Systematic Review

# Return to Play After Arthroscopic Stabilization for Posterior Shoulder Instability—A Systematic Review

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**Purpose:** To ascertain the rate and timing of return to play (RTP) and the availability of specific criteria for safe RTP after arthroscopic posterior shoulder stabilization. **Methods:** Medline, EMBASE, and the Cochrane Library were searched according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines to find studies on arthroscopic posterior shoulder stabilization. Studies were included if they reported RTP data or rehabilitation protocols and excluded if concomitant procedures influenced the rehabilitation protocol. Rate and timing of RTP, along with rehabilitation protocols, were assessed. **Results:** This review found 25 studies, including 895 cases, meeting the study's inclusion criteria. The majority of patients were male (82.7%), with an age range of 14 to 66 years and a follow-up range of 4 to 148.8 months. The overall RTP rate ranged from 62.7% to 100.0%, and 50.0% to 100.0% returned to the same level of play. Among collision athletes, the overall rate of RTP was 80.0% to 100.0%, with 69.2%-100.0% returning to the same level of play. In overhead athletes, the overall rate of RTP was 85.2% to 100.0%, with 55.6% to 100.0% returning to the same level of play. Four studies (128 patients) specifically addressed the timing of RTP, and the range to RTP was 4.3 to 8.6 months. Specific RTP criteria were reported in a majority of studies (60%), with the most reported item being restoration of strength (44%). **Conclusion:** There is a high rate of return to sport after arthroscopic posterior shoulder stabilization, ranging from 4.3 to 8.6 months after surgery. Return to preinjury level is higher for collision athletes compared with overhead athletes. However, there is inadequate reporting of RTP criteria in the current literature, with no clear timeline for when it is safe to return to sport. **Level of Evidence:** IV, systematic review of level II to IV studies

Posterior shoulder instability (PSI) represents an estimated 2% to 10% of all shoulder instability cases.[1-5] PSI often presents insidiously, as the most common symptom is shoulder pain and not an acute instability event. Repetitive microtrauma to the shoulder, atraumatic causes including baseline ligamentous laxity, and acute traumatic events have been proposed and suspected in PSI.[4,6-8] PSI is commonly seen in athletes who perform high-demand, dynamic posterior-loading activities, such as weightlifters and American football linemen, as well as athletes in sports that reward increased shoulder range of motion, including swimming and gymnastics. It is occasionally seen in the young military population.[4,5,8-12] PSI may be treated conservatively or operatively, with management dictated by patient factors (age, compliance, comorbidities), evidence of any bony pathology involving the glenohumeral joint, and mechanism of instability.[2,13]

Burkhead and Rockwood[14] found nonoperative management to be less successful in patients with a history of a traumatic event, as 16% of patients with a traumatic event had clinical success as opposed to 70% to 89% of patients without a traumatic event. Surgery is commonly considered when patients continue to experience instability symptoms and fail nonoperative treatment.[7,14,15] However, although surgical correction for PSI has provided improved clinical outcomes, the rates of return to play (RTP) for PSI are unclear.[9,10,16-20] Additionally, there is no consensus for guidelines or criteria on how to allow patients to return to play safely after posterior shoulder stabilization.

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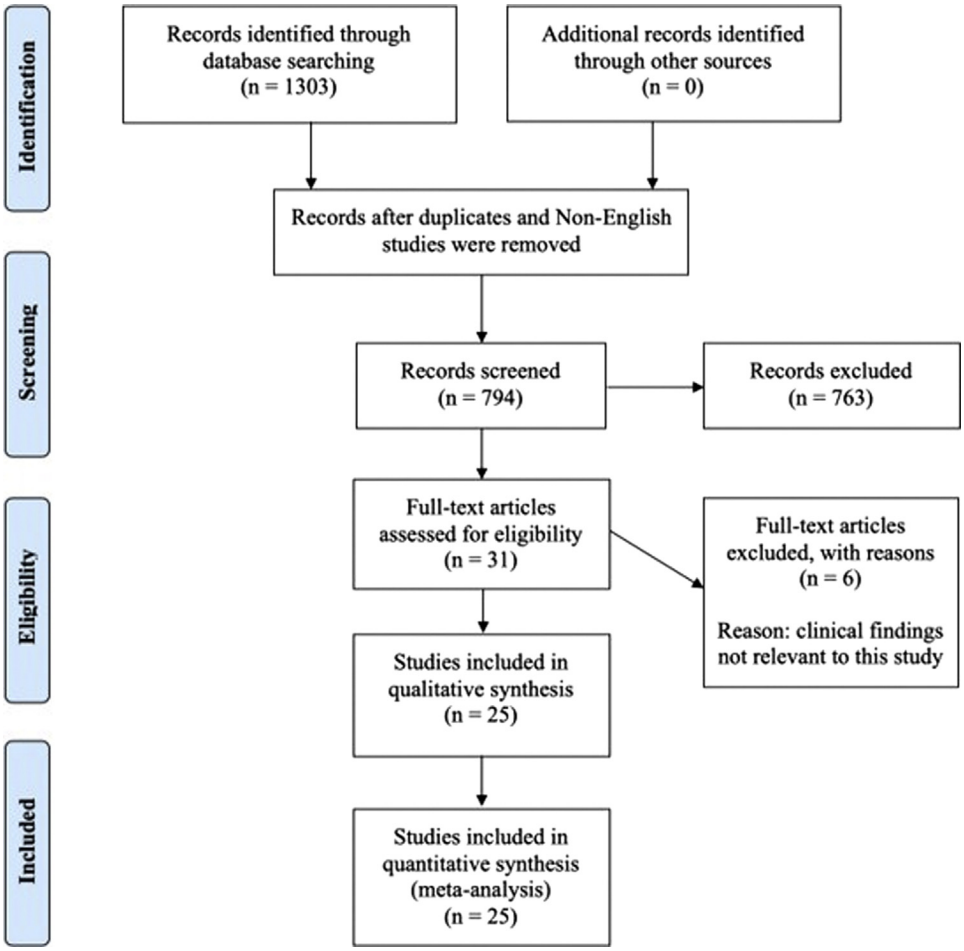


**Fig 1.** Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

The purpose of this systematic review is to ascertain the rate and timing of RTP and the availability of specific criteria for safe RTP after arthroscopic posterior shoulder stabilization. The hypothesis is that there is a significant rate of RTP after arthroscopic posterior stabilization but substantial differences in RTP protocols.

## Methods

### Search Strategy and Study Selection

To collate the existing evidence related to rehabilitation protocol and RTP after posterior shoulder stabilization, a systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Eligibility criteria for this review consisted of clinical studies of patients undergoing arthroscopic posterior shoulder stabilization in which rehabilitation protocols or RTP data were reported. Further study characteristics required for eligibility included publication in a peer-reviewed journal and availability of the full text of the study. Studies were deemed ineligible for this review if they included concomitant procedures that explicitly influenced the rehabilitation protocol or patients with multidirectional laxity. Review articles, case reports, surgical technique articles, biomechanical studies, and non−English language articles were not included.

Screening, eligibility, and inclusion were determined by 2 independent reviewers (J.W.F. and E.T.H.). The Medline, EMBASE, and Cochrane Library databases were searched from their inception to December 20, 2019, using the following algorithm: posterior AND shoulder instability AND (arthrosc*). The titles and abstracts of returned results were screened according to the described eligibility criteria (Fig 1). Potentially relevant studies were identified, and the associated full text was reviewed. The reference lists of all relevant studies were screened for any articles not identified through the database search. Studies were included based on agreement of both independent reviewers. Any instances of disagreement were resolved through consultation with the senior author.

### Assessment of Level and Quality of Evidence

The level of evidence (LOE) of the included studies was evaluated based on the criteria from the Oxford Centre for Evidence-Based Medicine.[21] The quality of

**Table 1.** Study Characteristics

| Reference | LOE | QOE | Patients | Age (y) | Male sex (%) | Follow-up (mo) |
|---|---|---|---|---|---|---|
| Andrieu et al. 2017[25] | III | 63 | 101 | 28.8 | 74.2 | 49.7 |
| Arner et al. 2015[26] | IV | 79 | 56 | 17.9 (14.8 to 25.5) | 100 | 44.7 (24 to 98) |
| Bahk et al. 2010[27] | IV | 62 | 29 | 26.3 (18.3 to 43.4) | 97 | 66 (24 to 148.8) |
| Badge et al. 2009[12] | IV | 87 | 11 | 24.8 (15 to 36) | 100 | 32 (17 to 54) |
| Bradley et al. 2006[18] | II | 92 | 100 | 23.3 (15 to 61) | 77 | 27.7 (12 to 77) |
| Bradley et al. 2013[28] | II | 72 | 200 | 24.3 (15 to 65) | 79 | 36.7 (12 to 115) |
| Castagna et al. 2007[29] | IV | 63 | 9 | 25.2 | 77.8 | 34.2 (28 to 39) |
| Eckenrode et al. 2009[30] | IV | 65 | 5 | 20.2 (18 to 22) | 100 | NR |
| Garret et al. 2017[31] | III | 49 | 25 | 30 (16 to 45) | 64 | NR |
| Hines et al. 2018[37] | III | 52 | 32 | 30.8 (20 to 47) | 93.8 | 53.7 (25 to 82) |
| Katthagen et al. 2017[33] | III | 69 | 38 | 27.6 (13 to 66) | 92.1 | 49.2 (24 to 93.6) |
| Kercher et al. 2019[35] | IV | 76 | 32 | 20.5 (16 to 41) | 100 | 41.58 (24 to 92) |
| Kim et al. 2003[36] | IV | 72 | 15 | 21 (17 to 25) | 93 | 39 (31 to 47) |
| Kraeutler et al. 2018[34] | III | 74 | 22 | 26.6 (17 to 45) | 95 | 43.2 (26.4 to 88.8) |
| Lacheta et al. 2019[32] | IV | 72 | 7 | 23.5 (17 to 43) | 100 | 96 (36 to 120) |
| Lenart et al. 2012[19] | IV | 70 | 19 | 21.4 (15 to 33) | 81 | 36 (12 to 67) |
| Mair et al. 1998[9] | IV | 73 | 9 | 18.8 (16 to 21) | 100 | 30 (24 to 42) |
| McClincy et al. 2015[38] | III | 77 | 48 | 17.8 | 71 | 37 (12 to 97) |
| McClincy et al. 2020[39] | IV | 80 | 68 | 17.2 (14 to 19) | NR | 45 |
| Papendick and Savoie 1995[20] | IV | 62 | 41 | 23 (15 to 42) | NR | 10 (4 to 41) |
| Radkowski et al. 2008[40] | II | 90 | 98 | 22.9 | 76.5 | 27 |
| Robins et al. 2017[41] | IV | 58 | 42 | NR | NR | 39.6 |
| Wanich et al. 2012[42] | IV | 68 | 12 | 20.3 (16 to 33) | 100 | 33.6 (18 to 64) |
| Wolf and Eakin 1998[43] | IV | 60 | 5 | 26 (14 to 54) | 79 | 33 (24 to 45) |
| Wooten et al. 2015[44] | IV | 74 | 22 | 17.3 | 86.30 | 63 (24 to 115) |

Data for age and follow-up are mean (range).
LOE, level of evidence; NR, not reported; QOE, quality of evidence.

studies was assessed based on the criteria from the Modified Coleman Methodology Score as performed by Ramponi et al.[22] The methodological quality of the RTP guidelines described in each study was assessed based on the criteria outlined by Zaman et al.[23] Instances of scoring discrepancy were resolved through consultation with the senior author to reach a consensus.

### Data Extraction

Two reviewers independently extracted data in duplicate from the included studies using a predesigned data collection form. Screening was performed to remove duplicate patients between studies. Demographic variables included total number of patients, sex ratio, patient age, and follow-up time. Variables related to RTP were recorded, including percentage of patients returning to play, ability to return to the preoperative level of play, patient-reported timing of return to athletic activity, and reasons for not returning to sport.

### Statistical Analysis

Statistical analysis was performed using SPSS (release 2013; IBM SPSS Statistics for Macintosh, version 22.0. Armonk, NY). Descriptive statistics were determined for all categorical and continuous variables. Categorical variables were reported as frequencies with percentages, and continuous variables were reported as a weighted mean with an estimated standard deviation. The quality of RTP for each study was determined according to the quality of the RTP guidelines outlined by Zaman et al.[23] For all analyses, $P$ values $<.05$ were considered to be statistically significant.

## Results

Initially, 1303 studies were identified. After removal of duplicates and non-English studies, 794 studies were further analyzed. After application of inclusion and exclusion criteria, 25 studies reporting on 996 shoulders were included in the final analysis (Fig 1).

### Study Characteristics

Overall, 25 clinical studies (LOE II, 3; LOE III, 6; LOE IV, 16) reported RTP rates, including 996 shoulders. There were 740 males and 155 females, with ages ranging from 14.8 to 66 years, who were followed up for 4 to 148.8 months (Table 1).

### Rate and Time of RTP

Rates of return to play were reported in 25 studies. The overall rate of RTP was 62.7% to 100%; in 18 studies, 50.0% to 100% returned to the same level of play. Four studies (128 patients) reported time of return to play, which was 4.3 to 8.6 months (Table 2).

### Rate of RTP Among Collision and Overhead Sports

Among collision athletes, the overall rate of return to play was 80% to 100%, with 69.2% to 100% returning

**Table 2.** Rate and Time of Return to Play

| Reference | Return to Play (%) | Return to Play at Same or Higher Level (%) | Time (mo) |
|---|---|---|---|
| Andrieu et al. 2017[25] | 62.7 | NR | 7.7 |
| Arner et al. 2015[26] | 92.9 | 78.6 | NR |
| Bahk et al. 2010[27] | 100 | 100 | 4.3 |
| Badge et al. 2009[12] | 84.6 | 65.4 | NR |
| Bradley et al. 2006[18] | 89.0 | 67.0 | NR |
| Bradley et al. 2013[28] | 90.0 | 63.5 | NR |
| Castagna et al. 2007[29] | 100 | 100 | NR |
| Eckenrode et al. 2009[30] | 80.0 | 80.0 | NR |
| Garret et al. 2017[31] | 71.4 | NR | NR |
| Hines et al. 2018[37] | 87.5 | NR | NR |
| Katthagen et al. 2017[33] | 78.6 | 78.6 | NR |
| Kercher et al. 2019[35] | 93.8 | 62.5 | NR |
| Kim et al. 2003[36] | 100 | NR | NR |
| Kraeutler et al. 2018[34] | 68.2 | 50.0 | 8.6 |
| Lacheta et al. 2019[32] | 100 | 100 | NR |
| Lenart et al. 2012[19] | 100 | 100 | NR |
| Mair et al. 1998[9] | 100 | 100 | NR |
| McClincy et al. 2015[38] | 85.4 | 60.4 | NR |
| McClincy et al. 2020[39] | 89.0 | 76.8 | NR |
| Papendick and Savoie 1995[20] | 100 | NR | NR |
| Radkowski et al. 2008[40] | 88.8 | 73.5 | NR |
| Robins et al. 2017[41] | 91.9 | NR | NR |
| Wanich et al. 2012[42] | 91.7 | 91.7 | 5.9 |
| Wolf and Eakin 1998[43] | 100 | NR | NR |
| Wooten et al. 2015[44] | 80.0 | 68.0 | NR |

Abbreviation: NR, not reported.

to the same level of play. In overhead athletes, the overall rate of return to play was 85.2% to 100%, with 55.6% to 100% returning to the same level of play (Table 3).

## RTP Criteria

Overall return-to-play criteria were reported in the majority of studies (60%), with the most commonly report item being restoration of shoulder strength

**Table 3.** Rate of Return to Play in Collision and Overhead Athletes

| Reference | Return to Play (%) | Return to Play at Same or Higher Level (%) | Time (mo) |
|---|---|---|---|
| Collision athletes | | | |
| Arner et al. 2015[26] | 92.9 | 78.6 | NR |
| Badge et al. 2009[12] | 100 | 100 | 4.3 |
| Bradley et al. 2006[18] | 86.3 | 74.5 | NR |
| Bradley et al. 2013[28] | 90.6 | 69.2 | NR |
| Castagna et al. 2007[29] | 100 | 100 | NR |
| Eckenrode et al. 2009[30] | 80.0 | 80.0 | NR |
| Kim et al. 2003[36] | 100 | NR | NR |
| Lacheta et al. 2019[32] | 100 | 100 | NR |
| Lenart et al. 2012[19] | 100 | 100 | NR |
| Mair et al. 1998[9] | 100 | 100 | NR |
| Robins et al. 2017[41] | 91.9 | NR | NR |
| Wolf and Eakin 1998[43] | 100 | NR | NR |
| Overhead athletes | | | |
| Kercher et al. 2019[35] | 93.8 | 62.5 | NR |
| Kim et al. 2003[36] | 100 | NR | NR |
| Lenart et al. 2012[19] | 100 | 100 | NR |
| McClincy et al. 2015[38] | 85.4 | 60.4 | NR |
| Papendick and Savoie 1995[20] | 100 | NR | NR |
| Radkowski et al. 2008[40] | 85.2 | 55.6 | NR |
| Wanich et al. 2012[42] | 91.7 | 91.7 | 5.9 |
| Wolf and Eakin 1998[43] | 100 | NR | NR |

Abbreviation: NR, not reported.

**Table 4.** Return-to-Play Criteria

| | |
|---|---|
| Overall | 15 (60) |
| Strength | 11 (44) |
| Range of motion | 10 (40) |
| Time | 9 (36) |
| Pain | 5 (20) |
| Sport-specific rehabilitation | 4 (16) |
| Proprioception | 1 (5) |

Data are n (%).

(44%). There was a small discrepancy in reported time of return, with 9 studies (36%) reporting return at either 4 or 6 months, 6 months being the most commonly used time point (24%). Other criteria including range of motion (ROM) (40%), absence of pain (20%), completion of sport-specific rehabilitation (16%), and proprioception (4%) were also reported. The mean RTP quality of evidence was 1.8 (range 0 to 4) (Table 4).

## Discussion

The most important finding from this systematic review of the literature was a high rate of return to sport after arthroscopic posterior shoulder stabilization, with the majority of patients returning to the same level of play. Both collision and overhead athletes returned to play at high rates, but one third of overhead athletes were unable to return to their preinjury status. However, there is inadequate reporting of RTP criteria in the current literature. Additionally, it remains unclear in the literature when it is safe to return to play, with appreciable variations in when athletes could return. Time, strength, and ROM were the most commonly reported criteria for RTP, but a few studies used sports-specific rehabilitation protocols.

Return to play is a key and desirable outcome after orthopaedic procedures. Healthy, active patients place great importance on returning to sports and returning to the same (or higher) level as preinjury.[24] This systematic review demonstrated that RTP was achievable at a high rate after posterior shoulder stabilization.[9,18,19,25-44] Bradley et al.[28] evaluated 200 shoulders, diagnosed with unidirectional recurrent posterior shoulder instability, and noted that 90% returned to play. Both McClincy et al.[38] and Radkowski et al.[40] compared surgical outcomes and RTP rates in throwing and nonthrowing athletes. McClincy et al.[38] reported that 86% of the athletes were able to return to play, with no significant difference between the throwing and nonthrowing athletes. Radkowski et al.[40] reported that throwing and nonthrowing athletes returned to play at 85% and 91%, respectively. These reported findings indicate that athletes of varying sports-specific motions return to play at high levels after posterior shoulder stabilization. However, it is still unknown whether these players were able to sustain their activity level, or what the impact of returning to play had on the durability of their posterior shoulder stabilization. It is worth mentioning that the reported rates compare well to other commonly performed sports surgeries such as anterior shoulder stabilization, anterior cruciate ligament reconstruction, and medial patellofemoral ligament surgery.[23,45-47]

Although several studies reported high rates of RTP, the number of athletes who return to the same or higher level varies. Studies by Bradley et al.[18] and Bahk et al.[27] reported similar RTP rates. However, return to the same or higher level rates was ~20% lower, suggesting excellent results after surgery but room for improvement, and future research with regard to returning with the same ability before the athlete's injury.[18,27] A study in 2009[30] documented the outcomes and RTP rates for 5 collegiate Division I wrestlers after posterior shoulder stabilization. Four of the 5 athletes returned to their preinjury status (the fifth graduated from college), including 2 achieving All-American honors.[30] Although they make up a small sample size, these wrestlers were able to recover fully and perform at an elite level. Lacheta et al.[32] followed athletes after arthroscopic posterior bony Bankart bridge repair technique and found all 9 athletes returned to play and achieved their previous athletic level. The type of sport had no significance on the outcomes or the ability to return to the same or higher level of performance among this cohort.

Several studies reported data on overhead and collision subcohorts, determining whether the physical motion of the shoulder or the type of sport had an impact on RTP rates and return to preinjury status.[9,18,19,26,28,38,40,42] Our systematic review revealed that overhead and collision athletes returned to play at similar rates, but collision athletes were more likely than overhead athletes to return to the same or higher level. A study in 2015 assessed 56 American football players, concluding that 93% of the players successfully returned to sport. However, only 79% were capable of returning to their preinjury status.[26] Another study in 2015 compared nonthrowing athletes to overhead throwing athletes, documenting similar RTP rates. Although overhead throwing athletes returned to play at a rate of 85%, only 60% were able to return to the same or higher level.[38] The discrepancy in return to preinjury status between collision and overhead athletes suggests the need for validated RTP criteria.

Most of the selected studies reported general criteria for RTP, with most reporting time, ROM, and strength as important components. The majority of the studies allowed RTP at 6 months. Developing a verified RTP guideline may potentially help decrease the rate of recurrence of instability. Several studies reported the rate of recurrence within each respective cohort after posterior shoulder stabilization. Bahk et al.[27] and Hines

et al.[37] reported 3.4% and 6% recurrence rates, respectively. Bradley et al.[28] prospectively reviewed 200 patients, and 14 of the 200 required arthroscopic revision. A systematic review conducted in 2018 defined RTP criteria after operative stabilization for traumatic anterior shoulder instability in hopes of reducing the recurrence rate.[48] Much like the Hurley et al.[49] systematic review that reported RTP rates after anterior shoulder stabilization, creating a validated checklist for a safe RTP after posterior shoulder stabilization would help improve surgical outcomes, decrease recurrence rates, and help close the gap between RTP and rates of return to the same or higher level.

Several factors have been postulated and correlated with athletes who are unable to return to play, such as poor healing, timing of life events (graduation from high school or college), and loss of interest in the injury-causing sport. Bahk et al.[27] evaluated clinical outcomes and attempted to identify predictors of success after arthroscopic posterior Bankart reconstruction, concluding that 96.6% of the cohort reported success, with 84.6% returning to sports. Of the 8 athletes who did not return to sports, 75% documented that it was because of their shoulder.[27] A 2015 study evaluated American football players after arthroscopic stabilization of PSI, with a majority returning to sport. However, the study team reported that some players returned at a different level or not at all because of injuries other than PSI or because they chose to partake in a different sport.[26] Military personal were evaluated for the presence of posterior glenoid bone loss after arthroscopic isolated stabilization of the posterior labrum, investigating its impact on return to duty, complications, and surgical outcomes. Patients were separated according to mean posterior glenoid bone loss: <13.5%, considered minimal loss, and >13.5%, considered subcritical. Patients with >13.5% bone loss were less likely to return to full duty compared with those with minimal bone loss, 14.3% versus 8%, respectively.[37] Baseball players who underwent arthroscopic posterior labral repair were assessed for surgical outcomes and described a large RTP rate. However, pitchers were less likely than position players to return to preinjury levels (41% versus 86%).[35] This suggests that it may be harder to return to certain positions in baseball and potentially other major sports after PSI.

## Limitations

Systematic reviews are vulnerable to limitations, including possible biases in the selected studies. Specific variables restrict the conclusions made from this study, including the retrospective composition, low level of evidence, and irregular reporting of RTP information. Because of limitations in the included studies' reporting, we were unable to analyze whether demographic factors or dominance of shoulder were potential risk factors for inability to RTP and return to the same or higher level. Additionally, we were unable to determine whether concomitant pathologies hindered an athlete's ability to return to play or return to their preinjury status. A few studies reported a mean follow-up <12 months, questioning the potential effect of a return at 4 months on overall outcomes and a return to athletic activities. Lastly, the long-term effects of loss of ROM and overconstraint could not be assessed given the short- and medium-term nature of the reviewed studies.

## Conclusion

There is a high rate of return to sport after arthroscopic posterior shoulder stabilization, ranging from 4.3 to 8.6 months after surgery. Return to preinjury level is higher for collision athletes compared with overhead athletes. However, there is inadequate reporting on RTP criteria in the current literature, with no clear timeline for when it is safe to return to sport.

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