Subsidence Starts Distally: Scaffolding vs. Reconstitution Closure of an Extended Trochanteric Osteotomy in Revision Total Hip Arthroplasty

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INTRODUCTION:

Removal of well-fixed femoral stems during revision THA (rTHA) can be technically demanding and associated with complications. The extended trochanteric osteotomy (ETO) facilitates safe implant removal and canal access. Two main closure techniques for managing the ETO fragment are the *"scaffolding"* method, which leaves the osteotomy open during femoral preparation, and the *"reconstitution"* method, which closes the osteotomy before preparation. We previously published a biomechanical study demonstrating no difference in tapered splined titanium stem (TSTS) subsidence between techniques, however cadaveric specimens do not perfectly represent the environment encountered in revision surgery, and therefore the clinical impact remains uncertain. This study aimed to compare clinical and radiographic outcomes between the two ETO closure methods, hypothesizing no significant difference in TSTS subsidence.

METHODS: A retrospective review was conducted of patients undergoing rTHA with ETO and TSTS implantation between 2016 and 2020 at a tertiary center. Patients were grouped by ETO closure technique: reconstitution (n=35) or scaffolding (n=31). Radiographic stem subsidence was measured using calibrated anteroposterior radiographs at immediate postoperative and latest follow-up. Contact length above and below the ETO was also recorded. Statistical analyses included Mann-Whitney U tests, Chi-squared tests, Pearson correlations, and multivariable logistic regression.

RESULTS:

The final cohort comprised 66 patients (mean age 65.3 years, BMI 28.2 kg/m²). The most common indications for revision were periprosthetic joint infection (33.3%) and aseptic loosening (25.8%). The mean stem subsidence was 5.2±3.2 mm, with no significant difference between reconstitution (6.0±3.6 mm) and scaffolding (4.3±2.9 mm) techniques (p=0.995). Subsidence >5 mm occurred in 31.4% of reconstitution and 32.3% of scaffolding cases (p=0.958). ETO union was achieved in 94.0% of cases, with no significant difference between techniques (p=0.246). The scaffolding group demonstrated greater bicortical contact compared to reconstitution below the ETO (50±5.4 mm vs. 28±4.8 mm, p=0.002), which was inversely associated with subsidence (r=-0.26, p=0.037). Contact within the ETO was higher in the reconstitution group (31±4.2 mm vs. 14±4.4 mm for scaffolding, p=0.001) but did not correlate with subsidence. Logistic regression demonstrated bicortical contact >30 mm below ETO as a protective against significant subsidence (OR=0.12, p<0.001). Re-revision and reoperation rates were similar between groups.

Subgroup analysis showed reconstitution patients with a healed ETO (e.g., in 2-stage periprosthetic joint infection revisions) had lower subsidence (4.0 ± 1.1 mm) compared to those with a fresh ETO (9.1 ± 2.4 mm). ETO union rates were high (94.0%) and similar between groups.

DISCUSSION AND CONCLUSION: Both scaffolding and reconstitution techniques are effective for managing the ETO fragment during rTHA with TSTS. However, the scaffolding technique offers superior distal fixation and reduced subsidence in fresh osteotomies. The reconstitution technique yields similar outcomes when the ETO has healed as part of a two stage exchange. Achieving robust bicortical contact >3cm distal to the transverse limb of the osteotomy is critical for minimizing stem subsidence, regardless of closure technique.

Table 1.

Patient Demographics

Variable	Overall (n = 66)	Reconstitution (N = 35)	Scaffolding (N = 31)	P-Value
Age	65.3±11.4	64.4±13.5	66.4±8.6	0.781
Gender				0.237
Male	37 (56.1%)	22 (62.9%)	15 (48.4%)	
Female	29 (43.9%)	13 (37.1%)	16 (51.6%)	
BMI (kg/m^2)	28.2±7.2	26.6±7.3	29.7±6.8	0.378
Indication for Revision				0.001
Aseptic Loosening	17 (25.8%)	7 (20.0%)	10 (32.3%)	
Periprosthetic Fracture	3 (4.5%)	0 (0%)	3 (9.7%)	
Periprosthetic Joint Infection	22 (33.3%)	21 (60.0%)	1 (3.2%)	
Polywear & Osteolysis	11 (16.7%)	4 (11.4%)	7 (22.6%)	
ALTR/Metallosis	1 (1.8%)	0 (0%)	1 (3.2%)	
Fractured Femoral Component	9 (13.6%)	2 (5.7%)	7 (22.6%)	
Other	3 (4.5%)	1 (2.9%)	2 (6.4%)	
Paprosky Bone Loss				0.548
1	0 (0%)	0 (0%)	0 (0%)	
2	36 (54.5%)	23 (65.7%)	13 (41.9%)	
3A	24 (36.4%)	9 (25.7%)	15 (48.4%)	
3B	6 (9.1%)	3 (8.6%)	3 (9.7%)	
Weight Bearing Precautions				0.228
Weight Bearing as Tolerated	6 (9.1%)	5 (14.2%)	1 (3.2%)	
Partial Weight Bearing	21 (31.8%)	8 (22.9%)	13 (41.9%)	
Toe-Touch Weight Bearing	38 (57.6)	22 (62.9%)	16 (51.7%)	
Non-Weight Bearing	1 (1.5%)	0 (0%)	1 (3.2%)	
Follow-up (Months)	19.7±11.8	18.0±10.3	21.7±11.6	0.169

Table 2. Data on Implanted Femoral Stems

Variable	Overall (N = 66)	Reconstitution (N= 35)	Scaffolding (N=31)	p- value
Femoral Stem				<0.001
Restoration	30 (45.5%)	11 (36.7%)	19 (63.3%)	
Redapt	24 (36.4%)	21 (87.5%)	3 (12.5%)	
Arcos	11 (16.7%)	2 (18.2%)	9 (81.8%)	
Alteon Monobloc	1 (1.5%)	1 (100%)	0 (0%)	
Mean stem diameter	17±2 (12-24)	17±1 (12-21)	17± (12-24)	0.622
Mean stem Length	203±42 (150-300)	215 ± 6 (150-300)	189± 7 (150-300)	0.002
Trochanteric Plate Use	9 (13.6%)	2 (22.2%)	7 (77.8%)	0.072

Table 3. Clinical and Radiographic Outcomes

	Overall (n=66)	Reconstitution (N = 35)	Scaffolding (N = 31)	P-Value
Mean Subsidence (mm)	5.2±3.2	6.0±3.6	4.3±2.9	0.995
Subsidence > 5mm	21 (31.8%)	11 (31.4%)	10 (32.3%)	0.958
Bicortical Contact (mm)	61±4.1	59±5.2	64±6.5	0.482
Above ETO	23±3.2	31±4.2	14±4.4	**0.001**
Below ETO	38±3.8	28±4.8	50±5.4	**0.002**
ETO Union Rate (%)	(94.0%%)	34 (97.1%)	28 (90.3%)	0.246
All cause reoperation	14 (21.2%)	5 (14.3%)	9 (29.0%)	0.332
Periprosthetic Joint Infection	2 (3.0%)	0 (0.0%)	3 (9.7%)	
Periprosthetic Fracture	4 (6.1%)	1 (2.9%)	1 (3.2%)	
Fractured Femoral Stem	2 (3.0%)	0 (0.0%)	2 (6.5%)	
Aseptic Loosening	1 (1.5%)	1 (2.9%)	0 (0.0%)	
Instability	2 (3.0%)	1 (2.9%)	1 (3.2%)	
Subsidence/LLD	2 (3.0%)	1 (2.9%)	1 (3.2%)	
Superficial Surgical Site Infection	1 (1.5%)	0 (0.0%)	1 (3.2%)	
Trochanteric Plate Failure	1 (1.5%)	1 (2.9%)	0 (0.0%)	
Femoral component re-revision	7 (10.6%)	3 (8.6%)	4 (12.9%)	0.554

Table 4: Reconstruction Subgroup Analysis Comparing Septic vs. Aseptic Cases

	Septic (n= 21)	Aseptic (n = 14)	P - value
Mean contact length below ETO	31.7 ± 7.4	22.1±4.9	0.646
Mean subsidence	4.0±1.1	9.1±2.4	0.179