3M Capital hip arthroplasty

3–8-year follow-up of 208 primary hip replacements

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Submitted 01-04-21. Accepted 01-12-04

ABSTRACT – We reveiwed 267 Capital hip replacements. Patients were recalled in 1998 after reports of failure of this prosthesis. 208 hips (200 patients) were followed-up (average 6 years). 9 hips (4%) had been revised for aseptic loosening and 10 stems (5%) were radiographically loose. Males and both varus and valgus stems showed a higher incidence of loosening. The failure rate, however, was considerably lower than the published figures. The reason for this is not clear, but obviously design is not the only factor contributing to loosening. Therefore, a continuous routine registration of clinical data and relevant outcome parameters on a large scale seems desirable.

The Charnley hip replacement has been accepted as gold standard in the U.K. (Best et al. 1998, Fender et al. 1999, Tennent and Goddard 2000). The 3M Capital hip was marketed as a design similar to that of the Charnley system, but with the added advantage of modularity, optional head sizes and various material construct for the head and a low cost. This system was discontinued after a 26% incidence of aseptic loosening was reported at 26 months (Massoud et al. 1997). Since we had the impression that the failure rate was lower, we reviewed 200 patients with 208 primary 3M Capital hip arthroplasties.

Patients and methods

267 hip replacements (Capital Hip 3 M) were performed on 250 patients, mean age 68 (30–88) years, 148 females, from 1991 to 1994. 174 hips had osteoarthrosis, 14 rheumatoid arthritis, 9 failed femoral neck fractures, and 11 other conditions. Operations were performed through a trochanteric or anterolateral approach in a supine position. The femoral canal was prepared using Charnley tapered reamers, distal femoral plug and cement (Palacos with gentamicin) inserted digitally with a vent.

All patients were recalled in 1998 and assessed clinically and radiographically and then reviewed annually, mean follow-up 69 (40–100) months. 59 hips were excluded: 47 patients had died, 4 were not traceable, 3 had emigrated, and 2 were infirm. 3 hips were revised for reasons other than aseptic loosening. 208 hips (200 patients) were thus included.

The experience of the operating surgeon, type of approach, implant details and complications were obtained from patient records. At the annual review, patients were examined and pain recorded on a four-grade scale. Radiographs were assessed for alignment and canal fill index (Ebramzadeh et al. 1994), width of medial cement and cancellous bone in Gruen zone 7 (Gruen et al. 1979), subsidence (Loudon and Charnley 1980), stem failure (Kobayashi et al. 1997), and linear acetabular wear (Charnley and Halley 1975). Progression of any of the signs or occurrence of two of the signs were regarded as failure. Radiolucencies and osteolysis were recorded in each Gruen zone and assessed for the type of failure (Gruen et al. 1979).

Table 1. Parameters evaluated

Parameters	P-values
Male: Female	0.001
Consultant: Middle grade	0.4
Monoblock: Modular prosthesis	0.5
Trochanteric: Antero-lateral approach	0.2
Trochanteric union: Separation	0.5
Neutral: Varus stem	0.001
Neutral: Valgus stem [a]	0.02
Cement mantle (Zone 7)	1.0
Cancellous bone (Zone 7)	0.2
Canal fill index [a]	0.3
Acetabular yearly linear wear [b]	0.9

[a] Fisher exact test
[b] T-test

Results

We found a higher failure rate in men and varus/valgus stem, but not for grade of surgeon or approach (Table 1). 5/10 patients with radiographically loose stems had died of unrelated causes and 3 were pain-free. 43 (23%) patients without radiographic signs of loosening had mild to moderate pain in the thigh or groin.

3 (1%) patients had had a deep infection, 2 of them requiring surgery. 11 (5%) had one or more episodes of dislocation, one requiring revision for a retroverted cup. 3 patients had had a pulmonary embolism and 2 deep venous thrombosis. 1 patient had a painless unreduced dislocation with no evidence of stem failure.

In 18/19 of failed cases, radiographs were available: 2 stems were in varus, 2 had an inadequate cement mantle, and 5 both. 5 of the loose hips were asymptomatic. 23% complained of groin/thigh pain despite satisfactory radiographs. However, there was no difference in the failure rate between monoblock (stainless steel alloy) and modular (titanium) systems, which have a different modulus of elasticity.

Discussion

We had a failure rate at par with previous results of the Charnley prosthesis, but considerably lower than other studies of 3M Capital hips (Table 2). Why were the previous results so poor? An inadequate cement mantle and varied modulus of elasticity and surface finish are suggested as reasons (Massoud et al. 1997, Ramamohan et al. 2000). The prosthesis has a shot-blasted matt finish, a surface texture different from that of the Charnley stem, which may have contributed to early debonding.

We found a fairly high incidence of cement-prosthesis debonding. Major osteolysis was also noted in failed stems, although acetabular wear was not unusually high in the failed group. CMW cement has been associated with a higher failure rate than Palacos (Massoud et al. 1997, Malchau and Herberts 1998). We used Palacos cement, which may partly account for the lower incidence of failure. Males and patients with varus stems had a higher failure rate in our study and this is in keeping with the findings of other series (Tapadia et al. 1984, Malchau et al. 1993, Ebramzadeh et al. 1994, Roberts et al. 1986, Malchau and Herberts 1998). Our study showed no difference in the loosening rate as regards the width of the cement mantle or cancellous bone between the various groups in

Table 2. Comparison of results with other hip arthroplasty studies

First author	Year	Prosthesis	Radiographic failure, %	Revision %	Follow-up months	No.
Marston	1996	Charnley	6	4	78	200
Marston	1996	Stanmore	6	4	78	213
Massoud	1997	3M	26	9	26	76
Malchau	1998	Charnley	N/A	8	108	21,109
Fender	1999	Charnley	9	4	60	499
Ramamohan	2000	3M	20	13	34	40
Roy (this study)		3M	9	4	69	208

Gruen zone 7 unlike the findings of Massoud et al. (1997).

The different results with a design point up the need for hip replacement registers on a large scale, and regular clinical and radiographic audits, especially when new prostheses are used. The obstacles include funding and lack of interest-and perhaps also a reluctance to being assessed.

No funds have been received to support this study.

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