Assessment of the Accuracy of Monitor Unit Calculations in Three-Dimensional Treatment Planning

The purpose of this study was to investigate the sources and magnitude of the discrepancies in the monitor unit calculations between a three-dimensional treatment planning system and traditional hand calculation techniques. The convolution superposition algorithm is far less dependent on measured data than previous computational methods, and accounts for physical attributes that are roughly approximated or ignored by traditional hand calculation methods. Measurements were carried out in a water phantom and spherical plastic phantom to assess the accuracy of these two calculational methods. Several open and blocked fields with various points of interest were studied, including fields which employ oblique or curved surfaces, tangential geometry, extensive blocking (e.g. mantle fields), and compensators. For each point of interest the monitor units computed by the planning system and hand calculations are compared with those determined by in-phantom measurements. Additionally, a retrospective patient study was performed in which the sources and magnitude of disagreement between computed monitor unit calculations and traditional calculations were quantitatively analyzed for several specific patient cases. The planning system agreed well with the measured data for simple field shapes. Greater disagreement resulted when examining more complex scenarios such as heavily blocked fields, curved surfaces, and points near the heel or toe of wedges. Some discrepancies were unrelated to the accuracy of the algorithm used, such as disparities in patient thickness and SSD measured on CT versus on the simulator.