Purpose: The Valencia applicators are designed to treat skin lesions with the microSelectron-HDR afterloader. Although the radiation is highly directed to the treatment area, radiation might leak through the backside of the applicator. Recently, the manufacturer has introduced a new applicator design to reduce such radiation leakage. This new design consists mainly in the addition of about 4 mm of tungsten in the backside of the applicator making it thicker. The purpose of this study is to evaluate by means of the Monte Carlo method the radiation leakage of this new design and to evaluate whether this modification affects the dose rate distributions in the treatment area.

Methods: The complete geometry of the new applicators has been introduced in the Monte Carlo code GEANT4. The applicators have been located on the surface of a cylindrical water phantom following a methodology similar to the used in the original study of the Valencia applicators by Granero et al [Med.Phys 2008;35:495-503]. Kerma in the water phantom and kerma in air outside the phantom have been evaluated to estimate the radiation leakage of the new designed Valencia applicators.

Results: The Monte Carlo simulations of the new applicators show that the radiation leakage has been reduced significantly from the previous design. The largest radiation leakage of this design is now about 30% of the dose at the prescription point and about 10% at 1 cm from the backside of the applicators. The dose rate distributions in the area of treatment have not changed.

Conclusions: In this study the radiation leakage of the new design of the Valencia applicators has been obtained. The radiation leakages have been largely reduced from the previous design without compromising dose rate distributions in the treatment area.