

## RESEARCH ARTICLE

# Return to Golf Following Reverse Total Shoulder Arthroplasty

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## Abstract

**Background:** The object of this study was to examine return to golf and changes in golf performance after shoulder arthroplasty. Additionally, we set out to determine if there were differences in return to play and performance between total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (RTSA). We also examined pain during the golf swing to determine if there is a change in pain level after surgery.

**Methods:** Patients were identified using a Current Procedural Terminology code 23472 search for TSA. A 19-question online survey was sent out to each patient with questions detailing golfing performance and pain during the swing before and after surgery. Comparisons were made to determine differences in pain, performance and enjoyment between TSA and RTSA groups before and after surgery.

**Results:** A total of 586 patients who underwent shoulder arthroplasty were sent the online survey via email. Of those patients, 33 identified themselves as golfers and who responded to the survey, resulting in an overall response rate of 5.6%. Twenty-three of 31 (74%) patients were able to return to golf following their procedure. Overall, the respondents who reported pain associated with golfing activity had significantly decreased pain after undergoing either TSA or RTSA. The RTSA group had a significant drop in driving distance following the procedure and this was significantly lower than the postoperative driving distance in the TSA group, despite an insignificant preoperative difference.

**Conclusion:** Overall, TSA offers a safe and effective means for reducing pain during the golf swing in patients suffering from advanced shoulder osteoarthritis. While there were no significant changes in performance following TSA, individuals undergoing RTSA can be counseled that they are at risk for lower driving distances due to altered mechanics. Overall, patients were satisfied with their procedure and their ability to return to the golf course.

**Level of evidence:** IV

**Keywords:** Golf, Return to sport, Shoulder replacement arthroplasty

## Introduction

Golf is a popular recreational sport in the United States and participation continues to rise with over 30 million players in 2017. Golfers over the age of 65 comprise 15% of the participant base (1). Shoulder arthritis is also common in the aging population and has a profound impact on function and overhead activities (2, 3). Shoulder function is particularly important for golfers, as previous studies have demonstrated the

complex activation of the shoulder musculature that is necessary for the golf swing (4-6). Therefore, it is likely that an increasing number of patients are requiring operative intervention for shoulder arthritis with a goal of returning to golf participation.

Return to golf following total shoulder arthroplasty (TSA) has previously been evaluated in the literature. In a study by Papaliadis et al., 31 of 35 patients returned

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to golf within 9 months of surgery and experienced a significant improvement in pain levels and driving distance (7). Studies comparing anatomic and reverse total shoulder arthroplasty (RTSA) patients have found that return to sport is higher following TSA compared to RTSA, particularly for sports that require more shoulder function such as swimming and golf (8, 9). Other studies examining sports activity after RTSA have shown that over 60%-80% of patients return to moderate- or high-intensity activities including overhead sports (10, 11). There is a lack of evidence specifically describing return to golf after RTSA or postoperative golf performance.

The purpose of this study was to examine return to golf and changes in golf performance after shoulder arthroplasty. Additionally, the authors set out to determine if there were differences in return to play and performance between TSA and RTSA. Our investigation also examined pain during the golf swing to determine if there is a change in pain level after surgery. The hypothesis is that TSA would be successful in pain relief during the golf swing, and that performance following TSA would be better than those undergoing RTSA.

### Materials and Methods

Prior to study initiation institutional review board approval was obtained from our institution (IRB #12326). Consent to participate in the study was assumed based on completing the survey and patients were prompted that they may stop the survey at anytime. Patients who underwent TSA at our institution between October 2012 and October 2018 were identified using a Current Procedural Terminology code search for TSA (23470).

The authors created a 19-question online survey that was sent to all patients with items detailing the type of surgery and questions regarding golfing performance before and after surgery [Table 1]. Patients were instructed to only

**Table 1. 19 Question online survey**

1. What is your age?
2. What is your gender
  - a. Male
  - b. Female
3. What type of shoulder surgery did you have?
  - a. Reverse total shoulder arthroplasty (replacement)
  - b. Total shoulder arthroplasty (replacement)
  - c. Shoulder arthroplasty (replacement), unsure of type
  - d. Unsure of procedure
4. On which shoulder did you have surgery?
  - a. Right
  - b. Left
  - c. Both
5. Do you play golf right-handed or left-handed?
  - a. Right
  - b. Left
6. For how many years have you been playing golf?
  - a. <1
  - b. 1-5
  - c. 6-10
  - d. >10

7. Have you resumed golfing activity since surgery?
  - a. Yes
  - b. No
8. How long after surgery did you resume golfing activity?
  - a. <6 months
  - b. 6 months-1 year
  - c. 1 year - 2 years
  - d. > 2 years
9. How often do you play golf?
  - a. Multiple times per week
  - b. Weekly
  - c. Every other week
  - d. Monthly
  - e. Less than monthly
10. Since surgery have you golfed more frequently, the same amount or less frequently?
  - a. More frequently
  - b. The same amount
  - c. Less frequently
11. What was your handicap before the surgery?
12. What was your handicap after the surgery?
13. What was your average estimated driving distance (yards) before the surgery?
14. What was your average estimated driving distance (yards) after the surgery?
15. Do you feel your overall golf performance has improved, stayed the same or worsened since the surgery?
  - a. Improved
  - b. Stayed the same
  - c. Worsened
16. Prior to the shoulder surgery did you have pain when golfing?
  - a. Yes
    - i. If yes rate the pain 0-10
  - b. No
17. After the shoulder surgery did you have pain when golfing?
  - a. Yes
    - i. If yes rate the pain 0-10
  - b. No
18. How has your enjoyment of golf changes since your shoulder surgery?
  - a. Much more enjoyable
  - b. Somewhat more enjoyable
  - c. Same amount of enjoyment
  - d. Somewhat less enjoyable
  - e. Much less enjoyable
19. Rate your overall satisfaction with your shoulder surgery from 0-10

answer the survey if they participated in golfing activity prior to surgery. Surveys were sent out in October 2018 via [www.surveymonkey.com](http://www.surveymonkey.com) and patients received a reminder email two weeks following initial distribution of the survey. Responses were anonymous and there was no identifying information included in the questions. Subjects were only included if they participated in golfing activity prior to their surgeries and underwent either TSA or RTSA at our institution.

### Statistical Analysis

The mean changes following surgery in driving distance,

golfing handicap and visual analog scale pain score during golfing activity were tested for significance using the two-sided paired t-test. The change in the proportion of patients reporting pain with golfing activity following surgery was tested for significance using the two-sided z-test for proportions.

## Results

A total of 586 patients who underwent either RTSA or TSA at our institution were sent the online survey via email. Of those patients, 33 identified themselves as golfers and who responded to the survey, resulting in an overall response rate of 5.6%. Of the 33 respondents, 14 underwent RTSA and 17 underwent TSA, while two had TSA in one shoulder and RTSA in the other. The patients who had both procedures were excluded. Respondents were an average of 69.6±8.9 years old. Twenty-three patients (74%) identified as males. Most survey participants were right-handed golfers (90%) who play golf at least once a week (71%). Surgery was done on the right side only in 48% of subjects, the left only for 35% and both sides in 16% of cases. Demographic results are further summarized in Table 2, including comparisons

Group	Overall (N=33)	TSA (N=18)	RTSA (N=15)
Average age in years, mean (standard deviation)	69.6 (8.9)	66.5 (8.1)*	73.3 (8.8)*
Gender (% of total respondents)	Male: 74% Female: 26%	Male: 71% Female: 29%	Male: 79% Female: 21%
Side of Surgery (% of total respondents)	Right: 48% Left: 35% Both: 16%	Right: 47% Left: 29% Both: 24%	Right: 50% Left: 43% Both: 7%
Golf Handedness (% of total respondents)	Right: 90% Left: 10%	Right: 100%* Left: 0%	Right: 79%* Left: 21%

\* indicates significant result ( $P$  value<0.05)

between the RTSA and TSA group. Notably, the RTSA group was significantly older (73.3±8.8 vs 66.5±8.1 years,  $P=0.03$ ) and more left-handed (21% vs 0%,  $P=0.02$ ) than the TSA group. No significant differences were detected in the gender composition or side of surgery between the two groups.

Of the 31 patients included in our cohort, 23 (74%) golfers reported that they had returned to golf activity following their surgery. Two patients who reported resuming golf activity did not complete the survey, and were excluded for subsequent calculations. Overall, most golfers (85%) returned to sport within one year after surgery. In patients who returned to golf, handicaps slightly worsened (average of 16.7±4.8 to 18.1±6.3) and driving distance decreased (average of 215.7±36.5 yards to 207.3±34.1 yards); however, these changes were not statistically significant. Subjectively, most patients answered that their golfing performance stayed at about the same level (67%). We also compared mean 18-hole score, driving distance, and handicap between the two groups. The TSA group had a significantly higher postoperative driving distance than the RTSA group (221.4±39.4 vs 190.0±14.5), despite an insignificant preoperative difference. The rest of the differences were not significant when comparing TSA and RTSA [Table 3].

Pain during the golf swing was present in 76% of patients prior to surgery, and participants rated this pain at an average visual analog scale score of 5.3±2.8. Following surgery, only 19% of respondents had shoulder pain during golf, with an average visual analog scale rating of 4.0±0.8. Overall, the percentage of respondents who reported pain associated with golfing activity significantly decreased after undergoing either TSA or RTSA. Additionally, their average pain scores during golfing activity significantly decreased following surgery. Significantly more TSA patients reported pain while golfing before surgery than RTSA patients (92% vs 66%,  $P=0.04$ ). Differences in the other pain statistics were not significant [Table 4].

In our cohort, reported golfing frequency did not change for most respondents after surgery; however, 29% responded that they play less frequently. Only 1

Group		Overall (N=21)	TSA (N=12)	RTSA (N=9)
Average driving distance, mean (standard deviation)	Before	215.7 (36.5)	220 (42.2)	210.5 (29.7)
	After	207.3 (34.1)	221.4 (39.4)*	190.0 (14.5)*
Average handicap, mean (standard deviation)	Before	16.7 (4.8)	16 (4.8)	17.4 (5.0)
	After	18.1 (6.3)	17.3 (7.6)	19.0 (4.7)
Average 18-hole score, mean (standard deviation)	Before	92.1 (5.5)	91.4 (6.1)	92.8 (5.1)
	After	93.3 (6.3)	91.9 (7.0)	94.8 (5.3)

\* indicates significant result ( $P$  value<0.05)

**Table 4. Pain during the golf swing before and after surgery**

Group		Overall (N=21)	TSA (N=12)	RTSA (N=9)
Respondents reporting pain during the golf swing (% of total responses)	Before	76%*	92%* $\Delta$	66% $\Delta$
	After	19%*	17%*	22%
VAS rating during the golf swing, mean (standard deviation)	Before	5.3 (2.8)*	5.7 (2.8)	5.6 (2.9)
	After	4.0 (0.82)*	4.5 (0.7)	3.5 (0.7)

\* indicates significant intragroup difference ( $P < 0.05$ ) across time points.

$\Delta$  indicates significant intergroup difference ( $P < 0.05$ )

out of 21 (5%) golfers stated that they enjoyed playing golf less following the surgery, while 10 of 21 (43%) participants had more enjoyment of the game following either RTSA or TSA. Respondents rated their overall

experience with the shoulder surgery highly on a 0-10 scale, with an average rating of  $8.61 \pm 2.1$ . Significantly different satisfaction scores were not detected between the RTSA and TSA group [Table 5].

**Table 5. Answers to survey questions for golfers who returned to sport**

Group	Overall (N=21)	TSA (N=12)	RTSA (N=9)
How often do you play golf? (% of respondents)	Multiple times per week: 33% Weekly: 38% Every other week: 10% Monthly: 10% Less than monthly: 10%	Multiple times per week: 25% Weekly: 50% Every other week: 8% Monthly: 8% Less than monthly: 8%	Multiple times per week: 56% Weekly: 11% Every other week: 11% Monthly: 11% Less than monthly: 11%
How has your frequency of playing golf changed since the surgery? (% of respondents)	More: 0% Same amount: 71% Less: 29%	More: 0% Same amount: 83% Less: 17%	More: 0% Same amount: 56% Less: 44%
How has your golfing performance changed since the surgery? (% of respondents)	Improved: 19% Stayed the same: 67% Worsened: 14%	Improved: 25% Stayed the same: 58% Worsened: 16%	Improved: 11% Stayed the same: 78% Worsened: 11%
How has your enjoyment of golfing changed since the surgery? (% of respondents)	More enjoyable: 43% Same enjoyment: 52% Less enjoyment: 5%	More enjoyable: 42% Same enjoyment: 68% Less enjoyment: 0%	More enjoyable: 22% Same enjoyment: 67% Less enjoyment: 22%
How satisfied were you with your surgery, on a 1-10 scale? Mean (standard deviation)	8.6 (2.1)	8.8(2.6)	8.4(1.4)

## Discussion

This study surveyed 33 patients who underwent a shoulder replacement at our institution over a 6-year period to determine how surgery impacted their performance on the golf course. Overall, we found that shoulder replacement significantly decreased the proportion of patients suffering from pain during the golf swing. While overall the patients had higher scores and lower driving distances following surgery, these were not significant changes. Additionally, we found that while there was no significant difference between driving distances in RTSA and TSA groups before surgery,

the RTSA group had significantly lower driving distances postoperatively.

Shoulder osteoarthritis has detrimental effects on both shoulder motion and pain during overhead activity (12). While not the primary driver of the golf swing, shoulder motion is an essential aspect of the swing and limitations in shoulder abduction and external rotation inhibit performance (13). Outcomes following TSA offer reliable pain relief and return to function for patients suffering from advanced shoulder osteoarthritis (14, 15). A meta-analysis of patients undergoing any

type of shoulder replacement (anatomic, reverse or hemiarthroplasty) found an overall return to sport rate of 80.7% (16). Papaliadis et al. examined a group of 35 golfers following anatomic TSA to determine the impact of the procedure on golf performance. They found that the majority of golfers were able to return to sport with a reported significant increase in driving distance, better scores and pain relief (7). Our patient population also demonstrated significant pain relief following their procedure, and while performance did not statistically improve following surgery, the TSA group did not show any detriment to golfing performance. A study evaluating 24 golfers after TSA found that all but one golfer were able to return to play following TSA, and following patients radiographically over time did not show evidence of loosening of implants in this population compared to controls. The authors thus recommended that golf is a safe activity for participation after shoulder arthroplasty (17). Overall, the current body of literature corroborates our findings, that TSA is a safe and effective means of returning patients to golf without significantly impacting performance.

While the effect of anatomic TSA on golfing performance has been previously investigated, there is no literature on the effect of RTSA on golfing performance and the differences between these two groups. While previously reserved for low demand and elderly patients, advances in RTSA techniques and implants have expanded indications to include younger and more active patients (18-20). Our investigation found that RTSA patients were able to successfully return to sport and had significant pain relief during the golf swing. However, contrary to the TSA group, the RTSA group had a statistically significant decrease in performance as measured by a drop in driving distance of almost 20 yards. This is not wholly unexpected, as previous studies comparing TSA and RTSA have shown both strength and range of motion deficits in the latter group (21, 22). A retrospective review comparing RTSA and TSA found that while active forward flexion was similar between groups, the RTSA group had significantly lower ranges of abduction, internal and external rotation, all of which are contributing movements to the golf swing (23). Additionally the average age of participants in our study was in the mid-70s, which could contribute

to differences in strength ability and return to play rates in the RTSA group. In reviewing return to sport rates following RTSA, Garcia et al. found only 10 out of 20 golfers were able to get back on the course (11). Another study analyzing outcomes of RTSA in a senior specific athletic population found an overall return to sport rate of only 60%, however, of those that returned to sport, 95% did not report any decline in function and were participating at the same or higher levels (24). In our population of golfers, RTSA remained reliable in alleviating pain during the swing, and while objectively there was a decrease in driving distance, the majority of patients did not report a subjective worsening of performance.

There are limitations to our investigation. This is a survey study, thus patients are susceptible to recall bias and may not remember exact details from prior to surgery. Additionally, we did not use a validated questionnaire and were unable to obtain other validated patient reported outcomes. While all procedures were done at the same hospital system, there were multiple surgeons who may have differences in operative technique and perioperative care.

Overall, TSA offers a safe and effective means for reducing pain during the golf swing in patients suffering from advanced shoulder osteoarthritis. While there were no significant changes in performance following TSA, individuals undergoing RTSA can be counseled that they are at risk for lower driving distances due to altered mechanics. Overall, patients were satisfied with their procedure and their ability to return to the golf course.

**Disclosure:** The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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