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ORIGINAL STUDY

Dual-mobility socket in challenging total hip arthroplasty: 2-6 years follow-up

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The success of dual-mobility sockets in achieving implant stability in primary hip replacement is already well established. However, stability cannot always be achieved, especially when dealing with more difficult indications.

At our department, 104 dual-mobility sockets (92 uncemented and 12 cemented) were implanted for primary total hip arthroplasty in 97 patients between 2009 and 2013. Indications for hip arthroplasty included primary and secondary coxarthrosis, acetabular and subcapital fractures, avascular necrosis, tumor surgery and metastatic fractures. Although no loosenings were observed, 2 dislocations and 1 infection occurred shortly after surgery.

In this challenging group of patients no fixation problems or intraprosthetic dislocations have been observed. The design therefore seems to be a valid alternative to constrained implants, especially in high-risk cases, although dislocation cannot be prevented at all times. Although the findings are very promising, long-term survival studies are mandatory to evaluate intraprosthetic stability and fixation longevity of dual-mobility sockets.

Keywords : total hip arthroplasty ; dual-mobility socket ; dislocation.

INTRODUCTION

Total hip arthroplasty can sometimes be a very challenging procedure when dealing with fractures, complex secondary deformations after failed osteosynthesis or tumor surgery, especially when dealing with extensive bone defects or compromised bone quality at either the acetabular side, the femoral side, or both *(11)*. Soft-tissue and abductor muscle defects may further jeopardise the stability of the hip, resulting in higher dislocation rates *(6)*. Other risk factors as obesity, neurological disorders and hyper laxity may also increase the risk for dislocation even in primary coxarthrosis *(9,16)*.

Another challenge in primary hip arthroplasty may be the fixation of the acetabular component, especially when dealing with fractures or tumor surgery. When dealing with osteoporotic bone one may prefer cemented implants, however extensive bone defects at the acetabular side often necessitate the use of bone grafts and a reinforcement ring, which is fixed to the remaining bone with multiple screws *(13)*.

For those challenging cases a dual-mobility socket may be considered. This type of socket

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was developed in France by Gilles Bousquet and was found to provide excellent results for primary indications *(19)*. Specifically, stability of the implant has been reported to be exceptional, both early postoperatively and at long-term follow-up in normal cases *(3)*.

The purpose of this paper was to describe the mid-term results and the complications the authors encountered with the use of a dual-mobility socket in more challenging cases of primary total hip replacement, either cemented or cementless, and if required in combination with a reinforcement ring.

MATERIALS AND METHODS

At our department 104 dual-mobility sockets in 97 patients were implanted for primary total hip arthroplasty between 2009 and 2013.

The group consisted of 32 male and 65 female patients (54 left and 50 right hips). The mean patient age at the time of surgery was 71.5 (range 38 to 88) years. Indications for total hip arthroplasty are listed in table I and II. All included cases of primary coxarthrosis were assessed as having higher risk for dislocation for various reasons such as extreme obesity, hyper laxity and neurological disorders. The preoperative Harris hip score (HHS) was below 50 in all cases. All surgery was done by the same senior surgeon through a posterolateral approach.

In 92 cases, the uncemented version of the Apogée dual-mobility socket (Biotechni, La Ciotat, France) was implanted, while in 12 cases the cemented version of the same socket was used. An additional reinforcement ring was used in 5 cemented cases. The system consists of a stainless steel 22-mm or 28-mm head (INxx.0yy, Biotechni, La Ciotat, France) that is constrained in a large-diameter conventional polyethylene head which moves freely within within a cemented or uncemented stainless steel shell (Fig. 1). Only 2 cases required a 22-mm head related to the small size of the socket. For cemented cups Palacos® cement (Heraeus Inc., Hanau, Germany) was used. When applicable, a Ganz ring was used as reinforcement ring (Zimmer, Warsau, IN, USA).

At the femoral side an uncemented collarless Filler-3ND stem (Biotechni, La Ciotat, France) was used in 100 cases and a cemented version of the same stem in 4 cases (Fig 2). Only when dealing with tumor or metastatic cases a cemented stem was used to allow postoperative radiotherapy.

All patients received prophylactic antibiotics (cefazoline 3x2 g) for 24 hours postoperatively and indomethacin 3x25 mg daily for a postoperative period of 3 weeks to reduce the risk of periarticular ossifications. The antithrombotic prophylaxis consisted of low-molecular-weight heparin and compression stockings for 4 weeks after the surgical procedure.

Table I. — Indications for total hip arthroplasty in the study group

Indication	Count	%
High risk primary coxarthrosis	55	52.8
Secundary coxarthrosis	16	15
Avascular necrosis	2	1.9
Acetabular fractures	2	1.9
Subcapital fractures	14	13.4
Failed osteosynthesis	5	4.8
Metastatic fracture	2	1.9
Tumor	2	1.9

Table II. — Cause of secundary coxarthrosis

Cause	Count	%
Dysplasia	9	8.6
Pertrochanteric fractures	5	4.8
Arthritis	2	1.9

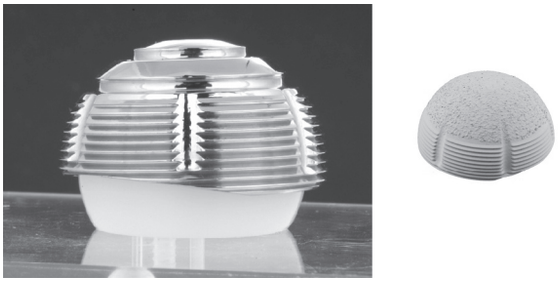

Fig. 1A and B. — cementless (A) and cemented (B) version of the Apogée dual-mobility cup

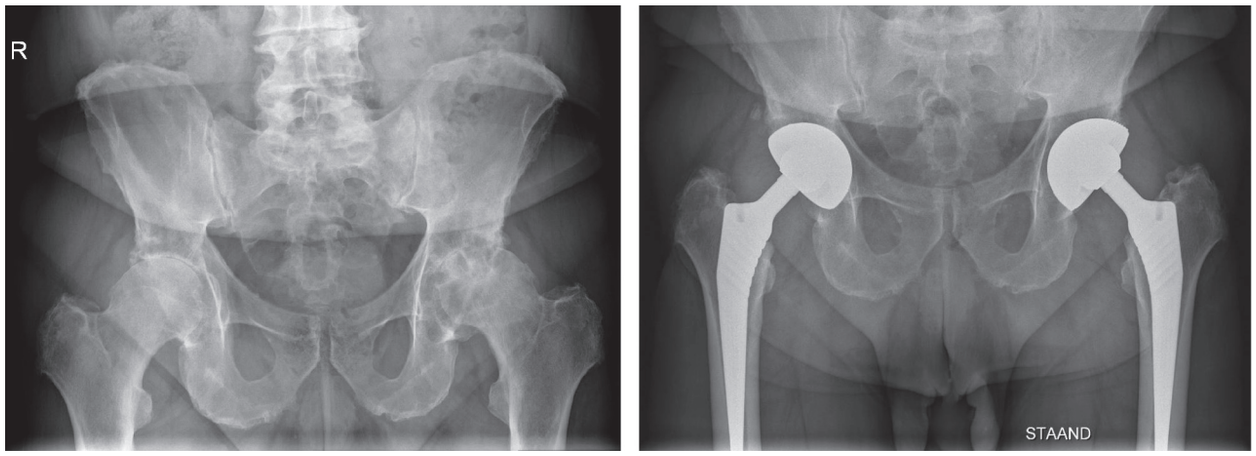

Fig. 2A and B. — Radiograph of a 77-year-old male patient preoperatively (A) and after bilateral total hip arthroplasty using Apogée dual-mobility socket in combination with Filler 3-ND cementless stem, 4 years postop left and 3 years postop right (B)

Postoperative rehabilitation was started within 1 week of surgery for all patients. Postoperative follow-up at our clinic is scheduled at regular intervals, i.e. at 6 weeks, 3 months, 1 year, and then advised every 2 years. All patients without recent follow-up were contacted by phone and invited for clinical and radiological evaluation at our clinic.

RESULTS

The mean clinical and radiographical follow-up was 3.6 years with an average HHS of 93 (range, 73-100). Nine patients were lost to follow-up; 17 patients died of a cause not related to the procedure at an average age of 75 years (range, 40 - 85 years).

In this follow-up period, 3 early complications were encountered requiring revision of the implant (Table III). There was a dislocation rate of 1.9% (n = 2). One dislocation of the large-diameter polyethylene occurred shortly postoperatively due to extreme spasticity of the operated limb in a cerebral palsy patient (Fig 3). She was finally treated with a Girdlestone procedure. Probably this patient was no indication at all for total hip arthroplasty. The other dislocation could not be explained. This patient needed 2 revision procedures using a modular neck in combination with a dual-mobility socket to stabilise the hip.

Table III. — Complications encountered with dual-mobility socket

Complication	Count	Indication for surgery
Dislocation	1	Dysplasia with neurological disorder
Dislocation	1	Primary coxarthrosis
Infection	1	Secondary coxarthrosis after arthritis

No intraprosthetic dissociation of the dual-mobility system has been observed in this particular group so far.

One patient operated for secondary coxarthrosis after previous septic arthritis developed an early postoperative infection requiring a successful two-stage revision using again a dual-mobility socket.

No radiological signs of loosening of both acetabular and femoral components have been observed in the this particular group of patients.

DISCUSSION

At our department, about 200 primary hip replacements are performed annually. Generaly, for primary coxarthrosis a cementless cup and stem with ceramic bearing is implanted in our patients. However, using the posterior approach, the biggest challenge remains stability of the hip, especially in the more challenging cases and when dealing with subcapital fractures in the elderly requiring a total hip arthroplasty *(4)*. Even for primary coxarthrosis the stability may compromised due to several factors such as obesity, neurological

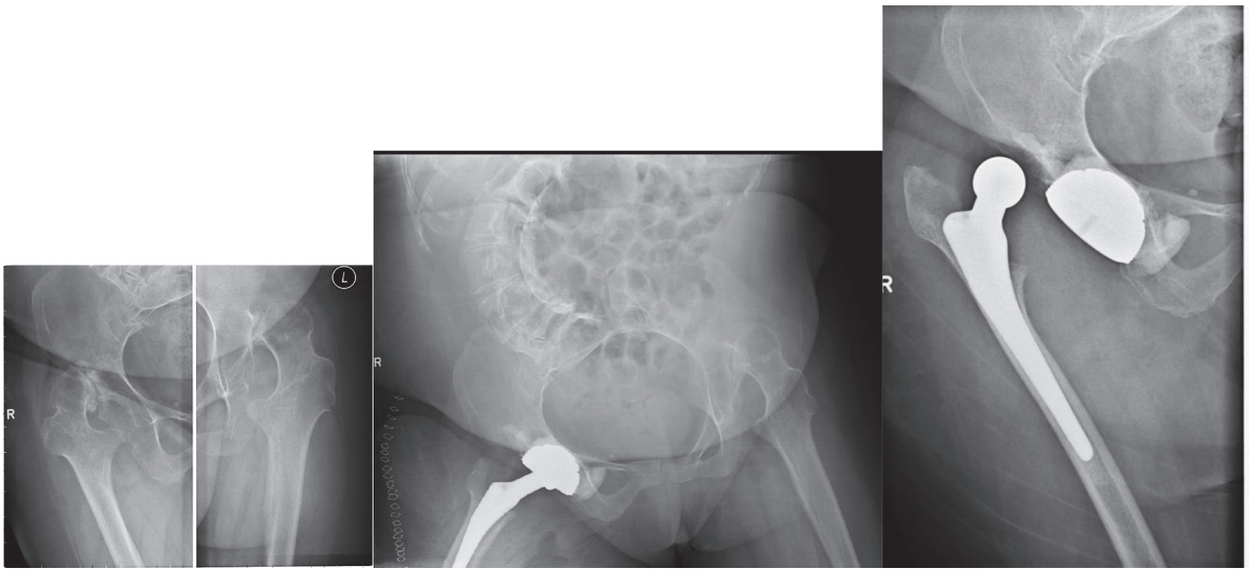

Fig. 3A, B and C. — Radiograph of a 53-year-old female patient with neurological disorder preoperatively (A), postoperatively (B) and after dislocation (C)

disorders or hyper laxity *(9)*. The problem becomes even more apparent in the presence of large bone defects, abnormal deformations, anatomical abnormalities as in dysplasia or when the abductor mechanism is absent, e.g. after failed intramedullary osteosynthesis. For those selective cases whit increased chance for dislocation, a dual-mobility socket, either cementless or cemented, is our preferred choice of implant as already recommended by Ko et al. *(10)*. In the event of poor bone stock, a reinforcement ring, usually combined with bone allografts, can be used at the acetabular side *(14)*. As positioning and orientation of the ring are mostly dictated by the bony remnants of the acetabulum, care should be taken to avoid malpositioning of the conventional cemented liner, as this could result in impingement or insufficient version of the components leading to instability of the hip. This problem can be solved partially by using larger femoral heads with a cemented dual-mobility socket *(1,2,7,8,17)*.

Alternatively, hip surgeons may sometimes be tempted to use constrained acetabular cups when confronted with a severe stability problem in total hip arthroplasty. However, constrained cups are not without complications caused by potential impingement problems, as reported by Pattyn et al. and Fricka et al *.(5,15)*. In addition, long- term fixation failure of these designs has been reported to be a major drawback *(20)*.

The advantage of the dual-mobility system used in this study is that the surgeon can decide preoperatively whether to use a cemented or uncemented socket using the same instrumentation, based on the quality of the bone. Despite the challenging indications for surgery in this study, an uncemented component could be used in most cases obtaining a stable press fit as well on the acetabular side as well on the femoral side. Only in severe osteoporotic cases a cemented acetabular component was used in combination with an uncemented stem. Only 5 cases required a reinforcement ring on the acetabular side in combination with a cemented dual-mobility cup. Obviously, all components were cemented in case of tumor or metastatic surgery in order to allow postoperative radiotherapy without compromising implant fixation.

The relative high number of patients who died postoperatively not related to the implants may reflect the high degree of co-morbidity of the cases that were involved in this study population.

Regarding possible intraprosthetic dissociation of the dual-mobility socket, Lyons et al. reported a 3.6% incidence, probably caused by polyethylene

wear of the smaller articulation of the dual system *(12)*. No intraprosthetic dissociations have been encountered in our study group so far. The 2 dislocations of the large-head polyethylene may illustrate the limitations of the dual-mobility system in order to prevent dislocations. Careful risk assessment of the patient remains critical as sometimes a total hip arthroplasty may be contra-indicated at all in some specific cases. Concerns exist about polyethylene wear with the use of large-diameter polyethylene dual-mobility sockets. However, although the long-term durability of these implants is unknown, the tested wear rates of a dual-mobility design with the current generation of polyethylene are significantly lower than any previously reported wear rates *(18)*.

To date no radiological or clinical signs of loosening of acetabular or femoral components have been reported in this particular study group. This may indicate that stable implant fixation may have been achieved in all cases. Longer follow-up is mandatory to establish whether implant stability will be maintained in the long term and whether intraprosthetic dissociation will occur due to polyethylene wear.

In conclusion, the dual-mobility socket seems to achieve good mid-term results regarding fixation and stability in this particular challenging group of patients.

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