Press-fit acetabular components are susceptible to deformation following implantation in an underreamed socket, with excessive deformation of metal-on-metal (MOM) components potentially leading to increased torsional friction and component micromotion. The purpose of this study was to evaluate the effect of design and material considerations on induced deformation in metal-on-metal as well as conventional metal-backed acetabular components. Digital image correlation was used to quantify diametral cup deformations caused by press-fit implantation in a previously-validated polyurethane, worst-case-scenario pinching model. Experimental groups consisted of 48, 54, 60 and 66 mm MOM cups with a 6 mm wall thickness, 58 mm cups with a 20 mm wall thickness, and both CoCrMo and Ti6Al4V 58 mm metal-backed modular cups. Increased deformation was correlated with increased cup diameter, thinner wall construction, and Ti6Al4V modular designs (p<0.0001). The greatest diametral deformation within the MOM subset of cups tested was measured in 66 mm diameter thin-walled MOM cups. Significantly higher, yet potentially less clinically significant, deformations were measured in titanium metal-backed modular cup designs and were passed along to the inserted modular polyethylene liner. In the foam model, a reduction in overall deformation was observed 120 hours following implantation, suggesting some cup recovery when implanted into a softer material. The results of this study reiterate the need for careful design planning encompassing deformation in thin walled and conventional metal-backed acetabular component designs.