What Threshold of Range of Motion Is Associated with Minimal Gain in Patient-Reported Outcome Scores after Total Shoulder Arthroplasty?

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INTRODUCTION: Satisfaction following shoulder arthroplasty (TSA) is partially dependent upon restoring shoulder range of motion (ROM). Patient-reported outcome measures (PROMs) are commonly used in orthopaedics to assess outcomes and have been validated to reflect patient satisfaction. There may exist a minimum amount of ROM necessary to perform functional tasks queried in PROM questionnaires, beyond which further ROM may provide no further improvement in PROMs or patient satisfaction. The purpose of this study was to identify the threshold of postoperative ROM after TSA that is associated with minimal gain in PROMs at minimum 2-year follow up.

METHODS: A retrospective review of a multicenter international shoulder arthroplasty database was performed between 1999-2020 for patients undergoing anatomic or reverse TSA (aTSA and rTSA) with minimum 2-year follow up. Shoulders were excluded for a preoperative diagnosis of nerve injury or periprosthetic fracture. Our primary outcome was to determine the threshold in postoperative active ROM (abduction, forward elevation [FE], external rotation [ER], and internal rotation [IR] score) whereby additional improvement was not associated with additional improvement in PROMs (Simple Shoulder Test [SST], American Shoulder and Elbow Surgeons [ASES] score, and the Shoulder Pain and Disability Index [SPADI]). For comparison, we also performed the analysis for the Shoulder Arthroplasty Smart (SAS) score. Piecewise two-segment continuous linear regression models were iteratively fitted to identify the threshold in each postoperative ROM measure that was associated with no further improvement in each outcome score.

RESULTS: We included 10,318 TSAs (4,770 aTSAs, 5,548 rTSAs) with minimum 2-year follow up (mean, 51.4±28.8 months). The threshold in postoperative active abduction associated with no further improvement ranged from 110-114° for PROMs versus 163° for the SAS score. The threshold in postoperative active FE associated with no further improvement ranged from 144-153° for PROMs versus 177° for the SAS score. The threshold in postoperative active ER associated with no further improvement ranged from 50-52° for PROMs versus 76° for the SAS score. The threshold in postoperative IR score associated with no further improvement was 5 points for all PROMs versus 7 points for the SAS score. Out of 8,742 TSAs with complete postoperative ROM data (3,934 aTSA, 4,808 rTSA), 11.4% (n=999) achieved or exceeded all ROM thresholds (18.6% [n=732] aTSAs, 5.6% [n=267] rTSAs).

DISCUSSION AND CONCLUSION: Our findings demonstrate that ROM exceeding 114° of abduction, 153° of FE, 52° of ER, and IR to L1 is associated with minimal additional improvement in PROMs. These results can help surgeons prioritize intraoperative decision making and physical therapists tailor postoperative rehabilitation regimens.