Purpose: The goal of episcleral eye plaque brachytherapy has been to deliver a prescribed dose to the apex of an intra-ocular malignancy. Advances in dose calculation and image guidance allow for optimal plaque treatment planning. The BEBIG Plaque Simulator™ utilizes calibrated fundus collages to more precisely localize intra-ocular tumors volumes, thus enabling physicists to plan plaque therapies that deliver the prescribed dose to the tumor while quantifying and limiting dose to critical optical structures, including the macula, optic disc, and lens.

Methods and Materials: A retrospective study of 30 patients at our institution who previously received episcleral eye plaque brachytherapy based on conventional treatment planning techniques. For each patient, the originally defined Ultrasound tumor dimensions, plaque specifications (COMS universal or notched), and treatment times were entered into Plaque Simulator. Fundus collages were calibrated and overlaid on a retinal diagram. The tumor was placed over the delineated tumor on the fundus collage. Doses to the tumor apex, macula, optic disc, and lens were calculated using TG-43U1 formalism after assuming correct plaque placement.

Results: Localization of intra-ocular tumors allowed for accurate plaque placement and realistic dose calculation for critical structures. Recreated plans validated the original prescriptions while elucidating doses to critical structures. Doses to the macula and optic disc have been correlated to clinical outcomes, including radiation maculopathy and optic neuropathy, in an effort to evaluate dose thresholds that can be enforced in future plaque therapies.

Conclusions: The use of image guidance gives radiation oncology-ophthalmology teams the ability to deliver plaque therapy with the intent to control the tumor and spare critical structures. Dose determination may highlight the necessity of proper plaque placement, plaque size, source strength, and carrier angle optimization to deliver the prescribed dose while reducing dose to critical structures below suggested thresholds in order to preserve vision.