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Comparison between Anatomic Total Shoulder Arthroplasty and Reverse Shoulder Arthroplasty for Older Adults with Osteoarthritis without Rotator Cuff Tears

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Background: Many older adults with glenohumeral osteoarthritis without rotator cuff tears experience muscle atrophy and fatty degeneration. In these cases, range of motion (ROM) recovery and clinical results after total shoulder arthroplasty (TSA) could be poor, with low subjective satisfaction after surgery. The purpose of this study was to compare the clinical outcomes of anatomic TSA and reverse shoulder arthroplasty (RSA) in patients aged over 70 years with primary glenohumeral osteoarthritis without rotator cuff tears. We hypothesized that the clinical outcomes of anatomical TSA would be better than those of RSA.

Methods: This single-center, retrospective comparative study involved patients who underwent TSA or RSA from 2013 to 2020. Clinical outcomes were assessed using the American Shoulder and Elbow Surgeons (ASES) score, Constant-Murley score, and active ROM preoperatively and at the follow-up. Walch classification and glenoid version angle were measured using preoperative computed tomography, and fatty infiltration of supraspinatus and infraspinatus muscles were checked through preoperative magnetic resonance imaging.

Results: Of the 67 patients included in this study, TSA was performed in 41 patients (TSA group), and RSA was performed in 26 patients (RSA group). The two groups had no clinical differences in the patients' preoperative demographic and radiographic data. At the final follow-up, both groups showed improved pain, ROM, and functional outcomes. Moreover, the TSA group demonstrated significantly better postoperative ASES (86.8 ± 6.3 vs. 81.6 ± 5.5, $p = 0.001$) and Constant-Murley (80.4 ± 5.7 vs. 73.4 ± 6.2, $p < 0.001$) scores than the RSA group. The TSA group showed a significantly better postoperative active ROM than the RSA group regarding forward flexion as well as external and internal rotations ($p < 0.001$). All patients in the RSA and TSA groups exceeded the minimal clinically important difference.

Conclusions: In older adult patients with degenerative glenohumeral osteoarthritis wherein the rotator cuff is preserved without excessive bone loss, anatomic TSA and RSA can improve pain, ROM, and clinical outcomes. However, clinical results and ROM were better with TSA than with RSA during the short- and mid-term follow-up periods.

Keywords: *Osteoarthritis, Arthroplasty, Replacement, Shoulder, Aged, Treatment outcomes*

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Anatomic total shoulder arthroplasty (TSA) is the treatment of choice for patients with severe pain and a limited range of motion (ROM) due to advanced degenerative glenohumeral osteoarthritis. However, an intact functional rotator cuff is essential to maintain normal glenohumeral joint kinematics after TSA. If the rotator cuff is defective, a rocking horse phenomenon could occur due to verti-

cal instability of the shoulder joint after TSA, resulting in premature dissociation of the prosthesis, which increases the need for revision surgery due to pain and functional impairment.[1,2] However, there are many older adult patients whose rotator cuff is not torn but experience muscle atrophy and fatty degeneration. In these cases, ROM recovery and clinical results after TSA could be poor, with low subjective satisfaction after surgery.[3]

Reverse shoulder arthroplasty (RSA) was first introduced as a treatment for rotator cuff tear arthropathy. Its indications have gradually expanded, and the frequency of its implementation is increasing explosively. Pain reduction, ROM recovery, and overall function restoration after surgery have been reported to be relatively satisfactory in patients with rotator cuff tear arthropathy or massive rotator cuff tears that cannot be repaired in older adult patients with low activity levels.[4,5] Accordingly, the indications for RSA have been gradually expanded to include comminuted fractures, nonunion or malunion of proximal humeral fractures in older adults, inflammatory arthritis such as rheumatoid arthritis, degenerative arthritis with severe glenoid bone loss, tumors, and revision surgery after total arthroplasty. It is also widely used with relatively good clinical results after surgery.[6-9] However, because of the biomechanical nature of prostheses, the recovery of the ROM, especially internal and external rotation, after RSA is less adequate compared with that after TSA. The possibility of complications such as infection and nerve damage is high, and studies on the long-term survival rate are lacking.[10-12]

In this study, we aimed to compare the clinical outcomes of anatomic TSA and RSA in patients over 70 years with degenerative glenohumeral osteoarthritis without rotator cuff tears. We hypothesized that the clinical outcomes of anatomic TSA would be better than those of RSA.

METHODS

Patient Selection

This retrospective comparative study was approved by the Institutional Review Board of National Health Insurance Service Ilsan Hospital (No. NHIMC 2020-03-024). And this study has been carried out in accordance with the ethical standards in the 1964 Declaration of Helsinki and relevant regulations of the U.S. Health Insurance Portability and Accountability Act. Written informed consent was obtained from all patients participating in the study. The medical records of patients who underwent anatomic TSA or RSA at the same hospital were analyzed between March 2013 and December 2020. The study included patients over 70 years of age, diagnosed with glenohumeral osteoarthritis without rotator cuff tears. It also included patients with tears confined to the articular side involving ≤ 50% of the cuff and those with interstitial tears. We excluded patients with < 2 years of postoperative follow-up, full-thickness rotator cuff tears on magnetic resonance imaging (MRI), inflammatory arthritis such as rheumatoid arthritis, a history of proximal humeral fractures or sequelae of fractures, and a history of rotator cuff repair.

In patients whose forward elevation was restricted to ≤ 90° during a physical examination, plain radiography and computed tomography (CT) were used to verify the presence of decreased joint spacing within the glenohumeral joint, bone loss in either the humeral head or glenoid, and the presence of osteophytes. All patients underwent MRI before surgery to evaluate rotator cuff status. There was no difference in the surgical indication between patients who underwent RSA and TSA, and the surgical procedure was selected according to the surgeon's preference.

Operative Technique

A single surgeon performed all the surgeries. All patients underwent surgery using a deltopectoral approach in the beach chair position. In both TSA and RSA, the subscapularis tendon was peeled off from the lesser tuberosity at the medial aspect of the bicipital groove and re-attached after the operation. The Aequalis prosthesis (Tornier), Aequalis Ascend Flex prosthesis (Tornier), and Equinoxe Primary System (Exactech) were used for anatomic TSA. The glenoids were all cemented using polyethylene pegged type implants, and the cemented or non-cemented type was used for the humeral stem. For RSA, Reverse Shoulder Prosthesis (DJO Surgical), Aequalis Ascend Flex prosthesis (Tornier), and Equinoxe Primary System (Exactech) were used; all humeral stems were non-cemented.

Attention was paid during soft-tissue release in patients with osteoarthritis having severely limited preoperative ROM. In patients with subdeltoid adhesions, the bursal tissue below the deltoid was sufficiently removed from the anterior to posterior region, and release was performed from the rotator cuff tendon. The capsule was removed from both the glenoid and humeral sides. The subscapularis tendon was peeled off from the lesser tuberosity just medial to the bicipital groove; subsequently, the glenohumeral ligament was sufficiently released from anterior to posterior at the humeral head insertion site. Sufficient capsular release was performed during glenoid exposure in all patients. On the glenoid side, the superior and middle glenohumeral ligaments were released, and the

inferior glenohumeral ligament was released in the order of anterior, inferior, and posterior.

However, in cases where there was severe posterior bone loss and the posterior ligament was loose, additional posterior release was not performed to prevent posterior subluxation. In particular, during TSA, a joint was created so loose that posterior subluxation occurred when the humeral head was pushed posteriorly after the final implant was inserted and reduced. During RSA, the supraspinatus tendon was excised in all patients with osteoarthritis. Neither group underwent glenoid bone grafting. Eccentric glenoid reaming was performed in patients with posterior bone loss ≤ 10°. During both procedures, patients with bone loss ≥ 10° underwent eccentric reaming and insertion of an 8° augmented base plate or base glenoid component. In the TSA group, the subscapularis was repaired using the transosseous method in all patients. In contrast, the repair was only performed in the RSA group when possible, using a similar technique as during TSA.

All patients were required to wear a shoulder abduction brace immediately after surgery, which was maintained until postoperative week 6. A passive range of shoulder motion was allowed below the waist level on the first day of the surgery when the pain was tolerable. Assisted active ROM exercises were started at postoperative week 6, and muscle strengthening training, including forward flexion and internal and external rotation using an elastic band, was started at postoperative week 12. The patients were instructed to return to their preoperative activities 6 months after surgery.

Clinical and Radiological Assessments

All patients underwent a physical examination of both shoulders and completed questionnaires regarding demographic information, such as age, sex, symptom duration, and dominant arm, preoperatively. The clinical assessment included regular evaluations of the active ROM, pain levels using a visual analog scale (VAS), and the American Shoulder and Elbow Surgeons (ASES) and Constant-Murley scores. Patients also completed the Single Assessment Numeric Evaluation (SANE) for satisfaction preoperatively and at their last postoperative visit. Active ROM was assessed by measuring forward flexion, abduction, external rotation of the side, and internal rotation of the back, with the resulting locations converted into numbers. The highest spine level the patient could touch with their thumb on the same side was recorded to measure internal rotation. The spine levels were given numbers for statistical analysis, with T1–T12, L1–L5, and the sacrum assigned the numbers 1–12, 13–17, and 18, respectively.[13] All pre- and postoperative parameters were recorded by a physician assistant who was not involved in this study. The primary outcome was the ASES score, with a minimal clinically important difference (MCID) of 20.1 for changes between pre- and postoperative scores based on previously published results.[14]

The Walch classification and glenoid version angle measured using preoperative CT were used for radiographic evaluation.[15] The glenoid version angle was defined as the angle at which the horizontal line of the scapular spine and the line connecting the anterior and posterior aspects of the joint surface meet in the CT image of the glenoid center. In all patients, the presence of a rotator cuff tear and muscle atrophy or fatty degeneration on sagittal MRI was checked.[16,17] Additionally, during postoperative outpatient follow-up, regular radiographic and CT examinations were performed to determine implant loosening. All pre- and postoperative radiologic evaluations were performed by an independent orthopedic surgeon.

Statistical Analysis

All statistical analyses were performed using IBM SPSS ver. 23 (IBM Corp.). The pre- and postoperative clinical scores were compared using a paired *t*-test. TSA and RSA outcomes were compared using Student *t*-test and chi-square test. The level of significance was set at $p < 0.05$.

RESULTS

Of the 392 patients who underwent anatomic TSA or RSA during the study period, 97 were diagnosed with glenohumeral osteoarthritis. Of these, 11 were excluded because of a full-thickness tear in the rotator cuff, and 9 were excluded because of a partial tear involving ≥ 50% of the articular side. Nine patients were lost to follow-up. A total of 67 patients who satisfied the inclusion criteria were analyzed. Forty-one patients underwent anatomic TSA (TSA group), and 26 underwent RSA (RSA group). The mean follow-up duration was 38.9 ± 13.7 months (range, 24–84 months) in the TSA group and 44.5 ± 16.3 months (range, 24–78 months) in the RSA group ($p = 0.135$). The preoperative demographic characteristics are summarized in Table 1. There were no statistically significant differences in the demographic data. There was no between-group difference in the Walch classification of the glenoid and the glenoid version angles evaluated using preoperative imaging. There was no statistically significant between-group difference in the preoperative MRI-assessed atrophy and fatty degeneration of the supraspinatus and infraspinatus tendons (Table 2).

No between-group differences were observed in the baseline VAS score for pain, ASES score, Constant-Murley score, and preoperative functional status. Pain reduction and functional improvement were observed in both groups after surgery ($p < 0.001$). At the final follow-up after surgery, the VAS score was 1.2 ± 0.8 in the TSA group and 1.6 ± 1.2 in the RSA group, showing no statistical significance. Patients who had undergone TSA demonstrated significantly better postoperative ASES (86.8 ± 6.3 vs. 81.6 ± 5.5, $p = 0.001$) and Constant-Murley (80.4 ± 5.7 vs. 73.4 ± 6.2, $p < 0.001$) scores. Preoperatively, no between-group difference in patient satisfaction (SANE score) was observed. However, the TSA group showed better results than the RSA group at the final follow-up after surgery (87.3 ± 8.1 vs. 81.7 ± 9.4, $p = 0.010$) (Table 3). All patients in the RSA and TSA groups exceeded the MCID.

In the active ROM measured before and after surgery, there was no statistically significant difference between the two groups regarding forward elevation, abduction, external rotation, and internal rotation. Both groups showed a statistically significant increase in ROM after surgery ($p < 0.001$). At the final follow-up, the forward elevation, abduction, external rotation, and internal rotation angles were 154.7° ± 10.7°, 145.0° ± 13.6°, 56.7° ± 12.8°, and 11.4° ± 1.6° in the TSA group, respectively. In contrast, the forward flexion, abduction, external rotation, and internal rotation angles were 133.7° ± 9.5°, 129.1° ± 22.5°, 32.6° ± 13.4°, and 15.2° ± 2.1° in the RSA group, respectively. The TSA group showed a significantly better postoperative passive ROM than the RSA group ($p < 0.001$) (Table 4).

Table 1. Patient Demographics

Variable	TSA group (n = 41)	RSA group (n = 26)	*p*-value
Age (yr)	76 ± 4 (70–88)	75 ± 5 (70–86)	0.268
Sex (male : female)	4 : 37	3 : 23	0.816
Dominant arm involvement	31 (75.6)	21 (80.8)	0.622
Duration of symptom (mo)	16.3 ± 16.0	13.9 ± 18.7	0.576
Follow-up duration (mo)	38.9 ± 13.7 (24–84)	44.5 ± 16.3 (24–78)	0.135

Values are presented as mean ± SD (range), number (%), or mean ± SD.
TSA: total shoulder arthroplasty, RSA: reverse shoulder arthroplasty, SD: standard deviation.

Table 2. Preoperative Radiographic Glenoid Assessments and Stage of Fatty Infiltration in the Supraspinatus and Infraspinatus Tendons

Variable		TSA group (n = 41)	RSA group (n = 26)	*p*-value
Walch classification	A1	31	16	0.251
	A2	7	5	
	B1	1	4	
	B2	2	1	
	C	0	0	
Glenoid version (°)		8.4 ± 6.9 (–1.5 to 29.5)	7.5 ± 5.1 (–0.7 to 19.7)	0.569
Fatty infiltration				
Supraspinatus tendon grade	1	13	5	0.354
	2	23	15	
	3	5	6	
	4	0	0	
Infraspinatus tendon grade	1	26	13	0.548
	2	13	11	
	3	2	2	
	4	0	0	

Values are presented as number or mean ± standard deviation (range).
TSA: total shoulder arthroplasty, RSA: reverse shoulder arthroplasty.

Table 3. Preoperative and Last Follow-up Clinical Outcomes for Patients Who Underwent Anatomic Total Shoulder Arthroplasty and Those Who Underwent Reverse Shoulder Arthroplasty

Variable	TSA group (n = 41)	RSA group (n = 26)	*p*-value
VAS score for pain			
Preoperative	7.6 ± 1.2	7.4 ± 1.5	0.496
Last follow-up	1.2 ± 0.8	1.6 ± 1.2	0.062
ASES score			
Preoperative	31.8 ± 6.3	32.3 ± 5.5	0.735
Last follow-up	86.8 ± 6.3	81.6 ± 5.5	0.001*
Constant-Murley score			
Preoperative	30.3 ± 5.5	29.4 ± 4.7	0.478
Last follow-up	80.4 ± 5.7	73.4 ± 6.2	< 0.001*
SANE score			
Preoperative	25.3 ± 10.2	24.6 ± 10.0	0.798
Last follow-up	87.3 ± 8.1	81.7 ± 9.4	0.010*

Values are presented as mean ± standard deviation.
TSA: total shoulder arthroplasty, RSA: reverse shoulder arthroplasty, VAS: visual analog scale, ASES: American Shoulder and Elbow Surgeons, SANE: Single Assessment Numeric Evaluation.
*Statistically significant difference between groups ($p < 0.05$). There were significant improvements in pre- and postoperative VAS, ASES, Constant-Murley, and SANE scores in both groups ($p < 0.001$).

Table 4. Preoperative and Last Follow-up Active Range of Motion for Patients Who Underwent Anatomic Total Shoulder Arthroplasty and Those Who Underwent Reverse Shoulder Arthroplasty

Variable	TSA group (n = 41)	RSA group (n = 26)	*p*-value
Forward flexion			
Preoperative	81.1 ± 12.5	79.9 ± 12.2	0.699
Last follow-up	154.7 ± 10.7	133.7 ± 9.5	< 0.001*
Abduction			
Preoperative	68.5 ± 15.8	63.8 ± 15.8	0.237
Last follow-up	145.0 ± 13.6	129.1 ± 22.5	0.001*
External rotation			
Preoperative	17.2 ± 11.9	13.2 ± 9.7	0.154
Last follow-up	56.7 ± 12.8	32.6 ± 13.4	< 0.001*
Internal rotation†			
Preoperative	17.2 ± 1.0	17.5 ± 0.8	0.235
Last follow-up	11.4 ± 1.6	15.2 ± 2.1	< 0.001*

Values are presented as mean ± standard deviation.
TSA: total shoulder arthroplasty, RSA: reverse shoulder arthroplasty.
*Statistically significant difference between groups ($p < 0.05$). There were significant within-group improvements in pre- and postoperative active range of motion in both groups ($p < 0.001$). †Internal rotation was determined by measuring the highest spinal segment that the patient could reach with his or her thumb. To facilitate statistical analyses, the spinal segment levels were converted into continuous numbers: T1–T12 were represented by 1–12, L1–L5 were represented by 13–17, and the sacrum was represented by 18.

Regarding postoperative complications, RSA was performed as a revision surgery in 1 patient due to a secondary rotator cuff tear and loosening of the glenoid implant after TSA. In another patient, the implant was removed due to infection after RSA.

DISCUSSION

This study showed significant improvements in shoulder function and ROM recovery after both anatomic TSA and RSA in older adult patients with degenerative glenohumeral osteoarthritis without rotator cuff tears. Overall, the TSA group demonstrated better results than the RSA group.

TSA has a long history in the treatment of degenerative joint disease with an intact rotator cuff, and many studies have reported satisfactory results.[18,19] However, when rotator cuff tears are present, or the cuff has severe atrophy and fatty degeneration, the outcomes are poor,[2,3] and RSA has been promoted as an alternative option. Recently, good results have been reported with RSA in cases of degenerative joint disease with preserved rotator cuff but with accompanying glenoid bone loss, such as Walch A2, B2, and C types, without bone grafting.[20] In this study, approximately 22.4% of the joints with accompanying bone loss were classified as Walch A2, B2, or C types, and no bone grafting was performed in any case. In all cases, additional glenoid reaming was performed, and in cases of the B2-type glenoids with significant posterior bone loss, an augmented prosthesis was inserted to reinforce the posterior slope. Classically, biomechanical and clinical studies have reported a high degree of glenoid implant loosening when cemented polyethylene pegs were used in biconcave glenoids with posterior bone loss of 15°–20° or more.[21,22] However, recently, Stephens et al. reported good clinical results using an augmented glenoid component to restore the glenoid version and offset the posterior glenoid bone loss.[23] In this study, the indications for TSA and RSA

were not differentiated according to the degree of glenoid bone loss. In both groups, only additional reaming was performed for posterior bone loss of < 10°, and augmented glenoid or baseplate components were used when the bone loss was > 10°. This study observed no glenoid failure associated with bone loss during follow-up. Nevertheless, in this study, the number of B2-type glenoids was small (4.5% of the total number of glenoids); hence, TSA may have shown good results in glenoids with little posterior bone loss, and the results may have been different if patients with large posterior bone loss were targeted.

Moreover, the condition of the rotator cuff was assessed using preoperative MRI in all patients. This study targeted patients aged at least 70 years with some degree of fatty degeneration and atrophy of the rotator cuff. In addition, most patients had a partial tear on the articular side of the rotator cuff, an interstitial tear, or tendinosis; furthermore, some patients without clear tears showed rotator cuff thinning. Nonetheless, the indications were not differentiated based on the degree of these conditions. The extent of fatty degeneration in the supraspinatus and infraspinatus tendons was similar in both groups before surgery. In a multicenter study of arthroplasty for degenerative arthritis, Edwards et al.[3] reported that partial tears confined to the supraspinatus tendon did not affect outcomes; however, the degree of fatty degeneration in the rotator cuff was associated with poor outcomes after arthroplasty. In this study, patients with full-thickness rotator cuff tears were excluded, and even in cases where < 50% articular-side partial tears were present, no suture repair was performed. Only one case (3.7%) required an RSA revision surgery due to implant loosening caused by a secondary rotator cuff tear during the follow-up period after TSA. In this patient, the condition of the rotator cuff muscle before surgery was good (supraspinatus grade 2 and infraspinatus grade 1), but the preoperative ROM was severely limited, and tightness was not sufficiently resolved despite sufficient soft-tissue and capsular release during surgery. During the postoperative follow-up, anterior subluxation of the humeral head occurred, and a tear of the subscapularis tendon was observed on ultrasound. It is presumed that healing failure may have occurred due to continuous pressure applied to the subscapularis tendon repair side resulting from postoperative overstuffing.

The most commonly reported complication after TSA is secondary rotator cuff dysfunction, which occurs in 6%–14.8% of cases and is reported to increase over time after surgery.[1,24] Although the TSA follow-up period in this study was relatively short (38.9 months) and the preoperative grade 3 fatty infiltration of the supraspinatus and infraspinatus tendon was 8.5%, the average age of the patients who underwent TSA was 75.6 years, and their activity level was low. Clinically significant secondary rotator cuff tears are rare.

For RSA, forward flexion and abduction recovery are satisfactory after surgery. However, the recovery of internal and external rotation is insufficient because of the changes in the position of the implant and the deltoid moment arm.[5,10] In this study, both groups showed significant ROM recovery and better clinical outcomes after surgery than before surgery. However, the TSA group showed a higher ROM after surgery. Simovitch et al.[25] reported that in terms of improved clinical outcomes after surgery, internal and external rotation showed better results in TSA than in RSA; however, the surgical indications for TSA and RSA were different. In this study, both surgeries were performed in patients with advanced degenerative osteoarthritis and severely reduced ROM. Furthermore, TSA showed better results in rotation and forward elevation and had higher functional scores. Given that both surgical methods involved the same rehabilitation protocol after surgery, it can be inferred that TSA is a biomechanically better method, especially in terms of ROM recovery. Meticulous release of the surrounding tissues, including the anterior and inferior portions of the glenohumeral ligament, is important because the shoulder with advanced osteoarthritis is often accompanied by capsular tightness. In Asians, dislocation rarely occurs after shoulder arthroplasty because the volume of the shoulder joint itself is relatively small. Therefore, creating a relatively loose joint through sufficient soft-tissue release is the most effective way to recover the ROM after TSA. In this study, the surgeon focused on creating a loose joint through sufficient release of the surrounding tissue during TSA, making it possible to recover the ROM after surgery, which may have influenced both clinical outcomes and satisfaction. In a study by Simovitch et al.,[25] forward flexion was quickly recovered in the RSA group after surgery, but a sudden decrease in forward flexion in the RSA group was reported during follow-up, probably because RSA itself relies only on the deltoid muscle strength for elevation. Postoperatively, deltoid fatigue occurs in elderly patients, leading to an inevitable decrease in elevation force over time. Conversely, since TSA preserves the original anatomy, it can be assumed that the deltoid muscle can lift the arm more efficiently as long as the function of the supraspinatus is maintained, and this can be relatively maintained over time. This study targeted elderly patients with a female predominance; hence, post-RSA deltoid fatigue may have occurred more quickly due to a lower muscle volume than

that in Western patients. Therefore, it can be inferred that the TSA group showed better forward flexion than the RSA group during the final follow-up.

This study had some limitations. First, the small and uneven number of patients may have resulted in inaccurate comparisons and statistical errors. However, only patients with degenerative arthritis without rotator cuff tears were included. The prevalence of primary degenerative arthritis of the shoulder in Asians is low, leading to a relatively small sample size. Additionally, as TSA is the preferred treatment for degenerative arthritis, the number of patients who underwent RSA was significantly lower than that of patients who underwent TSA. However, generally, patients who underwent TSA were relatively young, and both groups comprised patients aged over 70 years. There was no statistically significant between-group difference regarding preoperative demographic and radiographic data. The errors were expected to be minimized. Second, although the proportion of type A2 and B2 glenoids was considerable (approximately 22.4%), the proportion of type B2 glenoids with severe posterior bone loss was only 4.5%, which may have influenced the good TSA outcomes. Finally, the data related to implant survival could not be analyzed because of the relatively short follow-up period, which was due to the relatively older age of the study participants; therefore, the number of patients who were lost to follow-up was high, leading to a shorter follow-up period, making it difficult to adequately evaluate the survival rate after implant placement. Despite these limitations, this study had the advantage of being conducted at a single institution by a single surgeon; moreover the use of rehabilitation and follow-up observations reduced the potential for bias related to patient populations and surgical indications compared with that of multi-institutional studies.

In conclusion, for older adult patients with degenerative glenohumeral osteoarthritis without excessive posterior bone loss where the rotator cuff is preserved, anatomic TSA and RSA can improve pain, ROM, and clinical outcomes after surgery. However, clinical results and ROM were better with TSA than with RSA during the short-term and mid-term follow-up periods.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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