Comparative Analysis and Accuracy of Surgeon- and Prosthesis Manufacturer-Generated Radiographic Templates in Total Hip Arthroplasty

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INTRODUCTION: Preoperative templating in total hip arthroplasty (THA) enhances the accuracy and predictability of surgical outcomes. Recently, industry-led initiatives have allowed companies to start templating THAs in addition to the surgeon's standard preoperative templating plans. However, the accuracy of these industry-generated templates has yet to be evaluated.

METHODS: All THAs occurring between October 2023 and September 2024 performed by two orthopaedic surgeons at one site were retrospectively reviewed. Surgeon-generated templates and prosthesis manufacturer (PM)-generated templates (Advance Case Management, Depuy, Warsaw, IN) were collected for comparison. Data including actual implanted components and patient sex and body mass index (BMI) were collected. Accuracy of acetabular and femoral component sizes, as well as femoral offset, was analyzed between the two cohorts using $\chi 2$, with significance at $P<.05$. Additional subgroup analyses with respect to accuracy and BMI or sex were conducted. This study was approved by the IRB committee.

RESULTS: A total of 306 surgeon templates and 240 PM templates were analyzed, with 166 and 123 females, respectively. The surgeon templates identified the exact size of the acetabular and femoral components in 45.1 and 28.4% of cases, respectively (Table 1). PM templates identified the exact size of the acetabular and femoral components in 33.8 and 35.0% of cases, respectively. There was no significant difference between surgeon and PM templates when comparing the proportion of templates that matched implanted components within zero, one, two, three, or greater than three sizes (acetabular: P=0.09; femoral: P=0.08). Statistical significance was observed upon offset prediction accuracy between the surgeon and PM (83.7 v 73.3%, respectively; P=0.003). Subgroup analyses revealed a statistically significant association between surgeon stem accuracy and patient BMI (P<0.001).

DISCUSSION: PM templating demonstrated a promising ability to predict implant sizes in THA, achieving nondifferent results of the femoral and acetabular component to high volume, fellowship-trained arthroplasty surgeons. Application of this system will help vendors optimize inventory management to ensure hospitals are adequately supplied.

SIGNIFICANCE/CLINICAL RELEVANCE: For certain instances, surgeons may depend on PM templating, and it is vital, particularly with some approaches and techniques, that the template is dependable. Other patient-specific implications include predicting the correct size so as to minimize operating room traffic while the wound is open.

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TABLES:

Table 1: Templating Accuracy and Mismatch of Surgeon and Device Manufacturer by Component and Offset.

	Acetabular		*Femoral*		*Offset*	
Variable	Surgeon (%)	PM (%)	Surgeon (%)	PM (%)	Surgeon (%)	PM (%)
n=	306	240	306	240	306	240
Exact Match	138 (45.1)	81 (33.8)	87 (28.4)	84 (35.0)	256 (83.7)	176 (73.3)
Match within ±1 size	250 (81.7)	188 (78.3)	240 (78.4)	177 (73.8)	-	-
Match within ±2 sizes	289 (94.4)	223 (92.9)	294 (95.4)	231 (96.3)	-	-
Match within ±3 sizes	304 (99.3)	236 (98.3)	305 (99.0)	239 (99.6)	-	-
P-value	.09		.08		**.0003**	

Note: Bold P-values designate statistical significance.

Abbreviations: PM=prosthesis manufacturer.