The Journal of Arthroplasty 29 (2014) 172–175

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

High Short-Term Loosening Rates with the Wagner Standard Cup

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ARTICLE INFO

Article history:
Received 10 December 2012
Accepted 24 March 2013

Keywords:
total hip arthroplasty
Wagner Standard Cup
osteointegration
primary and secondary stability
periprosthetic radiolucencies

ABSTRACT

The stability of prosthetic fixation is to a large extent dependent on component design. The purpose of this study is to analyze the short-term radiological results obtained with the Wagner Standard Cup in primary hip arthroplasty. An assessment was made of one hundred primary hip arthroplasties. The radiological evaluation revealed bone ingrowth in 37 of cases, fibrous integration in 49 and loosening in 14. In summary, osseointegration of the Wagner Standard Cup was unsuccessful in a high percentage of cases. This finding, which was unrelated to the type of stem or bearing surface used, bore a statistically significant relation ($P < 0.05$) with an observed poor bone coverage of the acetabular component. Although insufficient bone coverage could arguably be attributable to a poor surgical technique, we would tend to agree with other authors that it is rather likely to result from a flawed implant design that impedes osseointegration.

Total hip arthroplasty is one of the most successful procedures in orthopaedic surgery. Two implant fixation techniques are available: cemented and cementless implantation. Cementless acetabular components gained popularity because of the increased rate of loosening associated with cemented cups after medium and long-term follow-up [1–3]. In studies of primary total hip arthroplasties, with a minimum of ten years' follow-up, the survivorship rate of press-fit acetabular component shells ranges from 83% to 98%. Survivorship of polyethylene liners ranges between 82% and 92% [1,4–11].

The key aspects that determine the durability of cementless total hip arthroplasty include the stable anchorage of the implant achieved by direct bone-to-implant contact (osseointegration) and the durability of the prosthetic bearing surface (tribologic implant performance).

The primary or mechanical stability of the acetabular component depends on correct implant positioning, so it is essential to maximize the contact area between the component and the host bone [12–15]. Primary stability can be augmented by means of pegs, screws or fins.

Requirements to achieve secondary or long-term stability include a firm primary or mechanical stability and an adequate osseointegration potential of the materials used. The purpose of our study is to analyze the short-term radiological results of the Wagner Standard Cup in primary hip arthroplasty.

The Wagner Standard Cup (Zimmer [formerly Centerpulse, Switzerland], now USA) is a hemispherical press-fit pure titanium, it's made from CP titanium with a wall thickness of 3 mm. The surface roughness of the gritblasted Wagner Standard Cup ranges between 40 and 60 μm. On its proximal half, the component incorporates 7 conical prominences with screw holes and on its distal half there are 13 sharp-edged pyramid-like elevations also intended to enhance initial stability (Fig. 1).

Materials and Methods

This is a descriptive retrospective study of a series of consecutive total hip arthroplasties with the Wagner Standard Cup implanted in our hospital (Hospital Universitario Parc Taulí Sabadell, Barcelona, Spain) between 2001 and 2004.

Post-fracture arthroplasties and those with a follow-up of less than 6 months were excluded from the study, which left a final sample of 100 cases.

A clinical and radiographic follow-up examination was performed 1 month, 3 months, 6 and 12 months after the surgery and, thereafter, at annual intervals.

The mean duration of follow-up was 45 months (range 6–75 months). Spinal anesthesia was administered in all cases. An anterolateral Hardinge approach was used in all the procedures, with the patient in a lateral position. The acetabulum was reamed until a bed of bleeding cancellous bone was obtained. The acetabular implant selected was 2 mm larger than the last reamer used so as to obtain a tight press-fit, according to the recommendations in the literature [16–23].

The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2013.03.025.

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http://dx.doi.org/10.1016/j.arth.2013.03.025

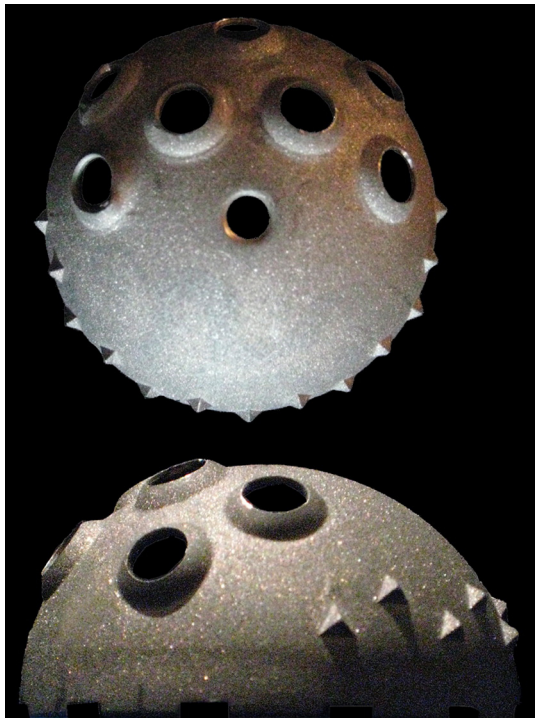

Fig. 1. Wagner Standard Cup.

Intraoperatively, we detected a sizeable gap in zone II as a result of the excessive conical elevations on the surface of the Wagner Standard Cup. In an attempt to improve contact between the acetabular cup and the bone surface, a heavy 1.5 kg mallet was used for cup impaction. In addition, multiple screws were used to enhance primary stability.

The variables analyzed are presented in the following table (Table 1). The surgery was performed on 62 males and 38 females (n = 100) with a mean age of 64 years (range: 36–84). The main diagnosis was primary hip arthritis in 76 cases. There were also 19 cases of arthritis secondary to osteonecrosis of the femoral head, 4 cases of post-traumatic arthritis and only one case of rheumatoid arthropathy. The most frequently used Wagner Standard Cup diameters were 52, 54 and 56 mm. In most cases, 2 or 3 screws were used to enhance primary stability; screws were unnecessary in only one case. The most frequently used bearing surface was metal/metal (Metasul) in 48 cases, metal/highly-crosslinked PE bearings (Durasul) were used in 39 cases and CoCrMo alloy (Protasul) was used in the remaining 13 cases. A cemented self-locking Müller femoral stem was used in 46 cases, with a cementless stem being used in the remaining 54 cases (42 Spotorno, 7 Furlong and 4 PCD total hip prosthesis with compression disk).

All femoral heads were 28 mm and most prosthetic necks were of medium length. Radiographic measurements for cup migration were performed using currently accepted protocols [24,25].

In 42 cases, the cup inclination angle ranged between 40° and 50°; in 28 inclination was less than 40° and in the remaining 30 the cup was inclined more than 50°. Using the radiographic inter-teardrop line as a reference, it was determined that the half of the Wagner Standard Cups were well-centered, while the remaining half were either medialized or lateralized.

Mean bone coverage of the acetabular cup was 88.43% (range: 69–100). An analysis was also made of the presence of periprosthetic radiolucencies and the variations in bone density in the different De Lee–Charnley zones [26]. A total of 27.7% radiolucency was found in zone I with 35.5% bone sclerosis at this level; radiolucencies in zone II amounted to 73.3%, whereas those in zone III added up to 49.9% (Fig. 2).

Table 1
Clinical and Radiological Variables.

Clinical Variables	Radiological Variables
Age	Cup inclination angle
Gender	Cup medialization/lateralization
Type of hip arthritis	Extent of bone coverage of the acetabular cup
Cup diameter	Periacetabular radiolucencies
Number of screws used	Variations in bone density
Bearing surface	Modified Engh loosening criteria
Type of femoral stem	
Neck length	

Results

In our study, we determined the stability of the acetabular component on the basis of a modification of Engh's loosening criteria [27]. Three distinct grades of stability were defined: A component was designated as stable with osseous ingrowth if there were no radiolucent lines extending across 50% or more of any zone and there was no measurable migration of the component; as stable with fibrous ingrowth if radiolucent lines were present in all three zones but the component had not migrated; and as unstable if there were radiolucent lines in all three zones and the cup had migrated.

Migration of the acetabular component was defined as a change of more than 3 mm in the horizontal or vertical direction or a change of more than 3° in the cup angle. According to these criteria bone incorporation of the Wagner Standard Cup occurred in 37 cases, fibrous integration was observed in 49 and frank loosening in 14 cases.

Pearson's chi square test revealed that there was a statistically significant relation ($P < 0.05$) between the high incidence of cup loosening obtained in the series (14%) and lack of bone coverage of the acetabular cup. This finding was seen to be unrelated to the type of stem or bearing surface used, as well as to the other variables studied.

Discussion

Our study had a mean follow-up of 45 months (range: 6–75), and in 78 cases follow-up exceeded 24 months. Two years' follow-up is

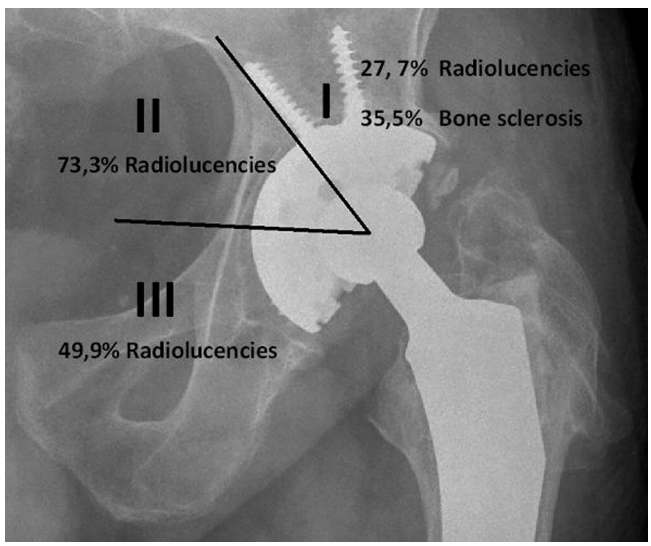

Fig. 2. Radiolucent lines were measured in each of the three zones described by Charnley and DeLee.