



# Return to sport following reverse shoulder arthroplasty: a systematic review

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**Background:** The purpose of this study is to systematically review the evidence in the literature to ascertain the rate and timing of return to sport following reverse shoulder arthroplasty (RSA).

**Methods:** A systematic literature search based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, using the Embase, MEDLINE, and Cochrane Library Databases. Eligible for inclusion were clinical studies reporting on return to sport following RSA. Statistical analysis was performed using SPSS.

**Results:** Overall, 8 studies including 455 patients (464 shoulders) met our inclusion criteria. The majority of patients were female (77.7%), with an average age of 74.2 years. The overall rate of return to sport was 79.1%; with 66.7% of golfers, 74.3% of swimmers, 50.0% of tennis players, 94.4% of joggers, and 69.7% of cyclists returning. In addition, 71.4% of patients returned to the same level of sporting activity. The average time to return to sport was 3.4 months with a mean follow-up of 34.0 months.

**Discussion and conclusion:** The results from our systematic review show that the majority of patients are able to return to sport following RSA, with a large number returning to the same level of sport. However, results were modest in overhead athletes, with a concerning number unable to return to tennis post-RSA.

**Level of evidence:** Level IV; Systematic Review

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There have been an increasing number of reverse shoulder arthroplasty (RSA) procedures performed worldwide in recent years.<sup>24</sup> Traditionally, RSA was reserved for patients with limited functional postoperative goals. However, RSA is now being performed for an expanding spectrum of indications,<sup>1,4,8,10-12,23,30</sup> including massive rotator cuff tears, osteoarthritic degeneration, and proximal

humeral fractures.<sup>9,11</sup> As a result, RSA is being carried out on a greater number of patients, including younger and more active patients, who often expect high functional outcomes from their surgery, including a desire for some patients to return to sport (RTS) postoperatively.<sup>2,9,19,21,32,33,37</sup>

The clinical utility of RSA has proven useful in enabling elderly patients to regain functionality and to perform their activities of daily living.<sup>3,29</sup> Although the evidence regarding RSA allowing people to return to sporting activities is limited, expanding indications have led to an increased number of people returning to sporting activity postoperatively.<sup>3,22</sup> As more orthopedic surgeons

Institutional review board approval was not required for this systematic review.

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elect to use RSA in the management of their patients, investigation is warranted to assess the role for RSA as a surgical option to allow patients to return to preoperative levels of activity.<sup>6,22</sup> The purpose of this study is to systematically review the evidence in the literature to ascertain the rate and timing of return to sport following RSA. Our hypothesis was that there would be satisfactory rates of RTS overall, with moderate rates of RTS following RSA in the overhead sports person.

## Methods

### Study selection

The literature search was performed by 2 independent reviewers (M.G.D. and M.S.D.) using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A senior author (L.P.) arbitrated on any disagreements following the search. The titles and abstracts identified in the search were screened, before potentially eligible studies received a full-text review. The reference of each included study was then reviewed to assess whether inclusion in this systematic review was necessary.

### Search strategy

A search was performed in May 2020 of MEDLINE, Embase, and Cochrane Library databases using predetermined keywords. The following keywords were applied for the search: (RSA OR RTSA OR reverse shoulder arthroplasty OR reverse total shoulder arthroplasty OR reverse shoulder replacement OR reverse total shoulder replacement). No time limit was given to publication date.

### Eligibility criteria

The inclusion criteria were the following: (1) clinical study in relation to outcomes of RSA, (2) reports on RTS, (3) published in a peer-reviewed journal, and (4) published in English. The exclusion criteria were the following: (1) review studies, (2) cadaver studies, (3) biomechanical studies, (4) abstract only, and (5) studies of level V evidence.

### Data extraction/analysis

Study characteristics were collected by 2 blinded reviewers using a predetermined data sheet. These characteristics included (1) study design, (2) level of evidence, (3) methodological quality of evidence, (4) population, (5) clinical outcome measures, and (6) follow-up time points. Recorded results were combined by a third independent reviewer (E.T.H.). In case of discrepancies in opinion between the reviewers, the senior author was asked to arbitrate. Clinical outcomes of interest included (1) overall rate of RTS, (2) level of RTS, and (3) time to RTS. Overhead sports were defined as (1) golf, (2) swimming, and (3) tennis.

## Statistics

Quantitative statistical analysis was performed using IBM SPSS Statistics for Macintosh, version 22.0 (IBM, Armonk, NY, USA).

## Results

### Literature search

The initial literature search resulted in 3224 total studies. Overall, assessment for removal of duplicates yielded 852 duplicate studies. The remaining 2372 articles were screened for inclusion and exclusion criteria. Subsequently, 158 unique studies were evaluated and full texts were assessed for eligibility. Overall, 8 clinical studies were included in this review article, as demonstrated in [Figure 1](#).

### Study characteristics/patient demographics

Our review found 8 studies including 455 patients (464 shoulders) meeting our inclusion criteria. The majority of patients were female (77.7%), with an average age of 74.2 years (range 33-92) and a mean follow-up of 34.0 months. The mean methodological quality of evidence was 62 (47-73). The study characteristics and patient demographics are illustrated in [Table I](#).

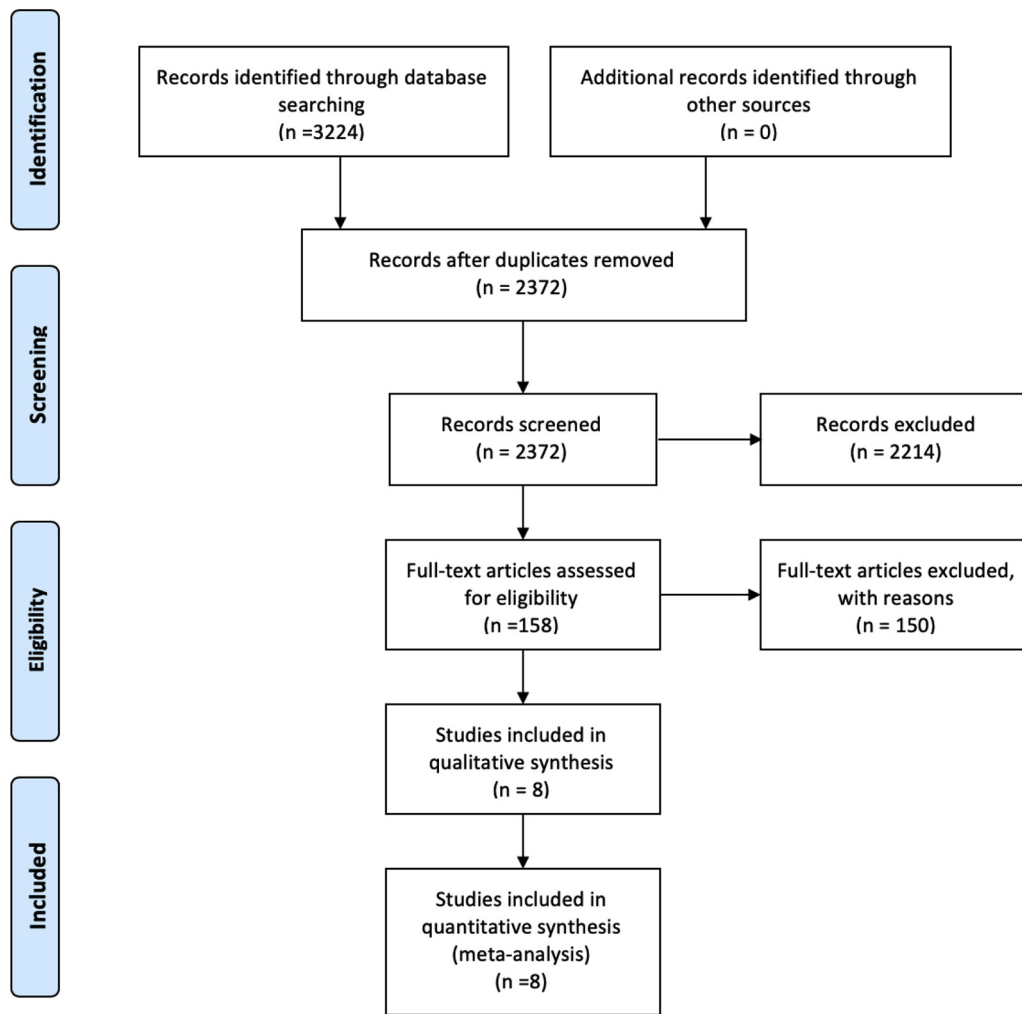
### Return to sport

The overall rate of RTS was 79.1%, with 71.4% of those who returned to sport returning to the same level. The mean time of RTS for all sports was 3.4 months (range 1.5-6). The overall RTS criteria were reported in 5 of the 8 included studies (62.5%). Overall, 50% of studies reported allowing RTS at 3 months post-RSA (range 1.5-6 months). Rates of RTS by sporting activity are illustrated further in [Table II](#).

## Discussion

The most important finding in this study was that the majority of patients were capable of returning to sport at the same level following RSA. This suggests that RSA is a suitable operative option for surgical management of glenohumeral pathologies in the aging sports person. However, the authors acknowledge the considerable differences in the RTS rates between athletic activities, as joggers, golfers, swimmers, and cyclists demonstrate moderate to high rates of RTS, whereas the chances of returning to tennis following RSA were relatively low.

The primary goal of this systematic review was to evaluate the potential of use of RSA as a surgical option to



**Figure 1** PRISMA study selection flow diagram.

**Table I** Study characteristics and patient demographics

Author	LOE	MQQE	Shoulders, n	Sex: female, n (%)	Age, yr	Follow-up, mo
Bulhoff et al (2015) <sup>7</sup>	IV	73	15	46 (59.0)	76.2	58
Fink Barnes et al (2015) <sup>16</sup>	III	70	78	NR	75.3	58
Drignei et al (2009) <sup>13</sup>	IV	51	6	5 (83.3)	73	18
Kolling et al (2018) <sup>25</sup>	III	65	166	164 (98.8)	77.1	35
Latif et al (2012) <sup>27</sup>	III	47	18	NR	72.9	23
Liu et al (2016) <sup>31</sup>	III	65	102	70 (69.0)	72.3	31
Simovitch et al (2015) <sup>34</sup>	IV	65	67	NR	73	43
Weber-Spickschen et al (2015) <sup>39</sup>	III	59	12	NR	74	6
Total	—	62	464	285/367 (77.7)	74.2	34

LOE, level of evidence; MQQE, methodological quality of evidence; NR, not reported.

enable noncollision sport athletes to RTS. We appreciate that medical literature reports a wide range of RTS rates between various studies: Edwards et al<sup>15</sup> reported that 75% of their patients returned to sport post-RSA; however,

significant selection bias was observed in this study as the results of only 4 patients were reported. In contrast, a larger study from Simovitch et al<sup>34</sup> reported an RTS rate of 60% following RSA, and results as high as 85% for patients

**Table II** Return to play by sport

Sport	Studies	% (n/n)
Golf	3	66.7 (20/30)
Swim	4	74.3 (81/109)
Tennis	3	50.0 (15/30)
Jogging	3	94.4 (67/71)
Cycle	3	69.7 (46/66)
Not specified	2	87.0 (138/158)
Overall	8	79.1 (367/464)
Same level	5	71.4 (262/367)

hoping to return to at least 1 sport were reported in another study from Garcia et al.<sup>18</sup> We hypothesized a moderate RTS rate post-RSA, particularly in patients who play overhead sports. This prediction was based on the evidence reported in numerous biomechanical studies reporting that there is more stress on the shoulder joint at a range of different movements in overhead sports compared with other sports.<sup>3,5,14,17,35</sup> Despite RSA being classically seen as mainly an option for severe rotator cuff arthropathy in older patients with low baseline activity levels,<sup>4</sup> our results demonstrate high rates of RTS postoperatively. These results suggest RSA is a viable option for orthopedic surgeons in the management of sportspersons who desire to RTS postoperatively; however, patients should be counseled with regard to the marked discrepancy in return rates between various sports.

Our results strongly support returning to sport after RSA for patients who wish to re-engage in nonoverhead sports, such as jogging. This is unsurprising as such sports do not heavily rely on shoulder function affecting performance. Consequentially, RTS is favorable for these sportspersons, with more than 90% managing to RTS at final follow-up. In contrast, sportspersons wishing to return to overhead sports such as tennis, swimming, and golf were much less successful, with moderate rates of RTS seen in this group. This study highlights the significant inconsistencies between reported results for each of the overhead sports: although approximately 70% of golfers and swimmers were able to return to their sports, only 50% of tennis players did so postoperatively, a result for tennis players that is in keeping with our original hypothesis. On the contrary, all other sports included in this analysis exceeded our original expectations, with unprecedented satisfactory RTS for these sportspersons.

Despite these encouraging findings, the authors wish to acknowledge there is limited evidence with regard to returning to play after RSA in sports that rely heavily on shoulder function and biomechanics. In their series, Fink Barnes and colleagues<sup>16</sup> illustrate that none of their 78

tennis players could RTS following RSA. The reported poor postoperative outcomes for tennis players following RSA have been attributed in medical literature to the large kinetic energy generated in a tennis serve.<sup>38</sup> Similarly, RSA has been demonstrated to impair the full motion in golf swings,<sup>36</sup> consequently resulting in a combined functional and psychological impact on golfers and their desire to RTS. On the contrary, excellent rates of RTS (95.8%) have been reported in golfers within younger patient cohorts (mean age 52.4 years) following either total shoulder arthroplasty or hemiarthroplasty.<sup>7,30</sup> Although our findings are somewhat promising for returning to sports for such sports as golf and swimming, perhaps it appears that this surgical approach is less predictable in facilitating a return to overhead sporting activities when compared to total shoulder arthroplasty and hemiarthroplasty.<sup>20,26,28</sup>

### Limitations

The main limitation of this study is that more than a third of patients included in the study failed to detail which sport patients wished to return to postoperatively. This consideration may diminish the validity of the reported results derived from those with sport-specific data. The body of evidence in this systematic review is primarily based off lower levels of evidence with low methodical quality; a lack of high-level prospective trials exists on this topic, with no Level I or II studies included in this review. Furthermore, this study limited the search to articles with full text published in the English language, which may have resulted in a loss of literature as well as a potential selection bias.

### Conclusion

The results from our systematic review show that the majority of patients are able to return to sport following RSA, with a large number returning to the same level of sport. However, the results were more modest in overhead athletes, with a concerning number unable to return to tennis post-RSA.

### Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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