Influence of dosimetric leaf gap (DLG) and MLC transmission in the anisotropic analythical algorithm of the Eclipse TPS

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Introduction

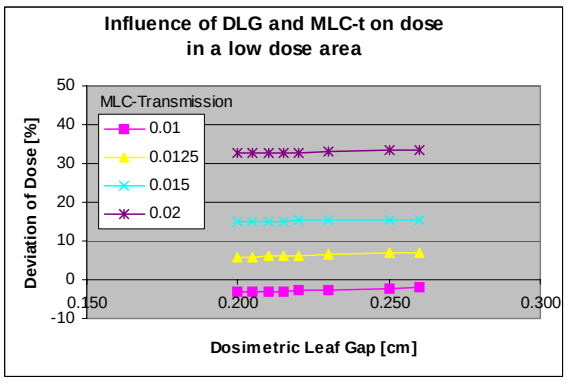
For sliding window IMRT special parameters are required in the Eclipse TPS (Varian, Palo Alto) to account for the effects of the MLC shape and the penumbra during the MLC motion. Standard procedures are described to evaluate these two parameters. This presentation shows the result from phantom measurement for high, low and medium dose areas for a chair-shaped field measured using the verification setup for IMRT QA.

Material and Methods

The PTV consists of a chair to be irradiated to different dose levels. Typical dose levels for SIB IMRT treatments such as high and medium dose PTV and medium dose in OAR. Transmission dose under MLC are evaluated. One single field was optimised to these dose levels. Dosimetric leaf gap (DLG) and MLC transmission (MLC-t) have previously been measured according to the recommendations. Then the two parameters were varied within 10% and the dose has been recalculated without new optimisations as a verification plan on a RW3 phantom and a 2D Array from PTW Freiburg. Calculations were compared with the measurement.

Results

The deviations in the different areas can be plotted as a linear function to DLG and MLC-t. Dose variations are within 2.5% percent for the high dose area, 30% and more in the low dose areas.



Deviationof dose in the low dose area above the "chair". The influence of MLC-t and DLG can be plotted as a linear function. DLG has no significant influence.

0.6	37.1	33.1
0.6	-0.2	-0.5
0.3	36.0	0.4

Deviation in %

Optimizing dose to the high dose area (MLC-t 2.0%; DLG 0.23cm) results in large deviations in the low dose area.

-2.1	5.8	-3.0
-1.1	-1.8	-2.2
-1.2	10.9	-1.1

Deviation in %

Optimizing dose to the low dose area (MLC-t 1.0%; DLG 0.20cm) results in large deviations in the high dose area.

Discussion

Minimizing the error for all areas requires compromises. Dose calculation can be optimized either for the high dose area or the low dose area. The deviation is dependent on the mean leave gap during irradiation. Therefore other planning parameters such as "smoothing" or RT site should also be considered for the final decision of DLG and MLC-t. For dose escalation it is important that this dose be as exact as possible because overdosage increases the side effects whereas underdosage reduces the cure rate. Therefore the (high) dose of a PTV has to be within a tolerance. On the other side medium and low dose areas represent generally doses to organs at risk (OAR). When this dose is irradiated to the limit it is important that the dose is not higher then calculated. This may be considered when defining the final parameters of the DLG and MLC-t.