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Golf participation after rotator cuff repair: functional outcomes, rate of return and factors associated with return to play

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Background: Golf is a popular sport involving overhead activity and engagement of the rotator cuff (RC). This study aimed to determine to what level golfers were able to return to golf following RC repair, the barriers to them returning to golf and factors associated with their failure to return to golf.
Methods: Patients preoperatively identifying as golfers undergoing RC repair at the study centre from 2012 to 2020 were retrospectively followed up with to assess their golf-playing status, performance and frequency of play and functional and quality of life (QoL) outcomes.
Results: Forty-seven golfers (40 men [85.1%] and 7 women [14.9%]) with a mean age of 56.8 years met the inclusion criteria, and 80.1% were followed up with at a mean of 27.1 months postoperatively. Twenty-nine patients (76.3%) had returned to golf with a mean handicap change of +1.0 (P=0.291). Golf frequency decreased from a mean of 1.8 rounds per week preinjury to 1.5 rounds per week postoperatively (P=0.052). The EuroQol 5-dimension 5-level (EQ-5D-5L) index and visual analog scale (EQ-VAS) score were significantly greater in those returning to golf (P=0.024 and P=0.002), although functional outcome measures were not significantly different. The primary barriers to return were ipsilateral shoulder dysfunction (78%) and loss of the habit of play (22%).
Conclusions: Golfers were likely (76%) to return to golf following RC repair, including mostly to their premorbid performance level with little residual symptomatology. Return to golf was associated with a greater QoL. Persistent subjective shoulder dysfunction (78%) was the most common barrier to returning to golf.
Level of evidence: Level IV.

Keywords: Golf; Shoulder; Rotator cuff; Outcome assessment; Health care return to sport

INTRODUCTION

Golf is a popular worldwide sport with rounds typically lasting between 3.5–6 hours [1,2]. While played by individuals of all ages, most golfers are unusually frequently adults of middle or older age [3]. Whilst golf has well-established benefits, including positive impacts on wellness, cardiorespiratory health and metabolic health profiles [4], the golf swing is a repetitive and strenuous motion, and injuries can occur [5]. A systematic review has reported that the elbow (24.9%), shoulder (18.6%) and lumbar spine (15.2%) are the sites most commonly injured in amateur golfers [6]. A range of shoulder pathologies have been reported in golfers [7-9], primarily affecting their lead shoulders during their swing [10].

Persons who play golf may also sustain injuries in everyday life that can impact their golf. Rotator cuff (RC) tears are a common

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shoulder pathology in middle-aged and older adults [11], and the RC in health has been shown in electromyographic analyses to be actively engaged in both lead (non-dominant) and trail (dominant) shoulders throughout the golf swing [12,13]. The involvement of the RC musculature in the golf swing is asymmetric, with the supraspinatus and infraspinatus muscles mostly engaged in the lead shoulder during acceleration and follow-through of the swing and the subscapularis primarily involved in the trail shoulder from the start of the downswing [12,13]. Whilst golfers can sustain non-golfing shoulder injuries in a similar manner to the wider population, it has been suggested that overuse syndromes account for 92% of RC tears in golfers [5].

Given the significant involvement of the RC in the golf swing, symptoms from RC tears can restrict patients' ability to play golf at their usual premorbid level or even participate in golf at all [9]. RC repair is a procedure typically employed to address tears unsuitable for nonoperative management or for which nonoperative management has failed [14], and systematic reviews of the literature have reported that most patients are able to return to sport postoperatively [15]. However, lower rates of return have been reported in baseball and softball pitchers, which are sports with significant engagement of the shoulder, and rates of return to the same level of play for these patients have been reported to be as low as 38% [16]. However, there is a paucity of literature exploring the return to golf following RC repair despite the shoulder-specific demands of golf, and, as such, surgeons and physicians are unable to reliably counsel patients about this preoperatively.

The primary aim of this study was to determine whether golfers undergoing RC repair were able to return to golf postoperatively and to what level they returned to. Secondary aims included revealing the barriers to returning to golf and the factors associated with failing to return to golf.

METHODS

Approval was obtained from the Research Ethics Committee, South East Scotland Research Ethics Service, Scotland (16/SS/0026) for analysis and publication of the presented data. Data collection was carried out in accordance with the general medical council guidelines for good clinical practice and the Declaration of Helsinki. Informed consent was obtained from all patients.

Patients were identified from a prospectively compiled elective shoulder surgery database held at the study centre. Patient-reported outcome measure (PROM) completion Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) was used to determine which patients were golfers (by them answering the sports module component). All golfers who underwent RC repair between 2012 and 2020 for whom outcomes were available over a period of ≥12 months postoperatively were included. Patients not consenting to follow-up, individuals aged <18 years and patients with associated ipsilateral bony injury were excluded. The decision to undergo concomitant subacromial decompression (SAD) was made on a case-by-case basis by the fellowship-trained specialist shoulder surgeon performing the RC repair according to the case history, clinical examination and intraoperative findings. For biceps pathology, tenodesis was performed where possible, but where the tendon was found to be of extremely poor quality intraoperatively, tenotomy was performed instead. Demographic data were collected preoperatively. Patients were retrospectively followed up with to collect PROMs in order to assess whether they had returned to golf following surgery and to determine their degree of involvement in golf and their postoperative performance level. RC tear size was determined using preoperative magnetic resonance imaging scans or intraoperative measurements. Tear size was then grouped according to the DeOrio and Cofield classification [17].

Patient-Reported Outcome Measures

PROMs collected included the QuickDASH score [18] (scored 0–100 points total, with 0 points representing the best-possible score or least-symptomatic state), the Oxford Shoulder Score (OSS) [19] (scored 0–48 points total, with 48 points representing the best-possible score), the Western Ontario Shoulder Instability (WOSI) score [20] (scored 0–2,100 points, with higher scores reflecting greater degrees of shoulder disability) and the EuroQol 5-dimension 5-level (EQ-5D-5L) general health questionnaire [21] (scored on a scale of −0.594 to 1 points, where 1 point represents perfect health and negative values are indicative of a health state perceived as worse than death [22]). A 20-cm visual analog scale (VAS) was used to assess the current health-related quality of life, which was scored from 0 (worst health) to 100 (best health) points.

Patient satisfaction was assessed by asking the question "How satisfied are you with your operated shoulder?"; their responses were recorded using a 5-point Likert scale, as follows: "very satisfied," 'satisfied," "neither satisfied nor dissatisfied," "dissatisfied" and "very dissatisfied." Satisfaction was then dichotomised into "satisfied" and "dissatisfied." 'Satisfied" included "satisfied" and "very satisfied" responses, while the remaining answers fell under "dissatisfied." Pain was assessed on a scale of 0–100 points, with 0 points representing no pain and 100 points indicating the worst pain possible.

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Golf-Related Outcomes

Golfers were asked how often they had played golf prior to the onset of their shoulder symptoms, whether they were able to play following symptom onset, and whether they returned to golf postoperatively. They were also asked if returning to golf was a primary motivator for undergoing RC repair. Patients who returned to golf were asked to define how satisfied they were with their involvement in the game of golf since shoulder surgery on a 5-point Likert scale, with responses scored, coded and dichotomised in the same manner as the process for shoulder satisfaction. Further golf-specific outcomes assessed included premorbid and postoperative handicap, premorbid and postoperative golf frequency and pain severity during play (none, mild, moderate or severe). A higher golf handicap (or positive change in handicap) was reflective of worse golf performance.

Rehabilitation

A poly-sling was used in all cases for 4 weeks. On the day following surgery, patients' postoperative rehabilitation commenced with gentle pendular exercises. At 4 weeks postoperatively, formal physiotherapy was started for all patients, progressing from both passive and active movement to full active range of movement at 8 weeks postoperatively. Patients then completed strengthening training for 3 months. As there was no validated return to golf recovery protocol following RC repair, the return to golf for these patients was an individualised decision at the physiotherapists' discretion based on patients' pain, range of movement and strength.

Statistical Analysis

The IBM SPSS ver. 24.0 (IBM Corp.) was used for all analyses. Continuous data were assessed for normality using the Shapiro-Wilk test and presented using mean and standard deviation (SD) values. Continuous variables were assessed using independent and paired Student t-tests or non-parametric equivalents if the distribution was non-normal. Chi-square tests (or Fisher's exact test if group size <5) were used to assess differences in dichotomous outcomes between groups. Effect sizes were presented as Cohen's D (D) values for t tests or odds ratio (OR) values for chi-square tests. Cohen's D values of 0.2 were considered small, those of 0.5 were considered medium and those of 0.8 were considered large [23]. Significance was set at the $\alpha=0.05$ level.

RESULTS

Study Demographics

Forty-seven shoulders (44 patients) meeting the inclusion criteria underwent RC repair during the study period, and 38 (80.1%) had postoperative golfing outcomes available at a mean of 27.1 months of follow-up. Forty shoulders (85.1%) were male, with an overall mean age of 56.8 years (SD, 10.0 years) and a mean body mass index (BMI) of 27.5 kg/m^2 (SD, 3.7 kg/m^2). Forty-five shoulders (95.7%) were right-handed. Thirty-four repairs (72.3%) were performed on patients' trail shoulders; meanwhile, 84.2% of RC repairs were performed alongside concomitant ipsilateral shoulder procedures, most commonly SAD (52.6%) and biceps tenotomy (23.7%). The nine shoulders (77.7% male) unavailable at follow-up were similar in age and BMI to those that were followed up with ($P=0.10$ and $P=0.09$, respectively) and underwent a similar proportion of concomitant shoulder procedures (88.9% of cases, most commonly SAD [66.6%] or biceps tenotomy [44.4%], $P=0.45$). One patient returned to the clinic with reinjury and was awaiting revision RC repair at the time of last assessment, and one patient experienced a postoperative adhesive capsulitis that resolved with physiotherapy.

Golfing Outcomes

Preoperatively, 86.8% of patients were unable to play golf due to symptoms from their affected shoulder, while 10.5% of cases were able to play at the same frequency following the onset of shoulder symptoms and 2.6% were able to play at a reduced frequency. The desire to return to golf was an important motivator for patients when deciding whether to undergo RC surgery in 15.8% of cases.

We found that 76.3% of enrolled golfers returned to golf postoperatively. All patients undergoing surgery had the desire to return to golf but were unable to do so due to a range of factors. The reasons reported for failure to return are presented in Table 1. Patients returning to golf were satisfied with their involvement in the sport in 93.1% of cases. Of the patients returning to golf, 2 patients no longer recorded a golf handicap, and the remainder reported a mean handicap change of +1.0 (SD, 4.7; $P=0.291$). Of those who returned to golf, 62.1% reported no pain during play, 34.5% reported mild pain and 3.4% reported moderate pain. Patients' golfing frequency was 1.8 times/wk (SD, 1.1) preinjury and 1.5 times/wk (SD, 1.2) postoperatively ($P=0.052$).

Patient and Surgical Factors Associated with the Return to Golf

There was no significant difference in the preoperative EQ-5D-5L index ($P=0.174$), EQ-VAS score ($P=0.290$), pain score ($P=0.713$), OSS ($P=0.572$), QuickDASH score ($P=0.071$) or WOSI ($P=0.689$) between those returning and not returning to golf. There were also no preoperative differences in demographics,

symptom duration, golf involvement and tear size and type between those who returned to golf and those who did not (Table 2). Surgical procedures performed for patients returning and not returning to golf, respectively, are presented in Table 3; 44.4% of patients who underwent biceps tenotomy returned to golf compared to 86.2% of patients who did not undergo biceps tenotomy (OR, 0.128; P = 0.020). There was no significant association between return to golf rates and whether the lead or trail shoulder was operated on (63.6% and 81.5%, respectively, P = 0.401). All patients able to play golf preoperatively continued to play golf following RC repair.

Table 1. Reasons for golfers not returning to play following rotator cuff repair

Reason for not returning	No. of patients
Lost the habit of playing	2
Ipsilateral shoulder	
Pain alone	2
Pain and weakness	1
Pain and stiffness	1
Weakness and stiffness	1
Other medical reasons	
Mental health	1
Contralateral rotator cuff tear	1

Functional and Quality of Life Measures

Postoperative EQ-5D-5L index and EQ-VAS scores were significantly greater (better) in patients returning to golf postoperatively (P = 0.024 and P = 0.002, respectively). There was no significant difference in postoperative functional outcomes or pain scores

Table 3. RC procedures performed for patients returning and not returning to golf

Procedure	Returned to golf	
	Yes (n = 29)	No (n = 9)
RC repair		
Supraspinatus	14	3
Subscapularis	5	1
Supraspinatus+subscapularis	1	1
Supraspinatus+infraspinatus	3	1
Supraspinatus+infraspinatus+subscapularis	6	3
Biceps tenodesis	5	0
Biceps tenotomy	4	5
Humeral head microfracture	2	0
Subacromial decompression	16	4
ACJ excision	4	0
ACJ reconstruction	1	0
Capsular release	6	1
Rotator interval release	3	3

RC: rotator cuff, ACJ: acromioclavicular joint.

Table 2. Preoperative demographics and golf factors for patients returning and not returning to golf

Demographic	Returned to golf		P-value
	Yes (n = 29)	No (n = 9)	
Sex (male:female)	24: 5 (82.8:17.2)	9:0 (100:0)	0.312
Handedness (right)	28 (96.6)	8 (88.9)	0.422
Shoulder dominance (lead)	7 (24.1)	4 (44.4)	0.401
Age (yr)	55.9 ± 10.0	54.9 ± 10.7	0.796
Body mass index (kg/m^2)	27.7 ± 3.7	28.4 ± 4.1	0.653
Smoking	4 (13.8)	4 (44.4)	0.086
Follow-up (mo)	27.6 ± 23.0	25.4 ± 15.9	0.800
Symptom duration (mo)	31.5 ± 45.7	26.0 ± 34.6	0.740
Tear type			0.436
Degenerative	19 (65.5)	4 (44.4)	
Traumatic	10 (34.5)	5 (55.6)	
Preoperative golf participation (playing)	5 (17.2)	0	0.312
Premorbid handicap	17.1 ± 7.9	17.7 ± 7.3	0.860
Premorbid golf frequency (rounds per week)			0.157
< 1	6 (20.7)	4 (44.4)	
1–1.9	7 (24.1)	1 (11.1)	
2–2.9	10 (34.5)	4 (44.4)	
≥ 3	6 (20.7)	0	
Rotator cuff tear size			0.954
Small	2 (6.9)	1 (11.1)	
Medium	18 (62.1)	5 (55.5)	
Large	4 (13.8)	1 (11.1)	
Massive	5 (17.2)	2 (22.2)	

Values are presented as number (%) or mean ± standard deviation.

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according to whether patients returned to golf or not. Postoperative outcome measures for patients returning and not returning to golf, respectively, are presented in Table 4. Notably, 86.8% of patients overall were satisfied with their shoulder operation, with 96.6% of patients returning and 55.5% of patients not returning to golf, respectively, being satisfied with their shoulder operation (OR, 22.4; P = 0.008).

Complications

Two patients were diagnosed with adhesive capsulitis of their operated-on shoulder in the immediate postoperative period, requiring distension arthrography; subsequently, 1 of these patients returned to golf and 1 developed a recurrent RC tear. Two patients with clinical examination findings suggestive of repair re-tear were found to have radiologically confirmed re-tear and were awaiting revision RC repair at the time of follow-up, with neither having returned to golf postoperatively.

DISCUSSION

The most important findings from this study were as follows: (1) the rate of return to golf following RC repair was 76.3%, (2) most patients returned to golf with similar handicaps and frequency of play as their premorbid state, (3) patients who returned had greater quality of life outcome measures compared to those who did not return, and (4) persistent subjective shoulder dysfunction (78%) was the most common barrier preventing patients from returning to golf.

To our knowledge, this is the largest published series addressing golf outcomes for patients following RC repair, reporting a return to golf rate of 76.3%. Published rates of returning to golf following RC repair range from 60% to 100% [24,25], with smaller series and subgroups within published papers on return to sports documenting rates of > 90% [25-29]. Whilst Vives et al. [9] reported an 89.7% return to golf rate among 29 patients undergoing RC repair, a larger series documented in conference proceedings calculated a 75.6% rate of return postoperatively, which is in keeping with the findings reported here [30]. The rate of return reported in our study is less than the 84.7% rate reported in a systematic review analysing involvement in a range of sports postoperatively [15], but concurs with the findings from a review showing that 79% of baseball and softball players returned to their sport following RC repair [16]. It has been highlighted that reaching extremes of the overhead range of motion is not as necessary for the golf swing compared to in throwing sports [9], but golf does involve significant engagement of the shoulder musculature throughout the swing and a throwing-type motion [13].

Whilst postoperative outcomes for pain and function did not significantly differ between patients who did and did not return to golf, quality of life measures (as assessed by EQ-VAS and EQ-5D-5L) were significantly greater in those who returned to golf. This is an association and does not imply causation, but the beneficial impacts of golf participation on health and wellness have been well-documented [4]. Patients who returned to golf were satisfied with their involvement in the game in 91.1% of cases, which may be reflected in that those returning were found to be able to play at a similar frequency as that during their premorbid state with similar performance levels (as indicated by handicap data) despite them being older. A systematic review investigating golf outcomes following shoulder arthroplasty found similarly maintained performance outcomes (according to both handicap change and driving distance) [31]. Reduced postoperative performance levels in elite athletes following RC repair have been observed in professional tennis and baseball players [32,33], but the golfers in this population are primarily recreational rather than professional players. Given the lack of evidence in the literature addressing outcomes among elite golfers, it is difficult to determine whether the outcomes observed in this study would be

Table 4. Postoperative outcome variables for patients returning and not returning to golf

Postoperative outcome variable	Returned to golf		Effect size[a]	P-value
	Yes (n = 29)	No (n = 9)		
EQ-5D-5L index	0.9 ± 0.1	0.7 ± 0.2	1.16	0.024[c]
EQ VAS	85.8 ± 13.7	67.0 ± 17.0	1.22	0.002[c]
Pain score	59.0 ± 40.4	57.3 ± 34.7	0.04	0.913
OSS	42.3 ± 7.9	33.4 ± 14.1	0.78	0.124
WOSI	548.9 ± 489.8	902.5 ± 667.2	0.60	0.104
QuickDASH score	12.2 ± 17.0	32.4 ± 30.0	0.83	0.105
Surgery satisfaction (% satisfied)	96.6	55.5	22.40[b]	0.008[c]

Values are presented as mean ± standard deviation.
EQ-5D-5L: EuroQol 5-dimension 5-level, VAS: visual analog scale, OSS: Oxford Shoulder Score, WOSI: Western Ontario shoulder instability score, QuickDASH: Quick Disabilities of the Arm, Shoulder and Hand.
[a]Cohen's D effect size reported unless otherwise specified; [b]Odds ratio; [c]Significant at α = 0.05 level.

similarly applicable to this patient group. Despite the high rates of satisfaction regarding postoperative golf involvement observed in this study, 37.9% of patients experienced at least mild pain during play. However, it has been reported that 47% of "healthy" athletes experience shoulder pain during full performance, which may account for these findings [34].

Whilst most reasons for failure to return to golf were related to shoulder pain, weakness and stiffness (Table 1), two patients cited time out from the sport as their reason for non-return. As 86.8% of patients were unable to play preoperatively due to shoulder disability, it remains unclear how long patients are spending away from play due to RC tear symptoms. Orthopaedic waiting lists have grown significantly in recent years, and streamlining this process could serve to reduce the duration of preoperative morbidity prior to shoulder surgery [35,36]. In addition, golf-specific rehabilitation protocols have been documented [37], which could serve to optimise return to golf timelines and performance, although adequately powered studies with control groups will be required to determine their benefit.

Preoperative function, demographics and golfing variables were not associated with rates of return to golf postoperatively. A meta-analysis of the RC repair literature reported that patient age, the involvement of multiple structures, tear size, diabetes mellitus, cuff fatty infiltration, preoperative strength and insurance status all affect outcomes following RC repair [38]. Biceps involvement has also been reported to be a predictor of poor outcomes following cuff repair [39]. Similarly, in this study, patients who underwent RC repair with biceps tenotomy were significantly less likely to return to golf compared to those not who did not undergo biceps tenotomy. There was no association found between RC tear size and return to golf, although this trend may be accounted for by the lack of a broad range of tear sizes evident in the study population, with 60.5% of tears measuring 1–3 cm in size. The golf swing is asymmetric in nature, and the lead and trail shoulders engage differing components of the RC to different extents throughout the swing [12,13]. Despite the differing strains across the lead and trail shoulders, shoulder dominance did not impact the rate of return to golf in this study, in keeping with the findings reported by Vives et al. [9] However, electromyography has shown that the supraspinatus and infraspinatus are more engaged in the lead shoulder, while the subscapularis is more engaged in the trail shoulder [12], and study size prevented us from investigating the interplay between shoulder dominance, the individual muscles that were torn and golf performance postoperatively.

This study should be interpreted considering its limitations, including those commonly seen in retrospective studies, such as inconsistent reporting of information, loss to follow-up and lack of a control group. However, loss to follow-up was limited to 19.9% of the population, which is less than the benchmark used for quality assessments in retrospective series [40]. Additionally, patients lost to follow-up had similar baseline demographics and underwent similar procedures compared to those not lost to follow-up. The patient population consisted predominantly of men, although this is reflective of the overall golfing demographic. The limited sample size predisposes the findings to type 2 error. Patients with clinical examination findings suggestive of an intact RC repair did not undergo any direct radiological assessment of RC integrity at final follow-up. Potentially, some of these patients may have experienced a re-tear of their repair, although this has been shown to not correlate with functional outcomes [41,42]. In addition, various additional procedures were performed, and other markers of cuff tear severity out with the number of structures requiring repair and the indication for additional procedures were not measured. A further limitation existed in that handicap was used as a proxy measure for performance, but further metrics—including shot distances, club speed and accuracy—were not recorded. Furthermore, it has been proposed that up to 92% of RC tears in golfers are secondary to overuse syndromes [5]. However, this study reports outcomes for a high proportion of traumatic RC tears. This may be because this study focuses solely on RC tears requiring surgical repair, discounting those for which nonoperative management is most suitable. Finally, this study did not explore the impact of length of golf career or time away from the game on patient outcomes, nor did it assess the timing of return to golf postoperatively.

CONCLUSIONS

Golfers were likely (76%) to return to golf following RC repair, which was associated with a greater health-related quality of life, to their premorbid performance level with little residual symptomatology. However, persistent subjective shoulder dysfunction (78%) was the most common barrier preventing patients from returning to golf.

NOTES

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Conflict of interest

None.

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Data availability

Contact the corresponding author for data availability.

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REFERENCES

1. Sports Marketing Surveys. Global golf numbers report produced for the R&A. Sports Marketing Surveys; 2017.
2. Evans K, Tuttle N. Improving performance in golf: current research and implications from a clinical perspective. Braz J Phys Ther 2015;19:381–9.
3. Murray AD, Archibald D, Murray IR, et al. 2018 International Consensus Statement on Golf and Health to guide action by people, policymakers and the golf industry. Br J Sports Med 2018;52:1426–36.
4. Murray AD, Daines L, Archibald D, et al. The relationships between golf and health: a scoping review. Br J Sports Med 2017;51:12–9.
5. Gosheger G, Liem D, Ludwig K, Greshake O, Winkelmann W. Injuries and overuse syndromes in golf. Am J Sports Med 2003;31:438–43.
6. Robinson PG, Murray IR, Duckworth AD, et al. Systematic review of musculoskeletal injuries in professional golfers. Br J Sports Med 2019;53:13–8.
7. Hovis WD, Dean MT, Mallon WJ, Hawkins RJ. Posterior instability of the shoulder with secondary impingement in elite golfers. Am J Sports Med 2002;30:886–90.
8. Mallon WJ, Colosimo AJ. Acromioclavicular joint injury in competitive golfers. J South Orthop Assoc 1995;4:277–82.
9. Vives MJ, Miller LS, Rubenstein DL, Taliwal RV, Becker CE. Repair of rotator cuff tears in golfers. Arthroscopy 2001;17:165–72.
10. McCarroll JR, Gioe TJ. Professional golfers and the price they pay. Phys Sportsmed 1982;10:64–70.
11. Minagawa H, Yamamoto N, Abe H, et al. Prevalence of symptomatic and asymptomatic rotator cuff tears in the general population: from mass-screening in one village. J Orthop 2013;10:8–12.
12. Escamilla RF, Andrews JR. Shoulder muscle recruitment patterns and related biomechanics during upper extremity sports. Sports Med 2009;39:569–90.
13. Jobe FW, Moynes DR, Antonelli DJ. Rotator cuff function during a golf swing. Am J Sports Med 1986;14:388–92.
14. Dunn WR, Kuhn JE, Sanders R, et al. 2013 Neer Award: predictors of failure of nonoperative treatment of chronic, symptomatic, full-thickness rotator cuff tears. J Shoulder Elbow Surg 2016;25:1303–11.
15. Klouche S, Lefevre N, Herman S, Gerometta A, Bohu Y. Return to sport after rotator cuff tear repair: a systematic review and meta-analysis. Am J Sports Med 2016;44:1877–87.
16. Altintas B, Anderson N, Dornan GJ, Boykin RE, Logan C, Millett PJ. Return to sport after arthroscopic rotator cuff repair: is there a difference between the recreational and the competitive athlete. Am J Sports Med 2020;48:252–61.
17. DeOrio JK, Cofield RH. Results of a second attempt at surgical repair of a failed initial rotator-cuff repair. J Bone Joint Surg Am 1984;66:563–7.
18. Beaton DE, Wright JG, Katz JN; Upper Extremity Collaborative Group. Development of the QuickDASH: comparison of three item-reduction approaches. J Bone Joint Surg Am 2005;87:1038–46.
19. Dawson J, Fitzpatrick R, Carr A. Questionnaire on the perceptions of patients about shoulder surgery. J Bone Joint Surg Br 1996;78:593–600.
20. Kirkley A, Griffin S, McLintock H, Ng L. The development and evaluation of a disease-specific quality of life measurement tool for shoulder instability: the Western Ontario Shoulder Instability Index (WOSI). Am J Sports Med 1998;26:764–72.
21. Herdman M, Gudex C, Lloyd A, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). Qual Life Res 2011;20:1727–36.

22. Scott CE, MacDonald DJ, Howie CR. 'Worse than death' and waiting for a joint arthroplasty. Bone Joint J 2019;101:941–50.
23. Lakens D. Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. Front Psychol 2013;4:863.
24. Liu SH. Arthroscopically-assisted rotator-cuff repair. J Bone Joint Surg Br 1994;76:592–5.
25. Liem D, Lichtenberg S, Magosch P, Habermeyer P. Arthroscopic rotator cuff repair in overhead-throwing athletes. Am J Sports Med 2008;36:1317–22.
26. Antoni M, Klouche S, Mas V, Ferrand M, Bauer T, Hardy P. Return to recreational sport and clinical outcomes with at least 2years follow-up after arthroscopic repair of rotator cuff tears. Orthop Traumatol Surg Res 2016;102:563–7.
27. Baker CL, Liu SH. Comparison of open and arthroscopically assisted rotator cuff repairs. Am J Sports Med 1995;23:99–104.
28. Takayama K, Yamada S, Kobori Y, Shiode H. Modified load sharing rip-stop technique in patients with traumatic transtendinous rotator cuff tear: surgical technique and clinical outcomes. J Orthop Sci 2021;26:589–94.
29. Tibone JE, Elrod B, Jobe FW, et al. Surgical treatment of tears of the rotator cuff in athletes. J Bone Joint Surg Am 1986;68:887–91.
30. Tramer J, Okoroha K, Taylor K, Kuhlmann N, Muh S. Return to golf following arthroscopic rotator cuff repair. Arthroscopy 2021;37:e73–4.
31. Robinson PG, Williamson TR, Creighton AP, et al. Rate and timing of return to golf after hip, knee, or shoulder arthroplasty: a systematic review and meta-analysis. Am J Sports Med 2022 Jan 12 [Epub]. https://doi.org/10.1177/03635465211064292.
32. Dines JS, Jones K, Maher P, Altchek D. Arthroscopic management of full-thickness rotator cuff tears in major league baseball pitchers: the lateralized footprint repair technique. Am J Orthop (Belle Mead NJ) 2016;45:128–33.
33. Young SW, Dakic J, Stroia K, Nguyen ML, Safran MR. Arthroscopic shoulder surgery in female professional tennis players: ability and timing to return to play. Clin J Sport Med 2017;27:357–60.
34. Soldatis JJ, Moseley JB, Etminan M. Shoulder symptoms in healthy athletes: a comparison of outcome scoring systems. J Shoulder Elbow Surg 1997;6:265–71.
35. Williams P, Beard DJ, Verghese N. Yet another iceberg? The hidden potential harm of elective orthopaedic waiting lists [Internet]. Transient J; 2020 [cited 2023 Feb 17]. Available from: https://www.boa.ac.uk/resources/yet-another-iceberg-the-hidden-potential-harm-of-elective-orthopaedic-waiting-lists.html
36. British Orthopaedic Association. T&O waiting list the largest for over a decade [Internet]. British Orthopaedic Association; 2022 [cited 2023 Feb 17]. Available from: https://www.boa.ac.uk/resources/t-o-waiting-list-the-largest-for-over-a-decade.html
37. Brumitt J, Meira EP, En Gilpin H, Brunette M. Comprehensive strength training program for a recreational senior golfer 11-months after a rotator cuff repair. Int J Sports Phys Ther 2011;6:343–56.
38. Raman J, Walton D, MacDermid JC, Athwal GS. Predictors of outcomes after rotator cuff repair: a meta-analysis. J Hand Ther 2017;30:276–92.
39. Lambers Heerspink FO, Dorrestijn O, van Raay JJ, Diercks RL. Specific patient-related prognostic factors for rotator cuff repair: a systematic review. J Shoulder Elbow Surg 2014;23:1073–80.
40. National Institutes of Health. Quality assessment tool for before-after (pre-post) studies with no control group [Internet]. National Institutes of Health; 2021 [cited 2023 Feb 17]. Available from: https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools
41. Yoo JC, Ahn JH, Koh KH, Lim KS. Rotator cuff integrity after arthroscopic repair for large tears with less-than-optimal footprint coverage. Arthroscopy 2009;25:1093–100.
42. Frank JB, ElAttrache NS, Dines JS, Blackburn A, Crues J, Tibone JE. Repair site integrity after arthroscopic transosseous-equivalent suture-bridge rotator cuff repair. Am J Sports Med 2008;36:1496–503.

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