Evaluation of Early Motion based on Total Knee Arthroplasty Polyethylene Inserts: Is Posterior Stabilized Superior?

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INTRODUCTION: Contemporary total knee arthroplasty (TKA) design and utilization are controversial, with a variety of polyethylene options with differing levels of constraint and methods for achieving femoral rollback. We sought to evaluate recovery curves following TKA based on polyethylene design, with the hypothesis that there would be no difference in recovery of motion.

METHODS:

Prospective data collection from a multicenter MyMobility study was retrospectively queried. Patients who had a posterior stabilized (PS), cruciate retaining (CR), or ultra-congruent (UC) liner were included. Patients without preoperative range of motion and unicompartmental arthroplasties were excluded. Patients were stratified by polyethylene insert design and recovery curves evaluated at each follow-up time interval with univariable and multivariable analyses.

RESULTS: A total of 1,782 patients (875 CR, 806 PS, and 101 UC) were included with mean age 65 years and 62% female sex. Preoperative flexion was worse in PS knees compared to CR and UC ($p<0.01$) with significantly worse arc of motion ($p<0.01$). At 1-month postoperative, PS knees demonstrated improved arc of motion and flexion compared to CR ($p<0.01$) but not UC ($p=0.32$). At 3 months postoperative, this difference remained (PS vs. CR: $p<0.01$; PS vs. UC $p=0.885$), though lessened. Multivariable regression controlling for age, sex, BMI, and preoperative arc of motion demonstrated improved motion arc at 1 month for PS (Beta=10, 95%CI 8.3-11.8; $p<0.01$) and UC (Beta=8.5, 95%CI 4.7-12.1, $p<0.01$) relative to CR, which remained significant for PS at 3 months (Beta=2.2, 95% CI 0.8-3.7, $p<0.01$). There was no difference in KOOS scores at any timepoint.

DISCUSSION AND CONCLUSION: Despite a worse preoperative motion, PS designs (and UC) demonstrated improved motion early postoperatively relative to CR. The differences lessened over time and it is unclear if any long-term differences remained. Further evaluation of other contemporary designs including medial pivot/stabilized is warranted.

Demographic	PS (n=806)	CR (n=875)	Ultra (n=101)	p-value
Age (years)	66 (61, 72)	65 (59, 70)	65 (60, 71)	**<0.001**
Female Sex	495(61.4%)	549(62.7%)	63(62.4%)	0.853
BMI (kg/m²)	30.1 (26.4, 34.9)	30.0 (26.6, 34.4)	30.8 (27.6, 35.7)	0.315
Alignment Pre-op				0.832
Neutral	439 (54.5%)	451 (52.3%)	50 (49.5%)	
Varus	239 (29.7%)	272 (31.5%)	34 (33.7%)	
Valgus	128 (15.9%)	140 (16.2%)	17 (16.8%)	

Range of Motion	PS (n=806)	CR (n=875)	Ultra (n=101)	p-value
Pre-op flexion	115 (110, 120)	120 (110, 130)	120 (110, 125)	**<0.001**
Pre-op extension	3 (0, 5)	0 (0, 5)	0 (0, 5)	0.094
Pre-op arc	112 (105, 120)	115 (105, 125)	115 (106, 120)	**<0.001**
1-month motion				
Flexion	115 (100, 120)	103 (90, 115)	115 (100, 120)	**<0.001**
Extension	0 (0, 5)	2 (0, 5)	3 (0, 5)	**<0.001**
Arc	100 (112, 120)	100 (90, 110)	110 (95, 115)	**<0.001**
3-month motion				
Flexion	120 (115, 125)	120 (110, 125)	120 (115, 125)	**0.002**
Extension	0 (0, 2)	0 (0, 3)	0 (0, 3)	0.276
Arc	120 (110, 125)	118 (110, 123)	120 (113, 125)	**0.003**

Patient Reported Outcome	PS (n=806)	CR (n=875)	Ultra (n=101)	p-value
Pre-op KOOS	52.5 (44.9, 59.4)	52.5 (44.9, 59.4)	50.0 (44.9, 59.4)	0.774
1 month KOOS	63.8 (57.1, 68.3)	63.8 (57.1, 68.3)	61.6 (54.8, 68.3)	0.747
3 month KOOS	70.7 (63.8, 76.3)	70.7 (61.6, 76.3)	68.3 (63.8, 76.3)	0.176
6 month KOOS	73.3 (66.0, 84.6)	73.3 (66.0, 84.6)	76.3 (68.3, 84.6)	0.909
1 year KOOS	79.9 (70.7, 92.0)	79.9 (70.7, 92.0)	84.6 (76.3, 92.0)	0.134