

Development of RMRD and Moving Phantom for Radiotherapy in Moving Tumors

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Purpose: Planning target volume (PTV) for tumors in abdomen or thorax includes enough margin for breathing-related movement of tumor volumes during treatment. We developed a simple and handy method, which can reduce PTV margins in patients with moving tumors, respiratory motion reduction device system (RMRDs).

Materials and Methods: The patients clinical database was structured for moving tumor patients and patient setup error measurement and immobilization device effects were investigated. The system is composed of the respiratory motion reduction device utilized in prone position and abdominal presser (strip device) utilized in the supine position, moving phantom and the analysis program, which enables the analysis on patients setup reproducibility. It was tested for analyzing the diaphragm movement and CT volume differences from patients with RMRDs, the magnitude of PTV margin was determined and dose volume histogram (DVH) was computed using a treatment planning software. Dose to normal tissue between patients with RMRDs and without RMRDs was analyzed by comparing the fraction of the normal liver receiving to 50% of the isocenter dose(TD50).

Results: In case of utilizing RMRDs, which was personally developed in our hospital, the value was reduced to 5 ± 1.4 mm, and in case of which the belt immobilization device was utilized, the value was reduced to 3 ± 0.9 mm. Also in case of which the strip device was utilized, the value was proven to reduce to 4 ± 0.3 mm. As a result of analyzing the TD50 is irradiated in DVH according to the radiation treatment planning, the usage of the respiratory motion reduction device can create the reduce of 30% to the maximum. Also by obtaining the digital image, the function of comparison between the standard image, automated external contour subtraction, and etc were utilized to develop patients setup reproducibility analysis program that can evaluate the change in the patients setup.

Conclusion: Internal organ motion due to breathing can be reduced using RMRDs, which is simple and easy to use in clinical setting. It can reduce the organ motion-related PTV margin, thereby decrease volume of the irradiated normal tissue.

Key Words: respiratory motion reduction device system (RMRDs), moving tumor, dose volume histogram (DVH), breathing movement, setup reproducibility