Trends in Quality of Cementation for Total Hip Arthroplasty over 5 years at an Academic Orthopaedic Hospital

Ittai Shichman, Christian Thomas Oakley, Geidily Beaton, Spencer Alexander Ward, Vinaya Rajahraman[1], Roy Davidovitch[2], Ran Schwarzkopf[3], Joshua Craig Rozell
[1]NYU Langone, [2]NYU Langone Orthopedic Surgery, [3]NYU Langone Orthopedic Hospital, Hospital For Joi

INTRODUCTION:
Femoral stem cementation provides excellent implant longevity with a low periprosthetic fracture rate among patients with compromised bone quality or abnormal anatomy. Limited literature exists concerning the learning curve for femoral stem cementation in total hip arthroplasty (THA). We radiologically evaluated the quality of the femoral cement mantle in patients undergoing THA to examine whether cementation quality improved with increased institutional experience.
METHODS:
A retrospective study of 542 THAs performed using cemented, tapered stems from 2016 to 2021 at a high-volume orthopaedic specialty center was conducted. Immediate postoperative anterior-posterior (AP) and lateral radiographs were evaluated to assess cement mantle quality based on the Barrack classification. Cement mantles were deemed satisfactory (Barrack A and B) or unsatisfactory (Barrack C and D). Multivariate regression was performed to identify predictors of unsatisfactory cementation quality.
RESULTS:
The annual cemented THA volume has increased through the study period from 14 cases in 2016 to 201 cases in 2021. Overall, the majority of cement mantles were deemed satisfactory; 91.7% on AP radiographs and 91.0% on Lateral radiographs. In multivariate regression, satisfactory cementation on AP radiograph achievement rates improved during the study period, which coincided with greater annual volume ($p<0.001$). Compared to the posterior approach, the direct anterior (odds ratio [OR], 2.34) and lateral approaches (OR, 6.85) were associated with significantly higher odds of unsatisfactory cementation quality on an AP radiograph. Additionally, patient baseline characteristics and the use of collared stems and cement restrictors were not associated with cementation quality.
DISCUSSION AND CONCLUSION:
During primary THA, the majority of femoral stems had satisfactory cementation quality. Higher institutional annual cemented THA volume is associated with improved cementation quality. Residency and fellowship training programs should place greater emphasis on the importance of femoral stem cementation for the appropriately indicated patient. Surgical approach should also be considered while performing cemented THA.

Table 1. Demographics variables

	Overall (n=542)
Female- no. (%)	445 (82.1)
Age (years)	77.1±8.0
BMI (kg/m²)	26.9±5.5
Laterality- no. (%)	
Right	295 (54.4)
Left	247 (45.6)
Race- no. (%)	
White	455 (83.9)
African American	38 (7.0)
Asian	6 (1.1)
Other	43 (7.9)
ASA- no. (%)	
1	14 (2.6)
2	282 (52.0)
3	215 (39.7)
4	31 (5.7)
Smoking Status- no. (%)	
Current	13 (2.4)
Former	217 (40.0)
Never	312 (57.6)

Table 2. Cementation quality stratified by surgical year

	Overall (n=542)	2016 (n=14)	2017 (n=19)	2018 (n=69)	2019 (n=93)	2020 (n=146)	2021 (n=201)	P-value
Anterior-Posterior – no. (%)								**<.001***
A	198 (36.5)	1 (7.1)	4 (21.1)	18 (26.1)	48 (51.6)	45 (30.8)	82 (40.8)	
B	299 (55.2)	5 (35.7)	13 (68.4)	46 (66.7)	37 (39.8)	87 (59.6)	111 (55.2)	
C	45 (8.3)	8 (57.1)	2 (10.5)	5 (7.2)	8 (8.6)	14 (9.6)	8 (4.0)	
D	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Lateral – no. (%)								0.117
A	187 (34.5)	5 (35.7)	5 (26.3)	18 (26.1)	36 (38.7)	49 (33.6)	74 (36.8)	
B	306 (56.5)	8 (57.1)	13 (68.4)	46 (66.7)	44 (47.3)	78 (53.4)	117 (58.2)	
C	49 (9.0)	1 (7.1)	1 (5.3)	5 (7.2)	13 (14.0)	19 (13.0)	10 (5.0)	
D	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	

Table 3. Multivariate regression assessing predictors of unsatisfactory cementation quality (values expressed as odds ratio [95% confidence interval])

	Unsatisfactory AP Cementation	P-value	Unsatisfactory Lateral Cementation	P-value
Left (vs. Right)	0.95 (0.49-1.86)	0.877	1.15 (0.62-2.11)	0.663
Male (vs. Female)	1.44 (0.64-3.24)	0.382	1.55 (0.76-3.16)	0.232
Age	1.03 (0.98-1.08)	0.250	1.02 (0.98-1.06)	0.409
BMI	0.97 (0.91-1.04)	0.435	0.96 (0.91-1.02)	0.212
Smoking Status				
Never	-	-	-	-
Former	1.92 (0.95-3.86)	0.069	**2.50 (1.32-4.76)**	**0.005***
Current	3.38 (0.55-20.95)	0.190	3.19 (0.60-16.92)	0.174
Race				
White	-	-	-	-
Black	1.35 (0.29-6.20)	0.699	0.32 (0.04-2.47)	0.276
Asian	8.83 (0.86-91.11)	0.067	2.55 (0.26-25.04)	0.422
Surgical Year	**0.65 (0.51-0.84)**	**0.001***	0.97 (0.76-1.24)	0.819
Restrictor Use	0.66 (0.22-1.97)	0.451	1.00 (0.32-3.12)	0.994
Collared Stem	1.46 (0.44-4.88)	0.537	1.83 (0.62-5.38)	0.272
Surgical Approach				
Posterior	-	-	-	-
Direct Anterior	**2.34 (1.05-5.21)**	**0.037***	1.35 (0.67-2.71)	0.404
Direct Lateral	**6.85 (2.50-18.73)**	**<0.001***	2.44 (0.92-6.46)	0.073

AP, anterior-posterior; BMI, body mass index; vs. versus