Purpose: A dedicated stereotactic irradiation device, the GammaPodTM, was developed to treat early stage breast cancer. This study presents the first description of the dosimetric and geometric characteristics from the prototype unit.

Methods: The GammaPod stereotactic radiotherapy device is an assembly of a hemi-spherical source carrier containing 36 Co-60 sources, a tungsten collimator, a dynamically controlled treatment table and a breast immobilization cup embedded with a stereotactic coordinate system. The source carrier and the variable-size collimator rotate synchronously to form 36 non-coplanar, concentric arcs focused at the isocenter. The treatment table enables motion in three dimensions facilitating continuous dose painting in comparison to a sphere packing approach. Geometric and dosimetric evaluations and a method for absorbed dose calibration are provided. Dosimetric verifications of the dynamically delivered plans are performed for eight patients in hypothetical pre-op, post-op and dose painting treatment scenarios.

Results: Loaded with a cumulative activity of 4320 Ci, the GammaPod unit delivers 5.31 Gy/min at the isocenter. Due to non-coplanar beam arrangement and dynamic dose shaping features, the GammaPod delivers uniform doses to the targets with excellent conformity. The spatial accuracy of the device is less than 1 mm. Single shot profiles with the 25 mm collimator are measured with radiochromic film and found to be in good agreement with respect to the MC based calculations (congruence of FWHM less than 1 mm). Dosimetric verifications corresponding to all treatment plans corresponding to three target scenarios for each of the eight patients demonstrated Gamma index pass rates greater than 97%.

Conclusions: The first description of the dosimetric and geometric evaluation of the GammaPod was performed. The observed level of agreement between the treatment planning system calculations and dosimetric measurements has confirmed that the system can deliver highly complex treatment plans with remarkable geometric and dosimetric accuracy.

Funding Support, Disclosures, and Conflict of Interest:
C Yu and J Zhang have commercial affiliations with Xcision Medical Systems.