1).

Evaluating the PTV coverage (fig. 3), CI (fig. 1) and HI (fig. 2), we see the best PTV coverage for MoV, the best CI for RA and the highest homogeneity for rRA. The OAR exposure depends on the treatment site, but has also high standard deviations as some criteria are uncritical to achieve and some are discarded by the physician in favor of a better PTV coverage.

**Discussion and Conclusion**

All three investigated IMAT planning tools calculate reasonable IMAT plans with comparable learning curves. Calculation times differ due to adjustment of optimization parameter, calculation volume and case complexity. Differences in the DVH drop offs for serial OAR, skin dose and segment shapes were seen due to different optimization and dose calculation algorithms.

Non-competitive MoV plans can have their origin in either MONACO’s segmentation algorithm or RA and SA might predict non-realistic dose distribution – as here dose algorithms are used that model lateral scattering in case of tissue heterogeneities not as properly as the Monte Carlo dose engine in MONACO does. Future calculations using a later version of MONCAO, dose measurements at the linac and separate Monte Carlo calculations will prove the reliability of the calculated dose distributions.

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