AbstractID: 4416 Title: Synchrony -- Real-time respiratory compensation system for the CyberKnife

Fluoroscopic, ultrasonic and 4D CT studies of the organs in the thorax and abdomen have shown that some organs may move as much as 4 cm due to respiratory motion. If the motion is not compensated for during external beam radiation therapy, the dose coverage to target may be compromised. On the other hand, if the motion is compensated for with an increase of margin, a significant amount of normal tissue may be irradiated unnecessarily. The issue of respiratory compensation becomes more important for hypofractionated treatments and even more so for single-fraction extracranial radiosurgery applications. CyberKnife is an image-guided radiosurgery system that consists of a 6-MV LINAC mounted to a robotic arm coupled through a control loop to a digital diagnostic x-ray imaging system. The robotic arm can point the beam anywhere in space with six degrees of freedom, without being constrained to a conventional isocenter. The CyberKnife has been recently upgraded with a real-time respiratory tracking and compensation system called Synchrony. Using external markers in conjunction with diagnostic x-ray images, Synchrony helps to guide the robotic arm to move the radiation beam in real time such that the beam always remains aligned with the target. With the aid of the Synchrony, the tumor motion can be tracked in three dimensional space, and the motion induced dosimetric change to target can be minimized without an increase in margin. The working principles, advantages, limitations and our clinical experience with this new technology will be discussed.