Hindawi Publishing Corporation
Advances in Orthopedic Surgery
Volume 2014, Article ID 964358, 6 pages
http://dx.doi.org/10.1155/2014/964358

Clinical Study

Risk Factors for Recurrent Shoulder Dislocation Arthroscopically Managed with Absorbable Knotless Anchors

Raffaele Russo,[1] Fabio Cautiero,[1] and Giuseppe Della Rotonda[2]

[1] *Orthopaedic and Traumatology Department, Ospedale dei Pellegrini, 80134 Napoli, Italy*
[2] *Royal Berkshire Hospital, London Road, Reading RG1 5AN, UK*

Correspondence should be addressed to Fabio Cautiero; fabiocau@inwind.it

Received 16 June 2014; Accepted 3 November 2014; Published 25 November 2014

Academic Editor: Doron Norman

Purpose. To evaluate the clinical outcome and risk factors for recurrent dislocation after arthroscopic stabilization with absorbable knotless anchor. *Methods*. We treated 197 patients affected by anterior shoulder instability, either traumatic or atraumatic with the same arthroscopic suture technique. We recorded age at surgery and number and type of dislocations (traumatic/atraumatic). Of the 197 patients, 127 (65.4%) were examined with a mean follow-up of 5.6 years (range: 25–108 months). Eighty-one shoulders were evaluated with the Rowe score and 48 with the Simple Shoulder Test (SST). *Results*. The mean Rowe score was 90.8, while the mean SST score was 10.9. Recurrence occurred in 10 cases (7.7%) but only in 4 cases was atraumatic, which reduces the real recurrence rate to 3.1%. Patients with recurrence were significantly younger at surgery than patients who did not relapse ($P = 0.040$). Moreover, neither the number ($P = 0.798$) nor the type of shoulder instability ($P = 0.751$), or the amount of glenoid bone loss ($P = 0.184$) significantly affected the probability of recurrence. *Conclusions*. In a patient population with involuntary monodirectional anterior shoulder instability, use of absorbable knotless anchor was reliable and resulted in a good outcome. In this series the statistical significant risk factors for recurrent dislocation were age of patient.

1. Introduction

Unidirectional shoulder instability is a very frequent condition that generally responds well to arthroscopic surgery. However, arthroscopic procedures can fail due to such factors as patient age [1], number of previous dislocations and rehabilitation program [2], chondral and bone defects [3], sports activity [4], insufficient soft-tissue tensioning [5], failure of surgical devices [6], and bone quality [7].

Very little is known about risk factors associated with recurrence of shoulder instability after arthroscopic treatment. There appears to be no statistically significant differences in outcome using absorbable versus non absorbable sutures [8]. However, severe osteoarthritis has been associated with metal anchors [9]. Other complications have been reported in patients treated with bioknotless anchors. Athwal et al. [10] reported four failures that led to destructive glenoid osteolysis, anchor pull-out, and subsequent severe damage of the articular surface. Barber [11] described 2 failures: one due to rapid degradation of the suture anchor; the other because the upper part of the anchor and a portion of the eyelet became loose bodies as the anchor absorbed. Freehill et al. [12] reported synovitis, implant debris, and full-thickness chondral damage in 10 of 52 patients. Meyer and Gerber [6] described 2 cases of instability recurrence after arthroscopic Bankart repair. During reoperation, all sutures were correctly knotted around the labrum but were intact and torn out of the anchor eyelets. There was no sign of anchor displacement (3 anchors in each patient). The authors described these cases as "unambiguous structural suture anchor failure."

The purpose of our study was to identify the risk factors of recurrent dislocation and complications in anterior shoulder instability treated with arthroscopic absorbable knotless anchors in a large series of patients with anterior unidirectional shoulder instability.

2. Materials and Methods

From September 2001 to December 2007, 197 patients affected by unidirectional shoulder instability were operated on by the senior surgeon (RR) of our hospital; 127 patients (100 men and 27 women) were available for the minimum follow-up of 24 months. Both shoulders were affected in 2/127 patients for a total of 129 shoulders followed-up. The average age at surgery was 27.8 years (range 16–48 years). After surgery, all patients were monitored by the same surgical team. In addition, the 129 shoulders were also independently assessed at a minimum follow-up of 24 months by two surgeons working outside the surgical team.

Patients were selected based on the following inclusion criteria: (1) clinical history of recurrent anterior shoulder instability, whether traumatic or not; (2) Bankart lesion, also associated with superior labral anterior posterior (SLAP) lesions and rotator cuff lesions; (3) absence of severe bone defects at the anteroinferior glenoid edge (less than 20% of the unaffected contralateral side, as preoperatively assessed). Patients were excluded if one of the following conditions was present: (1) multidirectional, posterior, and voluntary instability; (2) previous surgical stabilization; (3) incomplete passive range of motion; (4) first dislocation; (5) large Hill-Sachs lesions.

Fifty-one (39.5%) cases were related to sports activities, and 16 of these patients (12.4%) practiced high-risk contact sports. All patients had a history of anterior traumatic or atraumatic dislocation, and preoperative examination revealed a positive apprehension and relocation test without passive limitation of range of motion. Sulcus sign for shoulder laxity and rotator cuff tests were performed in all cases. Sixty-five patients (50.4%) underwent a preoperative radiographic evaluation according to Bernageau and Patte [13]. Magnetic resonance imaging was performed in 90 patients (69.8%). Arthro-MRI was performed in 26 patients including athletes (20.1%) and arthro-CT scan in 10 cases (7.8%). In one patient affected by bilateral anterior shoulder instability we used one CT scan to evaluate both shoulders.

We use an instrumental imaging like MRI, arthro-MRI, or arthro-CT scan to evaluate lesion of the glenoideal labrum and glenohumeral ligaments.

From 2001 to 2004, we used the nonobjective method described by Burkhart and de Beer [14] to evaluate the glenoid bone. From 2005, we evaluated bone loss using the "PICO" CT scan technique [15] and treated arthroscopically those patients with a maximum bone loss of 15%. All patients were treated with the arthroscopic technique described by Thal [16] using bioknotless anchors (De Puy Mitek, Raynham, MA). During this procedure, it is important to make a good capsular south-north shift and a capsular bumper on the glenoid rim. In hyperlaxity cases, rather than closing the rotator interval we use an appropriate number of anchors to fix the ligaments on the glenoid. From 2001, we also treated associated superior labral anterior to posterior (SLAP) lesions with absorbable knotless anchors using the surgical technique subsequently described by Yian et al. [17].

As shown in Table 1, during surgery, we found a Bankart lesion in all 129 patients, and, in 21 of them, the lesion was associated with a SLAP lesion. In 4 patients the Bankart lesion was associated with a partial rotator cuff lesion that was treated with debridement. Seven patients had a Bony-Bankart lesion and 14 an anterior labral periosteal sleeve avulsion (ALPSA) lesion.

Table 1: Type of lesion detected at surgery.

Type of lesion	Number
Bankart	129
Bankart with SLAP	21
Bankart with rotator cuff lesion	4
Bony-Bankart	7
ALPSA	14

The shoulder was immobilized for 4 weeks in a sling in adduction-internal rotation. After this period, patients were allowed to remove the brace intermittently and start rehabilitation with the Lyon protocol in water [18]. When the shoulder reached the complete passive range of motion, active movement was begun with strengthening exercises according to the Hawkins et al.'s Protocol [19]. Regular sports practice was allowed 8 months after surgery.

In our protocol a postoperative MRI is not expected.

3. Statistical Analysis

Statistical analysis was designed to assess whether there was a correlation between risk factors and recurrent shoulder instability treated with absorbable knotless anchors. We performed a separate statistical analysis for the Rowe and the SST groups. The level of stability at 24 months of follow-up was the dependent variable (Rowe stability score, SST results). Age (≤20 years, >20 years), number of dislocations (<5 or ≥5) and type (traumatic or not traumatic) of shoulder dislocation (traumatic or not traumatic), difficulty in shoulder movements (Rowe movement score ≤15, >15), and functions (Rowe function score <30, ≥30) were the independent variables when the Rowe group was evaluated. Age (≤20 years, >20 years), number of shoulder dislocations (<5 or ≥5), and type of shoulder dislocation (whether traumatic or not) were the independent variables considered for the subjects evaluated by means of the SST questionnaire. The bivariate association of the dependent variable with the independent variables was analyzed using the Chi-square test or the Fisher exact test (when the expected frequencies were less than 5). The effect of the independent variables on the postoperative shoulder stability was investigated using a multiple logistic regression model.

We also analyzed the distribution of relapses according to age at intervention, shoulder dislocations number, and type (whether traumatic or not). Because of the small number of relapses, we used a nonparametric approach, namely, the Wilcoxon rank test for quantitative variables and the Fisher exact test for the qualitative variables. We used survival analysis to evaluate the relapse-free probability. The Kaplan-Maier method was applied considering age at intervention, number, and type of shoulder dislocation as factors that could affect the probability of relapse. The log-rank test was used to compare strata. A level of probability equal to 0.05 was

Table 2: Main features of patients evaluated by the Rowe score according to the level of shoulder stability.

	Level of stability		
	Score 30	Score 50	P
	$n = 19$	$n = 62$	
Age [n (%)]			
≤20 years	4 (21.0)	16 (25.8)	0.770*
>20 years	15 (79.0)	46 (74.2)	*Fisher exact test
No. of shoulder dislocations N. (%)			
<5	9 (47.4)	29 (46.8)	0.964
≥5	10 (52.6)	33 (53.2)	Chi-square test
Traumatic dislocation N. (%)			
No	7 (36.8)	19 (30.6)	0.613
Yes	12 (63.2)	43 (69.4)	Chi-square test
Difficulty in movement N. (%)			
≤15 score	7 (36.8)	4 (6.5)	0.003
≥20 score	12 (63.2)	58 (93.5)	Chi-square test
Difficulty in function N.nd (%)			
<30 score	11 (57.9)	18 (29.0)	0.03
=30 score	8 (42.1)	44 (71.0)	Chi-square test

chosen to assess statistical significance; all the analyses were performed using the SAS program versus 9.1.

4. Results

At minimum follow-up of 24 months, 79 patients (total number of shoulders 81; 2 cases were bilateral) were assessed. The main features of patients according to the level of shoulder stability evaluated by the Rowe score are shown in Table 2. Sixty-two of the 81 shoulders (76.5%) had a stability score of 50 and 18 a stability score of 30. The latter patients had significantly greater difficulty in movement (Rowe movement score ≤15, $P = 0.003$) and in function (Rowe function score <30, $P = 0.03$) than those with a stability score of 50. The level of shoulder stability was not significantly associated with the patients' age, or with the number or type of shoulder dislocations. Only one patient in the Rowe group relapsed; consequently, this variable was not included in the analysis.

We performed a multiple logistic regression analysis to evaluate the effect of age, number and type of dislocations, difficulty in movement, and function on the level of shoulder stability in patients with a low Rowe stability score (Table 3). Among the factors considered in the analysis, difficulty of movement was statistically significant. In fact, the probability of having a low level of shoulder stability was 6.41 times higher in patients with a Rowe movement score ≤15 than in patients with a Rowe movement score ≥20. The 95% CI of the odds ratio was particularly large due to the small number of patients who had both a Rowe movement score ≤15 and a Rowe stability score of 30 (7 of a total of 11 subjects with a Rowe movement score ≤15).

In the SST group, constituted by 48 patients (Table 4), an unstable shoulder was significantly more frequent in patients aged ≤20 years ($P = 0.040$). A number of dislocations ≥5 and traumatic dislocations were more frequent in patients with an unstable shoulder than in patients with a stable shoulder, but the difference was not statistically significant. No relapse occurred in patients with a stable shoulder; 50% of patients with unstable shoulder relapsed ($P < 0.001$).

The distribution of relapses according to the type of shoulder dislocation, the year of surgery, the age at surgery, and the number of dislocations is shown in Table 5. Patients who relapsed were significantly younger at surgery than patients who did not relapse. Up to the end of 2004, we treated

Table 3: Effect of age, number and type of dislocations, movement,and function on shoulder instability (Rowe stability score = 30).

	Odds ratio	95% CI		P
		LL	UL	
Age: ≤20 versus >20	1.13	0.29	4.38	0.857
N. dislocations: ≤5 versus <5	0.86	0.27	2.72	0.798
Traumatic dislocation: yes versus no	0.83	0.25	2.77	0.751
Movement score: ≤15 versus ≥20	5.95	1.21	29.41	0.029
Function score: <30 versus 30	1.86	0.51	6.76	0.350

95% CI: confidence interval; LL: lower level; UL: upper level.

Table 4: Main features of patients evaluated by the SST questionnaire according to shoulder stability.

	Stability		
	No	Yes	P
	$n = 18$	$n = 30$	
Age [n (%)]			
≤20 years	6 (33.3)	2 (6.7)	0.040
>20 years	12 (66.7)	28 (93.3)	Chi-square test
No. of shoulder dislocations [n (%)]			
<5	7 (38.9)	16 (53.3)	0.332
≥5	11 (61.1)	14 (46.7)	Chi-square test
Traumatic dislocation [n (%)]			
No	6 (33.3)	15 (50.0)	0.260
Yes	12 (66.7)	15 (50.0)	Chi-square test
Recurrence [n (%)]			
No	9 (50.0)	30 (100.0)	<0.001*
Yes	9 (50.0)	0 (0.0)	*Fisher exact test

Table 5: Features of the 10 cases of dislocation recurrence.

Case number	Age at surgery	Type of lesion	Time from surgery	Type of instability	Cause of recurrence
1	22	Bankart + ALPSA	3 years	Traumatic	Traumatic
2	25	Bankart + ALPSA	2 years	Not traumatic	Traumatic
3	34	Bankart	1 year	Traumatic	Traumatic
4	22	Bankart + ALPSA	1 year	Traumatic	Traumatic
5	23	Bankart + SLAP	3 months	Traumatic	Traumatic
6	19	Bankart + ALPSA	1 year	Traumatic	Not traumatic
7	18	Bankart	1 year	Traumatic	Traumatic
8	20	Bankart + ALPSA	1 year	Traumatic	Not traumatic
9	21	Bankart	1 year	Traumatic	Not traumatic
10	20	Bankart + ALPSA	18 months	Traumatic	Not traumatic

Table 6: Distribution of recurrence dislocation in relation to type and number of dislocations and age at surgery.

	Relapse		
	No $n = 119$	Yes $n = 10$	P
Traumatic dislocations [n (%)]			
No	46 (38.7)	1 (10.0)	0.092
Yes	73 (61.3)	9 (90.0)	Fisher exact test
Year of intervention [n (%)]			
<2005	64 (53.8)	4 (40.0)	0.184
≥2005	55 (46.2)	6 (60.0)	Fisher exact test
Number of dislocations			
[Median (25th–75th percentile)]	4 (2–6)	4 (3–5)	0.922*
Age			*Wilcoxon rank test
Years [median (25th–75th percentile)]	24.1 (21.6–27.2)	21.6 (19.1–22.4)	0.016* *Wilcoxon rank test

cases with a glenoid bone loss less than 25% and thereafter cases with a glenoid bone loss lower than 15%. The incidence of recurrence did not differ statistically between these two groups (data not shown).

Table 6 shows the patient's age, lesion at surgery, type of instability, and cause of redislocation in our cohort. The probability of remaining relapse-free was significantly higher in subjects who were 20 years old at surgery. Neither the number nor the type of shoulder dislocations significantly affected the probability of relapsing. The dislocation recurrence rate was 7.7% (10 cases). Recurrence was due to a trauma in 60% of cases and was spontaneous in the remaining 40%.

In the 80 cases treated for nontraumatic instability, the apprehension test in external rotation at 90° of abduction was positive in 5/80 patients (6.2%); pain was present in 2 patients (2.5%), while apprehension and pain were present in 3 (3.7%). In all cases treated for traumatic instability ($n = 117$), the apprehension test was positive in 15 patients (13%) while 38 patients (33%) reported apprehension and pain.

Fifty-one (39.5%) patients were involved in sports and 16 of them (12.4%) practiced high-risk contact sports. Thirty-eight (74.5%) of these patients resumed their sport at preinjury level and 10 (19.6%) at a lower level, whereas 3 (5.8%) could not resume sport either because of pain during sports practice ($n = 2$) or due to relapse.

We did not observe any case of synovitis or anchor mobilization. There was only one case of chondral damage (0.07%), which could have been related to the use of articular infusion of local anesthetic.

5. Discussion

Arthroscopic treatment has evolved to become the main surgical option in the management of anterior shoulder instability given the comparable outcome of open and arthroscopic techniques: 10% of failure [20]. However, the use of absorbable versus not absorbable and of knotted versus knotless anchors is still controversial because of the lack of data about the frequency and complications associated with arthroscopic techniques [21]. To our knowledge, there are no reports of large series of patients treated with knotless absorbable anchors. Thal et al. [22] evaluated 73 consecutive patients, with 5 cases (6.9%) of failure of knotless anchors in patients aged 22 years or younger; however follow-up was short. Oh et al. [23] reported that 5 cases out of 37 (13.5%) treated with absorbable suture anchors perceived mild pain during the apprehension test without a sense of instability and one case (2.7%) with a sense of instability during normal daily activity.

Age at surgery, number of dislocations, type of dislocation, hyperlaxity glenoid bone loss, and Hill Sachs lesions have been reported to be risk factors for recurrence [1, 3–7]. In our study of 129 shoulders with unidirectional anterior instability for a minimum 2-year follow-up, we found that age of 20 years or lower was a significant risk factor ($P = 0.011$) for recurrence in patients managed with the arthroscopic Bankart repair technique using absorbable knotless anchors. Patients who were significantly younger at surgery did not relapse (see Table 4). The incidence of recurrence was higher in patients who had more than 5 dislocations or whose previous dislocation was traumatic, but the difference was not statistically significant.

Many of our patients (76.5%) had a high level of stability and good recovery of motion without stiffness. There was only case (0.07%) of chondral damage. We did not observe any cases of synovitis or anchor mobilization. Fifty-one of our patients (39.5%) had practiced sports before surgery: 16 of them (29.4%) practiced contact or collision sports and 36 (70.6%) noncollision sports. Thal et al. reported failure in 42/72 patients (7.1%) who practiced contact or collision sports and in 30 who did not (6.7%) [22]. Konrad et al. [24] reported that 29/35 patients (83%) with traumatic, unidirectional anterior shoulder instability treated with arthroscopic transglenoid fixation were able to return to their preoperative level of sports activity. In a prospective randomized study on absorbable versus nonabsorbable sutures for arthroscopic treatment of anterior shoulder instability in athletes, Monteiro et al. [8] reported 50 patients randomly assigned to two groups: one treated with absorbable and the other one with nonabsorbable sutures. They obtained excellent results in 22 patients (90.5%) of the former group and in 21 patients (87.5%) of the latter group. In our experience, 38/51 cases (74.5%) returned to sports at preinjury level, 10 (19.6%) at a lower level, while 3 (5.8%) could not resume sports activity due to relapse. In our series, the recurrent dislocation rate was 7.7%, but it should be stressed that recurrence was traumatic in 6 cases and spontaneous in 4 cases, so the true recurrence rate was 3.1%.

6. Conclusions

The risk factors for recurrent shoulder dislocation arthroscopically managed with absorbable knotless anchors in our series were age, number, and type of dislocation. The use of bioabsorbable materials did not increase the risk of synovitis, anchor mobilization, stiffness, or chondral damage. Correct execution of the arthroscopic technique and careful patient selection based on the patient's age, type of dislocation, and glenoideal bone loss are the key to a successful clinical outcome and a recurrence-free outcome.

Conflict of Interests

The authors declare that there is no conflict of interests.

Acknowledgment

The authors thank Jean Ann Gilder (Scientific Communication Srl.) for revising and editing the text.

References

[1] F. Postacchini, S. Gumina, and G. Cinotti, "Anterior shoulder dislocation in adolescents," *Journal of Shoulder and Elbow Surgery*, vol. 9, no. 6, pp. 470–474, 2000.

[2] S. H. Kim, K. I. Ha, M. W. Jung, M. S. Lim, Y. M. Kim, and J. H. Park, "Accelerated rehabilitation after arthroscopic Bankart repair for selected cases: a prospective randomized clinical study," *Arthroscopy*, vol. 19, no. 7, pp. 722–731, 2003.

[3] T. J. Gill, R. F. Warren, C. A. Rockwood Jr., E. V. Craig, R. H. Cofield, and R. J. Hawkins, "Complications of shoulder surgery," *Instructional Course Lectures*, vol. 48, pp. 359–374, 1999.

[4] H. H. Handoll, M. A. Almaiyah, and A. Rangan, "Surgical versus non-surgical treatment for acute anterior shoulder dislocation," *Cochrane Database of Systematic Reviews*, no. 1, Article ID CD004325, 2004.

[5] H. E. Segmüller, M. G. Hayes, and A. D. Saies, "Arthroscopic repair of glenolabral injuries with an absorbable fixation device," *Journal of Shoulder and Elbow Surgery*, vol. 6, no. 4, pp. 383–392, 1997.

[6] D. C. Meyer and C. Gerber, "Failure of anterior shoulder instability repair caused by eyelet cutout of absorbable suture anchors," *Arthroscopy*, vol. 20, no. 5, pp. 521–523, 2004.

[7] C. R. Good and J. D. MacGillivray, "Traumatic shoulder dislocation in the adolescent athlete: advances in surgical treatment," *Current Opinion in Pediatrics*, vol. 17, no. 1, pp. 25–29, 2005.

[8] G. C. Monteiro, B. Ejnisman, C. V. Andreoli, A. C. Pochini, and M. Cohen, "Absorbable versus nonabsorbable sutures for the arthroscopic treatment of anterior shoulder instability in athletes: a prospective randomized study," *Arthroscopy*, vol. 24, no. 6, pp. 697–703, 2008.

[9] M. Ozbaydar, B. Elhassan, and J. J. P. Warner, "The use of anchors in shoulder surgery: a shift from metallic to bioabsorbable anchors," *Arthroscopy*, vol. 23, no. 10, pp. 1124–1126, 2007.

[10] G. S. Athwal, S. M. Shridharani, and S. W. O'Driscoll, "Osteolysis and arthropathy of the shoulder after use of bioabsorbable knotless suture anchors: a report of four cases," *Journal of Bone and Joint Surgery A*, vol. 88, no. 8, pp. 1840–1845, 2006.

[11] F. A. Barber, "Biodegradable shoulder anchors have unique modes of failure," *Arthroscopy*, vol. 23, no. 3, pp. 316–320, 2007.

[12] M. Q. Freehill, D. J. Harms, S. M. Huber, D. Atlihan, and D. D. Buss, "Poly-L-lactic acid tack synovitis after arthroscopic stabilization of the shoulder," *The American Journal of Sports Medicine*, vol. 31, no. 5, pp. 643–647, 2003.

[13] J. Bernageau and D. Patte, "The radiographic diagnosis of posterior dislocation of the shoulder," *Revue de Chirurgie Orthopedique et Reparatrice de l'Appareil Moteur*, vol. 65, no. 2, pp. 101–107, 1979.

[14] S. S. Burkhart and J. F. de Beer, "Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: Significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion," *Arthroscopy*, vol. 16, no. 7, pp. 677–694, 2000.

[15] P. Baudi, P. Righi, D. Bolognesi et al., "How to identify and calculate glenoid bone deficit," *La Chirurgia degli Organi di Movimento*, vol. 90, no. 2, pp. 145–152, 2005.

[16] R. Thal, "A Knotless suture anchor: technique for use in arthroscopic Bakart repair," *Arthroscopy*, vol. 17, no. 2, pp. 213–218, 2001.

[17] E. Yian, C. Wang, P. J. Millett, and J. J. P. Warner, "Arthroscopic repair of SLAP lesions with a bioknotless suture anchor," *Arthroscopy*, vol. 20, no. 5, pp. 547–551, 2004.

[18] J.-P. Liotard, T. B. Edwards, A. Padey, G. Walch, and A. Boulahia, "Hydrotherapy rehabilitation after shoulder surgery," *Techniques in Shoulder & Elbow Surgery*, vol. 4, no. 2, pp. 44–49, 2003.

[19] R. J. Hawkins, R. Litchfield, J. Atkins, G. Hagerman, and C. J. Dillman, "Rehabilitation of the shoulder," *Annales Chirurgiae et Gynaecologiae*, vol. 85, no. 2, pp. 173–184, 1996.

[20] P. Bacilla, L. D. Field, and F. H. Savoie III, "Arthroscopic Bankart repair in a high demand patient population," *Arthroscopy*, vol. 13, no. 1, pp. 51–60, 1997.

[21] G. M. Gartsman, T. S. Roddey, and S. M. Hammerman, "Arthroscopic treatment of anterior-inferior glenohumeral instability. Two to five-year follow-up," *Journal of Bone and Joint Surgery*, vol. 82, no. 7, pp. 991–1003, 2000.

[22] R. Thal, M. Nofziger, M. Bridges, and J. J. Kim, "Arthroscopic Bankart repair using knotless or BioKnotless suture anchors: 2- to 7-year results," *Arthroscopy*, vol. 23, no. 4, pp. 367–375, 2007.

[23] J. H. Oh, H. K. Lee, J. Y. Kim, S. H. Kim, and H. S. Gong, "Clinical and radiologic outcomes of arthroscopic glenoid labrum repair with the bioknotless suture anchor," *The American Journal of Sports Medicine*, vol. 37, no. 12, pp. 2340–2348, 2009.

[24] G. G. Konrad, V. Rössler, P. C. Kreuz, and N. P. Südkamp, "Sports activity and proprioceptive ability after arthroscopic capsulolabral repair of post-traumatic shoulder instability," *Zeitschrift für Orthopädie und Unfallchirurgie*, vol. 147, no. 4, pp. 452–456, 2009.