

AbstractID: 4803 Title: Is PTV coverage a valid indicator for plan evaluation in shallow tumor cases where the PTV extends into the build-up region?

Purpose: The Planning Target Volume (PTV) is defined by ICRU report 50 as a geometrical concept, used to select appropriate beam sizes and beam arrangements. Clinically, a plan is normally acceptable if the 95% isodose surface covers the PTV. The goal of this study is to investigate the validity of using the PTV coverage for plan evaluation in shallow tumors where the PTV extends into build-up region.

Method and Materials: A conventional 3-D conformal technique with a 10mm CTV-PTV margin was used to produce 3-field plans for a deep tumor (Prostate) and a shallow tumor (Head&Neck). For the H&N case, as the CTV is normally at a fixed distance below the skin, the geometric uncertainties are mainly from patient-beam positioning errors. The CTV coverage with these errors was assessed by shifting the isocenter to 200 separate positions. The isocenter offsets were randomly selected using 3 uniform random Cartesian deviations between -10mm and 10mm, with a 3D distance constraint of 10mm. For the shallow tumor case, another plan with a 5mm larger field was made. The DVH of each plan with 200 shifted isocenters was analyzed.

Results: In the H&N case, an “unacceptable plan” was obtained, which has $V_{95}=81\%$ for the PTV. In the prostate case, we obtained an acceptable plan which has $V_{95}=94.9\%$ for the PTV. However, both cases gave the same good CTV coverage for 200 shifted isocenter plans. For the H&N case, PTV coverage (V_{95}) can be improved (from 81% to 83%) by increasing field sizes, but without improvement in CTV coverage, and larger fields increase skin dose.

Conclusion: The current method of evaluating plan quality by means of PTV coverage is adequate for deep tumors, but is not adequate for shallow tumors. A new indicator for CTV coverage evaluation in shallow tumor cases needs to be developed.