AbstractID: 6422 Title: Tomotherapy MVXCT Numbers versus RLSP for Various Ions and Materials

Purpose: Optimization of ion radiotherapy and spacecraft shielding is critically dependent upon the relative linear stopping power (RLSP) of each material through which an ion would pass. In radiotherapy, RLSPs for patient tissues are usually obtained by converting kilovoltage x ray computed tomography (KVXCT) numbers; however, some registration and immobilization devices, implant materials, and dosimetry phantoms do not lie on the standard KVXCT number to RLSP conversion curve. KVXCT imaging is also prone to artifacts created by high atomic number and density materials. Ion computed tomography (ICT) could reduce these problems but these systems currently exist only in the research stage and, for abdominal scanning, would require energies and field sizes greater than available with current therapy accelerators and beam delivery systems. Megavoltage x ray computed tomography (MVXCT) may offer an alternative imaging scheme.
Methods and Materials: The RLSPs for twenty-two materials were measured using a parallel plate ionization chamber and scanning water phantom in proton, carbon ion, and iron ion beams. These same materials were scanned using both KVXCT and MVXCT.
Results and Discussion: The MVXCT versus RLSP functions for the three ions were almost identical. The functions were approximately bi-linear but the change in slope was smaller than for the KVXCT curves and deviations between measured and fit data were smaller.
Conclusions: An MVXCT number to ion RLSP conversion function has been generated for use in treatment planning. Although the function does not account for the effect of ion nuclear interactions, MVXCT numbers can be used to predict the range of ions and may serve as an intermediate step until ICT is developed. Experiments may now be performed to compare KVXCT and MVXCT based treatment planning in the presence of artifacts and non-tissue like materials.
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