Purpose: Motion-encoded dose distributions, taking into account intra-fraction motion during intensity modulated radiation therapy (IMRT), can be determined both computationally and experimentally, with a number of analysis techniques available to quantify the dosimetric changes. The analysis results can provide important information regarding the clinical impact of motion and the appropriateness of a given treatment plan. This study provides a comparison of different analysis techniques performed on computationally predicted motion-encoded dose distributions.
Methods: A total of 3,768 motion-encoded dose distributions were calculated computationally for 38 step-and-shoot and 38 compensator IMRT plans across 9 lung patients. The motion-encoded dose distributions were compared to static dose distributions using four analysis techniques: 2D and 3D gamma, histogram (looking at the fraction of voxels with a dose deviation exceeding 3% of the prescription dose) and dose volume histogram (DVH) analyses. Tests were also implemented to separate failing voxels caused by either over-dosing or under-dosing. In addition tests were performed both globally (not taking into account the planning regions of interest) and within restricted regions of interest, such as the target volume.
Results: Global analysis techniques did not accurately predict clinically relevant dosimetric changes in the target D_{95%}. Three-dimensional gamma and histogram analyses, localized within the target and considering only voxels experiencing decreased doses due to motion, provided the strongest correlations with changes in D_{95%} (r^2=0.68 and r^2=0.71 respectively). A global 2D gamma analysis correlated less well with changes in D_{95%} (r^2=0.44), and was both less specific and sensitive.

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