

Breathing-Synchronized Radiotherapy Program at the UC Davis Cancer Center

This paper presents a complete description of the breathing synchronized radiotherapy (BSRT) system which has been jointly developed between the University of California Davis Cancer Center and Varian Associates. BSRT is a description of an emerging radiation oncology procedure where simulation, CT scan, treatment planning and radiation treatment are synchronized with the patient breathing by undergoing voluntary breath-hold, forced breath-hold, or breathing gating. The BSRT system consists of a breathing monitoring system (BMOS) and a linear accelerator gating hardware and software package. Two methods, a video camera-based method and the use of wrap-around inductive plethysmography (RespiTrace), generate the BMOS signals. The BMOS signals and the synchronized fluoroscopic images are simultaneously recorded in the simulation room and are analyzed later to define the ideal treatment point (ITP) where the tumor is completely covered and the critical normal tissue is maximally spared. The BMOS signals at ITP can be used to gate a CT scanner or a Varian "Clinac" series linear accelerator to maintain the same organ configuration as in the simulation. The BSRT system allows the use of breath-hold and gating. This dual role allows the system to be applicable for a variety of patients, i.e., the breath-hold method for those patients who can maintain and reproduce the ITP, and the forced breath-hold or gating method for those who are not ideal for voluntary breath-hold.

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