Introduction: More than 40 years after its introduction, Charnley low friction total hip arthroplasty (THA) remains the gold standard. The main reason for revision is socket loosening related to high polyethylene wear and peri-acetabular osteolysis. In these situations, the monobloc cemented stem is frequently not loosened, and it is not clear whether the femoral component can be retained or not during the revision procedure.

The aim of this study was to evaluate surface and sphericity damage to the femoral head of a prospective series of revision total hip arthroplasties during which the cemented monobloc femoral component has been systematically revised.

Materials and Methods: Between April 2006 and April 2007, we performed 22 revisions of both components of Charnley type cemented total hip arthroplasties. In all cases, the 22.2 mm head of the monobloc femoral component made of 316L stainless steel was articulating with an all polyethylene cup. The international standards as determined by ISO7602/2 for such femoral heads include an average surface roughness (Ra) of 0.05 μm. Manufacturers specifications indicate a total roughness (Rt) value of 0.5 μm and a sphericity of ± 5 μm.

The mean age of the patients (12 females and 10 men) at the time of the index arthroplasty was 51.3 ± 12.1 years (17.6 to 69.6 years). The mean body mass index was 23.9 ± 3.9 Kg/m² (16.2 à 29.9 Kg/m²). The initial diagnosis was mainly primary osteoarthritis and developmental hip dysplasia. The average time to revision was 14.8 ± 5.3 years (7 to 25 years). The reasons for revision included isolated socket loosening (12), extensive peri-acetabular osteolysis without socket loosening (2), recurrent dislocation associated with socket loosening (1), sepsis without implant loosening (1), loosening of both components (1), and isolated loosening of the femoral component (5). Hence, 15 of the 22 (68.2%) femoral components could theoretically have been retained. All participating surgeons were aware of the ongoing study, and great care was taken not to alter the femoral head surface during extraction. Femoral components then were washed using non abrasive soap and water, wrapped in gauze, and stored in individual plastic containers.

The surface roughness of the femoral heads was evaluated using a contact-type profilometer (Talysurf 50, Rank Taylor Hobson, UK) with a 0.25 mm cut-off wavelength along 0.8 mm lines (Fig. 1). For each head, the apex and two zones either macroscopically scratched or with loss of the mirror finish were analyzed. Moreover, the sphericity of the heads was measured using a spherometer (MMQ3, Perthen, UK).

Results: All heads examined by the naked eye presented at least two areas with either loss of the mirror finish or macroscopic scratches. The median Ra and Rt of the series at the apex (Fig. 2) was 0.019 μm (interquartile range, 0.028 μm) and 0.421 μm (interquartile range, 1.122 μm), respectively. The median Ra and Rt of the series for the macroscopically damaged areas was 0.034 μm (interquartile range, 0.031 μm) and 1.179 μm (interquartile range, 1.213 μm), respectively. The median sphericity of the series was 5.86 μm (interquartile range, 7.93 μm). Hence among the 22 explanted stems, 10 femoral heads (45.4%) had Ra or Rt apex, and 18 (81.8%) Ra or Rt scratched area values beyond ISO standards, respectively. Sphericity was greater than ± 5 μm for 13 of the 22 femoral heads (59.1%). Only two femoral heads had normal Ra, Rt, and sphericity values. With the numbers available, the age at the time of the index arthroplasty, the BMI, the time to revision, and the reason for revision (Table 1) were not significantly associated with the degree of femoral head damage for both roughness and sphericity parameters.

Discussion: Retaining the femoral component during revision THA including a monobloc femoral component is theoretically an interesting alternative in cases with isolated acetabular loosening, periacetabular osteolysis, and recurrent dislocation without stem malposition. However, femoral head surface damage occurring in vivo would have lead us to retain severely scratched heads in over 80% of the hips, and heads with abnormal roughness and sphericity values in over 90% of the hips. Bases upon our results, we recommend systematically revising the femoral component during revision THA including a monobloc stem, irrespective of the reason for revision.