

Surgeons Experience More Physiologic Strain in Revision than Primary Total Joint Arthroplasty

Irfan Ali Khan¹, Colin Baker, Justin A Magnuson¹, Sophia Moody, Paul Maxwell Courtney, Chad A Krueger, Jess H Lonner¹

¹Rothman Orthopaedic Institute

INTRODUCTION: Revision total joint arthroplasty (rTJA) procedures are inherently more complex than primary TJA (pTJA), but their physiologic burden to the surgeon has not been quantified. While rTJA has longer operative times, it is unknown whether differences exist in cardiorespiratory stress and strain when compared to pTJA. The purpose of this study was to determine whether there is a difference in surgeon physiological response while performing rTJA compared to pTJA. We hypothesized that rTJA would be associated with increased cardiorespiratory strain compared to pTJA.

METHODS:

A prospective cohort study was performed at a tertiary academic practice. Two high-volume fellowship-trained arthroplasty surgeons wore a smart vest that recorded cardiorespiratory data while performing primary and revision total hip and knee arthroplasty. Heart rate (beats/minute), stress index (correlates with sympathetic activation), respiratory rate (respirations/minute), minute ventilation (liters/minute), and energy expenditure (Calories) were collected for every case. Other variables included patient body mass index (BMI; kilograms/meter²) and working operative time (minutes). Student t-tests were used to assess for differences between the two groups.

RESULTS: Among 70 consecutive cases (35 primary TJAs and 35 revision TJAs), patient BMI was significantly lower in the rTJA group [29.2 vs. 31.9; p = 0.037]. While performing rTJA, compared to performing pTJA, surgeons had a significantly higher working operative time [62.5 vs. 52.1; p = 0.020], heart rate [103.1 vs. 100.1; p = 0.021], stress index [16.1 vs. 14.4; p = 0.024], energy expenditure [421.1 vs. 300.3; p < 0.001], and energy expenditure per operative minute [6.9 vs. 5.8; p < 0.001] (Table 1).

DISCUSSION AND CONCLUSION: Surgeons experience significantly higher physiological stress and strain when performing rTJA compared to pTJA. In light of these findings, surgeons should consider case schedule and adequate nutritional preparation when performing rTJA. Additionally, arthroplasty surgeons should be appropriately compensated for their time and effort when performing rTJA.

Table 1: Stress and Strain Data for Primary TJA versus Revision TJA

Variables	Primary TJA N = 35	Revision TJA N = 35	P-Value
Patient Age	67.9 (8.3)	67.6 (10.5)	0.929
Patient BMI	31.9 (4.9)	29.2 (5.7)	0.037
Type of Surgery			0.092
Hip	12 (34.3%)	19 (54.3%)	
Knee	23 (65.7%)	16 (45.7%)	
Operative Limb			0.339
Right	20 (57.1%)	16 (45.7%)	
Left	15 (42.9%)	19 (54.3%)	
Operative Time	52.1 (12.6)	62.5 (22.4)	0.020
Stress Index	14.4 (3.1)	16.1 (2.7)	0.024
HRV	12.2 (1.7)	11.1 (1.6)	0.006
HR	100.1 (5.4)	103.1 (5.0)	0.021
RR	18.8 (2.1)	19.8 (2.1)	0.065
MV (L/min)	22.0 (4.3)	23.6 (3.9)	0.153
Calories	300.3 (73.9)	421.1 (132.9)	<0.001
Calories/Min	5.8 (1.0)	6.9 (0.9)	<0.001
Calories/Hour	349.1 (61.2)	411.1 (53.4)	<0.001

¹Legend: TJA = total joint arthroplasty; THA = total hip arthroplasty; TKA = total knee arthroplasty; BMI = body mass index; HRV = heart rate variability; HR = heart rate; RR = respiratory rate; MV = minute ventilation; L/min = liters per minute. All values reported as mean (standard deviation) or count (percentage).