

AbstractID: 4903 Title: Effect of motion on dosimetry in IMRT fields

Purpose:

The clinical implementation of IMRT, particularly for tumors of the thoracic cavity, may be complicated by the effects of breathing motion. We present an experimental evaluation of the effects of a sinusoidal breathing cycle on the dose delivered by IMRT plans.

Method and Materials:

A series of phantoms were placed on a wheeled cart connected to a computer-controlled step motor. The motor was moved with constant angular velocity, causing approximately sinusoidal motion of the phantom in the superior-inferior direction. The amplitude of the oscillation was 1 cm. The frequency of oscillation was matched to a 4 second breathing cycle. We measured the effects of this motion in open beams and IMRT fields in using films in the transverse and coronal planes, and with an ionization chamber at isocenter.

Results:

Dose profiles measured in a 10 x 10 cm open beam with a film placed at a depth of 10 cm in the horizontal plane confirm that the dose measured in the moving phantom is accurately modeled by the convolution of the static dose with an analytically determined motion kernel, despite the 20% change in dose induced by the motion in the penumbra region. When IMRT fields are delivered to the moving phantom, the change in the dose at isocenter varies, but is typically less than 5%. The variation at other points in the treatment region, however, is often much larger. The convolution model accurately predicts these changes except for regions dominated by small segments.

Conclusions: We have demonstrated that the effects of sinusoidal oscillatory phantom motion on dosimetry in open beams and IMRT fields can be measured experimentally, and can be accounted for using a motion kernel convolution. Motion may lead to significant errors in dose delivery, particularly for tumors in the lung and thoracic cavity.