



Acetabular Bone Loss in Endoprosthetic Articular Surface Replacement of the Hip Joint

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Introduction

The modern articular surface replacement of the hip joint, introduced by McMinn in the nineties of the last century, has now been well established clinically mainly for the younger osteoarthritis patients. One the one hand the accepted advantages are the tribological properties of a metal – metal bearing with the absence of polyethylene wear debris and enhanced stability [1]. On the other hand the preservation of the femoral neck and further the improved range of movement in comparison to a total hip arthroplasty [3]. Different clinical and experimental studies have been showed that a notching of the femoral neck during preparation of the bone for implantation of the head implant is associated with an increased risk of a femoral neck fracture [2, 4]. In consideration of this the anatomical parameters of the femoral neck are determining the femoral head size and further the diameter of the acetabular cup is related. By these means that may result in the use of greater acetabular components in a resurfacing procedure compared to the total hip arthroplasty. That major affects the acetabular revision in case of a resurfacing fail.

Our aim was the radiographic evaluation of the acetabular bone loss after resurfacing hip replacement using two different implants.

Materials & Methods

During 1998 and 2005 a number of 140 patients received hip resurfacing by two surgeons. For resurfacing the implants used were BHR (Midland Medical Technology) and ASR (DePuy). For this retrospective study, 30 patients who received a BHR (group II) implantation and 30 patients who received ASR (group III) implantation were included. The only inclusion criteria have been a primary osteoarthritis of the hip (Table I). For control from a pool of about 250 patients who received a hybrid arthroplasty by the same two surgeons, 30 patients were included randomised in consideration to the criteria mentioned. The implants in the hybrid arthroplasty group were an uncemented acetabular component (Duraloc Series, DePuy) and a cemented femoral stem (Centrament, Aesculap). For the resurfacing procedure a posterior approach was used. For the hybrid arthroplasty we preferred an anterior-lateral approach. The end-point of reaming was in the arthroplasty procedures when a sufficient cortical bone socket at the outer diameter was achieved. In the resurfacing procedures the end-point was determined of the implant diameter. A digital radiological measurement of the preoperative anatomical conditions of the acetabulum and the femoral neck were performed (Fig. 2, Fig. 3). The acetabular bone loss was determined as the difference of the anatomical acetabular cup diameter and the diameter of the implanted acetabular component.



Fig. 1 Acetabular Cup (A) Duraloc Series, (B) ASR, (C) BHR



Fig. 3 Digital Measurement of the diameter of the femoral neck

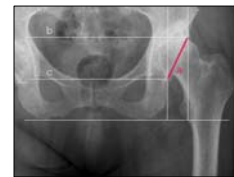


Fig. 2 Digital Measurement of the anatomic acetabular diameter

Table I. Criteria for Patient selection

Including Criteria	Excluding Criteria
Primary Osteoarthritis of the Hip	Dysplasia posttraumatic Osteoarthritis advanced Protusion of the Femoral Head

Results

The following results were obtained for the three groups in terms of age: group I (Duraloc) 66.3±3.3 years; group II (BHR) 50.3±5.2 years and group III (ASR) 53.7±4.9 years (Table II). The anatomic conditions of the acetabular cup and the femoral neck are shown in table II. The radiological determined bone substance loss was found to be in group I 3.69 ± 2.3 mm; in group II 8.48 ± 2.63 mm and in group III 7.03 ± 2.55 mm (Table II). The statistical analysis showed a significant difference between group I (Duraloc) and both groups II and III with surface replacements (p<0.001). Between the two resurfacing procedures in group II and III no significant difference could be found (Table III). Transforming the results concerning the acetabular bone loss from the radiographic evaluation to a cubic measure 18,5 ± 11,5 cm³ in group I, 35,9 ± 11,8 cm³ in group II and 31,4 ± 11,7 cm³ in group III were observed.

Table II. Results for age and diameter of the femoral neck

Group	Age [y]	Diameter of Femoral Neck [mm]
Group I (Duraloc)	66 ± 3,3	44,9 ± 4,75
Group II (BHR)	50 ± 5,1	44,3 ± 4,91
Group III (ASR)	54 ± 4,8	47,4 ± 4,13

Table III. Results for anatomic acetabular diameter and acetabular bone loss

Group	Acetabular Diameter [mm]	Acetabular Bone Loss [mm]	Significance
Group I (Duraloc)	50,37 ± 3,95	3,69 ± 2,3	III - II p=0,084
Group II (BHR)	50,37 ± 3,95	7,03 ± 2,55	I - III p<0,001
Group III (ASR)	49,19 ± 3,96	8,48 ± 2,63	I - II p<0,001

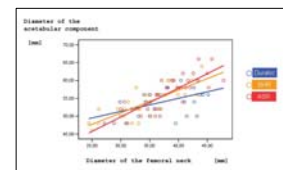


Fig. 4 Diameter of the used acetabular cup compared to the diameter of the femoral neck

Discussion

Today an increasing number of surface replacement prostheses are implanted in the younger patients suffering osteoarthritis of the hip joint. The accepted major advantages of a resurfacing procedure are an increased range of movement, enhanced stability and first of all the preservation of the femoral neck. Considering the surgical preparation of the acetabulum during a resurfacing procedure, the postoperative x-ray imaging and the implant size an enhanced bone loss was supposed. In our study we found on average an increased bone loss at the acetabulum in both groups of surface replacement implants with 8.5 mm in group II (BHR) and 7.0 mm in group III (ASR). In contrast using a conventional uncemented acetabular component a bone loss of 3.7 mm in group I (Duraloc) was documented.

The observed enhanced acetabular bone loss in resurfacing groups underlies the using of larger acetabular components. This is induced by the anatomic condition of the femoral neck. The key point is the relationship between the diameters of the femoral neck and the femoral head. In case of large femoral necks it is necessary to implant a large femoral head as well and further the use of a larger acetabular component in comparison to a conventional arthroplasty is resulting (Fig. 4). In consideration of the younger age of patients who receive a surface replacement of the hip that may lead to mechanical problems and failure in case of a revision procedure. Operational means should be carried out to minimize the bone substance loss.

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