AbstractID: 8937 Title: ROC Analysis of Radiation Therapy Software Couch Interlock Performance to Improve Patient Safety

Purpose: In modern linear accelerators, a software interlock compares the digital position of the couch against a planned value and applies a tolerance limit. For many treatments this is the only automatic computerized check of the setup. ROC analysis may be useful to quantify the ability of the software system to detect mistakes and provide a quantitative metric for system improvement.

Methods: A simulation of a one dimensional patient setup over 35 fractions was done to model systematic and random errors in setup, target position and fixation of the patient to the couch. Two different imaging protocols were used; daily imaging and correction, imaging for the first five fractions with a single correction of the observed average. Mistakes were modeled as a single translation. ROC curves were determined by varying the tolerance limit and calculating the false and true positive rate. The area under the curve (A_z) was used to compare the effects of imaging protocols and immobilization of different treatment sites. ROC analysis of patient histories was done as well.

Results: ROC analysis of identical simulation data show that daily imaging can degrade the ability of the software interlock to detect mistakes in patient setup compared to an offline protocol. Immobilization with poorer fixation reduced the ability of the system to detect mistakes in setup. Patient data showed that a 1cm displacement in H&N setups was as detectable as a 5cm displacement in prostate setups.

Conclusion: The couch position interlock is a crude tool to detect mistakes in patient setup. ROC analysis of this system illuminated differences in performance across body sites. The impact of different imaging protocols on this index shows the importance of understanding the nature of the setup protocol when optimizing use of the couch position as an interlock for setup error.

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