ATI = 88.6, CS = 74.0) and 12 (p<0.01, ATI = 93.3, CS = 62.9) months. The mean ASES scores in the ATI group improved from baseline to 6 and 12 months (14.4 and 19.1 points, respectively) and were greater than the MCI (12.0 points). At 12 months post treatment, 95% of ATI participants reported a PASS (patient acceptable symptom state) in their ASES score. Overall, 7 of 11 participants in the CS group withdrew from the trial between 6 and 12 months due to worsening shoulder pain and function. Conclusions: This study demonstrated that ATI resulted in a significantly better and sustained reduction in pain, and improvement in shoulder function, compared with CS. ATI is an emerging nonsurgical treatment to promote tendon healing and repair. This is the first Level 1 study using ATI to treat interstitial supraspinatus tears with chronic impingement syndrome.

Category: Shoulder - Rotator Cuff

Long-term Clinical and Structural Outcomes of Arthroscopic Superior Capsule Reconstruction for Irreparable Rotator Cuff Tears: 10-year Follow-up

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Summary: For irreparable rotator cuff tears, arthroscopic SCR restored shoulder function and relieved shoulder pain, with high rates of return to recreational sports and physically demanding work, and it maintained significant improvements in clinical and structural outcomes for at least 10 years after surgery.

Data:
INTRODUCTION Short-term follow-up studies have reported favorable clinical outcomes after arthroscopic superior capsule reconstruction (SCR) for irreparable rotator cuff tears. Our objective here was to assess whether these positive outcomes are maintained long-term and whether cuff tear arthropathy worsens over time after fascia lata autograft SCR. METHODS This study analyzed data collected prospectively from 34 consecutive patients (36 affected shoulders) with irreparable rotator cuff tears who underwent arthroscopic SCR from 2007 through 2011. Active shoulder range of motion (ROM) and American Shoulder and Elbow Surgeons (ASES), Japanese Orthopaedic Association (JOA), and Visual Analog Scale (VAS) scores were evaluated before SCR and at 1 year, 5 years, and 10 years after surgery; rates of return to participation in sports and physically demanding work were determined as well. In addition, radiography and MRI data were collected before surgery and at 3 and 6 months and at 1, 2, 3, 4, 5, and 10 years afterward. Acromiohumeral distance (AHD) and Hamada grade (stage of cuff tear arthropathy) were evaluated by using radiography. We defined Hamada grades 3 and 4b as acetalubarization and grades 4a and 4b as glenohumeral osteoarthritis. Graft survival rate and thickness were assessed by using T2-weighted MRI. RESULTS Compared with presurgery values, ASES and JOA scores and active ROM (elevation and external rotation) were increased significantly at 1 year after SCR (P < 0.001) and maintained throughout follow-up. At 10 years after SCR, 88% (15 of 17 patients) of workers with physically demanding jobs and 90% (9 of 10 patients) of sports players still participated in these activities. Graft survival rate was 94% (34 of 36 shoulders) at 1 year after SCR, 92% (33 of 36 shoulders) at 2 to 4 years, and 89% (32 of 36 shoulders) at 5 to 10 years. In healed grafts, graft thickness was maintained for at least 10 years after SCR (7.8 ± 2.0 mm at 3 months after SCR, 7.8 ± 1.6 mm at 10 years). The incidence of acetalubarization (affected shoulder, 9%; unaffected shoulder, 6%) and glenohumeral osteoarthritis (affected shoulder, 28%; unaffected shoulder, 16%) during the 10 years after SCR did not differ between affected and unaffected shoulders. The complication rate was 2.8% (1 of 36 patients, anchor pull-out). CONCLUSION For irreparable rotator cuff tears, arthroscopic SCR restored shoulder function and relieved shoulder pain, with high rates of return to recreational sports and physically demanding work, and it maintained significant improvements in clinical and structural outcomes for at least 10 years after surgery. In addition, graft healing completely prevented any progression of cuff tear arthropathy. Arthroscopic SCR is an effective surgical option for irreparable rotator cuff tears and retains positive outcomes for at least 10 years.

Category: Shoulder - Rotator Cuff

Temporal Changes in the Magnetic Resonance Imaging after Arthroscopic Rotator Cuff Repair with Superior Capsule Reconstruction for Reinforcement

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Summary: This study aimed to assess the temporal changes in magnetic resonance imaging (MRI) appearance after arthroscopic rotator cuff repair with superior capsule reconstruction for reinforcement (SCR-R). SCR-R prevented postoperative retear even in severely degenerated tendon tears. The MRI appearance of repaired tendon and graft continued to mature during 2-year follow-up.

Data:
INTRODUCTION Retearing of repaired rotator cuff tendons often worsens clinical outcomes and decreases patient satisfaction after arthroscopic rotator cuff repair. Recently, arthroscopic rotator cuff repair with superior capsule reconstruction for reinforcement (SCR-R) was developed to improve the repair integrity and prevent retear of the repaired tendon for the treatment of degenerated rotator cuff tears. However, there have been no study which assessed the temporal changes in the structural integrity of repaired tendons and graft on magnetic resonance imaging (MRI) after SCR-R. Hence, this study aimed to assess the temporal changes in MRI findings after SCR-R. Methods: We retrospectively reviewed 33 consecutive patients (11 men and 22 women; mean age:71.0 years) with degenerated rotator cuff tears (thin and/or fatty degenerated tendon) who underwent SCR-R and completed postoperative MRI examinations at 3, 6, 12, and 24 months. Thirty tears were medium and three were large tears. Seven shoulders had isolated supraspinatus tears, 23 shoulders had two tendon tears (supraspinatus and infraspinatus or supraspinatus and subscapularis), and three shoulders had three tendon tears (supraspinatus, infraspinatus, and subscapularis). The Goutallier grade of supraspinatus was 1–3. We assessed the postoperative repair integrity using the Sugaya classification and the high-intensity area between the repaired tendon and graft at 3, 6, 12, and 24 months. The McNemar test was used for the statistical analysis. Statistical significance was defined as P < .05. Results: None of the 33 patients had postoperative retears after SCR-R. Regarding repair integrity, five shoulders were type I and 28 were type II at 3 months; 10 were type I and 23 were type II at 6 months; 21 were type I, 10 were type II, and two were type III at 12 months; 26 were type I, 5 were type II, and two were type III at 24 months. There were 15%, 30%, 64%, and 79% type I shoulders at 3, 6, 12, and 24 months, respectively, with a significant increase between 6 and 12 months (P = 0.002). As for the high-intensity area between the repaired tendon and graft, there were 28, 23, 12, and 4 shoulders with high-intensity areas at 3, 6, 12, and 24 months, respectively. The rate of shoulders with high-intensity area between repaired tendon and graft was 85%, 70%, 36%, and 12% at 3, 6, 12, and 24 months, respectively, with a significant decrease between 6 and 12 months (P = 0.002) and between 12 and 24 months (P = 0.005). Discussion and Conclusion: SCR-R prevented postoperative retear of the repaired rotator cuff tendon even in severely degenerated tendon tears. During the 2-year follow-up after SCR-R, the MRI appearance of repaired tendons and grafts continued to mature. Furthermore, the rate of high-intensity areas between the repaired tendons and grafts continued to decrease. These results suggest that graft-to-tendon healing may occur following SCR-R.

Category: Shoulder - Rotator Cuff

New Bioactive Spatially-Embedded Growth Factor (SEGF) Scaffold Promotes Bone-To-Tendon Interface Healing After Chronic Rotator Cuff Repair

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Summary: This new bioactive spatially-embedded growth factor (SEGF) Scaffold effectively accelerated BTI healing in chronic rotator cuff tear model of rabbits.
Data: Background: Restoration of the original anatomical bone-to-tendon interface (BTI) after rotator cuff repair (RCR) remains a significant challenge, therefore a multitude of biocompatible biomaterials has been investigated to promote rotator cuff healing after repair. Purpose: To investigate the efficacy of 3D-printed scaffolds incorporated with spatiotemporal delivery of growth factors (GFs) to accelerate BTI healing after RCR. Methods: Advanced 3D printing was used to fabricate the multilayered scaffolds, spatially embedded with different GFs to guide regional differentiation of endogenous stem/progenitor cells. A sustained, spatially controlled release of GFs was confirmed. The multi-lineage differentiation potential of mesenchymal stem cells (MSCs) in the scaffold was assayed. In vivo, a total of 50 rabbits, with induced chronic rotator cuff injuries, were divided into 4 groups: Normal (N, n = 2), saline control (C, n = 16), scaffold without GF (B, n = 16), and scaffold with GF (C, n = 16). At 6 weeks after the creation of rotator cuff tears, surgical repairs were performed when scaffolds were implanted between the bony footprint and supraspinatus tendon. RT-qPCR analysis was performed at 4 weeks after the repair, and biomechanical and micro-CT analyses were performed at 12 weeks after repair. Results: In vitro, the scaffolds successfully guided regional differentiation of MSCs, forming multiphase tissues with tendon, cartilage, and bone-like regions. In vivo, group C showed higher collagen type Iα, collagen type IIIα1, and aggrecan expressions than the other groups (P < 0.001, 0.005 and >0.006, respectively) at 4 weeks after repair. For the biomechanical evaluation, group C showed a significantly higher load-to-failure rate than the other groups (P = 0.003) at 12 weeks after repair. For the micro-CT analysis, group C showed higher bone mineral density and bone volume/total volume rate than the other groups (P = 0.001 and < 0.001, respectively) at 12 weeks after repair. Conclusion: This new bioactive spatially-embedded growth factor (SEGF) Scaffold effectively accelerated BTI healing in chronic rotator cuff tear model of rabbits.

Category: Shoulder - Rotator Cuff

Postoperative Cuff Integrity Affects Clinical Outcomes After Superior Capsule Reconstruction Using Fascia Lata Autograft in Posterior-Superior Rotator Cuff Tears: A Multicenter Study

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Summary: Postoperative cuff thickness and size of cuff tear affected clinical and radiographic outcomes after superior capsule reconstruction using a fascia lata autograft. Shoulders with intact grafts of sufficient thickness restored glenohumeral stability and showed better clinical outcomes compared to those with graft thinning or graft tears.

Data: Background: Previous studies have postulated that graft thickness and graft healing may be important factors for optimizing clinical outcomes of superior capsule reconstruction (SCR) for patients with irreparable rotator cuff tears (RCTs). However, the relationship between postoperative graft integrity and clinical outcomes after SCR remains unclear. We aimed to assess the relationship between postoperative graft integrity, including graft thickness and size of graft tear, and clinical outcomes after SCR in patients with irreparable RCTs.

Methods: This retrospective multicenter study included 188 patients (86 women, 102 men; mean age, 69.2 years; range, 49–87 years) with irreparable RCTs who underwent arthroscopic SCR using fascia lata autografts. Postoperative graft integrity was evaluated using magnetic resonance imaging (MRI) at 1 year or later after surgery and was classified into four categories according to Hasegawa's classification: type I-II, intact graft of sufficient thickness; type III, thinned graft without continuity; type IV, presence of a minor discontinuity; and type V, presence of a major discontinuity. We compared (1) baseline characteristics, (2) visual analog scale (VAS) for pain, (3) American Shoulder and Elbow Surgeons (ASES) score, (4) active shoulder range of motion (ROM), and (5) acromiohumeral distance (AHD) among four groups based on postoperative graft integrity. Results: MRI scans revealed 152 shoulders (80.9%) with type I-II graft, 13 (6.9%) with type III graft, 13 (6.9%) with type IV graft, and 10 (5.3%) with type V graft. VAS and ASES scores significantly improved after SCR in all graft types (all P < 0.05). However, shoulders with type V grafts had significantly inferior postoperative VAS and ASES scores compared to those with type I-II grafts (all P < 0.05). Shoulders without graft tears (types I-II and III) showed significant improvements in shoulder ROM after SCR (all P < 0.05). In contrast, shoulders with large graft tears (types V) showed no significant improvement in shoulder ROM. Postoperative AHD was significantly increased only in shoulders with type I-II grafts (both P < 0.0001). Conclusion: Postoperative graft thickness and size of graft tear affected clinical and radiographic outcomes after SCR using a fascia lata autograft. Patients with large graft tears had significantly inferior postoperative clinical scores compared to those with intact grafts of sufficient thickness although arthroscopic SCR provided pain relief even in patients with graft tears. Shoulders with intact grafts of sufficient thickness restored glenohumeral stability and showed better clinical outcomes compared to those with graft thinning or graft tears.

Category: Shoulder - Rotator Cuff

A Comparative Study of Patch Graft Procedure and Superior Capsular Reconstruction in the Treatment of Irreparable Large to Massive Rotator Cuff Tears

Abstract ID# 23574

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Summary: In treatment of massive rotator cuff tears with high-grade fatty degeneration of the infraspinatus, superior capsular reconstruction may not be superior to patch procedure for graft integrity.

Data: Purpose: This study compared clinical and radiographic outcomes after superior capsular reconstruction (SCR) and fascia lata autograft patch procedure (PG) in treatment of large to massive rotator cuff tears (RCTs). Methods: This study included 42 shoulders in 42 patients who underwent the patch graft procedure (Group PG) and 42 patients who underwent SCR (Group SCR) for irreparable large or massive RCTs. Clinical assessments were assessed using Constant score ASES Scores. We used magnetic resonance imaging (MRI) evaluation especially focusing on the patch integrity or retears of the native cuff (the infraspinatus and/or subscapularis tendons). The repair integrity was classified as intact or nonintact based on the appearance of the native cuff, the tendon-graft interface, and the graft at the anatomic footprint on the humeral head. Intact repairs showed no high signal intensity areas in the native cuff, the tendon-graft interface, or the graft-humeral interface. In addition, we assessed the presence of Sugaya 5 retear (a major discontinuity in each MRI image). Results: There were no significant differences in any variables between the 2 groups except for follow-up period, mediolateral tear size, anterior to posterior tear size, biceps tenodesis (n), preoperative supraspinatus Goutallier stage 3 or 4 (%), preoperative Goutallier stage 3 or 4 (%). Postoperative MRI showed that 13 of 42 (31.0 %) shoulders had intact repairs in PG group and 27 of 42 (64.3 %) shoulders had intact repairs in SCR group (P = 0.044). In addition, Postoperative MRI showed that 19 of 42 (45.2 %) shoulders had shoulders with Sugaya 5 retear in PG group and 9 of 42 (21.4 %) shoulders had shoulders with Sugaya 5 retear in SCR group (P = 0.002). Compared with preoperative scores, the mean Constant, ASES scores were significantly improved at the final follow-up in both groups (P < .001) in the two groups. At the final follow-up, the mean Constant and ASES scores were higher in group SCR than in group PG without significance (71.8 vs 70.0; P = .474 for the Constant score, 84.4 vs 79.1; P = .118 for the ASES score). Stepwise multivariate logistic regression analysis identified the treatment group (PG vs SCR) and GFDI as the significant predictive factors for shoulders without intact repairs (odds ratio, 3.323; 95% CI, 1.271-8.691; P = .014 for the treatment group, odds ratio, 3.753; 95% CI, 1.374-10.253; P = .010 for GFDI, respectively). In addition, the analysis identified the presence of preoperative ISP Stage 3 or 4 and SSP stage 3 or 4 as the significant predictive factors for shoulders with Sugaya 5 retears (odds ratio, 6.791; 95% CI, 2.345-19.662; P < .001 for the ISP Stage 3 or 4, odds ratio, 5.681; 95% CI, 1.109-29.090; P = .037 for the SSP Stage 3 or 4).