Survival of cementless dual mobility sockets: 10-year follow-up

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ABSTRACT

Purpose of the study
We report a retrospective series of 106 total hip prostheses after 10 years of follow-up. The purpose of this study was to analyze survival of cementless dual mobility sockets.

Material and methods
The series included 90 consecutive patients with 106 first-intention total hip prostheses, all with cementless dual mobility sockets. All prostheses (Novae-1® socket and Profil-1® stem, Serf) were implanted within a 6-month period. The stainless steel socket was coated with alumina and had two short anchorage studs and a superior mooring screw and a polyethylene retentive liner. The stem had a 22.2 mm chromium cobalt head. The main indication for arthroplasty was degenerative joint disease. Mean age at implantation was 56 years (range, 23–87). All patients were seen for physical examination and x-rays every 2 or 3 years. We noted cup survival at 10 years (actuarial method), defining surgical revision for cup replacement due to an aseptic cause as the endpoint.

RÉSUMÉ

Nous rapportons les résultats d’une série rétrospective à 10 ans de 106 prothèses totales de hanche avec une cupule non cimentée à double mobilité. Le but de l’étude était d’évaluer la survie à dix ans de cet implant acétabulaire. La série étudiée était continue et homogène, l’ensemble des prothèses a été implanté en première intention chez 90 sujets.

Les implants étudiés sont constitués d’une tige Profil-1® (Serf) associée à une cupule inox Novae-1® (Serf), un insert rétentif en polyéthylène, avec une tête de 22,2 mm en chrome cobalt. La coxarthrose était la principale indication et l’âge moyen lors de l’implantation était de 56 ans (23-87). Les patients ont été revus cliniquement et radiologiquement. Nous avons étudié la survie de cette cupule à dix ans par une méthode actuarielle, en prenant comme définition de l’échec, la reprise chirurgicale de la cupule pour cause aseptique. Le taux de survie actuariel global à dix ans était de 94,6 % (quatre changements acétabulaires). Il n’y a eu aucune luxation dans cette série.

La survie à dix ans de cet implant était comparable aux autres systèmes publiés dans la littérature. Cette étude confirme la grande stabilité de la cupule double mobilité. Nous préconisons donc la pose de ce type de cupule en première intention chez les sujets à risque d’instabilité postopératoire. La principale limite de cette technique est la luxation intra-prothétique qui a cependant une incidence faible (2 % à 10 ans dans notre étude) et dont le traitement est simple pour peu que le diagnostic en soit fait précocement.

Mots clés : Cupule double mobilité, prothèse de hanche, luxation.
**Results**

Twelve patients died during the 10-year follow-up and one was lost to follow-up. The Postel-Merle d’Aubligné score improved from 7.1 before surgery to 15.8 at 10 years. There were two cases of isolated acetabular loosening, two intraprosthetic dislocations due to advanced wear of the polyethylene insert. The overall survival rate of the socket was 94.6% at 10 years. There were no episodes of prosthetic instability in this series.

**Discussion**

This study demonstrates the good 10-year survival of the dual mobility socket, comparable to that of conventional prostheses. The absence of a single case of prosthetic instability in this series confirms the good short-term and long-term stability of the dual mobility socket. Intraprosthesis dislocation, due to loss of the polyethylene retaining ring is the main limitation of this method. The incidence was, however, low (2% at 10 years) and treatment was not a problem. We recommend using the dual-mobility socket as the first-intention implant for patients with a high risk of postoperative instability, but also recommend it for all patients aged over 70 years since instability is the leading cause of surgical revision after this age.

**Key words:** Dual mobility socket, total hip arthroplasty, dislocation.

**INTRODUCTION**

The dual mobility system developed in 1974 by G. Bousquet and A. Rambert is today in rapid expansion. As the promotor of this concept, our team wished to evaluate this technique over the long term so as to clarify its indications and limitations. The dual mobility concept initially sought to meet two objectives: increase short- and long-term prosthesis stability and maintain postoperative range of movement close to physiological range of movement.

Many publications have shown the advantages of dual mobility sockets: as a first-intention implant, it reduces the early and delayed postoperative intraprosthetic dislocation rate [Farizon *et al.* [1], Aubriot *et al.* [2]], notably in high-risk patients (elderly subjects, gluteus insufficiency, low-compliance subjects, etc.). In second-intention treatment of chronic prosthesis instability, the dual mobility socket appears to be the choice therapeutic solution [Béguin *et al.* [3], Leclercq *et al.* [4]]. We investigated the 10-year survival of a cementless dual mobility socket in a retrospective continuous series, highly similar in the implants used and the population studied.

**MATERIAL AND METHOD**

**Patients**

Our study investigated the 10-year evaluation of a series of 106 consecutive prostheses implanted in 90 patients 16 of which were bilateral cases. This continuous series was treated from October 1993 to March 1994. All patients had the same type of first-intention implant. The mean age at the time of implantation was 56 years (range, 23–87). The series included 47 women and 43 men. Twelve patients died during this 10-year period, but only one patient was lost to follow-up. According to the Charnley classification, there were 65 Charnley A patients, 21 Charnley B, and four Charnley C. We retained only cases of first-intention total hip arthroplasty for primary or secondary degenerative joint disease, excluding prostheses for fractures and revisions.

The etiologies were divided among: 73 cases of primary coxarthrosis, 11 cases of secondary coxarthrosis (with epiphysiodesis, post-traumatic osteoarthritis, etc.), 16 cases of Crowe stages 1 and 2 dysplasia [Crowe *et al.* [5]], and six cases of aseptic osteonecrosis of the femoral head.

**Method**

The surgeries took place in a conventional operating room with all of the department’s senior surgeons (four surgeons), using a Moore posterolateral approach in all cases. Postoperative conditions were classic with early standing with immediate weight bearing, with patients discharged at 8–10 days.

The implants used were the same in all cases: a Novae-1® dual mobility socket by Serf (fig. 1). This socket with an uneven cylindrical, spherical geometry, 3 mm thick, was in stainless steel coated with porous alumina AL2O3. The alumina was plasma projected, resulting in a micropo-
rous aspect. This cementless socket was implanted with a 1-mm press-fit. Primary stability of the tripod socket was obtained from the press-fit effect and two impacted anchorage studs, interlocked to the socket by a Morse cone (one in the ischium and another in the iliopectineal eminence) and a superior mooring screw (screw 4.5 mm in diameter, bicortical, oriented at 45°, attached in the ilium). The mobile insert provided a double joint between the prosthesis head and the head was made of a retentive UHMWPE polyethylene liner, impacted on the head. The stems had 22.2 mm chromium cobalt heads. The implant thus developed a slight mobility between the prosthesis head and the concavity of the polyethylene insert and a large mobility between the convexity of the insert and the polished concavity of the cup. The stems were all screwed Profil-1® (Serf) stems made of titanium coated with alumina AL2O3.

**Evaluation method**

All patients were followed up with clinical and x-ray examinations in our unit, on average every 2 or 3 years. All patients were asked to return for a 10-year clinical evaluation based on the Postel Merle d’Aubigné score [6].

We had frontal and lateral x-rays at 10 years that we used to search for the presence of halos, punched-out lesions, or osteolysis in the acetabulum as well as signs of osteolysis at the calcar. Ectopic ossifications were classed following the method detailed in Brooker et al. [7]. We evaluated the frontal position of the socket at the last follow-up. Survival at 10 years was studied using an actuarial method [Lettin et al. [8]] with a 95% confidence interval. Failure was defined as surgical revision of the metal back caused by asepsis.

**RESULTS**

At 10 years, the Postel Merle d’Aubigné score was 15.8 ± 0.8, with 55 hips with a score over 16 and six hips under 15. The preoperative score was 7.1 ± 0.4. The sockets used had a mean diameter of 49.4 mm (range, 41–59). Sixty-five necks were average, 39 short, and two long.

The study at 10 years investigated the x-rays of 93 hips (fig. 2). Two hips presented an isolated cotyloid halo in DeLee and Charnley [9] in zone 3. Eleven hips showed severe atrophy of the calcar and two hips showed objective signs of stress shielding. However, granuloma around the stem was not observed in any of the 10-year images. None of the hips showed signs of major osteolysis; however, in ten cases, signs of osteolysis were found located around the anchorage studs and the mooring screws.

The study of ectopic ossifications using Brooker’s method at last follow-up showed three (3.2%) Brooker stage IV THA, one (1.1%) stage III, and 12 (12.9%) stages I and II. For socket position, the mean socket inclination at 10 years was 46.8°.

During follow-up, we found two dislocations, one with a ruptured mooring screw, corresponding to the two cases of aseptic loosening in the series.

From a clinical point of view, there was no prosthetic dislocation in this series at 10 years of follow-up.

Complications occurring during the 10 years of follow-up involved two deep infections: one occurred in an immunocompromised patient with AIDS and required explanting both prostheses. This patient received new dual mobility socket implants after 6 months of antibiotic therapy. Another deep infection occurred in the first 45 days following implantation and was treated by simple surgical lavage.

We encountered a total of five acetabular complications: two patients (22 and 29 years of age) presented aseptic acetabular loosening at 5 and 7 years after implantation. Two patients presented intraprosthesis dislocation 7 and 9 years after surgery. These intraprosthetic dislocations were caused by wear of the polyethylene retentive insert of the prosthesis head. They required acetabular revision because severe metallosis had developed from contact between the head and the metal back. These two patients were revised with a dual mobility socket. One patient was revised for substantial wear of the polyethylene (with no intraprosthetic dislocation); any worsening of signs of osteolysis was countered with systematic change of the socket and the friction couple.

Other complications occurred but did not require revision of the cup: three intraoperative fractures of the greater trochanter treated with cerclage, two screws loosening at 2 months that required changing the screws.

In terms of survival, defining failure as surgical revision of the metal back caused by asepsis, the cumulated survival rate at 10 years was 94.6% (range, 92.2%–97%) with a confidence interval of 95% (fig. 3). If the subpopulation of patients under 50 years of age (46 patients) is isolated, the
10-year survival rate was 90.7% (range, 86.3%–95.1%), with a confidence interval of 95% (fig. 4). Isolating the subpopulation of patients over 50 years of age (44 patients), the cumulated survival rate increases to 98% (range, 96%–100%), with a confidence interval of 95%.

Using the Logrank test, we found no statistically significant difference between survival in these two subgroups, because of the small sample size.

**DISCUSSION**

The Novae-1 cementless dual mobility socket presents a 10-year cumulated survival rate comparable to the survival rate of other series in the literature using a fixed acetabular implant in polyethylene. This three-point fixation developed by Gilles Bousquet is very stable when subjected to tearing and rotation stresses. The 10-year survival rate for the socket was 92.4% for the Charnley cemented socket [Kavanagh et al. [10]], 92.5%–98% 10-year survival for the Harris-Galante 1-type socket [Cruz-Pardos and Garcia-Cimbrello [11], Della Valle et al. [12]], and 99% 10-year survival for the Karl Zweimuller series of sockets [Delau-nay and Kapandji [13]].

Dual mobility therefore does not influence early fixation of the socket, nor does it seem to increase the long-term failure rate. The event defining the survival curve was revision of the metal back for reasons of asepsis, i.e., two cases of revision of the metal back for aseptic loosening and three cases of metal back revision for safety reasons (one case of wear with osteolysis and two cases of intraprosthetic dislocation). These precautions are not taken by all teams: out of seven intraprosthetic dislocations, Lecuire et al. [14] only changed the cup once. This systematic precautionary change of the socket lowers our survival curve, which would reach 98.2% at 10 years if we did not consider that clear aseptic loosening required revision, the usual criterion taken into account.

Our series did not include a single case of short- or long-term prosthetic instability. This is particularly determinant in the choice of the dual mobility socket. In the series reported in the literature, the early dislocation rate is considered the rate of dislocation occurring in the first 2 months after implantation, i.e., during the period of soft tissue healing. This rate is highly variable: in 1996 during his teaching conference on SOFCOT, Huten [15] situated it between 2% and 5%. However, the overall prosthetic instability rate with 10 years of follow-up, including both early and delayed prosthetic instabilities stemming from wear, is substantially higher than this early rate and is unfortunately never reported in the literature. This minimizes the true negative impact of prosthetic dislocation on survival rates in these series. Moreover, given that recurring prosthetic dislocation is the first cause of surgical revision in patients older than 70 [Terver et al. [16]], it is difficult to compare series. Our series, with no episodes of instability, clearly shows the advantage of using dual mobility sockets, which appears to be a reliable technique that prevents dislocations and their consequences. This technique therefore appears to be the choice arthroplasty technique for patients presenting a high risk of prosthetic instability.

To evaluate this risk of dislocation, the risk factors related to the patient must be considered (old age, neurological disorders, ethylism, cognitive troubles, poor compliance with postoperative instructions, etc.) as well as those related to the surgical context (damaging tumor surgery, desarthrodosesis prosthesis, and surgical revision).

Dual mobility in certain patients can progress to the onset of intraprosthetic dislocation: given the repeated impacts of the neck on the polyethylene insert, the retaining ring deteriorates and the prosthesis head can therefore be pulled out (fig. 5). This occurred in two of our patients who presented this complication 7 and 9 years after surgery. The chromium cobalt head progressively comes closer to the concavity of the metal back and eventually damages it, causing a more or less extensive metallosis if it is remedied too late. Many factors seem to promote this phenomenon: first of all, there is the head–neck relation, as Adam et al. [17] demonstrated that a
large socket is correlated with a high risk of intraprosthetic dislocation. Intraprosthetic dislocation is therefore a complication specific to dual mobility. It must be treated surgically, generally a simple procedure [Lecuire et al. [14]] if it is done early. This treatment consists in changing the polyethylene so as to restore effective retention if the incident is recent. However, we advise systematically changing the socket for safety reasons. Our continuous and homogenous series thus provides the first low rate of 10-year intraprosthetic dislocation: 2%. In addition, the 10-year survival rate of this dual mobility socket in patients under 20 years of age is 90.7%. In view of the results reported at the 2004 SFHG symposium [Philippot et al. [18]], this rate is low, which is why we do not advise dual mobility cups in active patients under the age of 50. On the other hand, this option should be rethought in young patients with a very low level of activity and in patients at a very high risk of instability.

CONCLUSION

Our continuous and homogenous series demonstrates the long-term good functioning of the first-intention cementless dual mobility socket. The 10-year survival rate of this first-intention socket is evidence for it use, and the absence of instability episodes in our series provides great encouragement. Intraprosthetic dislocation is the main limitation of dual mobility. However, the incidence of this complication remains low. This experience has encouraged us to evolve in our indications, based on the patient’s age, activity level, and the risk of dislocation. For subjects under 70 years of age, we prefer protection from long-term wear with a systematic alumina/alumina couple; in cases of high postoperative risk for dislocation, we propose a dual mobility socket. For patients over 70 years of age, we systematically implant a dual mobility socket.

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