Return to Sport as an Outcome Measure for Shoulder Instability

Surprising Findings in Nonoperative Management in a High School Athlete Population

Ellen Shanley,*†‡ PhD, PT, Charles Thigpen,†‡ PhD, PT, John Brooks,†§ PhD, Richard J. Hawkins,†‖ MD, Amit Momaya,¶ MD, Adam Kwapisz,# MD, PhD, Michael J. Kissenberth,†‖ MD, and John M. Tokish,** MD
Investigation performed at the Greenville Hospital System, Greenville, South Carolina, USA

Background: Young age and contact sports have been postulated as risk factors for anterior shoulder instability. Management after shoulder instability is controversial, with studies suggesting that nonoperative management increases the risk of recurrence. Several studies examined return to play after an in-season instability episode, and few followed these patients to determine if they were able to successfully compete in a subsequent season. No study has evaluated this question in a high school athlete population.

Purpose: To compare the likelihood of return to scholastic sport and complete the next full season without an additional time-loss injury among athletes with anterior shoulder instability in terms of treatment, instability type, and sport classification.

Study Design: Cohort study; Level of evidence, 2

Methods: Athletes were included in this study as identified by a scholastic athletic trainer as experiencing a traumatic time-loss anterior shoulder instability injury related to school-sponsored participation. The cohort was predominantly male (n = 108, 84%) and consisted mostly of contact athletes (n = 101, 78%). All athletes had dislocation or subluxation diagnosed by a board-certified physician who determined the athlete's course of care (nonoperative vs operative). Successful treatment was defined as completion of care and return to the athlete's index sport, with full participation for the following season. Chi-square and relative risk analyses were completed to compare success of treatment (nonoperative vs operative care) and instability type. Separate logistic regressions were used to compare the effect of sex and sport classification on the athletes' ability to return to sport. Statistical significance was set a priori as $\alpha = .05$.

Results: Scholastic athletes (N = 129) received nonoperative (n = 97) or operative (n = 32) care. Nonoperatively treated (85%) and operatively treated (72%) athletes successfully returned to the same sport without injury for at least 1 full season ($P = .11$). Players sustaining a dislocation were significantly more likely to fail to return when compared with those sustaining a subluxation (26% vs 89%, $P = .013$). Sex ($P = .85$) and sport classification ($P = .74$) did not influence the athlete's ability to return to sport, regardless of treatment type.

Conclusion: A high percentage of athletes with shoulder instability achieved successful return to sport without missing any additional time for shoulder injury. Those with subluxations were at almost 3 times the odds of a successful return compared with those sustaining a dislocation.

Keywords: shoulder instability; scholastic athletes; return to sport

Shoulder instability is common among individuals <20 years of age.[4] The instability incidence of young competitive athletes accounts for almost one-quarter of all shoulder injuries.[13] Treatment options for individuals after an episode of shoulder instability include nonoperative care (ie, immobilization, rehabilitation to restore range of motion and strength, functional bracing, followed by a gradual return to full activities) or early operative intervention (glenohumeral stabilization combined with postoperative rehabilitation).[1,3,5,17,18] Numerous studies have demonstrated that nonoperative management has a higher recurrence rate than operative management,[1,9] leading many clinicians to recommend early operative treatment. In-season instability events, however, are often approached with initial nonoperative treatment, allowing the player to attempt to finish the season. One critical question is what to do at the completion of the season with those athletes who were able to return.[1,8]

The American Journal of Sports Medicine
2019;47(5):1062–1067
DOI: 10.1177/0363546519829765

While recurrent instability is associated with poor patient-reported outcomes and is thought to reflect failure of care,[11,14,15] the patient's motivation to resume sports participation is a major indication for seeking care.[2] For many athletes, success is chiefly defined by the ability to return to sport. Few studies have evaluated whether nonoperatively treated patients can return to sport at a similar level,[5,8] and no study has evaluated a scholastic cohort of patients to determine what percentage can return to their sport and complete the next season without missing a single practice or game because of their shoulders. The purpose of this study was to compare the likelihood of returning to the same scholastic sport of injury and completing the next full season without an additional time-loss injury in terms of treatment, instability type, and sport classification.

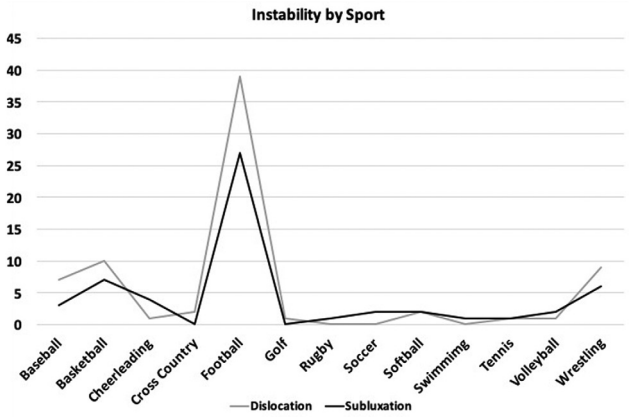

Figure 1. Instability type by sport.

METHODS

Participants and Setting

This study was conducted over a 4-year period and included athletes participating in scholastic sports at 20 high schools in the Upstate of South Carolina. Athletes were included if they competed on the high school team and suffered a traumatic time-loss anterior shoulder instability episode related to participation in a high school–sponsored athletic activity (game or practice). Athletes were excluded if they were not initially evaluated by the scholastic athletic trainer, had posterior/multidirectional instability, had a previous shoulder instability episode, lacked an additional season of eligibility in the sport of injury, or refused care. Institutional review board approval was obtained before data collection.

Injury, Participation, and Surveillance

An anterior shoulder instability injury was defined as any traumatic anterior shoulder dislocation or subluxation that occurred during any scholastic sport team-sponsored activity (Figure 1). The athletic trainer documented the date and sport of injury, medical provider, and demographic data within the Athletic Trainer System (Keffer Development Services, LLC). A board-certified sport medicine physician or orthopaedic surgeon within our tertiary care facility confirmed the direction and classification of instability with a combination of history, physical examination, and appropriate imaging and prescribed the initial course of care (nonoperative vs operative). The type of treatment by each provider (nonoperative vs operative), treatment visits, and discharge from care were documented within the medical record of each athlete. Patients were discharged from care when they met established standardized criteria according to the treatment pathway and per the agreement of the treating physician, physical therapist, and athletic trainer. Criteria for return-to-sport clearance included the absence of pain at rest, with training, or during activity; the absence of an apprehension sign; symmetrical shoulder range of motion (90% of unaffected side); a 67% external:internal rotation ratio within the affected extremity; and the ability to load upper extremity body weight during functional movement without apprehension.[7,10,12,16] After completion of treatment, the scholastic athletic trainer documented the date of return to full participation in the index injury sport. Athlete sport and position participation and subsequent injury were monitored throughout the season to identify all time-loss events. Success was determined by participation in the sport of injury, position of injury, and completion of the next season without a time-loss injury. Recurrence rate was obtained for

*Address correspondence to Ellen Shanley, PhD, PT, ATI Physical Therapy, 200 Patewood Rd, Greenville, SC 29615, USA (email: ellen.shanley@atipt.com).
†Center for Effectiveness Research in Orthopaedics, Greenville, South Carolina, USA.
‡ATI Physical Therapy, Greenville, South Carolina, USA.
§Arnold School of Public Health, University of South Carolina, Columbia, South Carolina, USA.
‖Steadman Hawkins Clinic of the Carolinas, Greenville Health System, Greenville, South Carolina, USA.
¶Division of Orthopedic Surgery, University of Alabama, Birmingham, Alabama, USA.
#Clinic of Orthopedics and Pediatric Orthopedics, Medical University of Łódź, Łódź, Poland.
**Orthopedic Surgery, Orthopedic Sports Medicine, Mayo Clinic, Phoenix, Arizona, USA.
Presented at the 43rd annual meeting of the AOSSM, San Diego, California, July 2017.
One or more of the authors has declared the following potential conflict of interest or source of funding: R.J.H. is a paid consultant for Arthrex, Encore Medical, and Pacira Pharmaceuticals; has received royalties from Encore Medical and Ossur; and has received hospitality payments from Peerless Surgical and DePuy Synthes. A.M. has received hospitality payments from Smith & Nephew and Arthrex and education funding from Smith & Nephew, DJO, and Arthrex. M.J.K. is a paid consultant for Arthrex; has received other financial or material support from Arthrex, ArthroCare, Arthrosurface, Breg, DJ Orthopaedics, Neurotech, Pacira, and Smith & Nephew; and has received hospitality payments from Exactech and Peerless Surgical. J.M.T. is a paid consultant for Arthrex, Mitek, and DePuy; has received hospitality payments from Peerless Surgical and DePuy Synthes; has received royalties from Arthrex; and has received consulting fees from Zimmer Biomet. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

TABLE 1
Demographics of Athletes by Treatment Group[a]

	Nonoperative Management	Operative Management	*P* Value
Age, y	15.8 ± 1.5	16.2 ± 1.4	.24
Height, cm	176.4 ± 10.0	177.7 ± 8.1	.53
Weight, kg	82.5 ± 21.8	85.8 ± 21.3	.49
Sex, n (%)			
Male	78 (72)	30 (28)	
Female	19 (91)	2 (9)	
Total, n	97	32	.08

[a]Data reported as mean ± SD, unless otherwise noted.

athletes who remained in the athletic trainer network. All recurrences were documented by the athletic trainer and verified by the board-certified sport medicine physician or orthopaedic surgeon throughout the follow-up period. Additional outcomes of interest included patient complaints and other reasons for failure to return to sport.

Initial Care and Return to Sport

Initial care was defined as nonoperative or operative. Initial care was determined by the treating physician in conjunction with the athlete and family after clinical and necessary radiologic examination. Nonoperative care included a rehabilitation intervention (minimum 2-week trial), including services provided by our sports medicine staff (physical therapy and athletic training) following a standard treatment pathway. The pathway included interventions such as joint mobilization, strengthening/endurance training, and neuromuscular retraining activities based on patient impairments. Use of a sport-specific shoulder brace was optional, depending on the preference of the physician and athlete. The volume and intensity of visits were patient specific and based on the athlete's readiness to meet the return-to-sport criteria. Operative care included arthroscopic or open stabilization addressing the intraoperative pathology, including capsular shift, Bankart/labral repair, capsulolabral reconstruction with or without remplissage, and the Latarjet procedure.

Athletes were considered returned to sport subsequent to (1) completing the entire course of care, (2) meeting the return-to-sport criteria, and (3) receiving release from the treating physician to begin sport-specific team-sponsored activities; the school athletic trainer determined resumption of full sport-specific activities without restriction. All athletes receiving nonoperative or operative care who were unable to return and continue to play through the next full season in their sports of injury were considered to have failed the initial care episode. Athletes were also considered to have failed their initial treatment if they sustained a time-loss upper extremity injury during the next full season. All athletes who failed their initial course of care, had a documented recurrence of instability, or were referred for operative treatment received advanced imaging studies to assist the physician in treatment planning. All athletes were monitored during follow-up care until discharge.

Statistical Analysis

Means and SDs were calculated for all demographic and descriptive variables to describe the population of interest. Chi-square and relative risk analyses were completed to compare the success of nonoperative versus operative care for the total cohort and by instability type and to determine the success of nonoperative care by instability type. Separate logistic regressions were used to compare the effect of sex and sport classification on the ability to return to sport within treatment types. For all statistical analyses, an alpha level of $P < .05$ was used. All data were analyzed with SPSS (v 24; IBM).

RESULTS

Scholastic athletes with remaining eligibility the following season (N = 129) received initial nonoperative (n = 97) or operative (n = 32) care. The injured athletes were a mean ± SD 15.9 ± 1.5 years old, 176.8 ± 9.5 cm, and 83.5 ± 21.6 kg. The cohort was predominantly male (84%), and 78% of the athletes were injured while participating in sports classified as contact/collision.[6] A similar number of contact/collision athletes experienced dislocation (57%) and subluxation (43%; $P = .71$). Based on sport classification, there was no difference in the frequency of nonoperative care as a treatment choice ($P = .15$). Regardless of treatment type, sex ($P = .85$) and sport classification ($P = .74$) did not influence the athlete's ability to return to sport. Athlete demographics (Table 1) were similar between treatment groups ($P > .05$).

Eighty-two nonoperatively treated (85%) and 23 operatively treated (72%) athletes successfully returned to the same sport without injury for at least 1 full season ($P = .11$). All nonoperatively treated patients received active therapy provided and supervised by an athletic trainer and/or physical therapist (mean visits, 17). The number of visits for nonoperatively treated patients was not significantly different between those who successfully returned to sport and those who did not (16.0 vs 18.3, $P = .68$). The use of a brace (n = 20) among nonoperatively treated athletes did not significantly influence the ability to successfully return to sport ($P = .09$).

Out of 129 athletes overall, 8 (6.2%) sustained a recurrence during the follow-up period: 6 of 97 (6.2%) nonoperatively treated athletes and 2 of 32 (6.3%) operatively treated athletes. Bipolar bone loss was documented for 14 of 32 (44%) athletes treated operatively. Table 2 presents the characteristics of the 15 athletes failing to return to sport after nonoperative care for anterior instability (including bone loss and instability recurrence). Seventy-three percent (11 of 15) of the nonoperatively treated patients who failed the initial treatment episode went on to operative care, with 82% successfully returning to sport

TABLE 2
Factors Related to Failure Among Nonoperatively Treated Players

No.	Sex	Age, y	Sport	Instability Type	Bone Loss	Track	Recurrence	Failure Reason
1	Male	16	Football	Dislocation	Hill-Sachs	On	No	Limited function[a,b]
2	Male	17	Football	Dislocation	None	On	No	MD recommendation[b,c]
3	Male	17	Basketball	Dislocation	None	On	No	Retired[d,e]
4	Female	16	Volleyball	Subluxation	None	On	Yes	Recurrence[b]
5	Male	17	Football	Dislocation	None	On	No	Weakness[b]
6	Male	15	Football	Dislocation	Bipolar	On	No	MD recommendation[b,c]
7	Male	17	Wrestling	Dislocation	None	On	Yes	Recurrence[b]
8	Male	17	Football	Dislocation	None	On	No	Retired[d,e]
9	Female	14	Basketball	Dislocation	None	On	Yes	Recurrence[b]
10	Male	16	Football	Dislocation	Bipolar	On	Yes	Recurrence[b]
11	Male	17	Football	Dislocation	Hill-Sachs	On	No	Returned to alternative sport[f]
12	Male	16	Football	Dislocation	Hill-Sachs	On	Yes	Recurrence[e]
13	Male	17	Football	Dislocation	Bipolar	On	No	Limited function[a,b]
14	Male	17	Football	Dislocation	Hill-Sachs	On	Yes	Recurrence[g]
15	Male	18	Football	Dislocation	None	On	No	Returned to alternative sport[d,e]

[a]Unable to return to previous level of performance.
[b]Subsequent surgery and full return to primary sport by next season.
[c]Returned to sport midseason without incident; chose surgery in off-season.
[d]Completed course of care; declined to return to sport or changed sport citing concern over reinjury.
[e]Refused additional care.
[f]Chose surgery in off-season; experienced contralateral dislocation.
[g]Subsequent surgery; recurrent instability.

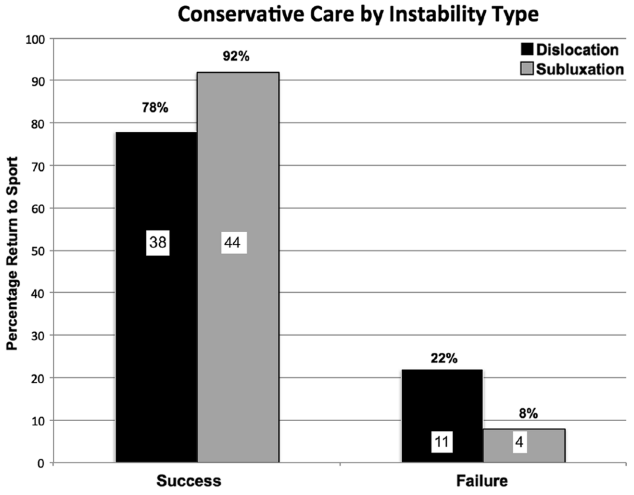

Figure 2. Nonoperatively treated players who returned to sport by instability type (%).

by the next season. Ultimately, 88% of the 129 patients sustaining traumatic instability were able to return to their index sport within 1 year of injury without further time loss.

Instability Type

Seventy-three athletes in our study experienced an anterior dislocation, while 56 had a subluxation episode. A similar frequency of males (59%) to females (43%) experienced a dislocation (P = .16). Dislocations were sustained with similar frequency between contact/collision sports (57%) and limited-contact sports (54%, P = .72). Players sustaining a dislocation were more likely to fail to return than those sustaining a subluxation (26% vs 89%, P = .013). Athletes sustaining anterior dislocation were at approximately 2.9 the odds of failing to return to sport than those sustaining subluxation (95% CI, 1.2-7.3).

A superior rate of return to sport was noted when nonoperative care (see Figure 2) was implemented for patients sustaining subluxation versus dislocation (P = .05). Among patients who were treated operatively, there was no difference in successful return to sport between patients with dislocations (n = 24) and those with subluxations (n = 8, P = .26).

DISCUSSION

Main Findings

Perhaps the most surprising finding in these data was that the majority of scholastic athletes returned to play the following season after sustaining an index instability event without subsequently missing any additional time for shoulder injury or instability when treated nonoperatively. To our knowledge, the only previous study that evaluated return to play the season after an index instability event was by Dickens et al.[9] In that study, 10 collegiate-level athletes attempted nonoperative treatment, and only 40% were successful in returning the following year without sustaining a recurrence. This is in sharp contrast to our success rate of 85% among 97 athletes. There are several

differences between the studies that may explain the differences. First, the definition of failure in the Dickens et al[9] study was any recurrence of instability. In the current study, our definition was the successful completion of the subsequent season without time loss. Patients with a recurrent instability episode who remained able to compete without time loss would have been classified as a failure by Dickens et al[9] and a success in the current study. While recurrence rate was not a primary outcome measure in this study, we were able to track all patients during the follow-up period and all patients beyond this who remained with additional eligibility. Surprisingly, the recurrence rate of the nonoperative group was quite low, and was similar to the operative group (6% in both groups). This highlights that recurrence was not the only reason limiting return to sport in our study and that lack of recurrence should not be equated to successful outcome. Additionally, this elucidates that future research should consider multiple factors as measures of successful outcome, including lack of recurrence, ability to return to sport, and patient-reported function.

Second, the Dickens[9] cohort was an intercollegiate athlete population, whereas the current study's cohort consisted of high school athletes. It is possible that the higher rate of speed, larger size, and other differences between high school and collegiate athletics may explain the differences in the 2 studies. It should be noted that the number of those attempting nonoperative treatment in the Dickens et al[9] study was only 10, as opposed to 97 in the current study. It may be that a higher number of patients in the former study might have changed the results.

Return to play after shoulder instability has been extensively reported in the literature. Zaremski et al[19] performed a meta-analysis of 17 studies that examined return to play and recurrence after shoulder instability among young and adolescent athletes. The authors found that return to play was 44% for nonoperatively treated patients and 95% for those treated operatively. None of these studies evaluated return to play the following season. It is possible that patients in our cohort sustained subsequent instability events but "coped" with them. Each practice and game in the following season were recorded by a certified athletic trainer for time loss; if players did sustain a subsequent instability event, it was not significant enough for them to report the injury or miss time.

We also found that instability type significantly correlated with success. Players sustaining subluxations were almost 3 times more likely to successfully return to sport than those sustaining dislocations. Additionally, superior return-to-sport outcomes were found when nonoperative care was applied to patients sustaining subluxation versus those sustaining dislocation. The importance of the severity of the instability event mirrors the findings in the Dickens et al[9] in-season instability study. In that study, collegiate athletes sustaining a subluxation were able to complete the season at a higher rate than those sustaining a dislocation.[9] In a prospective study of military cadets with a history of shoulder instability, the risk of a subsequent instability event was greater for those with a history of dislocation than subluxation.[7] These studies seem to support the concept that subluxation and dislocation events may be considered differently in treatment planning, given the subsequent injury risk and high rate of return to sport observed in our study.

Finally, it is important to note that among nonoperatively treated patients who failed and went on to subsequent surgery, they still met our definition of successful return at a high rate. Seventy-three percent (11 of 15) of the nonoperatively treated patients who failed the initial treatment episode went on to operative care, with 82% returning to sport successfully by the next season. This suggests that the treating physician can attempt a trial of nonoperative treatment for the unstable high school athlete and, if unsuccessful, can still expect high success rates with subsequent operative intervention.

Strengths of the Study

To our knowledge, this is the first study to examine the likelihood of returning to the same high school sport and completing the next full season without an additional time-loss injury after experiencing an acute traumatic anterior instability event. The study tracked a large cohort of high school athletes from injury through treatment and resolution within 1 large health care system. Recall bias and misclassification of injuries were minimized, as trained health care professionals collected the data in a controlled and systematic manner. Athletic trainers screened and monitored all injured athletes before, throughout, and after the episode of care. The study was conducted over a relatively small geographical area, which allowed us to control factors related to exposure (climate and competition level) and documentation of injury circumstances. Finally, the inclusion of high school athletes sustaining a traumatic anterior instability episode represents a different sample than that documented in the current literature, helping to extend the understanding of injury factors, treatment, and recovery as these athletes progress through competitive sport.

Potential Study Limitations

This study has several weaknesses. First, while all diagnoses of instability were made by fellowship-trained sports medicine physicians, the diagnosis of subluxation, in particular, can be challenging to make. In each included case, the physician used a combination of history, physical examination, and imaging to make his or her diagnosis, which, while potentially challenging, represents a realistic clinical setting paradigm. The fellowship-trained physicians prescribing and providing care may limit the generalizability of the findings, as the identification of athletes who would have the best chance of success with a particular type of care might affect the results of the study. Second, we did not longitudinally track recurrence rates or patient-reported outcomes in this study. It is possible that athletes sustained recurrence and did not report it to our trainers or physicians. Nevertheless, no patient who was classified as successful missed any time attributed to reinjury during the subsequent

season; thus, the significance of a recurrence with such criteria may be questioned. We used active participation without time loss attributed to injury as a proxy for a "patient-reported outcome" measure. It is possible that patients were participating at a lower level and coping with their injury, which is a weakness of this study.

Next, the current study followed athletes through only 1 subsequent season. Multiple studies showed that longer follow-up yields increasing instability rates; as such, we cannot state that the high rate of success experienced in our cohort would be sustained. Further study is ongoing to address a longer follow-up.

Finally, advanced imaging was not obtained for all patients, especially those successfully treated nonoperatively. All athletes who failed nonoperative care, sustained a documented recurrence, or were considered for operative intervention received advanced imaging to ensure the best possible outcome. It is possible that additional pathology among our nonoperatively treated athletes (eg, bone loss) may have gone underappreciated. But any underestimation should have decreased our success rates, and with a success rate of 85%, it is unlikely that this was a significant factor.

CONCLUSION

Our results show that among scholastic athletes experiencing a shoulder instability episode, the majority returned to play without missing any additional time for shoulder injury or instability when treated with nonoperative intervention regardless of sport or injury type. The majority of athletes returning to sport in the next season can be successfully treated with nonoperative care, and those who fail return after surgery at high rates as well. This study is in contrast to those recommending aggressive operative treatment for young athletes with shoulder instability, given the high rate of recurrent dislocation among nonoperatively treated patients. In the current study, we used completion of a subsequent season in the same scholastic sport as a successful outcome, and we observed that nonoperatively treated patients returned to their previous levels of sports, including contact/collision sports, at a high rate (85%). This information may prove useful in assisting clinicians and patients in determining the appropriate treatment after an instability event. These results warrant further study and consideration of nonoperative management for initial treatment after shoulder instability episodes among scholastic athletes.

ACKNOWLEDGMENT

The authors acknowledge the Greenville Hospital System athletic trainers for their assistance.

REFERENCES

1. Arciero RA, Wheeler JH, Ryan JB, McBride JT. Arthroscopic Bankart repair versus nonoperative treatment for acute, initial anterior shoulder dislocations. *Am J Sports Med*. 1994;22(5):589-594.
2. Ardern CL, Glasgow P, Schneiders A, et al. 2016 consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern. *Br J Sports Med*. 2016;50(14):853-864.
3. Aronen JG, Regan K. Decreasing the incidence of recurrence of first time anterior shoulder dislocations with rehabilitation. *Am J Sports Med*. 1984;12(4):283-291.
4. Bishop JY, Flatow EL. Pediatric shoulder trauma. *Clin Orthop Relat Res*. 2005;432:41-48.
5. Buss DD, Lynch GP, Meyer CP, Huber SM, Freehill MQ. Nonoperative management for in-season athletes with anterior shoulder instability. *Am J Sports Med*. 2004;32(6):1430-1433.
6. Committee on Sports Medicine and Fitness. American Academy of Pediatrics: medical conditions affecting sports participation. *Pediatrics*. 2001;107(5):1205-1209.
7. Creighton DW, Shrier I, Shultz R, Meeuwisse WH, Matheson GO. Return-to-play in sport: a decision-based model. *Clin J Sport Med*. 2010;20(5):379-385.
8. Dickens JF, Owens BD, Cameron KL, et al. Return to play and recurrent instability after in-season anterior shoulder instability: a prospective multicenter study. *Am J Sports Med*. 2014;42(12):2842-2850.
9. Dickens JF, Rue JP, Cameron KL, et al. Successful return to sport after arthroscopic shoulder stabilization versus nonoperative management in contact athletes with anterior shoulder instability: a prospective multicenter study. *Am J Sports Med*. 2017;45(11):2540-2546.
10. Funk L. Treatment of glenohumeral instability in rugby players. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(2):430-439.
11. Leroux TS, Saltzman BM, Meyer M, et al. The influence of evidence-based surgical indications and techniques on failure rates after arthroscopic shoulder stabilization in the contact or collision athlete with anterior shoulder instability. *Am J Sports Med*. 2017;45(5):1218-1225.
12. Mazzocca AD, Brown FM Jr, Carreira DS, Hayden J, Romeo AA. Arthroscopic anterior shoulder stabilization of collision and contact athletes. *Am J Sports Med*. 2005;33(1):52-60.
13. Owens BD, Agel J, Mountcastle SB, Cameron KL, Nelson BJ. Incidence of glenohumeral instability in collegiate athletics. *Am J Sports Med*. 2009;37(9):1750-1754.
14. Robinson CM, Howes J, Murdoch H, Will E, Graham C. Functional outcome and risk of recurrent instability after primary traumatic anterior shoulder dislocation in young patients. *J Bone Joint Surg Am*. 2006;88(11):2326-2336.
15. Robinson CM, Kelly M, Wakefield AE. Redislocation of the shoulder during the first six weeks after a primary anterior dislocation: risk factors and results of treatment. *J Bone Joint Surg Am*. 2002;84(9):1552-1559.
16. Safran O, Milgrom C, Radeva-Petrova DR, Jaber S, Finestone A. Accuracy of the anterior apprehension test as a predictor of risk for redislocation after a first traumatic shoulder dislocation. *Am J Sports Med*. 2010;38(5):972-975.
17. Simonet WT, Cofield RH. Prognosis in anterior shoulder dislocation. *Am J Sports Med*. 1984;12(1):19-24.
18. Taylor DC, Arciero RA. Pathologic changes associated with shoulder dislocations: arthroscopic and physical examination findings in first-time, traumatic anterior dislocations. *Am J Sports Med*. 1997;25(3):306-311.
19. Zaremski JL, Galloza J, Sepulveda F, Vasilopoulos T, Micheo W, Herman DC. Recurrence and return to play after shoulder instability events in young and adolescent athletes: a systematic review and meta-analysis. *Br J Sports Med*. 2017;51(3):177-184.