

ABSTRACT

Purpose: The use of gating in the delivery of radiation therapy (RT) has been shown as an effective means of treating tumors susceptible to motion. However, due to electronic and mechanical limitations of the radiation delivery equipment, the precision of gated IMRT is susceptible to equipment process time delays. The purpose of this study is to investigate the temporal accuracies of gated RT using a simple and inexpensive method that doesn't require complex or fast sampling equipment to measure response times.

Method and Materials: Using a Varian Trilogy treatment delivery system together with a Varian RPM respiratory gating system, the response times of both normal RT and step-and-shoot (SS) IMRT gated deliveries are investigated. Radiation dosage profiles, recorded using radiographic films, are digitalized to allow extraction of temporal data. In addition the same response time technique is used with an electronic portal imaging device (EPIDs).

Results: Static to dynamic comparison of specific MLC patterns is used to extract the gating response time. It is found that the time, from when an object enters into the specified phase to when the radiation beam is actually turned on, is approximately 0.15 s. This time error is found to be systematic in nature and is approximately the same for both normal and SS-IMRT gated deliveries.

Conclusion: A general and simple procedure has been developed that will allow the response time of a LINAC based gating systems to be made. The ~150 ms systematic timing error found to occur in the Trilogy/RPM system can be corrected by modification of the gating software provided if the patients breathing is regular and periodic.