AbstractID: 11110 Title: Microindexed Robotically-Delivered Photon Activation Therapy

Purpose: To investigate a theoretical approach to targeted therapy using kV x-rays with photon-activation dose enhancement (DE). **Method and Materials:** A robot is used to deliver large numbers of beams of radiation (“set”), of energy appropriate for DE (120–240kvp), that converge on the target and whose origins are “microindexed” relative to each other on mm centers (constituting a “port”). 1-5cm diameter targets centered 15cm deep in tissue were modeled loaded with variable percentage of high-Z materials possessing a k-edge in the energy range studied. Percentage depth dose curves (PDD) to 30cm were modeled in Excel as the product of beam attenuation, using HVLs in water (2–3cm), and an appropriate inverse square factor for each depth. PDDs were created for each HVL and target size across a range of SSDs and SADs, with/without DE. **Results:** A single “port” of 650-10,000 beams, delivered without DE, increased maximum dose to 1cm targets by 300%, 5cm targets by 50%. A uniform dose across the target was achievable with two “ports” using, from each “port”, multiple weighted “sets” of beams varying only in SSD (distance/range modulation). At achievable percentages of high-z materials and 3-4 “ports,” uniform target doses 1,000% (1cm) and 300% (5cm) of surface dose were achievable with up to 90% dose fall-off occurring within 1mm of the target. **Conclusions:** The combination of a unique kV delivery model and differential loading of targets with high-Z materials can deliver uniform high doses of radiation at clinical depth to small targets using limited numbers of ports. The use of robotic delivery allows the delivery of the large number of range-modulated and tightly packed beams required to achieve this result. This approach potentially can reduce the cost of RO technology and lessen dependence on subjective target definition by physicians through the use of biologic targeting.