Mid-term Clinical and Radiographic Outcomes of a Monobloc Tapered Stem for Paprosky 3 and 4 Femoral Bone Defects

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INTRODUCTION:

Achieving primary stability in conversion and revision hip arthroplasty (rTHA) cases with significant femoral bone loss is technically challenging. Modern monobloc fluted titanium tapered stems (FTTS) have been increasingly utilized for these cases. This study sought to determine the radiographic and clinical outcomes of a monobloc FTTS in patients with significant femoral bone loss at mid-term follow-up.

METHODS:

A multicenter retrospective observational study of all conversion and revision THA patients who received a monobloc FTTS with significant femoral bone loss and up to 5-year radiographic follow-up was conducted. Patients with a femoral Paprosky Classification of IIIa, IIIb, and IV were included. Stem subsidence and osteointegration were assessed on the most recent radiograph. All-cause re-revisions and survival of the stem at latest follow-up was assessed. Descriptive statistics were calculated for each output.

RESULTS:

Eighty-five monobloc FTTS were examined. Median clinical follow-up was 28.5 months (range, 18.0 to 57.8 months). Median subsidence was 1.4 millimeters (mm) (range, 0 to 15.0 mm). Sixteen (22.8%) and 3 (4.3%) had subsidence greater than 5 mm and 10 mm, respectively. Seventy-eight of 81 (95.1%) stems had osteointegration at latest follow-up. Ten (11.7%) required reoperations: four for periprosthetic joint infection (PJI), two for distal femoral periprosthetic fractures, two for acetabular periprosthetic fractures, one for the removal of a trochanteric plate, and one for hip instability. Within the 10 reoperations, five (5.8%) stems were removed; four due to PJI and one due to an acetabular periprosthetic fracture at one month postoperatively. Kaplan-Meier analysis yielded an all-cause stem survivorship of 95.8% at 2 years and 88.5% at 4 years. Stem survivorship free of aseptic failure was 100.0% at both 2 and 4 years.

DISCUSSION AND CONCLUSION: Monobloc FTTS in complex femoral reconstruction cases show encouraging clinical and radiographic results in patients with significant femoral bone loss at up to 5 years follow-up.

Figure 1. Kaplan-Meier survivorship for freedom from all-cause revision and aseptic revision of femoral stems

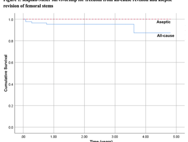

Table 1. Demographic characteristics of included patients

	No. of hips (n=85)
Age (years)	65.5±13.4
Male- no. (%)	34 (40.0)
BMI (kg/m²)	29.0±7.2
Smoking Status- no. (%)	
Current	6 (7.1)
Former	33 (38.8)
Never	46 (54.1)
Race- no. (%)	
White	60 (70.6)
African American	12 (14.1)
Asian	0 (0.0)
Other	13 (15.3)
ASA Class- no. (%)	
1	0 (0.0)
2	31 (36.5)
3	47 (55.3)
4	7 (8.2)
Paprosky Classification	
I	0 (0.0)
II	0 (0.0)
IIIa	71 (74.0)
IIIb	11 (11.5)
IV	3 (3.1)

ASA, American Society of Anesthesiologists; BMI, body mass index; kg, kilogram; No., number; m, meteer; SD, Standard deviation

Table 2. Surgical indications of included patients

Surgical Indication	No. of hips (%) (n=85)
Periprosthetic Fracture	29 (34.1)
Aseptic Loosening	20 (23.5)
PJI (second stage revision)	20 (23.5)
Trunnionosis/Metallosis	5 (5.9)
Hip Dysplasia[1]	4 (4.7)
Dislocation	2 (2.4)
Liner Wear	2 (2.4)
Post-traumatic Arthritis	1 (1.2)
Avascular Necrosis	1 (1.2)
Congenital Deformity	1 (1.2)

No., number; PJI, periprosthetic joint infection
[1]Complex primary total hip arthroplasties

Table 3. Surgical characteristics of included patients

	No. of hips (n=85)
Type of operation- no. (%)	
Complex primary	4 (4.7)
Conversion	13 (15.3)
Revision	68 (80.0)
ETO performed	7 (8.2)
Revised components- no. (%)	
Femur	34/68 (50.0)
Femur and acetabulum	34/68 (50.0)
Intraoperative cable use- no. (%)	42 (49.4)
Number of intraoperative cables	3.31±1.59
Stem length- no. (%)	
190 mm	40 (47.1)
240 mm	39 (45.9)
300 mm	6 (7.3)
Stem offset	
Standard	44 (51.7)
High	41 (48.3)
Stem diameter (median [IQR]) (mm)	17.0 (16.0-19.0)
Femoral head size (median [IQR]) (mm)	32.0 (30.0-36.0)
Femoral head offset (median [IQR]) (mm)	3.0 (0.0-4.0)

ETO, Extended trochanteric osteotomy; IQR, interquartile range; mm, millimeters; No., number

Table 4. Clinical and radiographic outcomes

	Overall (n=53)
Surgical time (minutes)	165.8±72.1
LOS (days)	4.20±3.30
Discharge Disposition- no.	
Home	53 (62.4%)
Skilled Nursing Facility	28 (32.9%)
Acute Rehabilitation Center	4 (4.7%)
90-day Readmission- no.	10 (11.8%)
Long-term	
Follow-up (months)- median (IQR) [range]	28.5 (23.9-37.3) [18.0-57.8]
Subsidence (n=70)	
Length (mm)- median (IQR) [range]	1.4 (0.5-3.3) [0.0-15.0]
>5 mm- no.	16 (22.8%)
>10 mm- no.	3 (4.3%)
Osteointegration- no.	77/81 (95.1%)
Dislocation- no.	5 (5.9%)
Reoperation- no.	10 (11.7%)
Revision- no.	7 (8.2%)
Reason for Revision- no.	
PJI	4 (4.7%)
Acetabular Periprosthetic Fracture	2 (2.4%)
Dislocation	1 (1.2%)

IQR, interquartile range; LOS, hospital length of stay; mm, millimeters; No., number; PJI, periprosthetic joint infection; SD, standard deviation

Table 5. Detailed follow-up of patients undergoing reoperation

Case No.	Index Operation	Time-to-event (months)	Reason for Revision	Operation	Explantation of Components			
					Stem	Head	Liner	Shell
1	rTHA	0.9	PJI	First-stage re-rTHA, insertion of antibiotic spacer	Y	Y	Y	Y
		8.2	PJI	Second-stage re-rTHA	Y	Y	Y	Y
2	Conversion THA	1.0	Periprosthetic fracture of the acetabulum resulting in pelvic discontinuity	Re-rTHA	Y	Y	Y	Y
		10.5	PJI	First-stage re-rTHA, insertion of non-articulating antibiotic spacer	Y	Y	Y	Y
3	Conversion THA	2.1	Periprosthetic fracture of the acetabulum	Re-rTHA	N	Y	Y	Y
4	rTHA	5.5	Recurrent Instability	Head and liner exchange	N	Y	Y	N
5	rTHA	9.2	PJI	First-stage re-rTHA, insertion of dynamic antibiotic spacer	Y	Y	Y	Y
		12.6	PJI	Second-stage re-rTHA,	Y	Y	Y	Y
		17.6	Instability	Head and liner exchange	N	Y	Y	N
6	Conversion THA, ETO with ORIF	16.1	Pain	Removal of trochanteric plate	N	N	N	N
7	rTHA	20.5	Periprosthetic fracture, Vancouver C classification	ORIF	N	N	N	N
8	rTHA	39.7	PJI	DAIR	N	Y	Y	N
		42.2	PJI, non-union greater trochanteric fracture	DAIR	N	Y	Y	N
		43.4	PJI	First-stage re-rTHA, insertion of dynamic antibiotic spacer	Y	Y	Y	Y
		52.9	PJI	Insertion of non-articulating antibiotic spacer with Steinmann pin	Y	Y	Y	Y
9	rTHA	50.1	Periprosthetic fracture, Vancouver C classification	ORIF	N	N	N	N
10	rTHA	3.3	PJI	First-stage re-rTHA, insertion of antibiotic spacer	Y	Y	Y	Y

DAIR, Debridement, antibiotics, and implant retention; ETO; extended trochanteric osteotomy; N, no; No., number; ORIF, open reduction internal fixation; PJI, Periprosthetic joint infection; rTHA, revision total hip arthroplasty; THA, total hip arthroplasty; Y, yes