Body Composition Changes Following Revision Total Joint Arthroplasty

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DISCLOSURES:

INTRODUCTION: Although total joint arthroplasties (TJA) are of the most successful surgeries in medicine, occasionally replacements fail and subsequently require revision surgery. Most commonly, this is due to infection, instability, fractures, or stiffness of the replaced joint. By comparison, revision TJAs are highly physically taxing events for patients to endure since they require a larger incision, specialized equipment, a more complicated procedure, and a lengthier recovery. Hence, one would expect to observe more dramatic consequences to a revision patient's body, ultimately diminishing their functional capacity and further complicating their recovery. Insights regarding this impact can be investigated through the use of bioimpedance analysis (BIA) to collect and follow body composition data such as skeletal muscle mass (SMM), percent body fat (PBF), phase angle (PA), and more. It is assumed that patients with a less favorable baseline body composition more often require a revision TJA following a primary TJA. The purpose of this study is to identify the baseline body composition parameters of revision TJA patients to contrast with a similar cohort undergoing primary TJAs. Further, this study aims to quantify the consequences of revision TJAs on patients' body composition and overall functional capacity. Insights gained from this study can be leveraged to guide clinical decision making for patients undergoing primary and revision TJAs.

METHODS: This prospective cohort study, which was approved by our institution's IRB, aims to enroll 100 participants undergoing revision TJA surgery. Body composition data is obtained via BIA pre-operatively and at each post-operative follow-up visit (3 weeks, 6 weeks, 12 weeks, 6 months, and 1 year). Additionally, maximal hand grip strength (HGS) is collected at the same intervals and is used as a surrogate measure for skeletal muscle function. Data is evaluated in comparison to pilot data on a similar cohort of patients who underwent primary TJA. Furthermore, retrospective review of BIA data in patients schedule to undergo revision BIA was reviewed. Primary outcomes for this study include baseline and changes in SMM, PBF, PA, and HGS. Secondary outcomes include baseline and changes in weight, skeletal muscle index (SMI), and body fat mass (BFM). Descriptive statistics and t-tests were calculated for body composition metrics of interest for each population with significance set at $\alpha = 0.05$.

RESULTS SECTION: To date, 12 subjects undergoing revision TJAs have been enrolled. 10 subjects have completed their pre-operative scan and HGS test, 2 subjects have completed their 3- and 6-week follow up visits. 34 additional patients were retrospectively reviewed for baseline analysis. The two patients who did not complete baseline measurements have been excluded from further analysis. The pilot study, to which this data is being compared, enrolled 84 subjects undergoing primary TJAs. Current analysis shows that the primary and revision cohorts shared similar baseline SMM (p = 0.23), PBF (0.28), SMIT (0.30), and PA (0.19). Additionally, 6-week postoperative analysis shows that weight decreased postoperatively in the primary cohort but increased in the revision cohort (p < 0.01). Further, the revision cohort demonstrated a much more dramatic decrease in SMM (0.28) and increase in PBF (0.27) than did the primary cohort on 6-week follow up. Finally, analysis shows the revision cohort had much larger reductions in hand grip strength 3-week (0.04) and 6-week (0.13) follow up compared to the primary cohort.

DISCUSSION: Baseline analysis has not yet revealed any dramatic differences between these two populations. The revision population has demonstrated similar baseline measures of SMM, BFM, PBF, SMI, weight, and PA without statistical significance. Despite lack of significance, PA, a measure of cellular health, trended lower in revision patients. This may indicate that the primary population has more favorable overall biological health and cell integrity than that of the revision population. Although the dataset remains in its infancy, preliminary results have begun revealing the dramatic impact felt by patients undergoing revision TJAs as compared to those undergoing primary TJAs. While both primary and revision populations experienced a 6-week post-operative decline in skeletal muscle mass, for example, the revision population did so to a much greater degree. Further, while the primary population had almost no change in their body fat percentage post-operatively, the revision population has experienced a dramatic increase in their body fat percentage. These two body composition parameters, in particular, are thought to be key players in a successful surgical recovery and in quality of life beyond recovery. However, despite current results demonstrating multiple substantial differences in these populations, limited conclusions should be drawn until sufficient data has been obtained.

SIGNIFICANCE/CLINICAL RELEVANCE: Conclusions drawn from this study can be used to inform clinicians and their patients on the impact revision TJAs have on physical health and in doing so will once again demonstrate the clinical utility of bioimpedance technology for orthopedic clinical practice.

TABLES AND FIGURES:

Table 1: Mean baseline body composition parameters for primary and revision subjects w/ SD and p values. *Denotes statistical significance*

	Weight (kg)	SMM (kg)	SMM (%)	BFM (kg)	PBF (%)	SMI (kg/m^2)	PA (°)
Primary (n=84)	98.9 ± 25.3	31.6 ± 8.3	32.2 ± 5.7	41.6 ± 17.0	41.1 ± 10.0	8.4 ± 1.5	4.8 ± 0.9
Revision (n=46)	102.3 ± 26.6	33.6 ± 9.8	33.2 ± 5.9	40.8 ± 16.5	39.1 ± 10.3	8.7 ± 1.8	4.6 ± 0.9
p	0.48	0.23	0.36	0.80	0.28	0.30	0.19

Table 2: Mean change by 6-week follow up in body composition parameters for primary and revision subjects w/ SD and p values.

	Δ Weight (%)	Δ SMM (%)	Δ PBF (%)	Δ PA (%)
Primary (n=69)	-0.76 ± 2.66	-0.18 ± 0.97	-0.01 ± 1.72	-2.61 ± 4.92
Revision (n=2)	0.62 ± 0.24	-3.16 ± 2.00	5.19 ± 3.38	-4.08 ± 9.94
p	0.0013*	0.28	0.27	0.87

Table 3: Mean baseline HGS and mean change in HGS by 3 and 6-week follow up for primary and revision subjects w/ SD and p values.

	Baseline HGS	n	Δ$_{3wk}$ HGS	n	Δ$_{6wk}$ HGS	n
Primary	27.3 ± 9.8	84	0.8 ± 4.5	58	-0.3 ± 4.8	30
Revision	31.0 ± 13.7	12	-6.0 ± 7.0	3	-5.7 ± 6.2	2
p	0.22		0.042*		0.13	