AbstractID: 5227 Title: Real-time treatment planning system for prostate photodynamic therapy

Purpose: To develop a real-time treatment planning system for prostate photodynamic therapy (PDT).

Method and Materials: A real-time treatment planning system has been developed for prostate PDT, which is composed of two sub-systems, i.e., image acquisition and light fluence rate calculation engine. The whole system is built in a personal computer. The image acquisition is implemented using an image frame grabber (DT-3120, Data Translation, Inc., MA) to acquire ultrasound images from a transrectal ultrasound unit in real time during a treatment. The software converts information about the organ geometries and the actual locations of the light sources on a template with 0.5-cm grids. These data are then input into the calculation system for prediction of light fluence rate distribution. The three-dimensional (3D) geometry of the prostate and the actual source arrangements are reconstructed and are used in the calculation, which takes into account the effect of optical heterogeneity. Treatment planning is accomplished with the prediction of 3D light fluence rate distribution.

Results: The system has been tested in experiments. In a phantom experiment, transrectal ultrasound images of the prostate phantom during treatment were acquired and the actual locations of the linear sources were recorded. The geometry of the phantom was reconstructed and light fluence rate was calculated in the geometry with the accurate source locations. The capability of calculating light fluence rate distribution in a heterogeneous phenomenon was tested in a patient prostate. The reconstructed prostate geometry, actual source strengths, and measured heterogeneous optical properties, were used in the calculation. The predicted light fluence rate distribution showed the effect of heterogeneous distribution of optical properties.

Conclusion: The real-time treatment planning system provides an efficient tool for prostate PDT, which improves accuracy in treatment planning.