

THE INFLUENCE OF FIELD WIDTH AND PITCH IN TOMOTHERAPY PLAN: PHANTOM STUDY

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Purpose : Field width (FW) and pitch factor (PF) are parameters that influence the quality of treatment plans and beam-on times in Tomotherapy that delivers helical radiation therapy. This study examines the relationship between these parameters and their influence on the quality of treatment plan.

Material and Method : Target volumes and organ at risk (OAR) volumes were delineated on a computerized tomography of a cylindrical chess phantom. Maintaining the weightings of each volume, treatment plans were optimized with a different combination of planning parameters (FW = 5, 2.5, 1 cm. PF = 0.2, 0.4, 0.6, 0.8). Each plan was analyzed for dose distribution, treatment time, homogeneity index, conformity index and ripple effect.

Result : For revolutions lasting between 15 and 60 seconds, the increase in treatment time correlated with decreasing field width. The ratio between treatment time with different field widths, when treatment time at 5 cm was 1, 1.8 and 4 times at widths of 2.5 cm and 1 cm respectively. Where change in pitch factor was did not result in change in treatment time. For revolutions under 15 seconds, smaller pitch denotes longer treatment time. The dimension of penumbra increased with increasing width. At pitch factor 0.6, the ripple effect was evident and the homogeneity index was at its worst. Transversely, conformity indices differed non-significantly. Longitudinally, the dose gradient increased with decreasing field width. Doses to OARs were minimized at small pitch and field width. OARs in longitudinal direction had higher median dose.

Conclusion : Change in field width could lead to change in treatment time. Treatment time could be shortened with combination of large field width and the pitch value, at expense of increased dose to longitudinal directions. Combination of small field width and small pitch yielded better planning quality, and increase in treatment time.

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Key words: Tomotherapy, Pitch, Ripple effect, Radiotherapy plan