ORIGINAL ARTICLE

Factors Affecting Return to Work in Patients Undergoing Arthroscopic Rotator Cuff Repair

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Objective: Although clinical outcomes after arthroscopic rotator cuff repair are generally favorable, postoperative return to work is also an important issue. This study aimed to assess clinical outcomes and clarify the factors affecting return to work in patients who had undergone arthroscopic rotator cuff repair. **Methods:** In total, 63 patients who had undergone arthroscopic rotator cuff repair were included in this study. Clinical assessment was performed using Japanese Orthopaedic Association (JOA) scores, along with measurements of pain, range of motion, muscle strength, cuff integrity, and fatty infiltration. Depending on their return-to-work status at the final follow-up, subjects were assigned to either the complete return group (the patient returned to work) or the incomplete return group (the patient had quit or had changed their occupation at final follow-up). Various clinical parameters affecting the return to work outcome were examined through univariate and multivariate analyses. **Results:** Of the 63 subjects, 42 belonged to the complete return group and 21 belonged to the incomplete return group. Therefore, the working capability recovery rate following arthroscopic rotator cuff repair was 66.7%. Both groups showed significant improvement from their preoperative status, but there were statistically significant differences in JOA scores between the groups at 9 and 12 months postoperatively ($P < 0.01$). Multivariate stepwise logistic regression analysis showed that heavy work and female sex were significantly adversely associated with return to work ($P < 0.05$). **Conclusion:** The working capability recovery rate following arthroscopic rotator cuff repair was 66.7%, and the preoperative factors affecting recovery of working capability were heavy work and female sex.

Key Words: arthroscopic rotator cuff repair; clinical assessment; return to work

INTRODUCTION

Rotator cuff tears are caused by traumatic and/or degenerative changes and often occur in middle-aged and elderly people. Arthroscopic rotator cuff repair (ARCR) can result in improvement in pain and shoulder function.¹⁻⁵⁾ McElvany et al.²⁾ and Galanopoulos et al.³⁾ reported favorable postoperative outcomes regardless of rotator cuff integrity. Heuberger et al.⁴⁾ reported favorable long-term results based on a 10-

year follow-up of ARCR patients. Moreover, Marrero et al.⁵⁾ reported that rotator cuff function was maintained for 9 years or longer postoperatively (mean follow-up, 151.7 months).

Although clinical outcomes after ARCR generally are favorable, postoperative return to work is also an important issue. Nové-Josserand et al.⁶⁾ reported a 59.5% postoperative return-to-work rate after 2 years of follow-up. Return-to-work rates of 81.6%,⁷⁾ 88.5%,⁸⁾ 83.6%,⁹⁾ and 94%⁹⁾ have been reported after average follow-up periods of 45 months, 1 year

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or longer, 6 months, and 9 months, respectively.

Workers' compensation leads to unfavorable surgical outcomes, which affects postoperative return to work.^{7,10–13} Furthermore, female sex, strenuous physical labor, the existence of persistent bursitis,⁹ and age⁶ are factors adversely affecting return to work. As described above, several studies have investigated the return-to-work status after ARCR; however, a consensus has not yet been reached. Therefore, we examined the postoperative return-to-work status following ARCR and clarified the factors affecting this recovery.

MATERIALS AND METHODS

Subjects

A total of 63 subjects (48 men and 15 women; mean age, 60.3 ± 9.0 years; mean period from onset to surgery, 9.6 ± 9.7 months) were included in this study. Inclusion criteria were postoperative follow-up for at least 1 year and individuals employed preoperatively. Exclusion criteria were a history of bilateral rotator cuff repairs, revision surgeries, fracture around the shoulders, osteoarthritis, and infection. According to the classification of DeOrto and Cofield,¹⁴ there were 6 small, 22 medium, 25 large, and 10 massive tears (**Table 1**).

Outcome Measures

Japanese Orthopaedic Association (JOA) scores were used for clinical evaluation. Visual analog scale scores at three states (at rest, during shoulder motion, and at night) were recorded as patients' subjective assessments of pain. Active range of motion (ROM) was measured with a goniometer, and isometric muscle strength was measured with a hand-held dynamometer (Micro FET2; Hoggan Health Industry) in forward flexion, abduction, and external and internal rotation. Isometric muscle strength was calculated as a percentage of that of the contralateral shoulder.

Magnetic resonance imaging was undertaken postoperatively to evaluate fatty infiltration of the rotator cuff muscles and the presence of recurrent tears. Fatty infiltration at the "Y-view" was evaluated according to the Goutallier classification.¹⁵

The return-to-work status was used to divide the subjects into two groups: the complete return group (CR; patients who returned to their previous work) and the incomplete return group (ICR; patients who quit or had changed their occupation at final follow-up). These data were obtained by physicians and physical therapists blinded to this study throughout.

Surgical Procedure

ARCR was performed on patients who did not respond to conservative treatment (anti-inflammatory drugs, physical therapy, and intraarticular corticosteroids or hyaluronic acid injections) lasting at least 3 months. ARCR was performed with the patient under general anesthesia in the beach-chair position. The torn cuff was repaired using the single-row method (one row of anchors were placed on the lateral aspect of the footprint, and the torn cuff was fixed with interrupted sutures) or the suture bridge method (one row of anchors was placed on the medial aspect of the footprint, with or without tying, and the torn cuff was fixed transosseously with a knotless anchor on the lateral aspect of the footprint). Additional procedures, including capsular release and tenotomy/tenodesis of the long head of the biceps tendon, were used if needed. Acromioplasty was performed in all cases. Postoperatively, the shoulder joint was immobilized in a sling for 6 weeks with an abduction pillow.

Postoperative Rehabilitation

Passive ROM exercises of the scapulothoracic, elbow, and hand joints were allowed 1 day postoperatively and that of the glenohumeral joint 4 days postoperatively. Active ROM exercise was allowed at 7 weeks postoperatively, and isotonic muscle strengthening exercises were allowed at 13 weeks.

Statistical Analysis

Statistical analyses were performed using PASW Statistics for Windows version 17.0 (SPSS Japan, Tokyo, Japan) and JMP13 (SAS Institute, Inc., Cary, NC, USA). Values are given as the mean (standard deviation). The Bonferroni correction was used to compare scores preoperatively and 3, 6, 9, and 12 months postoperatively. Characteristics of the CR and ICR groups were compared at baseline using Wilcoxon rank sum tests for independent samples for continuous variables and chi-squared tests for categorical data. Variables with $P < 0.25$ were selected from the univariate analysis results and were further selected using the stepwise method. Multivariate stepwise logistic analysis using clinical variables was performed to evaluate the parameters significantly affecting CR or ICR outcome, accompanied by odds ratios with 95% confidence intervals. $P < 0.05$ was considered significant.

RESULTS

In total, 42 patients (66.7%) were classified into the CR group, and 21 patients (33.3%) were classified into the ICR group. Total JOA scores (CR/ICR) before and at 3, 6, 9, and

Table 1. Demographic, functional, structural, and intraoperative data for the complete return and incomplete return outcome groups

	Total (n=63)	CR (n=42)	ICR (n=21)	P- value ^a
Demographic Variables				
Age, years (SD)	60.3 (9.0)	60.3 (7.9)	60.4 (11.2)	0.4
Sex, male / female, n	48 / 15	34 / 8	14 / 7	0.21
Diabetes, n (%)	4 (6.3)	2 (4.8)	2 (9.5)	0.47
Dominant-side surgery, n (%)	36 (57.1)	23 (54.8)	13 (61.9)	0.59
Traumatic onset, n (%)	35 (55.6)	23 (54.8)	12 (57.1)	0.86
Symptom duration, months (SD)	9.6 (9.7)	8.3 (8.3)	11.9 (11.8)	0.3
Workers' compensation, n (%)	17 (30.0)	7 (16.7)	10 (47.6)	0.0091 ^c
Heavy work, n (%)	39 (61.9)	21 (50.0)	18 (85.7)	0.0059 ^c
Preoperative Functional Variables				
Visual analogue scale of pain, mm (SD)				
Rest	21.2 (21.5)	22.5 (23.2)	18.2 (16.8)	0.64
Motion	56.4 (29.2)	56.9 (26.5)	55.2 (35.6)	0.86
Night	44.8 (28.1)	47.6 (27.6)	38.3 (29.0)	0.25
Range of motion, degrees (SD)				
Elevation	102.6 (39.1)	101.2 (38.1)	105.8 (42.3)	0.77
Abduction	97.2 (47.2)	95.2 (46.4)	101.7 (50.2)	0.53
External rotation	44.8 (15.6)	43.9 (14.6)	46.9 (17.9)	0.27
Internal rotation (vertebrae)	4.7 (3.3)	4.6 (3.2)	4.9 (3.5)	0.78
Isometric muscle strength ^b , % (SD)				
Elevation	71.0 (29.5)	67.2 (26.8)	79.6 (34.0)	0.26
Abduction	64.4 (27.2)	64.1 (25.5)	65.0 (31.5)	0.63
External rotation	66.1 (35.9)	66.2 (34.7)	65.9 (39.5)	0.84
Internal rotation	64.4 (27.2)	85.4 (28.1)	83.8 (29.8)	0.82
JOA score, points (SD)	68.2 (12.8)	67.4 (11.6)	70.4 (13.0)	0.48
Structural Variables				
Tear size, cm (SD)				
Tear size classification ^d , n				0.23
Small	6	2	4	
Medium	22	17	5	
Large	25	17	8	
Massive	10	6	4	
Preoperative Goutallier classification ^e , n (%)				
Supraspinatus				
Stage 0	-	-	-	0.88
Stage 1	29 (46.0)	19 (45.2)	10 (47.6)	
Stage 2	27 (42.9)	19 (45.2)	8 (38.1)	
Stage 3	6 (9.5)	3 (7.1)	3 (14.3)	
Stage 4	1 (1.6)	1 (2.4)	-	
Infraspinatus				
Stage 0	4 (6.3)	3 (7.1)	1 (4.8)	0.65
Stage 1	53 (84.1)	34 (81.0)	19 (90.5)	
Stage 2	5 (7.9)	4 (9.5)	1 (4.8)	
Stage 3	1 (1.6)	1 (2.4)	-	

Table 1. Demographic, functional, structural, and intraoperative data for the complete return and incomplete return outcome groups (continued)

	Total (n=63)	CR (n=42)	ICR (n=21)	P- value ^a
Subscapularis				0.12
Stage 0	2 (3.2)	2 (4.8)	-	
Stage 1	58 (92.1)	39 (92.9)	19 (90.5)	
Stage 2	3 (4.8)	1 (2.4)	2 (9.5)	
Retear at 3 months, n (%)	10 (15.9)	6 (14.3)	4 (19.0)	0.63
Retear at 12 months, n (%)	11 (17.5)	7 (16.7)	4 (19.0)	0.81
Intraoperative Variables				
Repair technique, n				0.13
Suture bridge	54	38	16	
Single row	9	4	5	
Capsular release, n (%)	17 (28.6)	12 (28.6)	6 (28.6)	1
Manipulation, n (%)	14 (22.2)	11 (26.2)	3 (14.3)	0.28
Contracture ^f , n (%)	21 (33.3)	14 (33.3)	7 (33.3)	1
Treatment of long head of biceps tendon, n (%)				0.31
Untreated	16 (25.4)	9 (21.4)	7 (33.3)	
Treated	47 (74.6)	33 (78.6)	14 (66.7)	

^a Statistics were evaluated by univariate analysis.^b Measured as a percentage of the unaffected side.^c Statistically significant.^d DeOrto and Cofield cuff tear size classification.¹⁴⁾^e Five-stage grading system developed by Goutallier.¹⁵⁾^f Contracture was judged by manipulation or capsular release. **Fig. 1.** Preoperative status and postoperative clinical course as indicated by the JOA score. B.O., before operation; P.O., post-operation; M, months. *Statistically significant ($P < 0.01$).

Table 2. Subitems in the JOA scores for the complete return and incomplete return groups

	CR (n=42)	ICR (n=21)	P-value ^a
9 months after surgery (SD)			
Pain	25.6 (4.1)	22.0 (4.9)	0.021 ^b
General functions	8.8 (1.6)	8.4 (1.8)	0.21
Activities of daily living	9.9 (0.5)	9.5 (0.8)	0.011 ^b
Range of motion	25.4 (3.9)	23.7 (3.1)	0.046 ^b
12 months after surgery (SD)			
Pain	26.3 (3.7)	22.6 (6.4)	0.017 ^b
General functions	9.1 (1.4)	8.6 (1.2)	0.01 ^b
Activities of daily living	9.8 (0.5)	9.3 (1.5)	0.029 ^b
Range of motion	25.5 (3.8)	23.7 (3.8)	0.029 ^b

^a Statistics were evaluated by univariate analysis.^b Statistically significant.**Table 3.** Multivariate logistic regression analysis

	Odds Ratio	95% Confidence Interval	P-value
Age	1.05	0.97–1.13	0.27
Female	0.11	0.02–0.71	0.02 ^a
Workers' compensation	0.39	0.09–1.68	0.21
Heavy work	0.1	0.01–0.64	0.02 ^a
Subscapularis (Goutallier classification)	0.15	0.01–1.78	0.1

^aStatistically significant.

12 months postoperatively were $67.4 \pm 11.6/70.4 \pm 13.0$, $77.5 \pm 11.1/74.1 \pm 10.1$, $85.4 \pm 8.7/81.3 \pm 10.6$, $89.3 \pm 7.0/85.0 \pm 7.6$, and $90.8 \pm 7.1/85.7 \pm 8.9$ points, respectively ($P < 0.01$). Both groups showed significant improvement from the preoperative scores. Moreover, there was a statistically significant difference between the groups in terms of postoperative JOA scores at 9 and 12 months ($P < 0.01$; **Fig. 1**), and also in the subitems of the JOA score at the same times. The details are shown in **Table 2**.

Univariate analysis indicated that preoperative heavy work, defined as occupations requiring repetitive overhead activities⁶⁾ or lifting of heavy items,⁸⁾ and workers' compensation were significantly associated with return to work ($P < 0.01$). Multivariate stepwise logistic regression analysis revealed that preoperative heavy work and female sex were significantly associated with return to work ($P < 0.05$; **Table 3**).

Consequently, a subanalysis was carried out regarding heavy work/light work and male/female workers. When comparing the clinical variables between heavy work and light work, there was a significant difference in workers' compensation (15 cases: 38.5% vs 2 cases: 8.3%, respec-

tively; $P < 0.01$) but not in the other variables. When comparing male/female workers, there was a significant difference in the preoperative pain score (a subitem of the JOA score) (25.9 ± 4.1 vs 22.0 ± 6.5 points, respectively; $P < 0.05$), but not in the other variables.

DISCUSSION

In 627 patients followed up for 2 years after ARCR, Kurowicki et al.¹⁶⁾ found that maximal functional recovery reached a plateau at 1 year postoperatively. In a systematic review of 19 studies comprising 1370 cases, Zuke et al.¹⁷⁾ also reported a maximum recovery period of 1 year postoperatively. Based on these reports, we evaluated the return-to-work status at 12 months postoperatively. In our study group of 63 subjects, 42 were able to return to work (return rate, 66.7%), and preoperative factors adversely affecting return to work were strenuous physical labor and female sex.

In a prospective study of 365 patients, Collin et al.⁹⁾ demonstrated that the percentages able to resume work and recreational physical activities at 6 and 9 months postoperatively were 83.6% and 94%, respectively. Bhatia et al.⁸⁾ reported a return-to-work rate of 88.5% within 1 year postoperatively in

78 ARCR patients, whereas Nové-Josserand et al.⁶⁾ reported a return rate of 59.5% within 2 years in 262 ARCR patients. The return-to-work rate after ARCR evidently varied among previous reports.

Different proportions of patients involved in strenuous physical labor in the study groups may have influenced the return-to-work rates. In the current study, 61.9% of subjects did heavy work, compared with 68.3%,⁶⁾ 61.5%,⁸⁾ and 35.6%⁹⁾ in prior studies. Moreover, the definition of strenuous physical labor differed among the studies. Nové-Josserand et al.⁶⁾ defined strenuous manual labor as work composed primarily of repeated overhead motions, whereas Bhatia et al.⁸⁾ applied the Canadian National Occupational Classification system, which has the following categories: sedentary, light, medium, heavy, and very heavy. Collin et al.⁹⁾ defined strenuous and nonstrenuous physical labor based on patient self-classifications. Our definition was work composed primarily of overhead operations or carrying heavy objects.

In previous studies, the proportion of cases with a large/massive tear also differed. Collin et al.⁹⁾ reported 32.9% of cases involved two or more tendon ruptures, excluding cases categorized as Goutallier stage 3 or higher. Consequently, it is possible that differences in the proportions of large/massive tears may have influenced the return-to-work rates.

In our study, multiple logistic regression analysis revealed physical labor and female sex as preoperative factors adversely affecting postoperative return to work. These findings were consistent with the results of Collin et al.⁹⁾ Misamore et al.⁷⁾ stated that, following cuff repair, workers performing light-to-moderate physical or nonphysical labor were able to return to work but not those performing strenuous labor. As stated previously, we strictly defined strenuous physical labor in accordance with prior studies and confirmed it to be an important factor affecting return to work, consistent with previous findings.^{7,9)}

Previous studies have indicated that workers' compensation claims were associated with poorer outcomes after rotator cuff repair.^{7,10,12,13)} Henn et al.¹⁸⁾ reported that psychosocial issues, secondary gain concerns, heavy work load demands, medical comorbidities, and smoking were related to poor performance after surgery in workers' compensation patients. In the present study, the number of workers' compensation patients was significantly larger in the heavy work group. This fact might have influenced the postoperative return-to-work rate in patients who did heavy work preoperatively.

Regarding the effect of being female, chronic musculoskeletal pain is more frequent in female than in male patients.^{19,20)}

Rollman and Lautenbacher¹⁹⁾ suggested that biological and psychosocial factors are associated with the state of pain hypersensitivity that predisposes an individual to chronic myalgia, and therefore that sex differences may affect these mechanisms. Tsang et al.²⁰⁾ stated that female-specific hormones may cause hypersensitivity to pain. Taken together, it is conceivable that, in female patients, the residual pain may have affected their work status after surgery.

An association between repaired cuff integrity and return to work has not been found. However, because healing of the rotator cuff tendon affects the muscular strength of the shoulder joints,²¹⁾ it is important to clarify these relationships. Our study failed to disclose a significant association between return to work and cuff integrity/fatty infiltration of the muscles postoperatively. This remains to be elucidated in the future.

Bhatia et al.⁸⁾ did not compare clinical outcomes between subjects who did and did not return to work; however, the mean constant score at final follow-up for all subjects was 72.2 points in their study. Collin et al.⁹⁾ showed an overall mean constant score at 6 months of 71.2 points, with a significant difference between subjects who did and did not return to work (73.8 vs. 58.5 points, respectively). Our study also found a significant difference in mean JOA scores between the groups at 12 months (90.8 ± 7.1 vs. 85.7 ± 8.9 points, respectively), although the mean score in both group reached the "Excellent" criterion (JOA score >80 points). Taken together, these results suggested that the clinical outcome does not necessarily reflect the return-to-work status.

The main limitations of our study were that it was a retrospective analysis with a small sample size, and there was the possibility that patient background may have affected the data. The strong point of the current study was that it clearly identified the factors affecting return to work after ARCR.

CONCLUSION

The return-to-work rate following ARCR was 66.7%, and the preoperative factors adversely affecting recovery of working capability were heavy work and female sex.

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The Institutional Review Board of Kurume University approved the study protocol (#18022), and all subjects gave their informed consent for participation in the study.

CONFLICT OF INTEREST

There are no conflicts of interest related to this study.

REFERENCES

1. Pauly S, Gerhardt C, Chen J, Scheibel M: Single versus double-row repair of the rotator cuff: does double-row repair with improved anatomical and biomechanical characteristics lead to better clinical outcome? *Knee Surg Sports Traumatol Arthrosc* 2010;18:1718–1729. PMID:20737134, DOI:10.1007/s00167-010-1245-7
2. McElvany MD, McGoldrick E, Gee AO, Neradilek MB, Matsen FA III: Rotator cuff repair: published evidence on factors associated with repair integrity and clinical outcome. *Am J Sports Med* 2015;43:491–500. PMID:24753240, DOI:10.1177/0363546514529644
3. Galanopoulos I, Ilias A, Karliafitis K, Papadopoulos D, Ashwood N: The impact of re-tear on the clinical outcome after rotator cuff repair using open or arthroscopic techniques – a systematic review. *Open Orthop J* 2017;11(Suppl-1, M4):95–107. PMID:28400878, DOI:10.2174/1874325001711010095
4. Heuberger PR, Smolen D, Pauzenberger L, Plachel F, Salem S, Laky B, Kriegleder B, Anderl W: Longitudinal long-term magnetic resonance imaging and clinical follow-up after single-row arthroscopic rotator cuff repair: clinical superiority of structural tendon integrity. *Am J Sports Med* 2017;45:1283–1288. PMID:28272899, DOI:10.1177/0363546517689873
5. Marrero LG, Nelman KR, Nottage WM: Long-term follow-up of arthroscopic rotator cuff repair. *Arthroscopy* 2011;27:885–888. PMID:21620635, DOI:10.1016/j.arthro.2011.02.019
6. Nové-Josserand L, Liotard JP, Godeneche A, Neyton L, Borel F, Rey B, Noel E, Walch G: Occupational outcome after surgery in patients with a rotator cuff tear due to a work-related injury or occupational disease. A series of 262 cases. *Orthop Traumatol Surg Res* 2011;97:361–366. PMID:21511555, DOI:10.1016/j.otsr.2011.01.012
7. Misamore GW, Ziegler DW, Rushton JL 2nd: Repair of the rotator cuff. A comparison of results in two populations of patients. *J Bone Joint Surg Am* 1995;77:1335–1339. PMID:7673282, DOI:10.2106/00004623-199509000-00007
8. Bhatia S, Piasecki DP, Nho SJ, Romeo AA, Cole BJ, Nicholson GP, Boniquit N, Verma NN: Early return to work in workers' compensation patients after arthroscopic full-thickness rotator cuff repair. *Arthroscopy* 2010;26:1027–1034. PMID:20678699, DOI:10.1016/j.arthro.2009.12.016
9. Collin P, Abdullah A, Kherad O, Gain S, Denard PJ, Lädermann A: Prospective evaluation of clinical and radiologic factors predicting return to activity within 6 months after arthroscopic rotator cuff repair. *J Shoulder Elbow Surg* 2015;24:439–445. PMID:25441555, DOI:10.1016/j.jse.2014.08.014
10. Hawkins RJ, Misamore GW, Hobeika PE: Surgery for full-thickness rotator-cuff tears. *J Bone Joint Surg Am* 1985;67:1349–1355. PMID:4077906, DOI:10.2106/00004623-198567090-00007
11. Watson EM, Sonnabend DH: Outcome of rotator cuff repair. *J Shoulder Elbow Surg* 2002;11:201–211. PMID:12070490, DOI:10.1067/mse.2002.122271
12. Cuff DJ, Pupello DR: Prospective evaluation of post-operative compliance and outcomes after rotator cuff repair in patients with and without workers' compensation claims. *J Shoulder Elbow Surg* 2012;21:1728–1733. PMID:22652063, DOI:10.1016/j.jse.2012.03.002
13. Lambers Heerspink FO, Dorrestijn O, van Raay JJ, Diercks RL: Specific patient-related prognostic factors for rotator cuff repair: a systematic review. *J Shoulder Elbow Surg* 2014;23:1073–1080. PMID:24725900, DOI:10.1016/j.jse.2014.01.001
14. DeOrio JK, Cofield RH: Results of a second attempt at surgical repair of a failed initial rotator-cuff repair. *J Bone Joint Surg Am* 1984;66:563–567. PMID:6707035, DOI:10.2106/00004623-198466040-00011
15. Goutallier D, Postel JM, Bernageau J, Lavau L, Voisin MC: Fatty muscle degeneration in cuff ruptures. Pre- and postoperative evaluation by CT scan. *Clin Orthop Relat Res* 1994;78–83. PMID:8020238
16. Kurowicki J, Berglund DD, Momoh E, Disla S, Horn B, Giveans MR, Levy JC: Speed of recovery after arthroscopic rotator cuff repair. *J Shoulder Elbow Surg* 2017;26:1271–1277. PMID:28131695, DOI:10.1016/j.jse.2016.11.002
17. Zuke WA, Leroux TS, Gregory BP, Black A, Forsythe B, Romeo AA, Verma NN: Establishing maximal medical improvement after arthroscopic rotator cuff repair. *Am J Sports Med* 2018;46:1000–1007. PMID:28650679, DOI:10.1177/0363546517707963

18. Henn RF III, Kang L, Tashjian RZ, Green A: Patients with workers' compensation claims have worse outcomes after rotator cuff repair. *J Bone Joint Surg Am* 2008;90:2105–2113. [PMID:18829907](#), [DOI:10.2106/JBJS.F.00260](#)
19. Rollman GB, Lautenbacher S: Sex differences in musculoskeletal pain. *Clin J Pain* 2001;17:20–24. [PMID:11289085](#), [DOI:10.1097/00002508-200103000-00004](#)
20. Tsang A, Von Korff M, Lee S, Alonso J, Karam E, Angermeyer MC, Borges GL, Bromet EJ, de Girolamo G, de Graaf R, Gureje O, Lepine JP, Haro JM, Levinson D, Oakley Browne MA, Posada-Villa J, Seedat S, Watanabe M, Watanabe M: Common chronic pain conditions in developed and developing countries: gender and age differences and comorbidity with depression-anxiety disorders. *J Pain* 2008;9:883–891. [PMID:18602869](#), [DOI:10.1016/j.jpain.2008.05.005](#)
21. Russell RD, Knight JR, Mulligan E, Khazzam MS: Structural integrity after rotator cuff repair does not correlate with patient function and pain: a meta-analysis. *J Bone Joint Surg Am* 2014;96:265–271. [PMID:24553881](#), [DOI:10.2106/JBJS.M.00265](#)