AbstractID: 8327 Title: Virtual simulator design for collision prevention during external radiotherapy planning

Purpose: Collision avoidance of the treatment accelerator components such as gantry, table, collimators, jaws, and fixation devices with the patient is one of the biggest concerns in external treatment planning. Most commercial treatment planning systems do not include collision prevention simulation step. On the other hand, a fool-proof collision-map, lookup table, and simpler analytical method guard only against the most apparent collisions. Thus, a comprehensive virtual simulator design for collision avoidance is very useful for external radiotherapy planning. **Method and Materials:** An accurate modeling of the treatment accelerator is possible with geometric data. **T**hree-dimensional patient modeling is also possible from the patient's CT data. Since each component in the data bank is described as an independent mesh modeling based on the type of associated polygons, relative position changes can be described easily for the device dynamics simulation. The relative motions of the gantry and the treatment table are collected from the treatment plan and the graphical user interface generates the events at the given time intervals. This visual system is incorporated with the treatment planning simulation system. **Results:** The quality verification of our virtual simulator for the potential collision has been performed with two combinations of treatment table and gantry rotations where a collision is eminent based on the visual assessment. The planner can search for beam paths with minimal critical structure interference before extensive optimization process. A database of CT and MR scans for all tumor sites is being built, which provide useful information to map all potential collision possibilities for all treatment isocenters. **Conclusion:** The important benefits of this virtual simulator is the replacement of the conventional laborious procedures required for the expensive hardware simulator unit, the efficiency increment, the accuracy improvement of radiation treatment procedure, and the cost reduction in terms of time and physical patient's presence.