

AbstractID: 13191 Title: A computer-aided design system to refine 3-D custom bolus making procedure

Purpose: To refine the custom bolus making procedure and improve the conformity of custom bolus on any irregular 3D surface. **Method and Materials:** A computer-aided system was developed to extract the custom bolus created in treatment planning system and unwrap/map it into a 2-D plane. Our 3D surface unwrapping technique works for any arbitrary 3D surface. The number of vertices and polygons were user-defined variable to determine the resolution of the 3D surface approximates custom bolus designed in treatment planning system. The custom design bolus can be made by cutting along the print-out and folding back into 3D. Three different types of custom boluses (larynx, nose, and full scalp) were tested in this study. The results were evaluated by comparing CT images of planning and actual bolus placed on anthropomorphic humanoid phantom. **Results:** All three custom boluses can be unwrapped and mapped into cutout patterns onto a 2D plane. The extracted 3D surfaces contain 20, 114, 88 vertices and 18, 180, 126 polygons to approximate larynx, nose and full scalp bolus respectively. The resolution of approximation surface depends on the curvature of surface. The result showed a mesh size up to 3 cm was adequate to approximate the most complex case e.g., scalp bolus in this study. The CT scan showed the actual bolus made by using this computer-aided system matched well with the boluses designed in treatment planning system by planners. Compare to convention way of manually-made bolus, the computer-aid 3D to 2D system significantly reduced the discrepancy in shape and size between planning and actual bolus. Excess material causing air gap and non-uniform thickness were minimized. **Conclusion:** Computer-aided system provides an accurate and precise way to customize bolus. With our 3D surface unwrap technique, a conformal bolus can be made without tailoring bolus on patient directly.