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Comparison of reverse total shoulder arthroplasty outcomes with and without subscapularis repair

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Background: Repair of the subscapularis with reverse total shoulder arthroplasty (rTSA) is controversial. The purpose of this study is to quantify rTSA outcomes in patients with and without subscapularis repair to determine if there is any impact on clinical outcomes.

Methods: Three hundred forty patients received rTSA and had the subscapularis repaired, whereas 251 patients received rTSA and did not have the subscapularis repaired. The patients were scored preoperatively and at latest follow-up using the Simple Shoulder Test; University of California, Los Angeles; American Shoulder and Elbow Surgeons; Constant; and Shoulder Pain and Disability Index metrics. Motion was also measured. Mean follow-up was 37 months.

Results: All patients showed significant improvements in pain and function after treatment with rTSA. For both cohorts, American Shoulder and Elbow Surgeons and Constant scores significantly improved, as did range of motion. The repaired cohort had significantly higher postoperative scores as measured by 4 of the 5 metrics and significantly more internal rotation, whereas the non-repaired cohort had significantly more active abduction and passive external rotation. The complication rate was 7.4% (0% dislocations) for the subscapularis-repaired cohort and 6.8% (1.2% dislocations) for the non-subscapularis-repaired cohort.

Conclusions: Significant clinical improvements were observed for both the subscapularis-repaired and non-repaired cohorts, with some statistical differences observed using a variety of outcome measures. Repair of the subscapularis did not lead to inferior clinical outcomes as predicted by biomechanical models. No difference was noted in the complication or scapular notching rates between cohorts. These clinical results show that rTSA using a lateralized humeral prosthesis delivers reliable clinical improvements with a low risk of instability, regardless of subscapularis repair.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

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Keywords: Shoulder; arthroplasty; reverse; subscapularis; dislocation; complications

Approved by the Medical University of South Carolina Institutional Review Board (protocol MS1_Pro00030914).

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Reverse total shoulder arthroplasty (rTSA) has been used in the United States since 2003 to treat a variety of shoulder conditions, with good to excellent results in the vast majority of patients.^{4,14} This has been accomplished with 3 basic

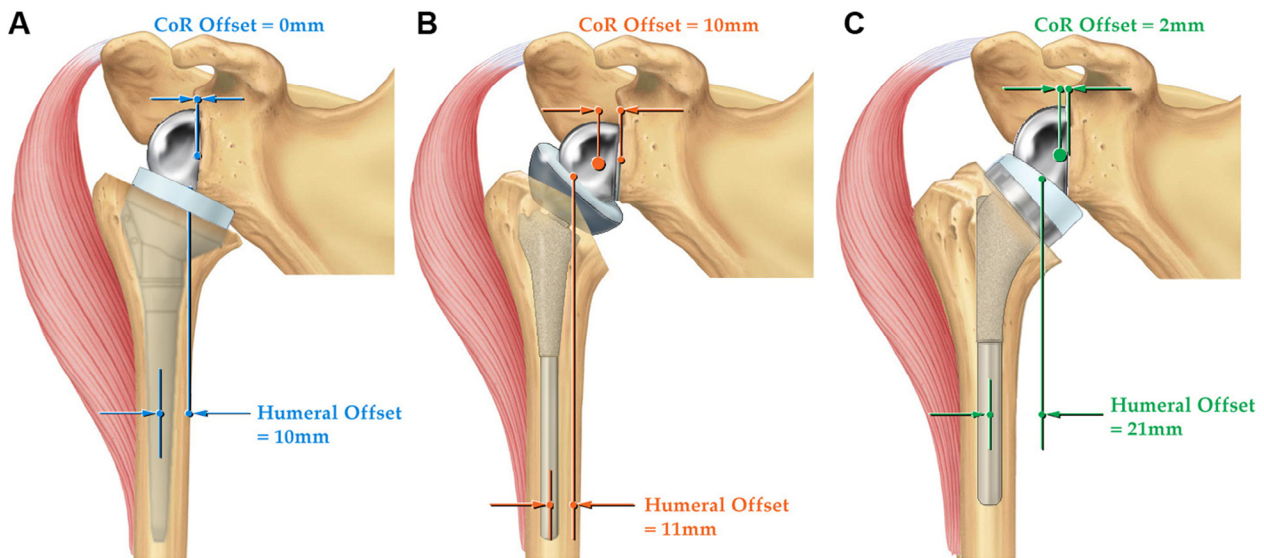


Figure 1 Drawings showing the differences among 3 different types of reverse total shoulder arthroplasty and the location of both the center of rotation (CoR) and the relative lateral displacement of the humerus based on the design of the implant: Grammont Delta III Reverse Shoulder, Depuy, Warsaw, IN (medial glenoid and medial humerus) (A), RSP Reverse Shoulder, DJO Surgical, Austin, TX (lateral glenoid and medial humerus) (B); and Equinox Reverse Shoulder (medial glenoid and lateral humerus) (C). Reprinted from: Routman HD, Flurin PH, Wright T, Zuckerman J, Hamilton M, Roche C. Reverse shoulder arthroplasty prosthesis design classification system. *Bull Hosp Jt Dis* 2015;73(Suppl 1):S5-14. With permission.

different prosthetic designs that influence the biomechanics of the shoulder and potentially the functional outcomes of the arthroplasty (Fig. 1). However, it remains controversial whether the subscapularis should be repaired or not in rTSA. Some studies have suggested that the risk of instability is increased if the subscapularis is not repaired with a prosthetic design that medializes the center of rotation and position of the humerus relative to the glenoid.³ Edwards et al³ reported a 5.1% dislocation rate with the Grammont prosthesis and concluded that the relative rate of dislocation with rTSA is doubled if the subscapularis is not repaired. Other studies have not found an increased risk of instability or complications if the subscapularis is not repaired using a prosthesis that lateralizes the center of rotation.² Clark et al² reported a 4.1% dislocation rate with the Reverse Shoulder Prosthesis (DJO, Vista, CA, USA), where 5.5% dislocations were reported for patients with the subscapularis repaired and 3.1% without repair. In addition, there are biomechanical studies that have reported that not repairing the subscapularis requires significantly less force to be generated by the deltoid and the posterior rotator cuff throughout arm abduction.⁶ If the subscapularis was repaired, the joint reaction force increased by 28%, the required deltoid force increased by 14%, and the required posterior rotator cuff force increased by 34%.⁶ Subscapularis repair is likely a function of prosthesis design and the position of the humerus relative to the glenoid center of rotation.

Reasons for repairing the subscapularis include anatomic preservation of a functioning rotator cuff muscle, an increased potential for internal rotation and therefore improved function, improved joint protection with better closure

of the joint, and improved stability of the arthroplasty. Theoretical reasons for not repairing the subscapularis include the following: it may be biomechanically unfavorable for deltoid function because with rTSA, the subscapularis functions as an adductor instead of an abductor as with an anatomic total shoulder arthroplasty, thus counteracting the work of the deltoid; it may be biomechanically unfavorable for the posterior rotator cuff as there are only 2 external rotators in the body that are often compromised, and not repairing the subscapularis minimizes the force required by these muscles to generate external rotation; and it may be unnecessary for stability in rTSA designs that lateralize the humerus, better tension the posterior rotator cuff, and improve deltoid wrapping.^{6,9,10}

Clearly, the issue regarding repairing the subscapularis in rTSA is unclear, with few data in the literature to guide the clinician on what is most appropriate to achieve the best possible clinical outcome for the patient. The purpose of this study, therefore, is to determine if not repairing the subscapularis affects the clinical outcomes as measured by a variety of outcome scoring metrics and range of motion. The null hypothesis is that not repairing the subscapularis does not affect clinical outcomes as measured by range of motion and outcome scoring metrics.

Materials and methods

A multinational database was analyzed to quantify rTSA outcomes in patients with and without subscapularis repair, with a minimum follow-up of 24 months, to determine if repair has any impact on outcomes with a modern rTSA lateral humerus prosthesis design. Preoperative and postoperative data were analyzed from

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