Introduction: Wear of the underside of modular tibial inserts (“backside wear”) has been reported by several authors. While this phenomenon seems to contribute to osteolysis in some implant designs, the actual volume of material lost through wear of the backside surface has not been quantified. This study reports the results of computerized measurements of tibial inserts of one design known to have a high incidence of backside wear in situ.

Material and Methods: A series of seven retrieved TKA components of one design (AMK, DePuy) with evidence of severe backside wear and polyethylene extrusions were examined (Figure 1). The duration of implantation of the retrieved components ranged from 36-96 months. This design has no peripheral ring around the baseplate to restrict the polyethylene. Laser surface profilometry with an accuracy of 50 µm resulting in approximately 100,000 points, in combination with CAD software (UniGraphics) was used to develop individual three-dimensional models of each retrieved insert. An “initial” planar surface representing the unworn backside was defined by protruding polyethylene with well-defined machining marks. The volume of material removed was then calculated between the worn backside surface and the initial surface (Figure 2). The worn backside surface was also examined with scanning electron microscopy (SEM).

Results: Computer reconstructions verified the visual observation that in all retrievals, the unworn surface of the remaining pegs, the rim of material extruded over the medial edge and unworn surfaces on the anterior-lateral edge all lie in a plane. This demonstrates that the “pegs” present on the backside of these inserts correspond to unworn areas remaining on each retrieved component surrounded by the severely eroded backside surface.

The average volume of material lost due to backside wear was 855±512mm³ (range: 213-1401mm³) from the medial compartment and 279±447mm³ (range: 9-1240mm³) from the lateral compartment (Figure 3). This corresponds to an total average loss of 1064mg of polyethylene debris. Based on the time in situ for each implant, this corresponds to an average linear wear rate of 219mg/year from the backside surface.

Discussion: The volume of material removed due to backside wear is significant and is of a magnitude large enough to generate osteolysis. Our results indicate that the appearance of pegs on the underside of components with screw holes on the baseplate is not due to creep, but instead is due to severe wear of the insert eroding away all of the insert except the pegs. It is clear that significant improvements in implant design are needed to prevent backside wear and osteolysis.