Systematic Review

Objective Measures for Assessing Readiness to Return to Sport After Shoulder Instability Procedures Are Not Standardized: A Systematic Review

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Purpose: To report objective measures utilized to assess readiness to return to sport after shoulder instability procedures. **Methods:** Our systematic review included studies if they assessed active individuals after a shoulder instability procedure with at least 1 patient-reported outcome or physical performance measure. We excluded studies of atraumatic instability, studies only reporting imaging, or studies of biomechanics. Risk of bias was assessed with the Methodological Items for Non-Randomized Studies tool, and studies were further scored with the Return to Sport Value Assessment. **Results:** Thirty-seven articles selected for inclusion scored a median of 18.5 (comparative) and 10.0 (noncomparative) on the Methodological Items for Non-Randomized Studies and a mean of 2.5 on the Return to Sport Value Assessment. Twelve patient-reported outcomes were utilized across 19 studies to assess pain, function, and psychological readiness, with the Western Ontario Shoulder Index and the Shoulder Instability Return to Sport Index reported most frequently. Eighteen studies reported strength, most commonly internal and external rotation, and 18 studies reported range of motion. Physical performance tests, 6 discrete tests and 1 composite score, were less frequently reported (8 studies), with the Closed Kinetic Chain Upper Extremity Stability Test, Y-Balance Test of the Upper Quarter, and Unilateral Seated Shot-Put Test reported in more than 1 study. Deficits in patient-reported outcomes and limb symmetry persisted at the time of return to sport. **Conclusions:** Most patients undergoing shoulder stabilization procedures regained fundamental strength and range of motion. However, some studies noted difficulties in achieving sufficient performance metrics for athletic activities 6 months postsurgery. Due to lack of standardized measures, recommendations for specific test components and benchmark data for clinical decision-making are not available. **Level of Evidence:** Level IV, systematic review of Level III and IV studies.

For athletes with acute shoulder instability, clinical studies support surgical intervention followed by a phased approach to rehabilitation. The success of shoulder stabilization procedures is often defined as a full return to the prior level of participation without recurrence. Although most athletes, 88%, report being satisfied with their outcomes and their ability to return to play, recurrence rates (5%-15%) can be significant, and some athletes, up to 30%, may fail to return to the desired level of competition.[1-3] To better optimize outcomes and improve the likelihood of a safe return to sport without diminished performance, providers may consider recent evidence indicating that objective measure of function, rather than time since surgery, is a better indicator of readiness to return to play.

In contemporary practice, most criteria for return to sport are based on time since surgery alone. In a systematic review, Ciccotti et al.[4] extracted the criteria used for return-to-play decision-making after anterior stabilization procedures and found that no study included a scoring instrument. Rather, time since surgery, strength, range of motion, absence of pain, radiographs, stability, and proprioception were included. In fact, time since surgery was the sole criterion in 75.8% of the studies.[4] When range of motion, strength, or stability was included, the assessments were not

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objectively measured but qualitatively described with terms such as "full," "near normal," or "good static stability."[4] Hurley et al.[3] performed a similar review of studies reporting on athletes undergoing the Latarjet procedure. The findings were similar: time since surgery, imaging, clinical examination, strength, pain, and range of motion were listed as criteria, but none of the studies described objective means of assessment or predetermined thresholds to be met prior to release to unrestricted activity.[3] After procedures addressing posterior instability, Fried et al.[2] found reports of strength, range of motion, time since surgery, absence of pain, completion of a sport-specific rehabilitation protocol, and proprioception but no consensus for guidelines to determine when it is safe to return an athlete to play.

Although a period of 6 months is reported as the most frequently used criterion in return-to-sport decision-making, it does not provide necessary information on the athlete's functional progress or readiness to return to athletic demands. The importance of incorporating criteria-based return-to-sport testing (CBRST), rather than time since surgery alone, in the decision-making process is emphasized by the findings of Wilson et al.,[5] which establish the presence of lingering strength deficits at 6 months after anterior or posterior stabilization. Drummond et al.[6] found that athletes who did not undergo CBRST were 4.85 times more likely to experience recurrent instability after returning to sport and had a 22% rate of recurrence compared with a 5% rate among athletes who were required to pass CBRST. While there is no consensus on which tests should be included in a CBRST to direct rehabilitation and to safely return the athlete to unrestricted athletic exposure, multiple upper-extremity tests have been described in the literature. Otley et al.[7] proposed that a test battery should include elements of what is required for sports participation and for athletes to adequately protect themselves during live play. These include assessments of psychological readiness and absence of kinesiophobia, adequate sport-specific range of motion, the ability to both develop and resist force, and scapulohumeral stability and endurance.[7]

Little is known about patient outcomes following shoulder instability procedures that require athletes to complete a CBRST battery as a means to inform return-to-sport (RTS) decision-making. To establish a suitable test battery for this purpose, reported measures should be examined and considered to develop appropriate expectations and to set thresholds to define passing performance. The purpose of this review is to report objective measures used to assess readiness to return to sport after shoulder instability procedures. We hypothesize that the variability of objective measures reported across studies, along with the performance deficiencies they may expose, will demonstrate a need to establish a multifactorial test battery to determine readiness to return to sport after shoulder instability procedures.

Methods

Search Strategy and Screening Process

A systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and was registered with PROSPERO (International Prospective Register of Systematic Reviews) under registration number CRD42021286872. A systematic search on the concepts of shoulder instability and sports was conducted on June 23, 2023. We searched MEDLINE (Ovid), CINAHL Complete (EBSCOhost), SPORTDiscus (EBSCOhost), and Scopus (Elsevier) using a combination of keywords and database-specific subject headings when available. No restrictions were placed by date or language. Editorials, letters, comments, case reports, book chapters/reviews, theses, and pamphlets were excluded from the search. Animal-only studies were similarly excluded. No additional registries or gray literature were searched. The full, reproducible search strategies for all included databases are located in Appendix Table 1 (available at www.arthroscopyjournal.org). In addition, a manual search of reference lists of the articles screened for inclusion was performed to find relevant articles not identified in the initial search. All citations were imported into Covidence, a systematic review screening software, for de-duplication and screening.[8]

Three independent reviewers (H.M., K.W., C.A.) screened all titles and abstracts. Conflicts were resolved by a fourth reviewer (S.B.). The same process was repeated for full-text review. Studies were included if they assessed individuals, aged 14 to 40 years, returning to organized recreation, sport, or military activities after a shoulder procedure to address traumatic instability and were objectively measured with respect to at least 1 of the following domains: patient-reported outcomes (function, pain, readiness, psychological factors) and/or physical performance (strength, range of motion, stability, proprioception, power, speed, endurance). We excluded studies of atraumatic instability, studies only reporting imaging, or studies of biomechanics.

Data Extraction and Quality Assessment

Three blinded reviewers (H.M., K.W., C.A.) recorded relevant information regarding the study characteristics, including the study design, level of evidence (based on the guidelines of the Oxford Centre for Evidence-Based Medicine), population, outcome measures, and timing of measurement collection.

The risk of bias was performed independently by three reviewers (H.M., K.W., C.A.) using the Methodological Items for Non-Randomized Studies (MINORS) tool, a methodological index for nonrandomized

studies.[9] A fourth reviewer (S.B.) resolved discrepancies. Each MINORS item was scored 0 if not reported, 1 if reported but inadequate, and 2 if reported and adequate. The maximum possible score was 16 for noncomparative studies and 24 for comparative studies. Scores between 13 and 16 for noncomparative studies or between 21 and 23 for comparative studies were considered at low risk of bias. Those scoring less than 12 for noncomparative studies or less than 20 for comparative studies were considered at high risk of bias. The level of agreeability of the risk of bias between the three reviewers was calculated using Cohen's κ.

To describe the value of each study with respect to RTS, this review used the Return to Sport Value Assessment (RTSVA), a 0 to 4 rating scale previously described by Zaman et al.[10] One point was awarded for the presence of each of the following items: a rehabilitation protocol, a desired timeline for RTS, an objective or subjective conditional criterion, and at least 1 specific measurement. A total score of 4 indicated that a study had well-defined RTS criteria. A score of 0 indicated no RTS criteria were defined. Scoring was performed independently by 2 of 3 reviewers (H.M., K.W., C.A.). The remaining third reviewer resolved discrepancies.

Two of 3 blinded reviewers (H.M., K.W., C.A.) recorded relevant information for each study. This included descriptive characteristics of each study, populations and their demographics, and types of stabilization procedures. Outcomes of interest were recorded if they were assessed between 3 and 9 months postoperatively in order to report on metrics during the period of return to play. These outcomes included patient-reported outcome measures, objectively measured range of motion, objectively measured strength, and physical performance tests.

Statistical Analysis

Given the nonrandomized design and relatively low levels of evidence of most of the included studies, pooled statistics were not reported. This group of studies demonstrated both clinical and methodological heterogeneity, making both meta-analysis and subgroup analysis unfeasible. As a result, individual measured outcomes are reported for each study.

Results

After 25,511 duplicates were removed, 12,474 studies were screened against eligibility criteria. Thirty-seven articles were included in the review (Fig 1). The median level of evidence of the included studies was Level III (28 studies), with 1 study at Level II and 8 studies at Level IV (Table 1). Based on MINORS criteria, 12 comparative studies had scores ranging from 12 to 21, and 25 noncomparative studies had scores ranging from 5 to 14. Median MINORS scores were 18.5 for comparative and 10.0 for noncomparative studies. The level of agreeability between MINORS raters was 71%, with Cohen's κ of 0.524 indicating moderate agreeability (Appendix Table 2, available at www.arthroscopyjournal.org). When assessing study quality with respect to return to sport, the included studies scored a median of 3 and a mean of 2.51 on the RTSVA. Ten studies met all 4 criteria. The level of agreeability between RTSVA raters was 77%, with Cohen's κ of 0.526 indicating moderate agreeability (Appendix Table 3, available at www.arthroscopyjournal.org).

Seven studies reported using a battery of tests while most measured only 1 or 2 constructs. Heterogeneous and insufficient data prevent the determination of normative values and limit this systematic review to a narrative discussion and conclusion.

Patient-Reported Outcome Measures

Twelve different patient-reported outcome measures were used across the included studies to assess the constructs of pain, function, and psychological readiness. The Western Ontario Shoulder Index (WOSI) was the most frequently administered (9 studies). Four of the 12 patients-reported outcome measures (PROMs) were specific to assessing patients with shoulder instability: WOSI, Athletic Shoulder Outcome Scoring System (ASOSS), Oxford Instability Score, and Shoulder Instability Return to Sport after Injury Score (SIRSI). These scores tend to improve over time between 3 and 6 months.[11-15] The Oxford Instability Score shows slightly better outcomes than the Oxford Shoulder Score in patients recovering from bony Bankart repair, confirming that this measure is more appropriate in the instability population than the Oxford Shoulder Score.[11] The SIRSI, which measures psychological readiness to return to sport, demonstrates improvement between 3 and 6 months in patients with Latarjet.[12] However, even at 6 months, patients are scoring between 68 and 78 (depending on sports demands), which is well below the ideal score of 100.[13] The WOSI and its subscales of symptoms, lifestyle, and sport also fall below ideal scores at 6 months.[14,16-18] In athletes with varying sport demands (i.e., whether they include contact or overhead demands), WOSI scores are similar at 8 months (70 [68-78]) but continue to fall below ideal (100).[13] As expected, during early testing time points of 2 to 3 months postoperatively, patients present with self-report of pain, range-of-motion (ROM) limitations, weakness, and function deficits on noninstability-specific PROMs such as the DASH (Disabilities of the Arm, Shoulder, and Hand),[19] the PENN Shoulder Score,[20] and the Oxford Shoulder Score.[11] There was an improvement noted between 3 months and later time points on the DASH[19] (6 and 9 months) and at 6 months on the American Shoulder and Elbow Surgeons (ASES) Score,[21,22] the Constant Score,[11,23] and the Oxford Shoulder Score.[11] At 6 months, the

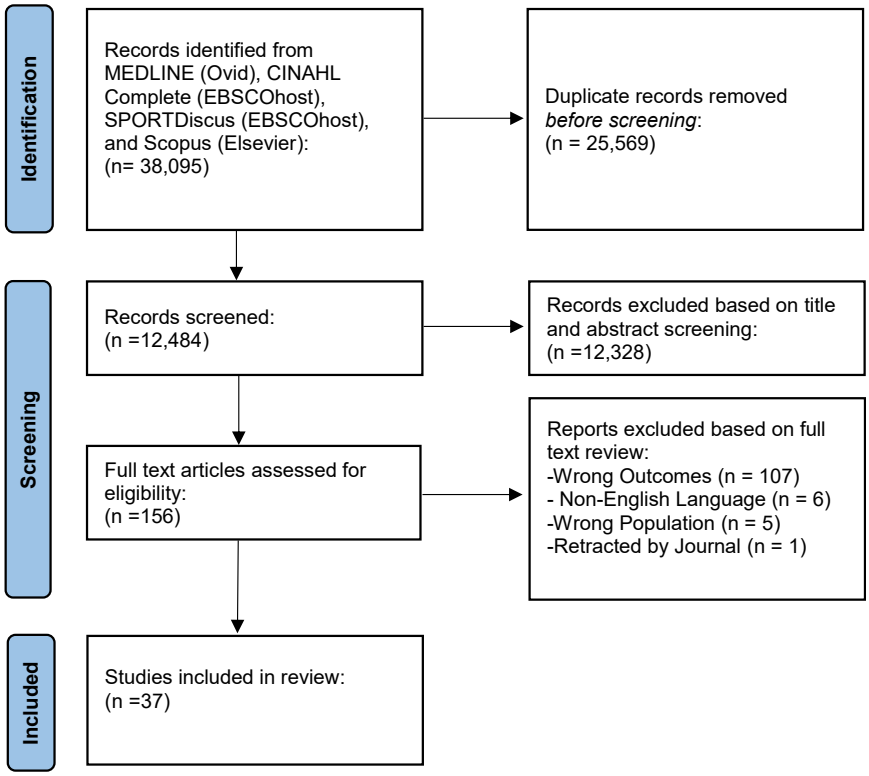

Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram for study inclusion.

ASOSS ranged from 64.0 to 70.4 out of 100, depending on if the athlete participated in overhead, impact, or collision sports.[23] The PROMIS UE (Patient-Reported Outcomes Measurement Information System—Upper Extremity) and PROMIS PF (Patient-Reported Outcomes Measurement Information System—Physical Function) showed good improvements between pre- and postsurgery but were found to be less responsive in this young and active population.[24] Table 2 summarizes the distribution of the PROMs along with scores for each population at the time of assessment.

Range of Motion

ROM was measured and reported in 18 of the included studies. Measurements of flexion, abduction, external rotation, and internal rotation were varied and reported as degrees of movement, asymmetry between sides (limb symmetry index [LSI]), and deficit of degrees of movement between sides. Generally, range of motion between 3 and 6 months increased, with minimal variations across the reported procedures and populations. At 6 months, mean flexion measures ranged across the included studies from 118° to 175°. Patients without capsullorhaphy[25] had more flexion motion than those with. For patients who returned to baseline, there was less than 2% asymmetry in flexion ROM versus more than 6% in those who did not return to baseline.[22] Those who returned to sport had similar flexion motion to those who did not return to sport.[26] Abduction measures were lower in patients who had capsullorhpahy.[25] Those who returned to baseline strength and ROM had a smaller asymmetry (1.46°) versus those who did not return to baseline (8.6°).[22] At 6 months, external rotation (ER) ROM at 0° ranged from 48° to 78°, and ER at 90° ranged from 62° to 92.1° across the included studies.[15,18,26-34] Those with remplissage[30] and those with capsullorhpahy[25] had less ER motion than those who did not. Asymmetry was greater in patients who did not return to sport.[22] Patients who did not return to sport versus those who did had similar ER ROM at 0°, but at 90°, those who did return measured an average of 86.8° versus those who did not return, who measured 80.0°.[26] Internal rotation (IR) also showed greater asymmetry in those failing to return to sport[26] and those with capsulorrhaphy.[25] IR measures reported as degrees of rotation, at 6 months, ranged from 49° to 70.2° across the included studies.[15,26,28,29,34,35] Outcomes, along with population and procedures, for each movement are included in Table 3.

Strength

Eighteen of the included studies reported objective measurements of strength, with the most commonly reported metric being both IR and ER. Eight studies also included the ratio of ER to IR strength. Methods of quantifying strength include manual muscle testing, handheld dynamometry, isokinetic (speeds range from

Table 1. Summary of Eligible Studies Included for Review

Study (First Author, Year)	Journal	Country	Years	Level of Evidence	Study Design	MINORS	RTSVA	N (shoulders)	Sex (M/F)	Mean Age ± SD (Range)	Population	Procedures Performed	Time of Measurement	Outcomes Included
Amako 2008[38]	*Journal of Shoulder and Elbow Surgery*	Japan	1996-2004	III	Cohort	9/16	3	54	53/1	(19-34)	Military population	Open Bankart and modified Bristow	3 mo, 4.5 mo, 6 mo	ER and IR isokinetic strength at 60°/s and 180°/s
Amako 2017[19]	*Orthopedic Journal of Sports Medicine*	Japan	2005-2012	III	Cohort	11/16	3	50	47/3	25 (15-38)	Military, amateur athletes	Arthroscopic Bankart repair	3 mo, 4.5 mo, 6 mo, 9 mo	ER and IR isokinetic strength at 60°/s and 180°/s; DASH
Anand 2021[34]	*International Journal of Pharmaceutical and Clinical Research*	India	2018	III	Retrospective review	10/16	1	50	45/5	33.2 ± 8.12	Contact sports (kabaddi), recreational sports (badminton, volleyball, cricket)	Open Latarjet	1 mo, 3 mo, 6 mo	Flexion and ER ROM; ASES; Quick Dash
Baldan 2022[16]	*Acta Ortopedica Brasileira*	Brazil	2013-2016	IV	Case series	21/24	1	8(9)	8/0	24.6 (20-35)	Combat athletes: martial arts, wrestling, boxing	Primary open Latarjet and bone block	12 wk, 6 mo, 12 mo	Flexion and ER ROM; ASES, WOSI
Bohu 2021[13]	*Knee Surgery, Sports Traumatology, Arthroscopy*	France	2015-2017	III	Retrospective review	15/24	3	217	184/33	26.8 ± 7.3 (15-62)	Overhead/non-overhead, contact/noncontact athletes	Latarjet	8 mo	WOSI; SIRSI
Bonnevialle 2017[27]	*International Orthopaedic*	France	2009-2013	IV	Nonrandomized experimental study	12/16	1	34	30/4	26 ± 8.5 (15-49)	Contact and overhead sports	Arthroscopic Bankart with remplissage	3 mo, 6 mo	Range of motion (flexion, ER, IR)
Bradley 2018[21]	*The American Journal of Sports Medicine*	United States	2000-2014	III	Case control	21/24	2	281(297)	236/61	20.1 (14-39)	Professional, college, high school, and recreational athletes	Arthroscopic posterior capsulolabral reconstruction	6 mo	ASES
Buckwalter 2018[22]	*Journal of Shoulder and Elbow Surgery*	United States	NR	III	Cohort	13/16	3	348	299/49	NR	Active individuals	Primary, revision, open, and arthroscopic anterior stabilization procedures	6 mo	Range of motion (flexion, abduction, ER, IR); WOSI; ASES
Chen 2005[25]	*The American Journal of Sports Medicine*	Australia	1996-2002	III	Cohort	15/24	2	66	46/20	NR	Majority injured during sport	Anterior arthroscopic stabilization with and without capsulorrhaphy	6 mo	Range of motion (flexion, abduction, ER, IR)
Choke 2021[44]	*Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*	Singapore	2012-2017	III	Retrospective review	11/16	1	7	6/1	40.2 (25-74)	Active individuals	Arthroscopic glenoid bone reconstruction using iliac crest bone graft	6 mo	Range of motion (flexion, abduction); Oxford Shoulder Score
Cortes-DelaFuente 2021[17]	*Acta Ortopedica Mexicana*	Mexico	2017-2019	III	Cohort	16/24	1	14	9/5	35 (20-68)	Not reported	Modified Eden Hybinette	6 mo, 12 mo	WOSI
Drummond 2021[6]	*Journal of Shoulder and Elbow Surgery*	United States	2014-2018	III	Case control	18/24	4	72	53/19	NR	High school and college athletes	Arthroscopic Bankart repair	6 mo	ER and IR isokinetic strength at 60°/s and 180°/s; CKCUEST; USSPT: ERET
Eckenrode 2009[20]	*Journal of Orthopaedic & Sports Physical Therapy*	United States	2004-2006	IV	Case series	11/16	4	5	5/0	20.2 (18-22)	College wrestlers	Arthroscopic posterior Bankart	7.2 wk (5-9)	Isometric Strength (HHD) of abduction, ER, IR; Penn Shoulder Score
Edouard 2010[40]	*Annals of Physical and Rehabilitation Medicine*	France	Not reported	III	Cohort	10/16	2	20	20/0	27 ± 8 (19-45)	Athletes—majority with shoulder use	Bristow Latarjet	3 mo, 6 mo	ER and IR Isokinetic Strength at 120°/s and 180°/s
Edouard 2012[39]	*International Journal of Sports Medicine*	France	2005-2008	III	Cohort	12/16	2	20	20/0	27 ± 8	Athletes—majority with shoulder use	Bristow Latarjet	3 mo, 6 mo	ER and IR isokinetic strength at 60°/s, 120°/s, and 180°/s
Ellenbecker 1999[28]	*Journal of Orthopaedic & Sports Physical Therapy*	United States	NR	III	Cohort	12/16	3	20	13/7	24.8 ± 8.48	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	12 weeks	Range of motion (flexion, abduction, ER, IR); ER and IR isokinetic strength at 90°/s, 210°/s, and 300°/s

(continued)

Table 1. Continued

Study (First Author, Year)	Journal	Country	Years	Level of Evidence	Study Design	MINORS	RTSVA	N (shoulders)	Sex (M/F)	Mean Age ± SD (Range)	Population	Procedures Performed	Time of Measurement	Outcomes Included
Frantz 2020[30]	*Orthopaedic Journal of Sports Medicine*	United States	2012-2018	III	Cohort	21/24	4	142	133/9	With remplissage: 27.0 ± 10.2 Without remplissage: 22.4 ± 7.9	Majority injured during sport	Arthroscopic Bankart with and without remplissage	6 mo	Range of motion (ER); Strength (MMT) ER
Frantz 2020[29]	*The American Journal of Sports Medicine*	United States	2012-2018	III	Cohort	14/16	4	65	59/6	24.5 ± .2	Contact and overhead sports	Primary and revision Latarjet	6 mo	Range of motion (flexion, abduction, ER, IR); strength (MMT) (flexion, abduction, ER, IR)
Girard 2022[33]	*The American Journal of Sports Medicine*	France	2018	III	Retrospective review	10/16	2	50	43/7	24 ± 8 (15-54)	Overhead sports; contact sports; contact with throwing	Latarjet and arthroscopic anterior stabilization	3 mo, 6 mo, 12 mo	Flexion, ER, and IR ROM; Subjective Shoulder Value
Hajewski 2019[24]	*Orthopaedic Journal of Sports Medicine*	United States	2015-2017	III	Cohort	11/16	1	72	57/15	22.1 (14-44)	Active individuals	Bankart; Latarjet; capsulorrhaphy	6 mo	PROMIS Pain and Function; PROMIS Upper Extremity
Inui 2020[31]	*International Orthopaedics*	Japan	1970-2012	III	Retrospective review	8/16	1	434(450)	322/112	22 (13-39)	Contact and overhead sports	Modified Putti-Platt	6 mo	ROM (ER), strength (MMT) (abduction)
Jeon 2021[32]	*Orthopedic Journal of Sports Medicine*	Republic of Korea	2007-2017	III	Retrospective review	9/16	2	85	68/17	30.4 ± 9.1 (15-43)	Limited to high-intensity sports	Primary and revision anterior arthroscopic stabilization	12 mo	Flexion, ER, and IR ROM, ER and IR isokinetic testing at 60/°s; ASES; WOSI
Jure 2021[12]	*Sports Health: A Multidisciplinary Approach*	France	NR	III	Cross Sectional	12/24	2	100	86/14	NR	Athletes	Open Latarjet	3 mo	Strength (HHD) (ER and IR); YBT-UQ; USSPT; CKCUEST; MEI; S-STARTS; SIRSI
Kumar 2021[15]	*International Journal of Pharmaceutical and Clinical Research*	India	NR	III	Retrospective review	10/16	1	50	50/2	34.22 ± 9.12	Contact sports (kabaddi), recreational sports (badminton, volleyball, cricket)	Latarjet	1 mo, 3 mo, 6 mo	Flexion, ER, and IR ROM; ASES; Quick DASH
Li 2021[43]	*An International Journal of Physical Therapy*	United States	NR	III	Cohort	7/16	3	16	15/1	20.3 ± 0.9	Division I college athletes	Anterior and posterior Bankart (some with capsular plication) (sample includes some SLAP)	3 mo, 4 mo	Push Up Peak Force; Push Up Asymmetry; YBT Medial Reach
Lima 2022[18]	*Journal of Shoulder and Elbow Surgery*	Brazil	2013-2018	III	Cohort	5/16	2	13	0/13	29.23 ± 9.47 (15-46)	Athletes	Primary open Latarjet	12 wk, 6 mo, 12 mo	Flexion and ER ROM; ASES; WOSI
McGinniss 2022[37]	*International Journal of Sports Physical Therapy*	United States	NR	IV	Case series	20/24	4	20	17/3	21.3 ± 1.9	Military cadets	Bankart	12w-6 mo	Flexion, ER, and IR ROM; isometric abduction, ER, and IR; CKCUEST, YBT-UQ, USSPT; SANE; SPADI; Quick DASH
Nourissat 2016[14]	*Orthopaedics & Traumatology: Surgery & Research*	France	2014	III	Cohort	12/24	1	184	NR	NR	Athletic population	Primary open and arthroscopic Latarjet	3 mo, 6 mo	WOSI
Rattier 2022[45]	*Orthopedic Journal of Sports Medicine*	France	2015-2018	III	Retrospective review	19/24	3	124	99/25	26.0 ± 7.8 (15-49)	Overhead and non-overhead sports	Primary open Latarjet	3 mo	Flexion, ER, and IR ROM
Reddy 2023[41]	*Journal of Shoulder and Elbow Surgery*	United States	2012-2021	III	Retrospective review	8/16	4	97	70/27	RTS: 19.9, control group: 22.5	Contact athlete; competitive athlete; overhead athlete	Posterior arthroscopic stabilization	5.7 mo	ER and IR isometric and isokinetic strength at 60°/s and 180°/s; ER Endurance Test; CKCUEST; Shot Put Test
Rhee 2007[36]	*The American Journal of Sports Medicine*	Korea	2002-2004	II	Randomized controlled trial	19/24	3	60	54/6	NR	Active individuals	Arthroscopic and open Bankart Repair	3 mo, 6 mo, 9 mo	Isometric strength (flexion, ER, IR)

(continued)

Table 1. Continued

Study (First Author, Year)	Journal	Country	Years	Level of Evidence	Study Design	MINORS	RTSVA	N (shoulders)	Sex (M/F)	Mean Age ± SD (Range)	Population	Procedures Performed	Time of Measurement	Outcomes Included
Rogowski 2023[42]	*The American Journal of Sports Medicine*	France	2017-2021	III	Cohort	8/16	4	133	115/18	DOM: 23.1 ± 6.3, Non-DOM: 23.6 ± 5.7, Control: 22.5 ± 4.8	Collision, contact, overhead	Open Latarjet	4.5 mo	ER and IR HHD, CKCUEST, YBT-UQ, USSPT
Shah 2018[11]	*Shoulder & Elbow*	United Kingdom	NR	IV	Retrospective review	11/16	3	22	21/1	29.7	Collision athletes—professional and recreational rugby players	Primary arthroscopic bony Bankart repair	3 mo, 6 mo	Oxford Shoulder Score, Oxford Instability Index
Stein 2011[23]	*The American Journal of Sports Medicine*	Germany	2006-2007	IV	Case series	11/16	4	47	39/8	Injury: 23.2 ± 6.6 Surgery: 26.9 ± 9.0	Shoulder-dependent sports	Primary arthroscopic Bankart	6 mo	ASOSS
Trinh 2019[26]	*The American Journal of Sports Medicine*	United States	NR	IV	Case series	11/16	1	49	42/7	21.7± 7.7	Overhead athletes	Primary arthroscopic anterior stabilization procedures	4-6 mo	Range of motion (flexion, abduction, ER, IR)
Wilson 2020[5]	*Journal of Shoulder and Elbow Surgery*	United States	2016-2018	IV	Case series	10/16	4	43	33/10	18.1	High school and college athletes	Anterior or posterior arthroscopic stabilization	6 mo	ER and IR isokinetic strength at 60°/s and 180°/s; CKCUEST
Yildiz 2022[35]	*Sports Health: A Multidisciplinary Approach*	Turkey	2019-2021	III	Cohort	6/16	4	32	32/0	24.5 ± 5.6	Athletes classified according to risk of shoulder injury based on type of sport	Anterior arthroscopic stabilization	6 mo	Range of motion (flexion, abduction, ER, IR); ER and IR isokinetic strength at 60°/s and 180°/s; CKCUEST, YBT-UQ, USSPT; WOSI

ASES, American Shoulder and Elbow Surgeons; ASOSS, Athletic Shoulder Outcome Scoring System; CKCUEST, Closed Kinetic Chain Upper Extremity Stability Test; DASH, Disabilities of the Arm, Shoulder, and Hand; DOM, dominant; ER, external rotation; ERET, External Rotation Endurance Test; HHD, handheld dynamometry; IR, internal rotation; MEI, Muscular Endurance Test; MINORS, Methodological Items for Non-Randomized Studies; MMT, Manual Muscle Test; NR, not reported; RTSVA, Return to Sport Value Assessment; SANE, Single Alpha-Numeric Evaluation; SIRSI, Shoulder Instability Return to Sport Index; SPADI, Shoulder Pain and Disability Index; USSPT, Unilateral Seated Shot Put Test; WOSI, Western Ontario Shoulder Index; YBT-UQ, Y-Balance Test of the Upper Quarter.

Table 2. Patient-Reported Outcome Measures of the Included Studies

PROM	Author	N	Population	Procedure	Outcomes/Scores
ASOSS	Stein et al.[23] 2011	47 (39/8)	Shoulder-dependent sports	Primary arthroscopic Bankart	6 mo: Nonimpact/noncollision: 70.4 ± 8.6 6 mo: high-impact/collision sport: 67.2 ± 9.5 6 mo: overhead sport: 66.5 ± 9.7 6 mo: martial arts sport: 64.0 ± 7.8
WOSI	Nourissat et al.[14] 2016	184	Athletic population	Primary open and arthroscopic Latarjet	3 mo: arthroscopic: symptoms subscale 7%, lifestyle subscale 25% 3 mo: open: symptoms subscale 13%, lifestyle subscale 13% 6 mo: arthroscopic: symptoms subscale 18%, sports/recreation/work subscale 24% 6 mo: open: symptoms subscale 13%, sports/recreation/work subscale 15%
	Buckwalter et al.[22] 2018	348 (299/49)	Active individuals	Primary, revision, open, and arthroscopic anterior stabilization procedures	6 mo: athletes who returned to baseline: 45.9 ± 20.2 (1.5-93.8) 6 mo: athletes who failed to return to baseline: 42.7 ± 21.1 (3.0-92.4)
	Bohu et al.[13] 2021	217 (184/33)	Overhead/non-overhead, contact/noncontact athletes	Latarjet	8 mo: overhead contact: 86 ± 14 (31-100) 8 mo: overhead noncontact: 88 ± 14 (38-100) 8 mo: non-overhead contact: 79 ± 17 (51-97) 8 mo: non-overhead noncontact: 84 ± 9 (14-88) 8 mo: all groups: 86 ± 13 (31-100)
	Baldan et al.[16] 2022	8 (8/0)	Combat athletes—martial arts, wrestling, boxing	Primary; open; anterior; Latarjet; bone block	6 mo: 63.4 12 mo: 42.4
	Cortes-DelaFuente et al.[17] 2021	14 (9/5)	Not reported	Primary; open; anterior; bone block	Sports: 6 mo: 253.857; 12 mo: 159.857 Lifestyle: 6 mo: 236.429; 12 mo: 158.071 Emotion: 6 mo: 169.357; 12 mo: 109.357 Score: 6 mo: 1,187.571; 12 mo: 806.500 Physical: 6 mo: 535.071; 12 mo: 379.214
	Jeon et al.[32] 2021	85 (68/17)	Limited to high-intensity sports	Primary; revision; arthroscopic; anterior	1 y: primary: 551.1 ± 305.0 1 y: revision: 636.7 ± 278.1
	Lima et al.[18] 2022	13 (0/13)	Athletes	Primary; open; Latarjet; anterior; traumatic	6 mo: 67.84 ± 4.79 1 y: 53.92 ± 5.33
	Kumar et al.[15] 2021	50 (48/2)	Contact sports (kabaddi), recreational	Open; Latarjet; anterior	3 mo: 81.4 ± 5.1 6 mo: 91.3 ± 5.3
	Yildiz et al.[35] 2023	32 (32/0)	Athletes classified by sport	Primary; arthroscopic; anterior	1 y: 53.92 ± 5.33
SIRSI	Jure et al.[12] 2021	50 (43/17)	Athletes	Open Latarjet	3 mo: patient group: 66.5 ± 18.1 3 mo: control group: 98.0 ± 4.0
	Bohu et al.[13] 2021	217 (184/33)	Overhead/non-overhead, contact/noncontact athletes	Latarjet	8 mo: overhead contact: 69 ± 25 (8-100) 8 mo: overhead noncontact: 78 ± 19 (27-98) 8 mo: non-overhead contact: 73 ± 17 (42-93) 8 mo: non-overhead noncontact: 68 ± 21 (30-100) 8 mo: all groups: 70 ± 23 (8-100)
PROMIS UE	Hajewski et al.[24] 2019	72 (57/15)	Active individuals	Bankart; Latarjet; capsulorrhaphy	6 mo: 52.15
PROMIS PF	Hajewski et al.[24] 2019	72 (57/15)	Active individuals	Bankart; Latarjet; capsulorrhaphy	6 mo: 57.18

(continued)

Table 2. Continued

PROM	Author	N	Population	Procedure	Outcomes/Scores
Oxford	Choke et al.[44] 2021	7 (6/1)	Active individuals	Arthroscopic glenoid bone reconstruction using iliac crest bone graft	6 mo: shoulder score: 20
	Shah et al.[11] 2018	22 (21/1)	Collision athletes—professional and recreational rugby players	Primary arthroscopic bony Bankart repair	3 mo: shoulder score: 20.2 (15.9-24.4) 6 mo: shoulder score: 18.5 (13.7-23.2) 3 mo: instability score: 22.3 (9.6-23.6) 6 mo: instability score: 26.0 (13.2-38.7)
ASES	Anand et al.[34] 2021	50 (45/5)	Contact and recreational sports	Open; Latarjet; anterior	3 mo: 82.4 ± 5.1 6 mo: 92.3 ± 5.3
	Baldan et al.[16] 2022	8 (8/0)	Combat athletes—martial arts, wrestling, boxing	Primary; open; anterior; Latarjet; bone block	6 mo: 69.2 12 mo: 73.2
	Bradley et al.[21] 2018	297 (236/61)	Professional, college, high school, and recreational athletes	Arthroscopic posterior capsulolabral reconstruction	6 mo: revision procedures: 78.0 ± 18.4 (33.2-100) 6 mo: non-revision procedures: 69.2 ± 23.6 (17.0-100)
	Buckwalter et al.[22] 2018	348 (299/49)	Active individuals	Primary, revision, open, and arthroscopic anterior stabilization procedures	6 mo: athletes who returned to baseline: pain subscale 2.8 ± 2.3, function/disability subscale 18.7 ± 7.7 6 mo: athletes who failed to return to baseline: pain subscale 2.9 ± 2.7, function/disability subscale 18.5 ± 6.8
	Jeon et al.[32] 2021	85 (68/17)	Limited to high-intensity sports	Primary; revision; arthroscopic; anterior	1 y: Primary 98.0 ± 6.2 1y: Revision 97.6 ± 3.1
	Lima et al.[18] 2022	13 (0/13)	Athletes	Primary; open; Latarjet; anterior; traumatic	6 mo: 70.92 ± 1.80 1 y: 78.38 ± 2.33
DASH	Amako et al.[19] 2017	50 (47/3)	Military and amateur athletes	Arthroscopic Bankart repair	3 mo: 11.8 ± 9.2 4.5 mo: 5.7 ± 4.4 6 mo: 7.5 ± 9.7 9 mo: 4.1 ± 4.7
Quick DASH	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Anterior; Bankart	Between 3 mo and 6 mo: −3.2
	Anand et al.[34] 2021	50 (45/5)	Contact and recreational sports	Open; Latarjet; anterior	3 mo: 20.1 ± 7.3 6 mo: 12.5 ± 6.9
	Kumar et al.[15] 2021	50 (48/2)	Contact sports (kabaddi), recreational	Open; Latarjet; anterior	3 mo: 19.1 ± 7.3 6 mo: 11.5 ± 6.9
Constant	Stein et al.[23] 2011	47 (39/8)	Shoulder-dependent sports	Primary arthroscopic Bankart	6 mo: 89.5 ± 7.6
	Shah et al.[11] 2018	22 (21/1)	Collision athletes—professional and recreational rugby players	Primary Arthroscopic bony Bankart repair	3 mo: 83.1 (47.0-92.1) 6 mo: 80.7 (64.2-97.2)
SPADI	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Anterior; Bankart	Change between 3 mo and 6 mo: −6.4
SANE	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Anterior; Bankart	Change between 3 mo and 6 mo: 12.2
Subjective Shoulder Value	Girard et al.[33] 2022	50 (43/7)	Overhead sports; contact sports; contact with throwing	Primary; open; arthroscopic; anterior; Latarjet	Arthroscopic: 6 mo: 92 ± 14, 12 mo: 93 ± 12 Open: 6 mo: 88 ± 12, 12 mo: 93 ± 11

(continued)

Table 2. Continued

PROM	Author	N	Population	Procedure	Outcomes/Scores
Sport Subjective Shoulder Value	Girard et al.[33] 2022	50 (43/7)	Overhead sports; contact sports; contact with throwing	Primary; open; arthroscopic; anterior; Latarjet	Arthroscopic: 6 mo: 79 ± 29, 12 mo: 83 ± 18 Open: 6 mo: 65 ±34, 12 mo: 87 ± 12
Penn SS	Eckenrode et al.[20] 2009	5 (5/0)	Wrestlers	Primary; arthroscopic; posterior; Bankart	7.2 (5-9) wk: pain: 22/27, satisfaction: 4/6, function: 32/54, total: 58/87

ASES, American Shoulder and Elbow Surgeons; ASOSS, Athletic Shoulder Outcome Scoring System; DASH, Disabilities of the Arm, Shoulder, and Hand; Penn SS, Penn Shoulder Score; PROM, patient-recorded outcome measure; PROMIS UE, PROMIS Upper Extremity; PROMIS PF, PROMIS Physical Function SANE, Single Alpha-Numeric Evaluation; SIRSI, Shoulder Instability Return to Sport Index; SPADI, Shoulder Pain and Disability Index; WOSI, Western Ontario Shoulder Index.

60°/s to 300°/s), and isometric instrumented assessment. Some studies reported the strength output, while others indicated the LSI or the percentage of patients who met predetermined criteria. Flexion and abduction strength both appeared to measure near normal at 6 months in patients recovering from both arthroscopic and open procedures.[20,29,36,37] Flexion continued to improve between 6 and 9 months.[36] IR at 6 months showed a near-normal return to baseline measures and limb symmetry index.[35,36,38-41] In studies measuring isokinetic strength, slower speeds (60-90°/s) revealed a greater deficit than faster speeds (180-300°/s).[5,39,40] Patients with arthroscopic procedures demonstrated greater strength earlier than those with open procedures.[36] Interestingly, 2 studies[6,41] measuring both isokinetic and isometric strength reported their findings as a percentage of patients who met the benchmark of 90% LSI. When reported this way, pass rates ranged from 43% to 72%.[6] For ER, the pass rate was even lower, with less than a 29% to 89% pass rate depending on speed and condition.[6,41] When comparing open versus arthroscopic procedures, ER strength was less in the open group at early stages.[36] Isometric ER/IR ratios were reported to have a pass rate at 6 months of 75.5% to 89.7% at 0° and 54.1% to 62.1% at 90°.[6,41] Predictably, ratios improved at higher speeds and at later follow-up.[28,39] Table 3 includes the study population, surgical procedure performed, time point of data collection, and results of strength measurements.

Performance Tests

Performance on both open kinetic chain and closed kinetic chain tests, 6 discrete tests and 1 composite score, was reported across only 8 of the included studies. These tests comprised constructs of strength, endurance, power, balance, and stabilization of the upper extremity and trunk. Four studies that included the Y-Balance Test of the Upper Quarter (YBT-UQ) found minimal deficit between limbs at 3 and 4 months.[12,35,42,43] The CKCUEST (Closed Kinetic Chain Upper Extremity Stability Test) was included in 7 studies. The number of touches ranged from 21.4 to 23.4 when measured between 3 and 6 months.[5,12,35,42] However, when considering standard deviations as high as 4.1 touches, this indicates that at least some athletes fell short of the 21-touch passing criteria. Drummond et al.[6] reported that only 70.3% of patients reached this passing criterion, while Reddy et al.[41] indicated that 90% passed. The ER Endurance Test, when performed at 6 months, showed a low pass rate (59%-81%) depending on test position.[6,41] The S-STARTS, a composite score that incorporates multiple strength and performance tests, showed a significant improvement between months 3 and 5.[12] Details and scores of the included tests are described in Table 4.

Table 3. Range of Motion and Strength Outcomes Reported in the Included Studies

RANGE OF MOTION

Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
Flexion	Bonnevialle et al.[27] 2017	34 (30/4)	Contact and overhead sports	Arthroscopic Bankart with remplissage	3 mo: 144° ± 22.5° (110°-180°) 6 mo: 166° ± 13.8° (140°-180°)
	Yildiz et al.[35] 2022	32 (32/0)	Athletes classified by sport	Anterior arthroscopic stabilization	6 mo: passive 179° ± 2.5°
	Rattier et al.[45] 2022	124 (99/25)	Overhead and non-overhead sports	Primary open Latarjet	3 mo: Active 169° ± 7°
	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Bankart	Interval change between 3 mo and 6 mo: 9.28°
	Buckwalter et al.[22] 2018	348 (299/49)	Active individuals	Primary, revision, open, and arthroscopic anterior stabilization procedures	Asymmetry at 6 mo: 1.46% ± 5.3% (returned to baseline); 6.15% ± 10.72% (failed to return to baseline)
	Chen et al.[25] 2005	66 (46/20)	Majority injured during sport	Anterior arthroscopic stabilization with and without capsulorrhaphy	6 mo: without capusulorrhaphy: 175° ± 9°, with capsulorrhaphy: 166° ± 22°
	Choke et al.[44] 2021	7 (6/1)	Active individuals	Arthroscopic glenoid bone reconstruction using iliac crest bone graft	6 mo: 118°
	Ellenbecker et al.[28] 1999	20 (13/7)	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	12 wk: 163° ± 12.7° (10/20 had over 100% LSI)
	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	6 mo: 170.6 ± 19.2°
	Lima et al.[18] 2022	13 (0/13)	Athletes	Primary open Latarjet	3 mo: active 144.61° ± 7.76° 6 mo: active 167.69° ± 5.25° 3 mo: passive 163.84° ± 7.12° 6 mo: passive 174.23° ± 4.49°
	Kumar et al.[15] 2021	50 (50/2)	Contact and recreational sports	Latarjet	1 mo: 150.7° 3 mo: 152.1° 6 mo: 157.7°
	Jeon et al.[32] 2021	85 (68/17)	Limited to high-intensity sports	Primary and revision anterior arthroscopic stabilization	12 mo: passive: primary group 162.5° ± 11°, revision group 164.9° ± 11.8°
	Girard et al.[33] 2022	50 (43/7)	Overhead sports; contact sports; contact with throwing	Latarjet and arthroscopic anterior stabilization	3 mo: arthroscopic group 145° ± 24° 6 mo: arthroscopic group 157° ± 41° 3 mo: open group 162° ± 11° 6 mo: open group 169° ± 9°
	Baldan et al.[16] 2022	8 (8/0)	Combat athletes—martial arts, wrestling, boxing	Primary open Latarjet and bone block	3 mo: active 122°, passive 132.6° 6 mo: active 132.6°, passive 140.4°
	Anand et al.[34] 2021	50 (45/5)	Contact and recreational sports	Open Latarjet	1 mo: 150.7° 3 mo: 152.1° 6 mo: 157.7°
	Trinh et al.[26] 2019	49 (42/7)	Overhead athletes	Primary arthroscopic anterior stabilization procedures	4-6 mo: returned to sport: 171.9° ± 9.1°, did not return to sport: 170.6 ± 19.2°

(continued)

Table 3. Continued

RANGE OF MOTION

Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
Abduction	Buckwalter et al.[22] 2018	348 (299/49)	Active individuals	Primary, revision, open, and arthroscopic anterior stabilization procedures	Asymmetry at 6 mo: returned to baseline: 1.46° ± 6.78°; failed to return to baseline: 8.46° ± 16.68°
	Yildiz et al.[35] 2022	32 (32/0)	Athletes classified by sport	Anterior arthroscopic stabilization	6 mo: passive 180 ± 3°
	Chen et al.[25] 2005	66 (46/20)	Majority injured during sport	Anterior arthroscopic stabilization with and without capsulorrhaphy	6 mo: without capsulorrhaphy: 173° ± 9°, with capsulorrhaphy: 163° ± 28°
	Choke et al.[44] 2021	7 (6/1)	Active individuals	Arthroscopic glenoid bone reconstruction using iliac crest bone graft	6 mo: 115°
	Ellenbecker et al.[28] 1999	20 (13/7)	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	12 wk: 162.8° ± 13.7° (6/20 had over 100% LSI)
	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	6 mo: 158.0 ± 27.1°
	Trinh et al.[26] 2019	49 (42/7)	Overhead athletes	Primary arthroscopic anterior stabilization procedures	4-6 mo: returned to sport: 167.1° ± 17.2°, did not return to sport: 167.8° ± 11.7°
ER	Bonnevialle et al.[27] 2017	34 (30/4)	Contact and overhead sports	Arthroscopic Bankart with remplissage	3 mo: ER at 0°: 34° ± 17° (5°-70°); ER at 90°: 71° ± 14° (20°-90°) 6 mo: ER at 0°: 48° ± 15° (30°-80°); ER at 90°: 81° ± 12° (60°-90°)
	Yildiz et al.[36] 2022	32 (32/0)	Athletes classified by sport	Anterior arthroscopic stabilization	6 mo: passive ER at 90°: 100° ± 7.4°
	Rattier et al.[45] 2022	124 (99/25)	Overhead and non-overhead sports	Primary open Latarjet	3 mo: active ER at 0°: 60° ± 16°; ER at 90°: 91° ± 4°
	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Bankart	Interval change between 3 mo and 6 mo: ER at 90°: 20.94°
	Lima et al.[18] 2022	13 (0/13)	Athletes	Primary open Latarjet	3 mo: active ER at 0°: 49.92° ± 4.8° 6 mo: active ER at 0°: 64.23° ± 6.07° 3 mo: passive ER at 0°: 59.61° ± 4.77° 6 mo: passive ER at 0°: 78.46° ± 3.76°
	Kumar et al.[15] 2021	50 (50/2)	Contact and recreational sports	Latarjet	1 mo: ER at 0°: 61.5° 3 mo: ER at 0°: 66.8° 6 mo: ER at 0°: 70.1° 1 mo: ER at 90°: 79.8° 3 mo: ER at 90°: 89.2° 6 mo: ER at 90°: 92.1°
	Jeon et al.[32] 2021	85 (68/17)	Limited to high-intensity sports	Primary and revision anterior arthroscopic stabilization	12 mo: passive ER at 0°: primary group 75.6° ± 15.9°, revision group 77.1° ± 17°
	Girard et al.[33] 2022	50 (43/7)	Overhead sports; contact sports; contact with throwing	Latarjet and arthroscopic anterior stabilization	3 mo: arthroscopic group ER at 0°: 36° ± 20° 6 mo: arthroscopic group ER at 0°: 57° ± 22°

(continued)

Table 3. Continued

RANGE OF MOTION

Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
					3 mo: open group ER at 0°: 41.17° ± 11° 6 mo: open group ER at 0°: 57° ± 14° 3 mo: arthroscopic group ER at 90°: 80° ± 13° 6 mo: arthroscopic group ER at 90°: 84° ± 24° 3 mo: open group ER at 90°: 74° ± 20° 6 mo: open group ER at 90°: 81° ± 19°
	Baldan et al.[16] 2022	8 (8/0)	Combat athletes—martial arts, wrestling, boxing	Primary open Latarjet and bone block	3 mo: active 36.7°, passive 42.8° 6 mo: active 52.0°, passive 56.6°
	Anand et al.[34] 2021	50 (45/5)	Contact and recreational sports	Open Latarjet	1 mo: ER at 0°: 61.5° 3 mo: ER at 0°: 66.8° 6 mo: ER at 0°: 70.1° 1 mo: ER at 90°: 79.8° 3 mo: ER at 90°: 89.2° 6 mo: ER at 90°: 92.1°
	Buckwalter et al.[22] 2018	348 (299/49)	Active individuals	Primary, revision, open, and arthroscopic anterior stabilization procedures	6 mo: ER at 0° asymmetry: 5.0% ± 10.57% (returned to baseline); 12.82% ± 14.67% (failed to return to baseline) 6 mo: ER at 90° asymmetry: 5.93% ± 8.84% (returned to baseline); 17.69% ± 20.70% (failed to return to baseline)
	Chen et al.[25] 2005	66 (46/20)	Majority injured during sport	Anterior arthroscopic stabilization with and without capsulorrhaphy	6 mo: 45° ± 23° (without capsulorrhaphy), 58° ± 18° (with capsulorrhaphy)
	Ellenbecker et al.[28] 1999	20 (13/7)	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	12 wk: ER at 90°: 86.6° ± 13.1° (4/20 had over 100% LSI)
	Frantz et al.[30] 2020	38 (33/5) with remplissage; 104 (100/4) without remplissage	Majority injured during sport	Arthroscopic Bankart with and without remplissage	6 mo: ER at 0°: 62° ± 18° (with remplissage), 59° ± 16° (without remplissage) 6 mo: ER at 90°: 85° ± 13° (with remplissage), 82° ± 16° (without remplissage)
	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	6 mo: ER at 0°: 66.0 ± 15.3°; ER at 90°: 82.3 ± 14.6°
	Inui et al.[31] 2020	434 (322/112)	Contact and overhead sports	Modified Putti-Platt	6 mo: ER at 0: 41° (10°-80°); ER at 90°: 62° (30°-130°)
	Trinh et al.[26] 2019	49 (42/7)	Overhead athletes	Primary arthroscopic anterior stabilization procedures	4-6 mo: ER at 0°: 66.5° ± 17.8° (returned to sport); ER at 0°: 66.7° ± 17.5° (did not return to sport) 4-6 mo: ER at 90°: 86.8° ± 16.4° (returned to sport); ER at 90°: 80.0° ± 17.5° (did not return to sport)

(continued)

Table 3. Continued

RANGE OF MOTION					
Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
IR	Bonnevialle et al.[27] 2017	34 (30/4)	Contact and overhead sports	Arthroscopic Bankart with remplissage	3 mo: IR AROM*: 8 ± 2.1(4-10) points 6 mo: IR AROM*: 8.9 ± 1.4 (6-10) points
	Buckwalter et al.[22] 2018	348 (299/49)	Active individuals	Primary, revision, open, and arthroscopic anterior stabilization procedures	6 mo: IR asymmetry: 2.85% ± 10.34% (returned to baseline); 12.82% ± 12.68% (failed to return to baseline)
	Chen et al.[25] 2005	66 (46/20)	Majority injured during sport	Anterior arthroscopic stabilization with and without capsulorrhaphy	6 mo: 11 ± 4 points without capsulorrhaphy, 9 ± 4 points with capsulorrhaphy†
	Ellenbecker et al.[28] 1999	20 (13/7)	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	12 wk: IR at 90°: 49.7° ± 11.1° (5/20 had over 100% LSI)
	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	6 mo: IR at 90°: 63.8° ± 17.4°
	Trinh et al.[26] 2019	49 (42/7)	Overhead athletes	Primary arthroscopic anterior stabilization procedures	4-6 mo: IR at 90°: 56.4° ± 17.0° (returned to sport); 62.8° ± 15.3° (did not return to sport)
	Yildiz et al.[35] 2022	32 (32/0)	Athletes classified by sport	Anterior arthroscopic stabilization	6 mo: passive IR 69° ± 7.2°
	Rattier et al.[45] 2022	124 (99/25)	Overhead and non-overhead sports	Primary open Latarjet	3 mo: active reach to greater trochanter
	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Bankart	Interval change between 3 mo and 6 mo: IR at 90°: 10.5°
	Kumar et al.[15] 2021	50 (50/2)	Contact and recreational sports	Latarjet	1 mo: IR at 90°: 59.2° 3 mo: IR at 90°: 67.3° 6 mo: IR at 90°: 70.2°
	Jeon et al.[32]2021	85 (68/17)	Limited to high-intensity sports	Primary and revision anterior arthroscopic stabilization	12 mo: primary group 6.7° ± 2.2°, revision group 7.1° ± 2.1° based on the vertebral level that corresponded to the patient's thumb placement (1-12 for thoracic vertebrae, 13-17 for lumbar vertebrae, and 18 for the sacrum)
	Girard et al.[33] 2022	50 (43/7)	Overhead sports; contact sports; contact with throwing	Latarjet and arthroscopic anterior stabilization	Active IR arthroscopic group: 45 days: L2, 3 mo: T12, 6 mo: T11 Active IR open group: 45 days: T12, 3 mo: T10, 6 mo: T 10
	Anand et al.[34] 2021	50 (45/5)	Contact and recreational sports	Open Latarjet	1 mo: IR at 90°: 59.2° 3 mo: IR at 90°: 67.3° 6 mo: IR at 90°: 70.2°
STRENGTH					
Test Parameter	**Author**	**N (M/F)**	**Population**	**Procedure**	**Outcomes/Scores**
Flexion	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	6 mo: percentage of patients scoring 5/5 on MMT: 95%
	Rhee et al.[36] 2007	Open: 30 (28/2) Arthroscopic: 30 (26/4)	Active individuals	Arthroscopic and open Bankart repair	LSI of arthroscopic group: 3 mo: 84.8% ± 8.3%, 6 mo: 90.6% ± 8.6%, 9 mo: 95.5% ± 7.8%

(continued)

Table 3. Continued

RANGE OF MOTION

Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
					LSI of open group: 3 mo: 76.3% ± 12.5%, 6 mo: 85.8% ± 11.5%, 9 mo: 93.4% ± 10.3%
Abduction	Eckenrode et al.[20] 2009	5 (5/0)	College wrestlers	Arthroscopic posterior Bankart	7.2 wk: isometric (kg): involved 17.1 (14.4 preseason); uninvolved 13.1
	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	6 mo: percentage of patients scoring 5/5 on MMT: 95%
	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Bankart	Isometric: interval difference between 3 mo and 6 mo, normalized to body weight (kg/kg): 0.011
IR	Amako et al.[38] 2008	54 (53/1)	Military	Open Bankart and modified Bristow	Isokinetic at 60 °/s (ft··lb): pre: 26.7 ± 8.3, 3 mo: 19.3 ± 4.5, 4.5 mo: 26.9 ± 6.7, 6 mo: 25.7 ± 4.6 Isokinetic at 180 °/s (ft·lb): pre: 22.7 ± 7.4, 3 mo: 17.0 ± 4.0, 4.5 mo: 24.6 ± 6.7, 6 mo: 22.9 ± 3.7
	Amako et al.[19] 2017	50 (47/3)	Military and amateur athletes	Arthroscopic Bankart repair	Isokinetic 60°/s (PT/W%): 3 mo: 14.8 ± 5.0, 4.5 mo: 17.3 ± 6.3, 6 mo: 17.8 ± 5.5, 9 mo: 18.0 ± 5.6 Isokinetic 180°/s (PT/W%): 3 mo: 13.4 ± 5.0, 4.5 mo: 15.8 ± 6.4, 6 mo: 15.8 ± 4.7, 9 mo: 16.7 ± 7.0 Isokinetic 60 °/s total work (ft-lb): 3 mo: 87.2 ± 36.1, 4.5 mo: 103.7 ± 37.7, 6 mo: 117.9 ± 37.5, 9 mo: 123.2 ± 34.6 Isokinetic 180°/s total work (ft-lb): 3 mo: 116.1 ± 62.9, 4.5 mo: 152.9 ± 76.1, 6 mo: 174.6 ± 64.2, 9 mo: 177.2 ± 65.5 Isokinetic peak torque ratio: 60°/s: 3 mo: 0.90 ± 0.36, 4.5 mo: 0.97 ± 0.21, 6 mo: 1.01 ± 0.24, 9 mo: 1.06 ± 0.23 Isokinetic peak torque ratio 180°/s: 3 mo: 0.92 ± 0.35, 4.5 mo: 1.03 ± 0.36, 6 mo: 1.14 ± 0.38, 9 mo: 1.12 ± 0.36
	Drummond et al.[6] 2021	36 (30/6)	High school and college athletes	Arthroscopic Bankart repair	6 mo: percentage of patients meeting criteria: isokinetic 60°/s: 56.8%, 180°/s: 56.8%, 60°/s + 180°/s: 43.2% Isometric IR at 0°: 62.2%, IR at 90°: 70.3%
	Eckenrode et al.[20] 2009	5 (5/0)	College wrestlers	Arthroscopic posterior Bankart	7.2 wk: isometric (kg): involved 16.5 (17.9 preseason); uninvolved 16.5
	Edouard et al.[40] 2010	20 (20/0)	Athletes—majority with shoulder use	Bristow Latarjet	Isokinetic 180°/s (Nm): pre: 42.5 ± 9.5, 3 mo: 30.8 ± 9.6, 6 mo: 41.0 ± 9.7 Isokinetic 120 °/s (Nm): pre: 45.7 ± 9.9,

(continued)

Table 3. Continued

RANGE OF MOTION

Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
	Edouard et al.[39] 2012	20 (20/0)	Athletes—majority with shoulder use	Bristow Latarjet	3 mo: 31.1 ± 9.4, 6 mo: 43.2 ± 10.3 Isokinetic 60°/s (Nm): pre: 45.9 ± 11.1, 3 mo: 32.1 ± 9.3, 6 mo: 42.9 ± 9.6 Isokinetic 60°/s (Nm): pre: 0.63 ± 0.14, 3 mo: 0.44 ± 0.12, 6 mo: 0.59 ± 0.12 Isokinetic 120°/s (Nm): pre: 0.63 ± 0.12, 3 mo: 0.43 ± 0.12, 6 mo: 0.59 ± 0.11 Isokinetic 180°/s (Nm): pre: 0.58 ± 0.12, 3 mo: 0.42 ± 0.12, 6 mo: 0.56 ± 0.12
	Ellenbecker et al.[28] 1999	20 (13/7)	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	Number of patients with LSI greater than 100% on isokinetic testing: 90°/s: 9, 210°/s: 11, 300°/s: 11
	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	Percentage of patients scoring 5/5 on MMT: 97%; percentage of patients passing lift-off test: 92%
	Inui et al.[31] 2020	434 (322/112)	Contact and overhead sports	Modified Putti-Platt	6 mo: percentage of patients scoring 5/5 on MMT of subscapularis: 100%
	Jeon et al.[32] 2021	85 (68/17)	Limited to high-intensity sports	Primary and revision anterior arthroscopic stabilization	12 mo: peak torque deficit (%) isokinetic 60°/s: primary 14.3 ± 17.9; revision 14.8 ± 12.1
	Jure et al.[12] 2021	50 (43/17)	Athletes	Open Latarjet	3 mo: LSI of HHD in supine 90/90: 0.98 ± 0.35
	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Bankart	Isometric: interval difference between 3 mo and 6 mo, normalized to body weight (kg/kg): 0.016
	Reddy et al.[41] 2023	97 (70/27)	Contact athlete; competitive athlete; overhead athlete	Posterior arthroscopic stabilization	5.7 mo: isometric pass rate (>90% LSI) at 0° = 89.7%; at 90° = 72.4% Isokinetic pass rate (>90% LSI) at 60°/s = 58.6%; at 180°/s = 69.0% Both 60°/s and 180°/s = 55.2%
	Rhee et al.[36] 2007	Open: 30 (28/2) Arthroscopic: 30 (26/4)	Active individuals	Arthroscopic and open Bankart repair	LSI of arthroscopic group: 3 mo: 85.9% ± 9.8%, 6 mo: 92.1% ± 11.7%, 9 mo: 95.5% ± 7.0%; LSI of open group: 3 mo: 81.8% ± 12.5%, 6 mo: 89.3% ± 13.3%, 9 mo: 95.9% ± 13.5%
	Rogowski et al.[42] 2023	133 (115/18)	Collision, contact, overhead	Open Latarjet	4.5 mo: HHD (N/kg) dominant 1.55 ± 0.50; nondominant 2.23 ± 0.43
	Wilson et al.[5] 2020	43 (33/10)	High school and college athletes	Anterior or posterior arthroscopic stabilization	6 mo: isokinetic 60°/s (Nm): involved: 35.8, uninvolved: 38.9; isokinetic 180°/s (Nm): involved: 32.3, uninvolved: 33.1
	Yildiz et al.[35] 2022	32 (32/0)	Athletes classified by sport	Anterior arthroscopic stabilization	6 mo: isokinetic LSI: type 2 95.3%; type 3 90.3%; type 4 93.3%

(continued)

Table 3. Continued

RANGE OF MOTION					
Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
ER	Amako et al.[38] 2008	54 (53/1)	Military	Open Bankart and modified Bristow	Isokinetic 60°/s (ft·lb): pre: 15.8 ± 4.2, 3 mo: 13.3 ± 3.7, 4.5 mo: 15.6 ± 3.2, 6 mo: 17.0 ± 3.8 Isokinetic 180°/s (ft·lb): pre: 11.8 ± 4.2, 3 mo: 9.3 ± 3.9, 4.5 mo: 13.1 ± 4.4, 6 mo: 13.9 ± 4.1
	Amako et al.[19] 2017	50 (47/3)	Military and amateur athletes	Arthroscopic Bankart repair	Isokinetic 60°/s (PT/W%): 3 mo: 8.8 ± 2.9, 4.5 mo: 10.7 ± 3.1, 6 mo: 11.3 ± 3.1, 9 mo: 10.8 ± 3.5 Isokinetic 180°/s (PT/W%): 3 mo: 7.4 ± 2.7, 4.5 mo: 9.0 ± 2.9, 6 mo: 9.6 ±2.8, 9 mo: 9.6 ± 3.8 Total work 60°/s (ft·lb): 3 mo: 51.8 ± 21.9, 4.5 mo: 62.8 ± 18.1, 6 mo: 72.7 ±22.0, 9 mo: 75.5 ± 21.2 Total work 180°/s (PT/W%): 3 mo: 55.4 ± 31.9, 4.5 mo: 73.7 ± 32.0, 6 mo: 86.9 ± 34.7, 9 mo: 91.2 ± 35.6 Peak torque ratio: 60 °/s: 3 mo: 0.78 ± 0.26, 4.5 mo: 0.86 ± 0.16, 6 mo: 1.14 ± 0.24, 9 mo: 1.06 ± 0.29 Peak torque ratio 180°/s: 3 mo: 0.69 ± 0.23, 4.5 mo: 0.95 ± 0.28, 6 mo: 1.10 ± 0.34, 9 mo: 1.16 ± 0.39
	Drummond et al.[6] 2021	36 (30/6)	High school and college athletes	Arthroscopic Bankart repair	6 mo: percentage of patients passing criteria: isokinetic: 60°/s: 45.9%, 180°/s: 45.9%, 60°/s + 180°/s: 29.7% Isometric: ER at 0°: 59.5%, ER at 90°: 48.6%
	Eckenrode et al. 2009	5 (5/0)	College wrestlers	Arthroscopic posterior Bankart	7.2 wk: isometric (kg): involved 13.4 (13.1 preseason); uninvolved 14.0
	Edouard et al.[40] 2010	20 (20/0)	Athletes—majority with shoulder use	Bristow Latarjet	Isokinetic 180°/s (Nm): pre: 29.0 ± 7.0, 3 mo: 24.0 ± 4.5, 6 mo: 30.0 ± 5.8 Isokinetic 120°/s (Nm): pre: 33.0 ± 6.9, 3 mo: 6.4 ± 4.7, 6 mo: 32.5 ± 6.7 Isokinetic 60°/s (Nm): pre: 34.7 ± 7.3, 3 mo: 27.4 ± 4.8, 6 mo: 33.6 ± 6.6
	Edouard et al.[39] 2012	20 (20/0)	Athletes—majority with shoulder use	Bristow Latarjet	Isokinetic 60°/s (Nm): pre: 0.47 ± 0.07, 3 mo: 0.38 ± 0.06, 6 mo: 0.46 ± 0.0 Isokinetic 120°/s (Nm): pre: 0.45 ± 0.08, 3 mo: 0.36 ± 0.06, 6 mo: 0.45 ± 0.08

(continued)

Table 3. Continued

RANGE OF MOTION					
Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
	Ellenbecker et al.[28] 1999	20 (13/7)	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	Isokinetic 180°/s (Nm): pre: 0.40 ± 0.08, 3 mo: 0.33 ± 0.05, 6 mo: 0.41 ± 0.0 Number of patients with LSI greater than 100%: isokinetic 90°/s: 12, 210°/s: 10, 300°/s: 7
	Frantz et al.[30] 2020	38 (33/5) With Remplissage; 104 (100/4) Without Remplissage	Majority injured during sport	Arthroscopic Bankart With and Without Remplissage	6 mo: Percentage of patients scoring less than 5/5: With Remplissage: 5%, Without Remplissage 2%
	Frantz et al.[29] 2020	65 (59/6)	Contact and overhead sports	Primary and revision Latarjet	6 mo: Percentage of patients scoring 5/5 on MMT: 95%
	Jeon et al.[32] 2021	85 (68/17)	Limited to high-intensity sports	Primary and revision anterior arthroscopic stabilization	12 mo: peak torque deficit (%) isokinetic 60°/s: primary 0.9 ± 26.6; revision 1.2 ± 23.4
	Jure et al.[12] 2021	50 (43/17)	Athletes	Open Latarjet	3 mo: LSI of HHD in supine 90/90: 0.96 ± 0.33
	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Bankart	Isometric: interval difference between 3 mo and 6 mo, normalized to body weight (kg/kg): 0.002
	Reddy et al.[41] 2023	97 (70/27)	Contact athlete; competitive athlete; overhead athlete	Posterior arthroscopic stabilization	5.7 mo: isometric pass rate (>90% LSI) at 0° = 89.7%; at 90° = 65.5%; isokinetic pass rate (>90% LSI) at 60°/s = 55.2%; at 180°/s = 65.5%; both 60°/s and 180°/s = 51.7%
	Rhee et al.[36] 2007	Open: 30 (28/2) Arthroscopic: 30 (26/4)	Active individuals	Arthroscopic and open Bankart repair	LSI of arthroscopic group: 3 mo: 88.5% ± 14.4%, 6 mo: 92.1% ± 9.1%, 9 mo: 94.3% ± 6.6% LSI of open group: 3 mo: 82.8% ± 11.4%, 6 mo: 89.5% ± 10.3%, 9 mo: 93.4% ± 8.0%
	Rogowski et al.[42] 2023	133 (115/18)	Collision, contact, overhead	Open Latarjet	4.5 mo: HHD (N/kg) dominant 1.16 ± 0.48; nondominant 2.28 ± 0.45
	Wilson et al.[5] 2020	43 (33/10)	High school and college athletes	Anterior or posterior arthroscopic stabilization	6 mo: isokinetic 60°/s (Nm): involved: 19.4, uninvolved: 22.5; isokinetic 180°/s (Nm): Involved: 17.9, uninvolved: 19.6
	Yildiz et al.[35] 2022	32(32/0)	Athletes classified by sport	Anterior arthroscopic stabilization	6 mo: isokinetic LSI: type 2 79.3%; type 3 64.2%; type 4 79.4%
ER/IR ratio	Drummond et al.[6] 2021	36 (30/6)	High school and college athletes	Arthroscopic Bankart repair	6 mo: percentage of patients passing criteria: ER/IR at 0°: 75.7%; ER/IR at 90°: 54.1%
	Eckenrode et al.[20] 2009	5 (5/0)	College wrestlers	Arthroscopic posterior Bankart	7.2 wk: involved 80.9% (73.5% preseason); uninvolved 85.4%

(continued)

Table 3. Continued

RANGE OF MOTION					
Test Parameter	Author	N (M/F)	Population	Procedure	Outcomes/Scores
	Edouard et al.[39] 2012	20 (20/0)	Athletes—majority with shoulder use	Bristow Latarjet	Isokinetic 180°/s: 3 mo: 0.83% ± 0.23%, 6 mo: 0.75% ± 0.17% Isokinetic 120°/s: 3 mo: 0.91% ± 0.26%, 6 mo: 0.78% ± 0.17% Isokinetic 60°/s: 3 mo: 0.91% ± 0.24%, 6 mo: 0.80% ± 0.16%
	Ellenbecker et al.[28] 1999	20 (13/7)	Athletes—half in overhead sport	Arthroscopic thermal capsulorrhaphy	12 wk: ipsilateral: 90°/s: 66.5% ± 12.8%, 210°/s: 59.2% ± 12.6%, 300°/s: 60.1% ± 17.5%; contralateral: 90°/s: 64.0% ± 14.1%, 210°/s: 60.8% ± 14.1%, 300°/s: 62.3% ± 18.7%
	Jeon et al.[32] 2021	85 (68/17)	Limited to high-intensity sports	Primary and revision anterior arthroscopic stabilization	Isokinetic 60°/s: 12 mo: primary 0.74 ± 0.18; revision 0.78 ± 0.19
	Jure et al.[12] 2021	50 (43/17)	Athletes	Open Latarjet	3 mo: HHD in supine 90/90: 1.11 ± 0.19
	Reddy et al.[41] 2023	97 (70/27)	Contact athlete; competitive athlete; overhead athlete	Posterior arthroscopic stabilization	5.7 mo: isometric pass rate (>90% LSI) at 0° = 89.7%; at 90° = 62.1%
	Rogowski et al.[42] 2023	133(115/18)	Collision, contact, overhead	Open Latarjet	4.5 mo: HHD: dominant 1.07 ± 0.23; nondominant 1.04 ± 0.16

AROM, active range of motion; ER, external rotation; HHD, handheld dynamometry; IR, internal rotation; LSI, limb symmetry index; MMT, Manual Muscle Test; PT/W%, peak torque to body weight percentage.

*Thumb on the buttock (2 points), sacrum (4 points), L3 (6 points), T12 (8 points), >T7 (10 points).

†IR was graded according to vertebral level: L5 and below L5 = 1, L4 = 2, L3 = 3, L2 = 4, L1 = 5, T12 = 6, T11 = 7, . . . T7 = 11.

Table 4. Physical Performance Test Outcomes Reported by Included Studies

Performance Test	Author	N	Population	Procedure	Outcomes/Scores
YBT-UQ	Jure et al.[12] 2021	100 (86/14)	Athletes	Open Latarjet	3 mo: patient group 0.97 ± 0.09 LSI 3 mo: control group 0.98 ± 0.05 LSI
	Rogowski et al.[42] 2023	133 (115/18)	Collision, contact, overhead	Open; Latarjet	4.5 mo: dominant 0.76 ± 0.08 4.5 mo: nondominant 0.82 ± 0.07
	Yildz et al.[35] 2023	32 (32/0)	Classified by type of sport	Primary; arthroscopic; anterior	6 mo: type 2, 68.6 ± 8.2 6 mo: type 3, 70 ± 5.2 6 mo: type 4, 68.8 ± 6
YBT— Medial Reach	Li et al.[43] 2021	16 (15/1)	Division I college athletes	Anterior and posterior Bankart (some with capsular plication) (sample includes some SLAP)	3 mo: uninvolved side 1.04 ± 0.09 limb length 3 mo: involved side: 1.03 ± 0.09 limb length 3 mo: limb asymmetry: 0.01 ± 0.04 4 mo: uninvolved side: 1.04 ± 0.07 limb length 4 mo: involved side: 1.05 ± 0.08 limb length 4 mo: limb asymmetry: −0.01 ± 0.003
CKCUEST	Drummond et al.[6] 2021	72 (53/19)	High school and college athletes	Arthroscopic Bankart repair	6 mo: 70.3% passed (>21 touches)
	Jure et al. 2021	100 (86/14)	Athletes	Open Latarjet	3 mo: patient group 22.2 ± 2.7 touches (modified CKCUEST) 3 mo: control group 22.6±2.8 touches (modified CKCUEST)
	Reddy et al.[41] 2023	97 (70/27)	Contact athlete; competitive athlete; overhead athlete	Arthroscopic; posterior	5.7 mo: pass rate 90%
	Rogowski et al.[42] 2023	133 (115/18)	Collision, contact, overhead	Open; Latarjet	mCKCUEST: 4.5 mo: dominant 22.00 ± 2.9; 4.5 mo: nondominant 22.90 ± 2.5 mCKCUEST*68% BW/15 = mCKCUEST power: 4.5 mo: dominant 78.50 ± 18.8; 4.5 mo: nondominant 78.20 ± 13.60
	Wilson et al.[5] 2020	43 (33/10)	High school and college athletes	Anterior or posterior arthroscopic stabilization	6 mo: 23.4 ± 3.6
	Yildz et al.[35] 2023	32 (32/0)	Athletes classified by sport	Primary; arthroscopic; anterior	6 mo: type 2, 22.2 ± 4.1 6 mo: type 3, 21.4 ± 2.2 6 mo: type 4, 21.7 ± 1.7
Push Up Peak Force	Li et al.[43] 2021	16 (15/1)	Division I college athletes	Anterior and posterior Bankart (some with capsular plication) (sample includes some SLAP)	3 mo: involved side 0.60 ± 0.13 body weight 3 mo: uninvolved side 0.70 ± 0.15 body weight 3 mo: limb asymmetry: 0.14 ± 0.11 4 mo: involved side: 0.68 ± 0.12 body weight 4 mo: uninvolved side: 0.74 ± 0.13 body weight 4 mo: limb asymmetry: 0.07 ± 0.10

(continued)

Table 4. Continued

Performance Test	Author	N	Population	Procedure	Outcomes/Scores
Unilateral Seated Shot Put	Drummond et al.[6] 2021	72 (53/19)	High school and college athletes	Arthroscopic Bankart repair	6 mo: 86.5% passed (criteria = 90% LSI plus 10% if dominant limb)
	Jure et al.[12] 2021	100 (86/14)	Athletes	Open Latarjet	3 mo: LSI: patient group: 1.10 ± .020; control group: 1.08 ± 0.10
	Reddy et al.[41] 2023	97 (70/27)	Contact athlete; competitive athlete; overhead athlete	Arthroscopic; posterior	5.7 mo: 90% of contralateral side criteria 93.3% passed
	Rogowski et al.[42] 2023	133 (115/18)	Collision, contact, overhead	Open; Latarjet	4.5 mo: dominant 61.10 ± 12.45 $cm \cdot kg^{-0.35}$ 4.5 mo: nondominant 70.67 ± 11.18 $cm \cdot kg^{-0.35}$
	Yildz et al.[35] 2023	32 (32/0)	Classified by type of sport	Primary; arthroscopic; anterior	6 mo: type 2, 4 ± 0.4 6 mo: type 3, 4 ± 0.5 6 mo: type 4, 4.3 ± 0.6
ER Endurance Test	Drummond et al.[6] 2021	72 (53/19)	High school and college athletes	Arthroscopic Bankart repair	6 mo: @0°: 73% passed; @90°: 59.5% passed; prone: 81.1% passed
	Reddy et al.[41] 2023	97 (70/27)	Contact athlete; competitive athlete; overhead athlete	Arthroscopic; posterior	5.7 mo: @0°: 78.3% passed; in prone: 73.4% passed
MEI	Jure et al.[12] 2021	100 (86/14)	Athletes	Open Latarjet	3 mo: patient group: 0.74 ± 0.15; control group: 0.69 ± 0.20
S-STARTS	Jure et al.[12] 2021	100 (86/14)	Athletes	Open Latarjet	3 mo: patient group: 13.5 ± 3.8; control group: 16.1±2.7
CKCUEST + YBT-UQ + USPT	McGinniss et al.[37] 2022	20 (17/3)	Military cadets	Anterior; Bankart	6 mo: CKCUEST + YBT-UQ + USSPT, 5 passed; CKCUEST + YBT-UQ, 2 passed; CKCUEST + USSPT, 4 passed; YBT-UQ+ USSPT, 3 passed

CKCUEST, Closed Kinetic Chain Upper Endurance Test; LSI, limb symmetry index; MEI, Muscular Endurance Test; S-STARTS, Shoulder-SanTy Athletic Return To Sport Score; USSPT, Unilateral Seated Shot Put Test; YBT-UQ, Y-Balance Test of the Upper Quarter.

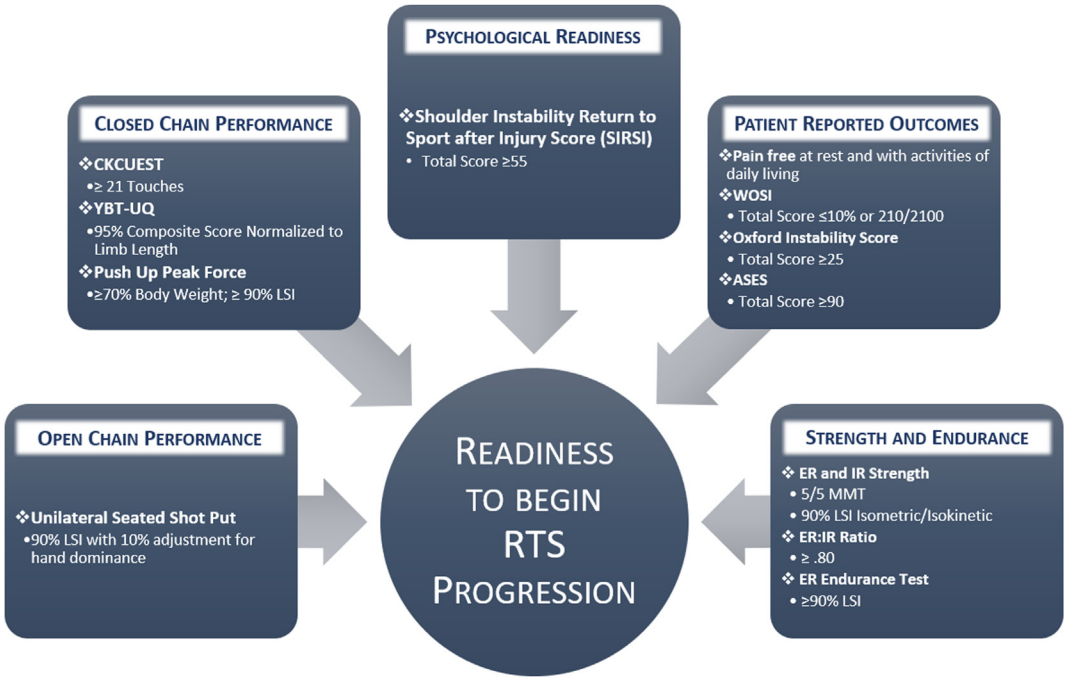

Fig 2. Common constructs reported in the included studies and how they may be associated with assessing RTS readiness. (ASES, American Shoulder and Elbow Surgeons; CKCUEST, Closed Kinetic Chain Upper Extremity Stability Test; ER, external rotation; IR, internal rotation; LSI, limb symmetry index; MMT, manual muscle test; RTS, return to sport; WOSI, Western Ontario Shoulder Index; YBT-UQ, Y-Balance Test of the Upper Quarter.)

Discussion

The main findings of this review are that deficits in strength and performance may persist between 4 and 6 months, a time when many patients are cleared to return to sport, few studies reported a battery of tests with pre-established pass/fail criteria, and the measures reported in the included studies may inform pass/fail standards when developing suitable criteria-based test batteries for patients returning to sport after shoulder stabilization procedures.

Deficits Persist at the Time Most Are Cleared to Return to Sport

Most patients return to sport between 4 and 6 months after a procedure to correct and prevent recurrence of shoulder instability, with time since surgery alone being the primary factor considered in RTS decision-making.[4] The studies included in this review reported at least 1 objective measure of patient-reported outcomes, ROM, strength, or physical performance testing. While some measures failed to capture a meaningful outcome for an active and athletic population, others were able to demonstrate improvement in measures at later stages of rehabilitation. More compelling were the studies that reported persistent deficits in patient-reported measures,[13] strength,[6,41] and performance[5,6,41] at 6 months.[5]

Criteria-Based Return-to-Sport Testing Batteries

Incorporating multiple constructs into a battery of testing may expose deficits that would not otherwise be captured and, subsequently, addressed through rehabilitation. For example, an athlete may perform well on a functional test but may not demonstrate adequate isolated strength or vice versa.[6] Few studies included in this review reported a battery of tests, with only 12 of 37 including predetermined pass/fail criteria. Generally, ROM was expected to be normal to within 20% of baseline/LSI. Strength was expected to be within 0% to 10% LSI, and performance test goals were based on established norms and expectations. None of the studies provided minimum criteria for PROMs. The PROMs reported across the included studies may inform passing score determination for future test battery development. Building upon the common constructs reported by the included studies of this review, along with suggested criteria for each as depicted in Figure 2, an extended duration of patient follow-up would enhance the utility of future studies incorporating return-to-sport testing batteries. This extension would allow for

a more comprehensive assessment of both reinjury and recurrence rates as patients resume full athletic participation.

Limitations

This systematic review has several limitations. Most of the studies were retrospective or cross-sectional designs with adequate methodological quality using the MINORS scale and a fair value in RTSVA. There was significant heterogeneity in both procedure type and measurement collection methods, which prevented meta-analysis and the determination of normative values. This was further complicated by differences in sport demands, age, sex, and hand dominance, which were not widely reported or accounted for in analyses. Only 2 studies directly associated testing performance with outcomes. For these reasons, clinicians looking for guidance with return-to-sport decision-making should use caution not to generalize the data provided in this review.

Conclusions

Most patients undergoing shoulder stabilization procedures regained fundamental strength and range of motion. However, some studies noted difficulties in achieving sufficient performance metrics for athletic activities 6 months postsurgery. Due to a lack of standardized measures, recommendations for specific test components and benchmark data for clinical decision-making are not available.

Disclosures

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Appendix Table 1. Search Strategy

Search Strategy Report:

Steph Hendren, MLIS; Duke University Medical Center Library, Duke University School of Medicine

Date of Completed Search: December 10, 2021

Date of Search Update: June 23, 2023

Total Number of Articles (before de-duplication): 38,095

Total Number of Articles (after de-duplication): 12,484

Database: MEDLINE (Ovid)

Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
1. Phrases that indicate both shoulder and instability	exp Shoulder Dislocation/ OR exp Bankart Lesions/	6,251	6,657
2. Shoulder	exp Shoulder Joint/ OR exp shoulder/ OR exp Glenoid cavity/ OR (shoulder OR shoulders OR humerus OR humeral OR "greater tubercle" OR "greater tuberosity" OR glenoid OR glenoids OR glenohumeral OR bankart OR capsulolabral OR hill-sachs OR SLAP OR "biceps brachii" OR bicipital OR bankart OR labrum OR labrums OR labral).ti,ab.	111,846	122,326
3. Instability/repair keywords	exp Joint Deformities, Acquired/ OR exp Tendon Injuries/ OR exp Joint Dislocations/ OR exp Joint Instability/ OR exp autografts/ OR exp allografts/ OR exp Arthroscopy/ OR (strain OR strains OR sprain OR sprains OR distress OR distressing OR dislocation OR dislocations OR dislocated OR subluxation OR subluxations OR instability OR instabilities OR unstable OR detached OR detaches OR detaching OR lesion OR lesions OR dyskinesis OR repair OR repairs OR repairing OR repaired OR stabilization OR stabilizations OR stabilizing OR stabilisation OR stabilisations OR stabilising OR stability OR stabilize OR stabilise OR Latarjet OR latarjet-bristow OR Capsulorrhaphy OR bristow OR "capular shift" OR reconstruction OR reconstructions OR reconstructed OR reconstructing OR allograft OR allografts OR autograft OR autografts OR homograft OR homografts OR arthropathy OR arthropathies OR arthroscopic OR arthroscopy OR arthroscopies).ti,ab.	3,257,874	3,567,810
4.	2 AND 3	44,067	48,492
5.	(exp Hip/ OR (hip OR hips OR Femoroacetabular).ti,ab.)		
6.	4 NOT 5	41,021	45,095
7.	1 OR 6	41,580	45,697
8. Sport keywords	exp Athletic Performance/ OR exp Baseball/ OR exp Basketball/ OR exp Bicycling/ OR exp Boxing/ OR exp Circuit-Based Exercise/ OR exp Cricket Sport/ OR exp Endurance Training/ OR exp Football/ OR exp Golf/ OR exp Gymnastics/ OR exp High-Intensity Interval Training/ OR exp Hockey/ OR exp Martial Arts/ OR exp Mountaineering/ OR exp Physical Fitness/ OR exp Physical Conditioning, Human/ OR exp Plyometric Exercise/ OR exp Racquet Sports/ OR exp Return to Sport/ OR exp Resistance Training/ OR exp Skiing/ OR exp Snow Sports/ OR exp Soccer/ OR Sports/ OR exp Sports for Persons with Disabilities/ OR exp Swimming/ OR exp Tai Ji/ OR exp Tennis/ OR exp Team Sports/ OR exp Track and Field/ OR exp Volleyball/ OR exp Water Sports/ OR exp Weight Lifting/ OR exp Wrestling/ OR exp Youth Sports/ OR (aikido OR archery OR archer Or archers OR athletes OR athletes OR athletic OR athletics OR badminton OR baseball OR basketball OR boxing OR boxer OR boxers OR bowling OR cheerleading OR cheerleader OR cheerleaders OR "circuit training" OR "circuit trainings" OR "circuit based training" OR "circuit based trainings" OR climbing OR climber OR climbers OR cricket OR competition OR competitions OR competitive OR competitively OR dancing OR dancer OR dancers OR	659,205	730,957

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Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
	"endurance training" OR "endurance trainings" OR fencing OR fencer OR fencers OR football OR futsal OR golf OR golfing OR golfers OR gymnastics OR gymnast OR gymnasts OR "hammer throw" OR "hammer throws" OR "hammer throwing" OR handball OR HIIT OR hiking OR hikes OR hiker OR hikers OR hockey OR "interval training" OR "interval trainings" OR "jai alai" OR javelin OR javeling OR judo OR jujitsu OR karate OR kendo OR kickboxing OR "kung fu" OR lacrosse OR "lifting weights" OR "martial arts" OR "martial art" OR "martial artist" OR "martial artists" OR mountaineering OR mountaineer OR mountaineers OR multisport OR pentathlon OR pentathlons OR pentathloner OR pentathloners OR pilates OR pitch OR pitches OR pitching OR pitcher OR pitchers OR "physical activity" OR "physical activities" OR "physical training" OR "physical trainings" OR "physical conditioning" OR plyometrics OR polo OR powerlifting OR pranayama OR qigong OR racquetball OR "racquet ball" OR "resistance training" OR "resistance trainings" OR rowing OR rower OR rowers OR rugby OR skating OR skater OR skaters OR skiing OR skier OR skiers OR soccer OR softball OR sport OR sports OR squash OR "strength training" OR "strength trainings" OR swimming OR swim OR swims OR swimmer OR swimmers OR taekwando OR "tae kwon do" OR "tai ji" OR "tai chi" OR tennis OR throw OR throws OR throwing OR threw OR triathlon OR triathlons OR triathloner OR triathloners OR volleyball OR "weight training" OR "weight trainings" OR "weight lifting" OR wrestling OR wrestler OR wrestlers OR wushu OR yoga OR RTS OR CBRTS OR NCAA OR NFL OR FIFA OR NBL OR NICA OR USASA OR NVA OR NBA OR Olympic OR olympics).ti,ab. OR sport.jw. OR sports.jw		
9.	7 AND 8	6,434	7,245
10.	9 not (case reports OR editorial OR letter).pt.	5,783	6,545
11.	10 not (exp animals/ not exp humans/)	5,690	6,429

Database: Embase (Elsevier)
Note: all searches conducted in "Results" tab.

Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
1. Phrases that indicate both shoulder and instability	'shoulder dislocation'/exp OR 'shoulder dislocations'/exp OR 'Bankart lesion'/exp OR 'recurrent shoulder dislocation'/exp	10,576	11,616
2. Shoulder	'shoulder'/exp OR 'glenoid cavity'/exp OR (shoulder OR shoulders OR humerus OR humeral OR 'greater tubercle' OR 'greater tuberosity' OR glenoid OR glenoids OR glenohumeral OR bankart OR capsulolabral OR hill-sachs OR SLAP OR 'biceps brachii' OR bicipital OR bankart OR labrum OR labrums OR labral):ti,ab	177,589	194,097
3. Instability/repair keywords	'arthropathy'/exp OR 'tendon injury'/exp OR 'joint dislocation'/exp OR 'joint instability'/exp OR 'autograft'/exp OR 'allograft'/exp OR 'arthroscopy'/exp OR (strain OR strains OR sprain OR sprains OR distress OR distressing OR dislocation OR dislocations OR dislocated OR subluxation OR subluxations OR instability OR instabilities OR unstable OR detached OR detaches OR detaching OR lesion OR lesions OR dyskinesis OR repair OR repairs OR repairing OR repaired OR stabilization OR stabilizations OR stabilizing OR stabilisation OR stabilisations OR stabilising OR stability OR stabilize OR stabilise OR Latarjet OR latarjet-bristow OR Capsulorrhaphy OR bristow OR 'capular shift' OR reconstruction OR reconstructions OR reconstructed OR reconstructing OR allograft OR allografts OR autograft OR autografts OR homograft OR homografts OR arthropathy OR arthropathies OR arthroscopic OR arthroscopy OR arthroscopies):ti,ab	4,967,217	5,423,038
4.	2 AND 3	82,315	94,086
5.	('hip'/exp OR (hip OR hips OR Femoroacetabular):ti,ab)	278,992	301,299
6.	4 NOT 5	73,246	84,034
7.	1 OR 6	74,448	85,259
8. Sport keywords	'aikido'/exp OR 'athletics'/exp OR 'ball sport'/exp OR 'baseball'/exp OR 'basketball'/exp OR 'boating'/exp OR 'body building'/exp OR 'boxing'/exp OR 'bowling'/exp OR 'car racing'/exp OR 'collision sport'/exp OR 'combat sport'/exp OR 'cricket (sport)'/exp OR 'contact sport'/exp OR 'cross training (sport)'/exp OR 'cycling'/exp OR 'disabled sport'/exp OR 'diving'/exp OR 'endurance sport'/exp OR 'extreme sport'/exp OR 'fencing (sport)'/exp OR 'football'/exp OR 'golf'/exp OR 'gymnastics'/exp OR 'hatha yoga'/exp OR 'hockey'/exp OR 'hot yoga'/exp OR 'horseback riding'/exp OR 'ice hockey'/exp OR 'iyengar yoga'/exp OR 'jiu jitsu'/exp OR 'jogging'/exp OR 'judo'/exp OR 'karate'/exp OR 'kickboxing'/exp OR 'kung fu'/exp OR 'lacrosse (sport)'/exp OR 'marathon running'/exp OR 'martial art'/exp OR 'motor sport'/exp OR 'motocross'/exp OR 'motorcycle racing'/exp OR 'mountaineering'/exp OR 'non contact sport'/exp OR 'nordic walking'/exp OR 'pranayama'/exp OR 'qigong'/exp OR 'racewalking'/exp OR 'racquet sport'/exp OR 'return to sport'/exp OR 'racquetball'/exp OR 'rock climbing'/exp OR 'roller skating'/exp OR 'rowing'/exp OR 'running'/exp OR 'rugby'/exp OR 'sailing (water sport)'/exp OR 'skateboarding'/exp OR 'skating'/exp OR 'skiing'/exp OR 'soccer'/exp OR 'softball'/exp OR 'sport'/exp OR 'surfing (water sport)'/exp OR 'swimming'/exp OR 'squash (sport)'/exp OR 'tennis'/exp OR 'track and field'/exp OR	856,617	949,883

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Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
	'taekwondo'/exp OR 'Tai Chi'/exp OR 'team sport'/exp OR 'triathlon'/exp OR 'volleyball'/exp OR 'water aerobics'/exp OR 'water polo'/exp OR 'water skiing'/exp OR 'water sport'/exp OR 'water polo'/exp OR 'weight lifting'/exp OR 'winter sport'/exp OR 'wushu (sport)'/exp OR 'wrestling'/exp OR 'wheelchair basketball'/exp OR 'wheelchair rugby'/exp OR 'wheelchair sport'/exp OR 'yoga'/exp OR 'yoga nidra'/exp OR 'youth sport'/exp OR (aikido OR archery OR archer Or archers OR athletes OR athletes OR athletic OR athletics OR badminton OR baseball OR basketball OR boxing OR boxer OR boxers OR bowling OR cheerleading OR cheerleader OR cheerleaders OR 'circuit training' OR 'circuit trainings' OR 'circuit based training' OR 'circuit based trainings' OR climbing OR climber OR climbers OR cricket OR competition OR competitions OR competitive OR competitively OR dancing OR dancer OR dancers OR 'endurance training' OR 'endurance trainings' OR fencing OR fencer OR fencers OR football OR futsal OR golf OR golfing OR golfers OR gymnastics OR gymnast OR gymnasts OR 'hammer throw' OR 'hammer throws' OR 'hammer throwing' OR handball OR HIIT OR hiking OR hikes OR hiker OR hikers OR hockey OR 'interval training' OR 'interval trainings' OR 'jai alai' OR javelin OR javeling OR judo OR jujitsu OR karate OR kendo OR kickboxing OR 'kung fu' OR lacrosse OR 'lifting weights' OR 'martial arts' OR 'martial art' OR 'martial artist' OR 'martial artists' OR mountaineering OR mountaineer OR mountaineers OR multisport OR pentathlon OR pentathlons OR pentathloner OR pentathloners OR pilates OR pitch OR pitches OR pitching OR pitcher OR pitchers OR 'physical activity' OR 'physical activities' OR 'physical training' OR 'physical trainings' OR 'physical conditioning' OR plyometrics OR polo OR powerlifting OR pranayama OR qigong OR racquetball OR 'racquet ball' OR 'resistance training' OR 'resistance trainings' OR rowing OR rower OR rowers OR rugby OR skating OR skater OR skaters OR skiing OR skier OR skiers OR soccer OR softball OR sport OR sports OR squash OR 'strength training' OR 'strength trainings' OR swimming OR swim OR swims OR swimmer OR swimmers OR taekwando OR 'tae kwon do' OR 'tai ji' OR 'tai chi' OR tennis OR throw OR throws OR throwing OR threw OR triathlon OR triathlons OR triathloner OR triathloners OR volleyball OR 'weight training' OR 'weight trainings' OR 'weight lifting' OR wrestling OR wrestler OR wrestlers OR wushu OR yoga OR RTS OR CBRTS OR NCAA OR NFL OR FIFA OR NBL OR NICA OR USASA OR NVA OR NBA OR Olympic OR olympics):ti,ab OR sport:jt OR sports:jt		
9.	7 AND 8	9,567	11,485
10.	9 not ('case report'/exp OR 'case study'/exp OR 'editorial'/exp OR [editorial]/lim OR 'letter'/exp OR [letter]/lim OR 'note'/exp OR [note]/lim OR [conference abstract]/lim OR 'conference abstract'/exp OR 'conference abstract'/it)	7,030	8,386
11.	10 AND [humans]/lim	6,562	7,857

Database: CINAHL Complete (EBSCOhost)

Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
1. Phrases that indicate both shoulder and instability	MH "Bankart Lesions" OR MH "Shoulder Instability, Anterior" OR MH "Shoulder Instability, Multidirectional" OR MH "Shoulder Instability, Posterior" OR MH "Shoulder Labrum Tear" OR MH "Shoulder Dislocation"	2,429	2,652
2. Shoulder	MH "Shoulder" OR MH "Shoulder Joint+" OR MH "Glenohumeral Joint" OR TI (shoulder OR shoulders OR humerus OR humeral OR "greater tubercle" OR "greater tuberosity" OR glenoid OR glenoids OR glenohumeral OR bankart OR capsulolabral OR hill-sachs OR SLAP OR "biceps brachii" OR bicipital OR bankart OR labrum OR labrums OR labral) OR AB (shoulder OR shoulders OR humerus OR humeral OR "greater tubercle" OR "greater tuberosity" OR glenoid OR glenoids OR glenohumeral OR bankart OR capsulolabral OR hill-sachs OR SLAP OR "biceps brachii" OR bicipital OR bankart OR labrum OR labrums OR labral)	40,486	44,265
3. Instability/repair keywords	MH "Joint Diseases" OR MH "Joint Instability" OR MH "Tendon Injuries" OR MH "Ligament Injuries" OR MH "Allografts+" OR MH "Autografts+" OR MH "Arthroscopy" OR TI (strain OR strains OR sprain OR sprains OR distress OR distressing OR dislocation OR dislocations OR dislocated OR subluxation OR subluxations OR instability OR instabilities OR unstable OR detached OR detaches OR detaching OR lesion OR lesions OR dyskinesis OR repair OR repairs OR repairing OR repaired OR stabilization OR stabilizations OR stabilizing OR stabilisation OR stabilisations OR stabilising OR stability OR stabilize OR stabilise OR Latarjet OR latarjet-bristow OR Capsulorrhaphy OR bristow OR "capular shift" OR reconstruction OR reconstructions OR reconstructed OR reconstructing OR allograft OR allografts OR autograft OR autografts OR homograft OR homografts OR arthropathy OR arthropathies OR arthroscopic OR arthroscopy OR arthroscopies) OR AB (strain OR strains OR sprain OR sprains OR distress OR distressing OR dislocation OR dislocations OR dislocated OR subluxation OR subluxations OR instability OR instabilities OR unstable OR detached OR detaches OR detaching OR lesion OR lesions OR dyskinesis OR repair OR repairs OR repairing OR repaired OR stabilization OR stabilizations OR stabilizing OR stabilisation OR stabilisations OR stabilising OR stability OR stabilize OR stabilise OR Latarjet OR latarjet-bristow OR Capsulorrhaphy OR bristow OR "capular shift" OR reconstruction OR reconstructions OR reconstructed OR reconstructing OR allograft OR allografts OR homograft OR homografts OR autograft OR autografts OR arthropathy OR arthropathies OR arthroscopic OR arthroscopy OR arthroscopies)	432,122	474,570
4.	2 AND 3	15,190	16,724
5.	(MH "Hip" OR TI (hip OR hips OR Femoroacetabular) OR AB (hip OR hips OR Femoroacetabular))	64,307	70,368
6.	4 NOT 5	13,690	15,038
7.	1 OR 6	14,065	15,416
8. Sport keywords	MH "Archery" OR MH "Amateur Sports" OR MH "Aeronautical Sports" OR MH "Animal Sports+" OR MH "Athletic Performance" OR MH "Athletic Training+" OR MH "Athletic Training Programs" OR MH "Aquatic Sports+" OR MH "Baseball" OR MH "Basketball" OR MH "Body Building" OR MH "Bowling" OR MH "Boxing" OR MH "Caving" OR MH "College Sports" OR MH "Contact Sports+" OR MH "Cricket	280,591	300,007

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Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
	Sports" OR MH "Cycling" OR MH "Diving+" OR MH "Endurance Sports" OR MH "Extreme Sports" OR MH "Fishing" OR MH "Football" OR MH "Golf" OR MH "Gymnastics" OR MH "Handball" OR MH "Hockey" OR MH "Horseback Riding" OR MH "Hunting" OR MH "Ice Skating" OR MH "Jogging" OR MH "Rowing" OR MH "Rugby" OR MH "Martial Arts" OR MH "Motor Sports" OR MH "Mountaineering" OR MH "Professional Sports" OR MH "Race Walking" OR MH "Racquet Sports+" OR MH "Rock Climbing" OR MH "Running+" OR MH "Running, Distance" OR MH "Skateboarding" OR MH "Skiing+" OR MH "Snow Skiing+" OR MH "Sport Specific Training" OR MH "Sprinting" OR MH "Sports+" OR MH "Sporting Events+" OR MH "Sports Facilities" OR MH "Sports, Disabled+" OR MH "Sports Participation" OR MH "Sports Re-Entry" OR MH "Skating+" OR MH "Soccer" OR MH "Softball" OR MH "Snowboarding" OR MH "Swimming" OR MH "Target Sports+" OR MH "Talent Identification, Sports" OR MH "Tennis" OR MH "Team Sports+" OR MH "Track and Field" OR MH "Triathlon" OR MH "Volleyball" OR MH "Water Skiing" OR MH "Wheelchair Sports" OR MH "Wrestling" OR MH "Weight Lifting" OR MH "Winter Sports+" OR TI (aikido OR archery OR archer Or archers OR athletes OR athletes OR athletic OR athletics OR badminton OR baseball OR basketball OR boxing OR boxer OR boxers OR bowling OR cheerleading OR cheerleader OR cheerleaders OR "circuit training" OR "circuit trainings" OR "circuit based training" OR "circuit based trainings" OR climbing OR climber OR climbers OR cricket OR competition OR competitions OR competitive OR competitively OR dancing OR dancer OR dancers OR "endurance training" OR "endurance trainings" OR fencing OR fencer OR fencers OR football OR futsal OR golf OR golfing OR golfers OR gymnastics OR gymnast OR gymnasts OR "hammer throw" OR "hammer throws" OR "hammer throwing" OR handball OR HIIT OR hiking OR hikes OR hiker OR hikers OR hockey OR "interval training" OR "interval trainings" OR "jai alai" OR javelin OR javeling OR judo OR jujitsu OR karate OR kendo OR kickboxing OR "kung fu" OR lacrosse OR "lifting weights" OR "martial arts" OR "martial art" OR "martial artist" OR "martial artists" OR mountaineering OR mountaineer OR mountaineers OR multisport OR pentathlon OR pentathlons OR pentathloner OR pentathloners OR pilates OR pitch OR pitches OR pitching OR pitcher OR pitchers OR "physical activity" OR "physical activities" OR "physical training" OR "physical trainings" OR "physical conditioning" OR plyometrics OR polo OR powerlifting OR pranayama OR qigong OR racquetball OR "racquet ball" OR "resistance training" OR "resistance trainings" OR rowing OR rower OR rowers OR rugby OR skating OR skater OR skaters OR skiing OR skier OR skiers OR soccer OR softball OR sport OR sports OR squash OR "strength training" OR "strength trainings" OR swimming OR swim OR swims OR swimmer OR swimmers OR taekwando OR "tae kwon do" OR "tai ji" OR "tai chi" OR tennis OR throw OR throws OR throwing OR threw OR triathlon OR triathlons OR triathloner OR triathloners OR volleyball OR "weight training" OR "weight trainings" OR "weight lifting" OR wrestling OR wrestler OR wrestlers OR wushu OR yoga OR RTS OR CBRTS OR NCAA OR NFL OR FIFA OR NBL OR NICA OR USASA OR NVA OR NBA OR Olympic OR olympics) OR AB (aikido OR archery OR archer Or archers OR athletes OR		

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Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
	athletes OR athletic OR athletics OR badminton OR baseball OR basketball OR boxing OR boxer OR boxers OR bowling OR cheerleading OR cheerleader OR cheerleaders OR "circuit training" OR "circuit trainings" OR "circuit based training" OR "circuit based trainings" OR climbing OR climber OR climbers OR cricket OR competition OR competitions OR competitive OR competitively OR dancing OR dancer OR dancers OR "endurance training" OR "endurance trainings" OR fencing OR fencer OR fencers OR football OR futsal OR golf OR golfing OR golfers OR gymnastics OR gymnast OR gymnasts OR "hammer throw" OR "hammer throws" OR "hammer throwing" OR handball OR HIIT OR hiking OR hikes OR hiker OR hikers OR hockey OR "interval training" OR "interval trainings" OR "jai alai" OR javelin OR javeling OR judo OR jujitsu OR karate OR kendo OR kickboxing OR "kung fu" OR lacrosse OR "lifting weights" OR "martial arts" OR "martial art" OR "martial artist" OR "martial artists" OR mountaineering OR mountaineer OR mountaineers OR multisport OR pentathlon OR pentathlons OR pentathloner OR pentathloners OR pilates OR pitch OR pitches OR pitching OR pitcher OR pitchers OR "physical activity" OR "physical activities" OR "physical training" OR "physical trainings" OR "physical conditioning" OR plyometrics OR polo OR powerlifting OR pranayama OR qigong OR racquetball OR "racquet ball" OR "resistance training" OR "resistance trainings" OR rowing OR rower OR rowers OR rugby OR skating OR skater OR skaters OR skiing OR skier OR skiers OR soccer OR softball OR sport OR sports OR squash OR "strength training" OR "strength trainings" OR swimming OR swim OR swims OR swimmer OR swimmers OR taekwando OR "tae kwon do" OR "tai ji" OR "tai chi" OR tennis OR throw OR throws OR throwing OR threw OR triathlon OR triathlons OR triathloner OR triathloners OR volleyball OR "weight training" OR "weight trainings" OR "weight lifting" OR wrestling OR wrestler OR wrestlers OR wushu OR yoga OR RTS OR CBRTS OR NCAA OR NFL OR FIFA OR NBL OR NICA OR USASA OR NVA OR NBA OR Olympic OR olympics) OR SO (sport OR sports)		
9.	7 AND 8	4,476	4,985
10.	9 NOT PT (Abstract OR Book OR Book Chapter OR Book Review OR Case Study OR Commentary OR Editorial OR Letter OR Masters Thesis OR Pamphlet OR Pamphlet Chapter OR Poetry)	3,626	4,015

Database: SPORTDiscus (EBSCOhost)

Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
1. Phrases that indicate both shoulder and instability	DE "SHOULDER joint injuries" OR	252	267
2. Shoulder	DE "SHOULDER" OR DE "SHOULDER joint" OR TI (shoulder OR shoulders OR humerus OR humeral OR "greater tubercle" OR "greater tuberosity" OR glenoid OR glenoids OR glenoids OR glenohumeral OR bankart OR capsulolabral OR hill-sachs OR SLAP OR "biceps brachii" OR bicipital OR bankart OR labrum OR labrums OR labral) OR AB (shoulder OR shoulders OR humerus OR humeral OR "greater tubercle" OR "greater tuberosity" OR glenoid OR glenoids OR glenoids OR glenohumeral OR bankart OR capsulolabral OR hill-sachs OR SLAP OR "biceps brachii" OR bicipital OR bankart OR labrum OR labrums OR labral)	27,827	29,244
3. Instability/repair keywords	DE "JOINT diseases" OR DE "JOINT dislocations" OR DE "JOINT instability" OR DE "TENDON injuries" OR DE "AUTOGRAFTS" OR DE "HOMOGRAFTS" OR TI (strain OR strains OR sprain OR sprains OR distress OR distressing OR dislocation OR dislocations OR dislocated OR subluxation OR subluxations OR instability OR instabilities OR unstable OR detached OR detaches OR detaching OR lesion OR lesions OR dyskinesis OR repair OR repairs OR repairing OR repaired OR stabilization OR stabilizations OR stabilizing OR stabilisation OR stabilisations OR stabilising OR stability OR stabilize OR stabilise OR Latarjet OR latarjet-bristow OR Capsulorrhaphy OR bristow OR "capular shift" OR reconstruction OR reconstructions OR reconstructed OR reconstructing OR allograft OR allografts OR autograft OR autografts OR homograft OR homografts OR arthropathy OR arthropathies OR arthroscopic OR arthroscopy OR arthroscopies) OR AB (strain OR strains OR sprain OR sprains OR distress OR distressing OR dislocation OR dislocations OR dislocated OR subluxation OR subluxations OR instability OR instabilities OR unstable OR detached OR detaches OR detaching OR lesion OR lesions OR dyskinesis OR repair OR repairs OR repairing OR repaired OR stabilization OR stabilizations OR stabilizing OR stabilisation OR stabilisations OR stabilising OR stability OR stabilize OR stabilise OR Latarjet OR latarjet-bristow OR Capsulorrhaphy OR bristow OR "capular shift" OR reconstruction OR reconstructions OR reconstructed OR reconstructing OR allograft OR allografts OR autograft OR autografts OR homograft OR homografts OR arthropathy OR arthropathies OR arthroscopic OR arthroscopy OR arthroscopies)	84,199	89,805
4.	2 AND 3	8,008	8,564
5.	(DE "HIP joint" OR TI (hip OR hips OR Femoroacetabular) OR AB (hip OR hips OR Femoroacetabular))		
6.	4 NOT 5	7,328	7,814
7.	1 OR 6	7,432	7,929
8. Sport keywords	DE "SPORTS" OR DE "AGE & sports" OR DE "AMATEUR sports" OR DE "AQUATIC sports" OR DE "BALL games" OR DE "BASEBALL" OR DE "BIOMECHANICS in sports" OR DE "COLLEGE sports" OR DE "COMBAT sports" OR DE "CONTACT sports" OR DE "CROSS-training (Sports)" OR DE "DISC golf" OR DE "ENDURANCE sports" OR DE	1,311,221	1,341,814

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Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
	"EXTREME sports" OR DE "GYMNASTICS" OR DE "HOCKEY" OR DE "INDIVIDUAL sports" OR DE "OLYMPIC Games" OR DE "PARKOUR" OR DE "PROFESSIONAL sports" OR DE "PROFESSIONALISM in sports" OR DE "RACKET games" OR DE "RECREATIONAL sports" OR DE "ROLLER skating" OR DE "SCHOOL sports" OR DE "SENIOR Olympics" OR DE "SKATEBOARDING" OR DE "SOFTBALL" OR DE "SPORT for all" OR DE "SPORTS for children" OR DE "SPORTS for girls" OR DE "SPORTS for older people" OR DE "SPORTS for people with disabilities" OR DE "SPORTS for youth" OR DE "SPORTS teams" OR DE "TEAM sports" OR DE "TEAMWORK (Sports)" OR DE "WINTER sports" OR DE "WOMEN'S sports" OR TI (aikido OR archery OR archer Or archers OR athletes OR athletes OR athletic OR athletics OR badminton OR baseball OR basketball OR boxing OR boxer OR boxers OR bowling OR cheerleading OR cheerleader OR cheerleaders OR "circuit training" OR "circuit trainings" OR "circuit based training" OR "circuit based trainings" OR climbing OR climber OR climbers OR cricket OR competition OR competitions OR competitive OR competitively OR dancing OR dancer OR dancers OR "endurance training" OR "endurance trainings" OR fencing OR fencer OR fencers OR football OR futsal OR golf OR golfing OR golfers OR gymnastics OR gymnast OR gymnasts OR "hammer throw" OR "hammer throws" OR "hammer throwing" OR handball OR HIIT OR hiking OR hikes OR hiker OR hikers OR hockey OR "interval training" OR "interval trainings" OR "jai alai" OR javelin OR javeling OR judo OR jujitsu OR karate OR kendo OR kickboxing OR "kung fu" OR lacrosse OR "lifting weights" OR "martial arts" OR "martial art" OR "martial artist" OR "martial artists" OR mountaineering OR mountaineer OR mountaineers OR multisport OR pentathlon OR pentathlons OR pentathloner OR pentathloners OR pilates OR pitch OR pitches OR pitching OR pitcher OR pitchers OR "physical activity" OR "physical activities" OR "physical training" OR "physical trainings" OR "physical conditioning" OR plyometrics OR polo OR powerlifting OR pranayama OR qigong OR racquetball OR "racquet ball" OR "resistance training" OR "resistance trainings" OR rowing OR rower OR rowers OR rugby OR skating OR skater OR skaters OR skiing OR skier OR skiers OR soccer OR softball OR sport OR sports OR squash OR "strength training" OR "strength trainings" OR swimming OR swim OR swims OR swimmer OR swimmers OR taekwando OR "tae kwon do" OR "tai ji" OR "tai chi" OR tennis OR throw OR throws OR throwing OR threw OR triathlon OR triathlons OR triathloner OR triathloners OR volleyball OR "weight training" OR "weight trainings" OR "weight lifting" OR wrestling OR wrestler OR wrestlers OR wushu OR yoga OR RTS OR CBRTS OR NCAA OR NFL OR FIFA OR NBL OR NICA OR USASA OR NVA OR NBA OR Olympic OR olympics) OR AB (aikido OR archery OR archer Or archers OR athletes OR athletes OR athletic OR athletics OR badminton OR baseball OR basketball OR boxing OR boxer OR boxers OR bowling OR cheerleading OR cheerleader OR cheerleaders OR "circuit training" OR "circuit trainings" OR "circuit based training" OR "circuit based trainings" OR climbing OR climber OR climbers OR cricket OR		

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Search Concept		Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
		competition OR competitions OR competitive OR competitively OR dancing OR dancer OR dancers OR "endurance training" OR "endurance trainings" OR fencing OR fencer OR fencers OR football OR futsal OR golf OR golfing OR golfers OR gymnastics OR gymnast OR gymnasts OR "hammer throw" OR "hammer throws" OR "hammer throwing" OR handball OR HIIT OR hiking OR hikes OR hiker OR hikers OR hockey OR "interval training" OR "interval trainings" OR "jai alai" OR javelin OR javeling OR judo OR jujitsu OR karate OR kendo OR kickboxing OR "kung fu" OR lacrosse OR "lifting weights" OR "martial arts" OR "martial art" OR "martial artist" OR "martial artists" OR mountaineering OR mountaineer OR mountaineers OR multisport OR pentathlon OR pentathlons OR pentathloner OR pentathloners OR pilates OR pitch OR pitches OR pitching OR pitcher OR pitchers OR "physical activity" OR "physical activities" OR "physical training" OR "physical trainings" OR "physical conditioning" OR plyometrics OR polo OR powerlifting OR pranayama OR qigong OR racquetball OR "racquet ball" OR "resistance training" OR "resistance trainings" OR rowing OR rower OR rowers OR rugby OR skating OR skater OR skaters OR skiing OR skier OR skiers OR soccer OR softball OR sport OR sports OR squash OR "strength training" OR "strength trainings" OR swimming OR swim OR swims OR swimmer OR swimmers OR taekwando OR "tae kwon do" OR "tai ji" OR "tai chi" OR tennis OR throw OR throws OR throwing OR threw OR triathlon OR triathlons OR triathloner OR triathloners OR volleyball OR "weight training" OR "weight trainings" OR "weight lifting" OR wrestling OR wrestler OR wrestlers OR wushu OR yoga OR RTS OR CBRTS OR NCAA OR NFL OR FIFA OR NBL OR NICA OR USASA OR NVA OR NBA OR Olympic OR olympics) OR SO (sport OR sports)		
9.	7	AND 8	4,577	4,867
10.	9	not PT (Abstract OR Book OR Book Chapter OR Book Review OR Case Study OR Commentary OR Editorial OR Letter OR Masters Thesis OR Pamphlet OR Pamphlet Chapter OR Poetry)	4,348	4,631

Database: Scopus (Elsevier)

Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
1. Shoulder	TITLE-ABS (shoulder OR shoulders OR humerus OR humeral OR {greater tubercle} OR {greater tuberosity} OR glenoid OR glenoids OR glenohumeral OR bankart OR capsulolabral OR hill-sachs OR SLAP OR {biceps brachii} OR bicipital OR bankart OR labrum OR labrums OR labral)	160,194	176,863
2. Instability/repair keywords	TITLE-ABS (strain OR strains OR sprain OR sprains OR distress OR distressing OR dislocation OR dislocations OR dislocated OR subluxation OR subluxations OR instability OR instabilities OR unstable OR detached OR detaches OR detaching OR lesion OR lesions OR dyskinesis OR repair OR repairs OR repairing OR repaired OR stabilization OR stabilizations OR stabilizing OR stabilisation OR stabilisations OR stabilising OR stability OR stabilize OR stabilise OR Latarjet OR latarjet-bristow OR Capsulorrhaphy OR bristow OR {capular shift} OR reconstruction OR reconstructions OR reconstructed OR reconstructing OR allograft OR allografts OR autograft OR autografts OR homograft OR homografts OR arthropathy OR arthropathies OR arthroscopic OR arthroscopy OR arthroscopies)	7,029,085	7,767,474
3.	1 AND 2	48,717	54,386
4.	TITLE-ABS (hip OR hips OR Femoroacetabular)	201,571	221,745
5.	3 NOT 4	45,377	
6. Sport keywords	TITLE-ABS (aikido OR archery OR archer Or archers OR athletes OR athletes OR athletic OR athletics OR badminton OR baseball OR basketball OR boxing OR boxer OR boxers OR bowling OR cheerleading OR cheerleader OR cheerleaders OR {circuit training} OR {circuit trainings} OR {circuit based training} OR {circuit based trainings} OR climbing OR climber OR climbers OR cricket OR competition OR competitions OR competitive OR competitively OR dancing OR dancer OR dancers OR {endurance training} OR {endurance trainings} OR fencing OR fencer OR fencers OR football OR futsal OR golf OR golfing OR golfers OR gymnastics OR gymnast OR gymnasts OR {hammer throw} OR {hammer throws} OR {hammer throwing} OR handball OR HIIT OR hiking OR hikes OR hiker OR hikers OR hockey OR {interval training} OR {interval trainings} OR {jai alai} OR javelin OR javeling OR judo OR jujitsu OR karate OR kendo OR kickboxing OR {kung fu} OR lacrosse OR {lifting weights} OR {martial arts} OR {martial art} OR {martial artist} OR {martial artists} OR mountaineering OR mountaineer OR mountaineers OR multisport OR pentathlon OR pentathlons OR pentathloner OR pentathloners OR pilates OR pitch OR pitches OR pitching OR pitcher OR pitchers OR {physical activity} OR {physical activities} OR {physical training} OR {physical trainings} OR {physical conditioning} OR plyometrics OR polo OR powerlifting OR pranayama OR qigong OR racquetball OR {racquet ball} OR {resistance training} OR {resistance trainings} OR rowing OR rower OR rowers OR rugby OR skating OR skater OR skaters OR skiing OR skier OR skiers OR soccer OR softball OR sport OR sports OR squash OR {strength training} OR {strength trainings} OR swimming OR swim OR swims OR swimmer OR swimmers OR taekwando OR {tae kwon do} OR {tai ji} OR {tai chi} OR tennis OR throw OR throws OR throwing OR threw OR triathlon OR triathlons OR triathloner OR triathloners OR	1,710,419	1,917,452

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Search Concept	Search String	Original Search (December 10, 2021)	Updated Search (June 23, 2023)
	volleyball OR {weight training} OR {weight trainings} OR {weight lifting} OR wrestling OR wrestler OR wrestlers OR wushu OR yoga OR RTS OR CBRTS OR NCAA OR NFL OR FIFA OR NBL OR NICA OR USASA OR NVA OR NBA OR Olympic OR olympics) OR SRCTITLE (sport OR sports)		
7.	5 AND 6	6,818	8,853
8.	Selected Document Types: Article, Review	6,215	7,961
9. Date filter	2021-present	n/a	1,661

Appendix Table 2. MINORS (Methodological Index for Non-Randomized Studies)

Study ID	A Clearly Stated Aim	Inclusion of consecutive Patients	Prospective collection of Data	Endpoints appropriate to The Aim of the Study	Unbiased Assessment Of The Study Endpoint	Follow-up period Appropriate to the Aim of the Study	Loss to follow up less than 5%	Prospective Calculation of the Study Size	Comparative Study: An Adequate Control Group	Comparative Study: Contemporary Groups	Comparative Study: Baseline Equivalence of Groups	Comparative Study: Adequate Statistical Analyses	Total
Amako 2008	2	1	2	2	0	2	0	0					9
Amako 2017	2	2	2	2	0	2	1	0					11
Anand 2021	2	0	0	2	0	2	0	0					6
Baldan 2022	2	0	2	1	0	2	1	0					8
Bohu 2021	2	0	2	2	0	2	0	2	0	2	1	2	15
Bonnevialle 2017	2	1	2	2	1	2	2	0					12
Bradley 2018	2	2	2	2	0	2	1	2	2	2	2	2	21
Buckwalter 2018	2	2	2	2	0	2	1	2					13
Chen 2005	2	2	0	2	0	2	1	0	2	1	2	1	15
Choke 2021	2	1	2	2	0	2	2	0					11
Cortes-DelaFuente 2021	2	0	2	2	0	2	0	0					8
Drummond 2021	2	2	2	2	0	1	2	0	2	1	2	2	18
Eckenrode 2009	2	2	1	2	0	2	2	0					11
Edouard 2010	2	0	2	2	0	2	2	0					10
Edouard 2012	2	2	2	2	0	2	2	0					12
Ellenbecker 1999	2	2	2	2	0	2	2	0					12
Frantz 2020 AJSM	2	2	2	2	0	2	2	2	2	2	1	2	21
Frantz 2020 OJSM	2	2	2	2	0	2	2	2					14
Girard 2022	2	2	2	2	0	2	2	0	2	1	2	2	19
Hajewski 2019	2	2	2	2	0	2	1	0					11
Inui 2020	1	2	1	2	0	2	0	0					8
Jeon 2021	2	2	2	2	2	2	0	0	2	2	2	2	20
Jure 2021	2	0	2	1	0	0	0	0	2	2	1	2	12
Kumar 2021	2	0	0	1	0	2	0	0					5
Li 2021	2	0	1	2	0	2	0	0					7
Lima 2022	2	2	2	2	0	2	0	0					10
McGinniss 2022	2	0	2	2	0	2	1	0					9
Nourissat 2016	2	0	1	2	0	1	0	0	1	2	2	1	12
Rattier 2022	2	2	2	2	0	2	0	0					10
Reddy 2023	2	0	1	2	0	2	2	0	2	1	2	2	16
Rhee 2007	2	2	2	2	1	2	2	0	0	2	2	2	19
Rogowski 2023	2	2	2	2	0	2	1	2	2	2	2	2	21
Shah 2018	2	2	1	2	0	2	2	0					11
Stein 2011	2	2	2	2	0	2	1	0					11
Trinh 2019	2	2	2	2	1	2	0	0					11
Wilson 2020	2	2	2	2	0	2	0	0					10
Yildiz 2022	2	0	2	2	0	2	2	0					10

NOTE. The items on the MINORS are scored 0 (not reported), 1 (reported but inadequate), or 2 (reported and adequate). The maximum score is 16 for noncomparative studies and 24 for comparative studies.

Appendix Table 3. The Return to Sport Value Assessment of the Included Studies

Study (Author, Year)	Total Score	Reports the Use of a Rehab Protocol	Reports a Desired Timeline	Reports the Use of Specific Measurements	Reports the Use of Specific Conditional Criteria for RTS	Criteria for Return to Sport (if included)
Drummond 2021	4	1	1	1	1	Patients who passed all components of the CBRTS test were cleared to RTS. Strength was evaluated by isokinetic IR and ER with a passing goal of 90% of the values for the contralateral extremity. A passing score for the CKCUEST was greater than or equal to 21 touches, which represented the 75th percentile for active females and 85th percentile for active males. A passing score for the USS test was 90% of the distance of the nonoperative extremity with a 10% adjustment for hand dominance.
Eckenrode 2009	4	1	1	1	1	Criteria for discharge from formal physical therapy included normal arthrokinematics of the glenohumeral and scapulothoracic joints, a satisfactory clinical exam, and shoulder strength greater than 90% compared to the uninvolved side.
Frantz 2020 *AJSM*	4	1	1	1	1	A failure to meet RTP criteria at 6 months was defined as 20% loss of ROM as compared with baseline in any plane, strength grade less than the baseline value, or both.
Frantz 2020 *OJSM*	4	1	1	1	1	A failure to meet return-to-play criteria by the patient's 6-month visit was defined as a 20% loss of ROM compared with baseline in any plane, strength grade less than the baseline value, or both.
Stein 2011	4	1	1	1	1	From the sixth month, stressful exercises for the anteroinferior capsule-labrum complex during rehabilitation and practice were performed for the return-to-play transition. After an adequate return-to-play transition, the resumption of the previous shoulder-dependent sport was allowed.

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Study (Author, Year)	Total Score	Reports the Use of a Rehab Protocol	Reports a Desired Timeline	Reports the Use of Specific Measurements	Reports the Use of Specific Conditional Criteria for RTS	Criteria for Return to Sport (if included)
Wilson 2020	4	1	1	1	1	Strength was evaluated by isokinetic IR and ER, as well as the ERET. The goal of strength testing was to reach 90% of the values for the contralateral extremity. A passing score for the CKCUEST was greater than or equal to 21 touches, which represented the 75th percentile for active females and 85th percentile for active males. A passing score for the USSPT was 90% of the distance of the nonoperative extremity with a 10% adjustment for hand dominance.
Yildiz 2022	4	1	1	1	1	The acceptable criterion for the LSI of rotator cuff strength, YBT-UQ, and USSPT was determined to be greater than 90%.
Rogowski 2023	4	1	1	1	1	Patients returned to running at 2 months postoperatively and to sport practice progressively from the third postoperative month after clinical and radiographic evaluation showed satisfactory healing of the coracoid graft.
Reddy 2023	4	1	1	1	1	Patients who passed all test components were cleared to RTS. Patients who failed a single component were given 4-6 weeks delayed clearance to RTS after focusing on the specific deficit. Patients who failed multiple components of the test underwent additional formal rehabilitation to address deficits over a period of 4-6 weeks and repeated the test before final clearance.
McGinniss 2022	4	1	1	1	1	The authors defined passing criteria to be within 90% LSI or meeting reference values for established physical performance tests.
Amako 2008	3	1	1	1	0	Did not report criteria
Amako 2017	3	1	1	1	0	Did not report criteria
Bohu 2021	3	1	1	1	0	Did not report criteria
Buckwalter 2018	3	1	1	1	0	Did not report criteria
Ellenbecker 1999	3	1	0	1	1	The criteria for return to throwing or overhead activities include isokinetic strength within 10% of the contralateral extremity for internal and external rotation, full functional ROM, and negative impingement and muscle tendon provocation tests.
Li 2021	3	1	1	1	0	Did not report criteria
Rhee 2007	3	1	1	1	0	Did not report criteria

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Study (Author, Year)	Total Score	Reports the Use of a Rehab Protocol	Reports a Desired Timeline	Reports the Use of Specific Measurements	Reports the Use of Specific Conditional Criteria for RTS	Criteria for Return to Sport (if included)
Shah 2018	3	1	0	1	1	Progression and return to play were based on satisfactory rehabilitation progression, including a strength of over 80% compared to preinjury, successful tackle training, falls training, and wrestling and skills assessment.
Rattier 2022	3	1	1	1	0	Did not report criteria
Bradley 2018	2	1	1	0	0	Did not report criteria
Chen 2005	2	1	1	0	0	Did not report criteria
Edouard 2010	2	1	1	0	0	Did not report criteria
Edouard 2012	2	1	1	0	0	Did not report criteria
Jure 2021	2	1	0	1	0	Did not report criteria
Jeon 2021	2	1	1	0	0	Did not report criteria
Girard 2022	2	1	1	0	0	Did not report criteria
Lima 2022	2	1	1	0	0	Did not report criteria
Bonnevialle 2017	1	0	1	0	0	Did not report criteria
Choke 2021	1	1	0	0	0	Did not report criteria
Hajewski 2019	1	1	0	0	0	Did not report criteria
Inui 2020	1	1	0	0	0	Did not report criteria
Nourissat 2016	1	1	0	0	0	Did not report criteria
Trinh 2019	1	0	0	1	0	Did not report criteria
Kumar 2021	1	1	0	0	0	Did not report criteria
Cortes-DelaFuente 2021	1	0	1	0	0	Did not report criteria
Baldan 2022	1	1	0	0	0	Did not report criteria
Anand 2021	1	1	0	0	0	Did not report criteria

NOTE. Each component is scored "1" if present and "0" if absent for a total score of 0 to 4, with 4 representing the highest value when considering evidence to inform return to sport decisions.

CBRTS, criteria-based return to sport; CKCUEST, Closed Kinetic Chain Upper Extremity Stability Test; ER, external rotation; ERET, External Rotation Endurance Test; IR, internal rotation; ROM, range of motion; RTP, return to play; RTS, return to sport; USS, Unilateral Seated Shot Put; USSPT, Unilateral Seated Shot Put Test; YBT-UQ, Y-Balance Test of the Upper Quarter.