The use of a volar locked plate in the treatment of unstable distal radius fractures can lead to good short-term outcomes. However, external fixation and radial column plating lead to equivalent outcomes at 1 year.

**Background:** The optimal surgical treatment of unstable distal radial fractures (U-DRFs) is controversial. Recent trends have favored internal fixation with volar locked plating. However, evidence from rigorous comparative trials is rare.

**Objectives:** To compare the functional and radiographic outcomes of U-DRFs with external fixation, a volar plate, or a radial column plate and to determine if volar plating accelerates functional recovery.

**Participants/Methods:** 46 patients with U-DRFs. **Methods:** Patients were randomly assigned to be treated with either external fixation (n=22) or internal fixation (n=24). During a second randomization, patients assigned to internal fixation were further randomized to be treated with either volar (n=12) or a radial column plate (n=12). The fracture classifications included Orthopaedic Trauma Association (OTA) types A3, C1, C2, and C3. The patients completed the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire at follow-up.

**Results:** At 6 weeks, the mean DASH score for patients with a volar plate was significantly better than for patients treated with external fixation but was similar to that of patients with a radial column plate. At 3 months, patients treated with a volar plating demonstrated a DASH score that was significantly better than that of patients treated with external fixation and those treated with radial column plating. However, by 6 months and 1 year, all 3 groups had similar DASH scores and grip strength. The range of motion of the wrist did not differ significantly among the groups at any time beginning 12 weeks after the surgery. At 1 year, patients with a radial column plate maintained radial inclination and radial length that was better than those treated with external fixation and volar plating.

**Conclusions:** The use of a locked volar plate leads to better patient-reported outcomes in the first 3 months after fixation of U-DRFs. However, at 6 months and 1 year, the outcomes of all 3 techniques were excellent, with minimal differences among them in terms of strength, motion, and radiographic alignment.

**Reviewer’s Comments:** I thought the results of this well-performed study demonstrated the short-term superiority of volar locked plating. However, it is surprising that patients treated with external fixation did equally as well in the long-term outcomes, given some of the potential adverse sequelae that can result. One potential weakness of this study was the smaller patient population in the 2 internal fixation groups, which may have impacted the lack of long-term differences. (Reviewer-Kris J. Alden, MD).

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Keywords: Distal Radius Fractures, External vs Internal Fixation, Outcomes

Print Tag: Refer to original journal article
Long-term results demonstrated excellent survivorship of knee arthroplasty at 10 years with both all-polyethylene and metal-backed tibial components.

**Background:** After total knee arthroplasty, the production of polyethylene wear particles can lead to an inflammatory response, resulting in osteolysis and premature failure of the knee prosthesis. This type of wear was accelerated when the polyethylene component was excessively thin, which was commonly seen when metal-backed tibial implants were introduced.

**Objectives:** To determine the 10-year survival rate of 2 different designs for a knee prosthesis and to determine the optimally performing material and design for the tibial component by comparing a metal-backed component with an all-polyethylene design.

**Methods:** Patients were randomly assigned to receive either an all-polyethylene or a metal-backed tibial component at knee arthroplasty. Patients were assessed preoperatively and again at 1, 3, 5, 8, and 10 years postoperatively. A total of 566 total knee arthroplasties were randomized in this study. The primary diagnosis was osteoarthritis for 458 knees (80.9%) and rheumatoid arthritis for 108 knees (19.1%). Each surgeon followed the same surgical technique for tourniquet use, bone cuts, and instrumentation, regardless of tibial component design. All knees had a minimum tibial component thickness of 10 mm.

**Results:** 293 patients returned for the 10-year follow-up. A total of 28 knees had been revised. The 10-year survivorship, with revision for any reason as the end point, was 94.5% for the all-polyethylene design and 96% for the metal-backed design. The 10-year survivorship, with aseptic failure as the end point, was 97% for the all-polyethylene design and 96.8% for the metal-backed design. On the basis of the numbers available at 10 years, there was no significant difference in survivorship between the 2 designs ($P>0.05$).

**Conclusions:** The long-term results demonstrate excellent survivorship, with revision as the end point, for both the metal-backed and the all-polyethylene tibial component designs, with no differences noted between the two. These long-term results reinforce the authors’ earlier report at 5 to 8 years, which also demonstrated no significant difference between the 2 types of components.

**Reviewer’s Comments:** I think that the results of this well-performed study add to the debate about optimal tibial components. All-polyethylene components eliminate backside wear and are less expensive. The lack of differences between the 2 groups in a randomized study should increase their use. One potential weakness of this study is the use of survivorship data, and not reporting clinical outcomes such as Knee Society scores, which would help bolster their conclusions. (Reviewer-Kris J. Alden, MD).

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Keywords: Total Knee Arthroplasty, Prosthesis Design, Survival

Print Tag: Refer to original journal article
Objective: To compare healing times of distal radius fractures in patients on and off bisphosphonate therapy.

Methods: 43 patients receiving bisphosphonate therapy for ≥1 month at the time of distal radius fracture were compared with 153 patients not receiving bisphosphonate therapy. Patients younger than age 50 years and those with polytrauma were excluded. Surgical intervention was offered for fractures with >20° of dorsal angulation, 100% displacement, 5 mm of shortening, or >2 mm articular incongruity. Thirty patients declined surgery, 67 had internal fixation, 16 had external fixation or percutaneous pinning, and 4 had a combination. Radiographic union was defined as bridging callus across fracture lines in at least 2 cortices.

Results: There were more women in the bisphosphonate group, otherwise there were no significant demographic differences between the 2 groups. Patients in the bisphosphonate group were taking either alendronate or risedronate. Radiographic fracture union was achieved in all patients in both groups. One patient in the bisphosphonate group had a radiographic healing time of 186 days but had clinical healing at 8 weeks. This patient was excluded as an outlier. Analyzing all other patients revealed an average time to healing of 55 ±17 days in the bisphosphonate group compared to 49 ±14 days in the control group (P=0.03). Bisphosphonate use and surgical treatment were independently associated with longer time to radiographic union.

Conclusions: Current and continued use of bisphosphonates in patients with a distal radius fracture is associated with a slightly longer time to radiographic union, which is not believed to be clinically significant. The possible longer radiographic healing time does not warrant cessation of bisphosphonate treatment in this setting.

Reviewer's Comments: This retrospective study is likely the first step toward a better understanding of the clinical effects of bisphosphonate therapy on the healing of distal radius fracture. All of the distal radius fractures achieved radiographic union whether or not patients were being treated with bisphosphonates. The authors note some of the study's limitations, such as its retrospective design, which inherently leads to large variation as to when radiographs are taken. However, the authors believed the intervals were similar between the 2 groups. Also, the retrospective nature prohibited the inclusion of clinical fracture healing as part of the analysis, which may occur before radiographic union. Distal radius fractures occur in younger patients and, thus, present an opportunity to start therapy for low bone mineral density in an effort to prevent later hip, vertebral, or other fragility fractures. (Reviewer-Kenneth R. Means, Jr, MD).

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Keywords: Distal Radius Fracture, Osteoporosis, Bisphosphonate Use

Print Tag: Refer to original journal article
Objective: To observe the results of local delivery of platelet-rich plasma (PRP) to 2 different type muscle injury patterns in rats.

Design: Controlled laboratory study.

Methods: 4-month old Sprague-Dawley rats were anesthetized, and the tibialis anterior muscle was ingeniously stimulated to create 1 of 2 muscle injury patterns. The first injury pattern was a large single electric contraction simulating a large muscle strain. Multiple small electric loads were applied to other rats to simulate repeated small muscle strains. Prior to injury, after injury, and on each test day prior to injection, the muscle maximal isometric torque was measured. The muscle injury was injected with PRP, with platelet-poor plasma (PPP), or with nothing at all. This was done on the day of muscle injury and again on days 3, 5, 7, 14, and 21. Also on each test date, 2 animals from each of the 3 treatment protocols were killed for histological staining, electrophoresis, and immunoblotting.

Results: Both injury protocols created significant loss of muscle force. In the large strain muscle injury, the PRP improved muscle function at only day 3 of the treatment. However, the PRP treatment of the minor strain muscle injury yielded improved muscle function at all time points measured, with significant increase at days 7 and 14. The PPP and no treatment groups showed no difference at any time. The PRP also resulted in quicker return of muscle function in the minor strain group but not in the large strain injury group. Biochemical assays and histological sections revealed significant accumulation of growth factors in the PRP treatment. This resulted in greater centrally nucleated fibers, a measure of myogenesis seen only in the small strain injured animals.

Conclusions: PRP directly applied to repetitive muscle strains resulted in enhanced myogenesis and quicker recovery in rats.

Reviewer's Comments: This is a timely article given the recent explosion of PRP being available commercially and coverage in the lay literature. The authors were able to replicate an eccentric injury load, single and large, or repetitive and small, simulating the 2 types of strains that beset competing athletes. The authors provide a lot of in vivo basic science to the mechanisms of PRP treatment. Large muscle injuries heal with sarcomere regeneration, whereas smaller injuries heal with myogenesis, which appears to be more sensitive to growth factors in PRP. I look forward to these authors continuing to advance our understanding of PRP in soft tissue injuries. (Reviewer-John H. Wilckens, MD).

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Keywords: Muscle Strain Injuries, Platelet-Rich Plasma

Print Tag: Refer to original journal article
Repairable meniscal tears fixed at the time of anterior cruciate ligament reconstruction have a 90% healing rate.

Objective: To determine the success of meniscal repairs done in conjunction with an anterior cruciate ligament (ACL) reconstruction.

Design: Case series.

Methods: The Multicenter Orthopaedic Outcomes Network (MOON) group consists of 6 centers that rigorously enroll and monitor patients undergoing ACL reconstruction. They incorporate 13 pages of validated patient-outcome questionnaires. This particular study looked specifically at patients undergoing unilateral ACL reconstruction and concomitant repair of a torn meniscus. Surgeons were allowed to reconstruct the ACL with the graft of their choice and to fix the meniscal tear with whatever method they wanted (all inside, inside-out, outside-in, or some combination of above) with absorbable and/or non-absorbable implants or sutures.

Results: During a 1-year study interval, 82 meniscal repairs were done with a concomitant ACL reconstruction. The average age of this study group was 25 years (range, 11-59 years). Follow-up at 2 years was available for 77 of the repairs (94% follow-up rate). Of the 54 medial meniscus tears repaired, 81% were vertical, 12% were bucket handle, and 7% were oblique. An average of 3 sutures/devices was used (range 1-10), and most (n=41) medial meniscus tears were fixed with an all-inside technique. Of the 28 lateral meniscus tears repaired, 70% were vertical, 14% were bucket handle, and 14% were oblique. An average of 2.9 sutures/devices was used (range 1-9), and most (n=24) lateral meniscus tears were fixed with an all-inside technique. At 2 years, 7 of these 77 patients underwent additional arthroscopy. In 4 of these cases, the meniscal tear was healed, and the remaining 3 had a failed meniscal repair. All failed meniscal repairs were medial, 2 by all-inside implant, and 1 by all-inside suture.

Conclusions: Meniscal tears repaired at the time of ACL reconstruction had a 90% healing rate, independent of the technique used.

Reviewer's Comments: This is another outstanding study from the MOON group. This is only a 2-year follow-up, with the next follow-up scheduled 6 years post repair. It is not known how many tears did not heal but are asymptomatic. The study documented failures by second-look arthroscopy. It is important to note the success of repair, regardless of repair or reconstruction techniques. This should encourage surgeons to be very aggressive in fixing repairable meniscal tears at the time of ACL reconstruction. (Reviewer-John H. Wilckens, MD).

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Keywords: ACL Reconstruction, Concomitant Meniscal Repair, Outcomes

Print Tag: Refer to original journal article
IA Steroids Provide No Lasting Benefit After Meniscectomy

A Randomized, Prospective, Double-Blind Study to Investigate the Effectiveness of Adding DepoMedrol to a Local Anesthetic Injection in Postmeniscectomy Patients With Osteoarthritis of the Knee.

Koyonos L, Yanke AB, et al:


The addition of a perioperative intra-articular corticosteroid injection provided short-term but no long-term benefit after meniscectomy in osteoarthritic knees.

**Objective:** To measure the effectiveness of adding an intra-articular (IA) corticosteroid to an arthritic knee after arthroscopic meniscectomy.

**Design:** Randomized controlled study.

**Methods:** During a 2-year study interval, 59 knees in 58 patients underwent arthroscopy for a meniscal tear. All knees had evidence of Grade 2 or higher chondral damage in the ipsilateral compartment. Each knee was randomly assigned to 1 of 2 treatment plans. The study group (29 knees) received an IA injection of 1 mL (40 mg) of DepoMedrol with 9 mL of 1% lidocaine after the arthroscopic procedure. The control group (30 knees) received an IA injection of 1 mL of normal saline with 9 mL of 1% lidocaine. Patients completed the Knee Injury and Osteoarthritis Outcome Score (KOOS), the International Knee Documentation Committee (IKDC), Lysholm, Tegner, Noyes, and Short-Form-12 (SF-12) surveys, preoperatively, at 6 weeks, and again at 6, 9, and 12 months.

**Results:** The average patient age was 52 years in the control group and was 49 years in the steroid group. The control group underwent 15 medial meniscectomies, 4 lateral, and 11 both. Thirteen control knees had chondral damage in one compartment, 8 in two compartments, and 9 in three compartments. The steroid group underwent 18 medial meniscectomies, 5 lateral, and 6 both. Seventeen steroid knees had chondral injury in one compartment, 10 in two compartments, and 2 in three compartments. The mean time to return to work was similar for both groups (13 days), as was the duration of pain medication (5 days). On outcome scores, both groups had very similar numbers preoperatively. At 6 weeks, the steroid group scored higher than the control group on the IKDC and on much of the KOOS scoring system. However, at all other times, there were no significant differences in any of the scores. On physical examination, each group had similar range of motion and quadriceps atrophy. Neither group had any complications.

**Conclusions:** IA injection of a corticosteroid in an arthritic knee following arthroscopic meniscectomy provides only short-term relief.

**Reviewer’s Comments:** This very simple study provides excellent information regarding osteoarthritic knees undergoing arthroscopic meniscectomy. Although corticosteroids provided no long-term benefit, the treatment did improve pain and function at 6 weeks postoperatively. While the authors report no complications in their study groups, IA corticosteroid use does increase the risk of infection in knee arthroscopy. It would be nice to repeat this study with hyaluronic acid. (Reviewer-John H. Wilckens, MD).

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Keywords: Osteoarthritis of Knee, Meniscal Repair, Corticosteroids

Print Tag: Refer to original journal article
Background: Studies of allograft anterior cruciate ligament (ACL) reconstructions have markedly different success rates. However, a variety of grafts and techniques have been used.

Objective: To compare the clinical outcomes of ACL reconstruction with bone-patellar tendon-bone (BPTB) allograft versus autograft.

Participants: 156 patients undergoing ACL reconstruction from May 2000 to June 2004 were evaluated and followed up.

Methods: Patients underwent reconstruction with a central-third BPTB autograft (10 mm wide) or a fresh frozen non-irradiated patellar tendon allograft (12 mm wide). Both had a patellar bone plug (10 mm x 25 mm) and a tibial bone plug (10 mm x 30 mm). Postoperatively, patients began closed kinetic chain exercises at 6 weeks, running by 6 months, and full activity by 10 to 12 months. They wore a functional brace for the first 1 to 2 years postoperatively. Patients were evaluated clinically with the Lachman exam, anterior drawer test, and pivot-shift test, as well as with KT-2000 arthrometer testing. They were rated with the Cincinnati knee score, International Knee Documentation Committee (IKDC) subjective knee form, Tegner activity level, and Lysholm knee score. Radiographs were taken to assess for osteoarthritic (OA) changes.

Results: Patients were evaluated at a mean of 5.6 years. There was a statistically higher mean duration of postoperative fever in the allograft group (6.8 days) than in the autograft group (4.4 days). Lab values did not indicate infection in either group during this time. There were no significant differences in any of the clinical tests for stability, including KT-2000. There were no differences in postoperative IKDC scores, Cincinnati knee score, Lysholm scores, and Tegner scores. There were significant differences between preoperative and postoperative Lysholm and Tegner scores in both groups. In each of the 2 groups, there was a significant increase in the development of OA changes on x-ray, with close to 50% decreasing by 1 or 2 Kellgren levels. However, there was no difference in the development of OA between the 2 groups.

Conclusions: At a mean of 5 years, there does not appear to be a difference in the outcomes between allograft and autograft ACL reconstructions.

Reviewer's Comments: This study highlights that ACL reconstructions can be performed effectively using both allograft and autograft BPTB. The strengths of the study are its randomized design, as well as its inclusion of a great number of patients. This relatively slow rate to return to sports, the use of non-irradiated graft, and the size of the graft may play a role in the outcomes seen here. (Reviewer-Nathaniel P. Cohen, MD).
Local Anesthetics Cytotoxic to Articular Cartilage

Local Anesthetics Induce Chondrocyte Death in Bovine Articular Cartilage Disks in a Dose- and Duration-Dependent Manner.

Lo IK, Sciore P, et al:

Arthroscopy 2009; 25 (July): 707-715

Lidocaine, bupivacaine, and ropivacaine all show cytotoxic effects on articular cartilage in a dose- and duration-dependent manner.

Background: Local anesthetics are commonly used in intra-articular injections in the office and perioperatively. In addition, some pumps allow for a constant infusion of local anesthetic into the joint for 48 to 72 hours. However, there is a growing concern that local anesthetics may be toxic to chondrocytes.

Objective: To evaluate the effect of bupivacaine, lidocaine, and ropivacaine on bovine chondrocytes. The authors hypothesized that these anesthetics would be toxic to articular cartilage in both dose- and duration-dependent manners.

Design: Controlled laboratory study.

Methods: Full-thickness (4 mm) bovine articular cartilage disks were harvested and used for cell culture. Three disks per well were used in a 24-well tissue culture plate. Thee disks were used per well with 1 mL of solution to reproduce the surface-area-to-joint volume ratio of the human shoulder. The disks were cultured with the following local anesthetics with and without epinephrine: 1% lidocaine, 0.25% bupivacaine, and 0.5% ropivacaine. For controls, disks were incubated in phosphate buffered solution (PBS). To assess dose dependence, the authors cultured disks in 0%, 2.5%, 5%, 10%, 25%, 50%, and 100% preparations of the local anesthetics for 12 hours. To assess duration dependence, the authors cultured disks for 1, 3, 5, 8, and 12 hours in 50% and 100% preparations of the local anesthetics. Each experiment was reproduced 3 times. Following culture, the disks were sectioned into 70-micron slices. The authors used SYTO 13 green fluorescent nucleic acid stain and ethidium bromide to assess cell viability. They also used electron microscopy to assess cell and nuclear morphologic changes. A separate observer blinded to the treatment examined the disks.

Results: With all local anesthetics, there were significant duration- and dose-dependent effects on articular cartilage viability. When the disks were cultured at 50% concentration for 12 hours, chondrocyte membrane integrity was <30%. The dose-dependent effect appears to be a have straight-line correlation. Epinephrine had a statistically significant effect on chondrocyte viability with bupivacaine but not for lidocaine or ropivacaine.

Conclusions: Lidocaine, bupivacaine, and ropivacaine all show cytotoxic effects on articular cartilage in dose- and duration-dependent manners.

Reviewer's Comments: This elegant and well-designed study clearly demonstrates the cytotoxic dose- and duration-dependent effects of local anesthetics on articular cartilage. The authors' inclusion of ropivacaine and their completeness in using different doses and times make this a landmark article. This article raises the issues of safety with use an intra-articular pain catheter. Other options for pain control exist, including local blocks. (Reviewer-Nathaniel P. Cohen, MD).

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Keywords: Local Anesthetics, Effect on Chondrocytes

Print Tag: Refer to original journal article
Surgery Superior to Nonoperative Treatment for Spondylolisthesis

Surgical Compared With Nonoperative Treatment for Lumbar Degenerative Spondylolisthesis: Four-Year Results in the Spine Patient Outcomes Research Trial (SPORT) Randomized and Observational Cohorts.

Weinstein JN, Lurie JD, et al:

J Bone Joint Surg Am 2009; 91 (June): 1295-1304

At 4 years, surgical treatment of lumbar degenerative spondylolisthesis appears to be superior to nonoperative treatment, but only in nonrandomized cohorts.

**Background:** The Spine Patient Outcomes Research Trial (SPORT) is a large ongoing multicenter trial comparing outcomes of operative and nonoperative treatments for various spinal disorders.

**Objective:** To evaluate outcomes of surgical and nonoperative treatment of lumbar degenerative spondylolisthesis.

**Design:** Prospective multicenter trial with randomized and observational cohorts.

**Participants:** Patients had symptoms of neurogenic claudication or lumbar radiculopathy for at least 12 weeks and were surgical candidates with evidence of stenosis on MRI and evidence of spondylolisthesis on radiographs. **Method:** 304 patients were randomly assigned to surgical or nonoperative treatment, and another 303 patients were enrolled in the observational cohort and allowed to choose their treatments. Surgical intervention included posterior decompression with or without fusion. Nonoperative treatment included at least physical therapy, home exercise teaching, and nonsteroidal anti-inflammatory drugs (NSAIDs). Patients were seen at 6 weeks, 3 months, 6 months, and once a year after that.

**Results:** Baseline characteristics of the 2 cohorts were similar, except for level of preference for surgery. There was a large amount of crossover between the assigned treatment groups. In the randomized cohort, only 66% of the patients assigned to surgery had the operation, and 54% of the nonoperative group underwent surgery. The follow-up rates ranged from 70% to 92%. The intent-to-treat analysis did not show any significant differences in outcomes in the randomized cohort at 4 years. When all patients were combined in the as-treated analysis, the surgery and the nonoperative groups were similar in many background variables. Those who underwent surgery tended to be younger, had more severe symptoms, and were more likely to be receiving compensation. This analysis demonstrated that both surgical and nonoperative groups showed significant improvement over time, but the improvement in the surgical group was significantly higher in all measured outcomes.

**Conclusions:** Due to high crossover rates, the statistical analysis had to be modified to as-treated, which removed the benefit of randomization. Although the study did not delineate between specific treatments, the results showed significant benefits of surgical treatment of degenerative spondylolisthesis at rates similar to previous studies and with positive effects lasting at least 4 years.

**Reviewer’s Comments:** This is a very important study showing superiority of surgical treatment for this problem. This information would help any physician discussing treatment options with patients who have lumbar degenerative spondylolisthesis. (Reviewer-Vladimir Sinkov, MD).

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Keywords: Lumbar Spondylolisthesis, Treatment, Outcomes

Print Tag: Refer to original journal article
Most patients with clubfeet due to syndromes or neuromuscular diagnoses can be successfully treated with the Ponseti technique, although they may require more casts than do idiopathic clubfeet.

**Objective:** To evaluate and compare outcomes of the Ponseti treatment in nonidiopathic clubfeet versus idiopathic clubfeet.

**Participants:** All patients attending the clubfoot clinic at the Hospital for Sick Children in Toronto between 2001 and 2006 and had a minimum follow-up of 1 year.

**Methods:** 171 patients with 249 neuromuscular clubfeet and 23 patients with 40 syndromic clubfeet were treated by weekly manipulation and long-leg casting in the clinic. The clinic used simirigid fiberglass (soft cast) versus plaster. Tenotomy of the Achilles tendon was performed if the patients did not have at least 20° of dorsiflexion when the foot reached correction of the abduction and of the varus.

**Results:** The nonidiopathic group presented at a slightly older age (11 weeks) than did the idiopathic group (8.7 weeks). Bilateral clubfeet were seen in 74% of the nonidiopathic group versus 46% of the idiopathic group. Failure to achieve initial correction was seen in 10% of the nonidiopathic clubfeet and in 2.8% of the idiopathic clubfeet. Among the nonidiopathic clubfeet, later recurrences developed in 44% and either required surgery or could be treated by further casting. Most of the recurrences occurred within the first 2 years of treatment. Comparing the 2 groups, nonidiopathic clubfeet required more casts (6.4 vs 4.8, respectively), had a higher rate of recurrences (44% vs 13%, respectively), and had a higher rate of additional procedures (28% vs 6.4%, respectively). Skin breakdown in 2 of the patients with myelomeningocele was the only reported complication.

**Conclusions:** Among patients with syndromic or neuromuscular clubfeet treated with the Ponseti method, more cases are bilateral, more casts are required, more cases recur, and more surgery is needed when compared with idiopathic clubfeet. However, any later surgery is often less extensive. Because a standardized scoring system for severity is lacking, the precision of this study was limited. The Ponseti method is worth applying in patients with syndromic or neuromuscular clubfeet.

**Reviewer’s Comments:** I thought this was a worthwhile article. If you are the treating physician for some of these rarer disorders, it is valuable to know that the Ponseti treatment is worth the time and effort, rather than going straight to surgery. I also worry about the osteopenia seen in some of these syndromes, and I worry about fracture or plastic deformation of the bone. However, these complications were not reported in the current series. In the future, larger numbers of study feet will probably allow computation of the success rate for each syndrome or diagnosis. (Reviewer-Paul D. Sponseller, MD).
The midforearm radial osteotomy with distal ulnar osteotomy effectively treats supination deformities of the forearm. The complications risk and the need for additional surgery associated with this procedure are small.

**Objective:** To report on the results of a midradial osteotomy with internal fixation combined with a distal ulnar osteotomy without fixation for the treatment of supination contracture of the forearm.

**Participants:** All patients treated with this approach at the Shriners Hospital of Los Angeles from 1998 to 2006 by a single surgeon were retrospectively reviewed. A follow-up of at least 6 months was required.

**Methods:** An ulnar osteotomy was done with a limited incision four-fifths of the way down the ulna. It was done percutaneously with low energy and left unclosed. A radial osteotomy was then performed in the midforearm, pronated, and then fixed with a 6-hole plate. Slight overcorrection was performed. The authors aimed for 30° to 45° of pronation. Patients were in a long-arm cast for 6 weeks postoperatively.

**Results:** The mean position was 80° of supination preoperatively and 24° of pronation postoperatively (average correction, 104°). There was only one nonunion of the distal ulna, which was asymptomatic. No other complications occurred. There was no plate breakage. There were no cases of compartment syndrome despite the significant degree of rotational correction achieved. The preoperative arc of motion was only about 20° maximum, and this was preserved.

**Conclusions:** The midforearm radial osteotomy with distal ulnar osteotomy allows an excellent arc of corrective motion and is safe. When compared to other methods of correction which generally involve osteotomies at the same level (with or without fixation) or release of the interosseous membrane with rerouting of the biceps, none of the other techniques preserve as much correction as does the one reported in this article. The authors also use a variation of this technique for proximal radioulnar synostoses, but they rotate the arm into supination, so it is the opposite technique.

**Reviewer’s Comments:** This is a useful article because there is no commonly accepted solution to this clinical problem. Osteotomies done more proximally pose a risk of compartment syndrome or nerve palsy, probably because of the torque on the neurovascular structures. This technique seems to avoid such a complication. The radial bow seems to be preserved according to the pictures in this article. The ulna usually heals and remodels. I recommend this article to all who care for upper extremity problems in children. This technique is one of the salvage options for brachial plexus problems in children. (Reviewer-Paul D. Sponseller, MD).

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Keywords: Supination Contracture of Forearm, Treatment

Print Tag: Refer to original journal article
To screen newborns for developmental dysplasia of the hip, the recommended approach uses physical examination and the selective use of ultrasonography for those with positive findings or an increased risk.

**Background:** Developmental dysplasia of the hip (DDH) occurs with an incidence of 1 to 10 per 1000 births. 

**Objective:** To use decision analysis to determine which approach to screening for DDH generates the best overall outcomes.

**Methods:** The authors compared the outcomes associated with no screening, screening by physical exam and ultrasound (US) in all neonates, and screening by physical exam with selected US based on findings. The major treatment complication was described as avascular necrosis (AVN). The risk of AVN with Pavlik harness treatment was set at 1%. A baseline risk of hip arthritis of 4% by age 60 years was assumed. The probability of the more severe types was calculated. The Severin classification was used to estimate the probability of a good outcome of the hip at the desired end point.

**Results:** The best outcomes were obtained with screening by routine physical exam with selective US for risk factors. However, the differences were relatively small. The chance that a hip would be free from arthritis by age 69 years was 95.90% with routine physical exam and selective US, 95.86% with routine US, and 95.78% with no screening whatsoever. These modest differences reflect the rarity of DDH in the population.

**Conclusions:** The screening technique associated with the best chance of avoiding an arthritic hip by age 60 years is routine screening of all newborns by physical exam with the use of US for those with physical findings, those who were breech babies, or those with a positive family history. Although the differences are small, >1000 babies born in the United States could be prevented from having an arthritic hip by routine screening.

**Reviewer’s Comments:** Guidelines from the American Academy of Pediatrics specifically state that, “The hips must be examined at every well-baby visit; 1, 2, 4, 6, 9, and 12 months.” They further state that the problem of late detection of dislocated hips will not be eliminated. Virtually all series have some missed hips no matter what the screening method. This highlights the complexity of screening. The authors do not take into account that missed hips often do not get left alone when they are eventually diagnosed; they undergo more high-risk treatment, such as osteotomies, with higher rates of AVN. I think this is a classic article which should provide the Preventive Services Task Force with an impetus to revise their statement. Hopefully, no primary physician will feel that they do not need to screen for DDH. It will be quoted widely by those discussing standards of care for DDH. (Reviewer-Paul D. Sponseller, MD).

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Keywords: Developmental Dysplasia of Hip, Screening

Print Tag: Refer to original journal article
The modified Jobe and Docking techniques provide valgus stability like that of the native ulnar collateral ligament of the elbow at 90° of flexion, but they provide significantly less stability at lower elbow flexion angles (30°).

Background: The modified Jobe and Docking techniques are the 2 most commonly performed surgical reconstruction procedures of the elbow's ulnar collateral ligament (UCL).

Objective: To evaluate the postsurgical ability of each of these 2 techniques to restore key biomechanical elbow properties to levels found with the native UCL.

Design: Controlled laboratory study.

Methods: 10 matched pairs of cadaver elbows (mean age, 79.2 years) underwent testing using a 4 degrees of freedom loading system. Subfailure valgus loads were applied to the native elbows at different flexion angles; motion and ligament elongation were measured. The elbows were then loaded to failure in valgus at 90° of flexion, and then surgical reconstruction was performed using palmaris longus autograft tendon via the modified Jobe technique or the Docking technique.

Results: Only the resting length of the anterior portion of the UCL anterior bundle remained isometric throughout range of motion. The middle and posterior bands of the anterior bundle elongate with increasing elbow flexion. In native and both reconstruction procedures, valgus laxity of the elbow decreased as elbow flexion angle increased. At higher flexion angles (90° to 110°), both reconstruction techniques closely approximated the valgus laxity of the native ligament. However, at lower flexion angles, neither reconstruction succeeded in fully restoring native valgus laxity. Kinematic coupling decreased with increased flexion for both native and reconstructed ligaments. The average load to failure for the native UCL was statistically greater than both the modified Jobe and Docking techniques. Both reconstruction techniques, however, were statistically similar in their load to failure.

Conclusions: The modified Jobe and Docking techniques reconstruct restraint of the native UCL to valgus laxity and kinematic coupling at 90° of flexion and higher angles where peak valgus torque is experienced during throwing. However, at a lower elbow flexion angle (30°), both reconstruction techniques provided significantly less valgus stability than the native UCL. This suggests that patients who have undergone either a modified Jobe or Docking surgical reconstruction should be cautioned against activities where large valgus loads are developed with the elbow at approximately 30° of flexion (side-arm throwing).

Reviewer's Comments: The authors point out that because the native UCL becomes tightened with elbow flexion, overtightening of the graft at 30° may have deleterious effects on the reconstruction at high elbow flexion. This study is limited by the fact that it is a biomechanical, cadaveric study with time-zero data only. (Reviewer-Adam J. Farber, MD).

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Keywords: Ulnar Collateral Ligament, Jobe & Docking Biomechanics

Print Tag: Refer to original journal article
The use of a soft tissue button and biotenodesis interference screw for the repair of acute distal biceps tendon ruptures through a limited anterior incision can allow early return to normal activities.

**Objective:** To evaluate patient outcome after an acute (<6 weeks) distal biceps rupture repaired through a single anterior incision with a soft tissue button and interference screw, followed by an accelerated rehabilitation protocol.

**Design:** Retrospective case series.

**Methods:** From February 2004 to July 2007, 41 elbows in 40 patients had repair of an acute distal biceps tendon rupture (<6 weeks) through an anterior incision using a soft tissue button (either an EndoButton or the Suture Button) and interference screw combined technique. All patients were placed in a postoperative splint. At 3 to 5 days postoperatively, the splint was removed. Home therapy was initiated at 1 week to include gentle active pronation, supination, flexion, and extension. Pain-free strengthening with 1-pound weights was started 1 week postoperatively. Patients were counseled to avoid excessive elbow flexion against resistance for 2 to 3 months. The patients were evaluated before and after surgery with a physical exam, radiographs, and the Andrews-Carson elbow score. The postoperative follow-up occurred at an average of 12 weeks (range, 4-16 weeks). Then, approximately 2 years later, 31 patients (32 elbows; mean age, 48.1 years) were contacted for a telephone interview.

**Results:** The average Andrews-Carson score was 168 points preoperatively and 196 points at final clinical follow-up (difference statistically significant). Postoperatively, 29 of the scores were excellent, 2 were good, and 1 was fair. Supination strength was grade 5 for 28 elbows and grade 4 for 4 elbows. Initiation of flexion was grade 5 for 30 elbows and grade 4 for 2 elbows. One patient had heterotopic ossification associated with decreased pronation and supination. Two superficial radial nerve palsies completely resolved by final follow-up. The average postoperative time to resume normal activities or return to work was 6.5 weeks. More than 90% of patients resumed normal activities by 6 weeks postoperatively. No patients reported a subsequent avulsion event.

**Conclusions:** Repair of acute distal biceps tendon ruptures using a soft tissue button and interference screw technique through a limited anterior incision can allow for accelerated rehabilitation and early return to function.

**Reviewer’s Comments:** This study is limited by the lack of a comparison control group and by the fact that patients were not seen at final follow-up. The telephone interview may lead to recall bias. (Reviewer-Adam J. Farber, MD).

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Keywords: Distal Biceps Rupture, Repair

Print Tag: Refer to original journal article
Inside-out meniscal repair in the elite athlete appears to be successful in the medium- to long-term follow-up, with most patients able to return to sport.

**Objective:** To present the medium- to long-term outcomes of inside-out meniscal repair in elite athletes.

**Participants:** 42 elite athletes (mean age, 23.2 years; age range, 15-38 years) who underwent 45 meniscal repairs between 1990 and 1997.

**Methods:** All repairs were performed using an arthroscopically assisted inside-out technique with vertical mattress sutures. All types of meniscal tears were considered for repair, including bucket-handle, radial, and complex tears. Transverse and degenerate tears were not repaired. The postoperative regimen was standardized and consisted of protected weightbearing for 6 weeks. Failure was defined by patients developing symptoms of joint line pain and/or locking or swelling requiring repeat arthroscopy and partial meniscectomy.

**Results:** 67% of the meniscal repairs were of the medial meniscus, and 33% were of the lateral meniscus. The average number of sutures per repair was 3.7. Meniscal repairs were performed simultaneously with ACL reconstruction in 83.3% of cases. The average time from injury to surgery was 7 months (range, 0-45 months). Follow-up was a mean of 8.5 years (range, 5.4-12.6 years). The average Lysholm and subjective International Knee Documentation Committee (IKDC) scores were 89.6 and 85.4, respectively. After repair, 81% of patients returned to their main sport and most returned to a level similar to the preinjury level. The mean time for return to sport was 11.8 months for the concurrent ACL reconstruction group and was 5.6 months in the isolated meniscal tear group. Postoperatively, there were 11 definite failures (medial meniscus, 10; lateral meniscus, 1) that required excision. This represents a 24% failure rate. One further patient had a possible failed repair, giving a worst-case failure rate of 26.7%. However, 7 of these failures were associated with a further injury. Therefore, the atraumatic failure rate was 11%. Age, size, and location of the tears were not associated with an increased failure rate. Medial meniscus repairs were significantly more likely to fail than were lateral meniscus repairs, with a failure rate of 36.4% and 5.6%, respectively. There were no intraoperative complications and no subsequent infections or neurovascular sequelae.

**Conclusions:** Inside-out meniscal repair allows most elite athletes to return to their preinjury level of activity.

**Reviewer’s Comments:** This study is limited by the lack of postoperative MRI or second-look arthroscopy to assess the true rate of meniscal healing. Future studies which assess the efficacy of all-inside repairs in an elite athletic population would be interesting. (Reviewer-Adam J. Farber, MD).

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Keywords: Meniscal Repair in Elite Athletes, Inside-Out Meniscal Repair

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Although, the FasT-Fix meniscal repair device is safe, noninflammatory, and easily deployed, this technique has inferior meniscal healing results compared with the inside-out meniscal repair technique in the goat model.

**Background:** Numerous techniques and implant devices exist for meniscal repair procedures. In vivo studies assessing the efficacy of repair and safety of the device in terms of avoiding chondral injury have not been performed for all such devices.

**Objective:** To compare the efficacy of and meniscal healing time associated with the FasT-Fix meniscal repair device versus conventional inside-out meniscal repair in a goat model.

**Design:** Controlled in vivo laboratory study.

**Methods:** The knees of 73 male goats had a 2-cm surgically created meniscal tear. All goats underwent subsequent meniscal repair with the FasT-Fix device on one knee and the inside-out meniscal repair using No. 0 Ethibond sutures on the contralateral knee. The animals were allowed to ambulate unrestricted 7 days after the repair. Necropsy was performed 6 months after the repairs. Gross and microscopic inspection was performed on all menisci and the adjacent articular cartilage.

**Results:** 64 of the 73 (88%) goats underwent necropsy, evaluation, and data analysis. The length of residual full-thickness and partial thickness meniscal defects was smaller in the inside-out group compared to the FasT-Fix group. The FasT-Fix device was easy and reliable to insert. The device inserted properly with no difficulties and attached correctly in 146 of 148 cases (98.6%), while the device improperly deployed in the remaining 2 cases. Gross inspection of the chondral surfaces of the medial compartment and surrounding compartments showed no evidence of obvious chondral injury, chondrolysis, grooving, thinning, dimpling, or other irregularity. When microscopic analysis of the meniscal and perimeniscal capsular specimens was performed, no evidence of increased inflammation was seen.

**Conclusions:** Meniscal repair performed using the FasT-Fix device has inferior meniscal healing results in this animal model. Implantation of the FasT-Fix device does not damage adjacent femoral or tibial cartilage. The insertion of the FasT-Fix device is simple and reproducible. There is no inflammatory reaction to the FasT-Fix implant.

**Reviewer's Comments:** As the authors note, the differences in residual full-thickness and partial-thickness defects between the 2 techniques in this goat study are statistically significant, but the clinical significance remains unclear. Future prospective clinical studies are needed to determine if the findings of this study have clinical implications. (Reviewer-Adam J. Farber, MD).

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**Keywords:** Meniscal Repair, Techniques

**Print Tag:** Refer to original journal article
Among patients with calcific deposits in the rotator cuff, those with osseous involvement benefit from arthroscopic debridement as much as those with pure tendinous involvement.

**Objective:** To determine the outcomes associated with the arthroscopic removal of calcific deposits in patients with calcifying tendinitis of the rotator cuff.

**Methods:** Between 2002 and 2007, 30 shoulders in 10 men and 18 women (mean age, 48.3 years) with calcifying tendinitis of the rotator cuff were surgically treated. Patients were subdivided into groups based on the location of the calcific deposits. Group I (n=25) had isolated tendinous/soft tissue calcification. Group II (n=5) had both osseous and tendinous/soft tissue involvement. All patients underwent arthroscopic surgical debridement of the involved tissues. After removal of the deposits, the subsequent hole in the rotator cuff tendon was closed with 1 or 2 side-to-side sutures. Those with osseous involvement underwent concomitant curettage of the bone lesion. Outcome measures included a 10-point pain score on a visual analog scale, the Constant score, and a self-assessment questionnaire.

**Results:** The mean size of the soft tissue calcification was significantly larger in patients with osseous involvement (19.6 mm) than in those without osseous involvement (10.4 mm). The mean final follow-up was at 38 months. Surgical treatments lead to a significant improvement in pain scores and Constant scores in both groups. The median Constant score was 42 preoperatively and 100 postoperatively in group I and was 40 preoperatively and 100 postoperatively in group II. The mean pain score was 6.5 preoperatively and 0.2 postoperatively in group I and was 6.2 preoperatively and 0.4 postoperatively in group II. There were no significant differences between groups I and II in terms of pain scores and Constant scores at final follow-up.

**Conclusions:** Arthroscopic removal of intraosseous and intratendinous calcific deposits is a safe and effective treatment method in patients with calcifying tendinitis of the rotator cuff. Bony involvement does not predict a worse outcome.

**Reviewer’s Comments:** The authors emphasize the importance of identifying and treating concomitant osseous pathology associated with calcifying tendonitis. In addition, they describe a successful treatment technique. However, this study is limited by its small sample size (especially group II) and the lack of a control group with osseous involvement that did not undergo bony debridement. (Reviewer-Adam J. Farber, MD).

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Keywords: Calcifying Tendinitis, Arthroscopy

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When performing lateral decubitus shoulder arthroscopy, the interval between the biceps tendon and supraspinatus tendon is present in >90% of patients with articular-sided, partial-thickness rotator cuff tears.

Biceps supraspinatus interval Partial-thickness rotor cuff tear Supraspinatus distension sign

**Background:** Direct contact between the biceps tendon and supraspinatus in patients undergoing shoulder arthroscopy performed in the lateral decubitus position has been described as an adjunct tool for verification of a full-thickness rotator cuff tear. No studies have evaluated the "biceps-supraspinatus interval" (BSI) in the setting of partial-thickness rotator cuff tears.

**Objective:** To determine whether loss of the BSI is predictive of full-thickness rotator cuff tears and for articular-sided partial-thickness rotator cuff tears in patients undergoing arthroscopy in the lateral decubitus position.

**Methods:** Between 2005 and 2007, the senior author performed shoulder arthroscopies on consecutive patients (mean age, 45.3 years). All procedures were performed with the patient in the lateral decubitus position and began with the arthroscope in the glenohumeral joint. The distance, if any, between the biceps tendon and supraspinatus tendon was evaluated on insufflating the joint with fluid delivered via gravity pressure. A thorough diagnostic arthroscopy of the glenohumeral and subacromial spaces was then performed in all patients to evaluate the rotator cuff.

**Results:** Of 539 patients analyzed, 309 had a rotator cuff tear. Of these tears, 232 cases were classified as articular-sided partial-thickness tears, and 77 were determined to be full-thickness tears. The BSI was preserved in 211 of 232 articular-sided partial-thickness tears (90.9%). The BSI was absent in 76 of 77 full-thickness tears (98.7%). After excluding cases with concomitant adhesive capsulitis, the false-negative rate was 1.3% for full-thickness rotator cuff tears and 0% for partial-thickness articular-sided rotator cuff tears.

**Conclusions:** Loss of supraspinatus distension is sensitive and specific for predicting full-thickness rotator cuff tears. In addition, supraspinatus distension is reliably maintained in patients with articular-sided partial-thickness rotator cuff tears.

**Reviewer’s Comments:** The supraspinatus distension sign is a useful sign to take note of at the initiation of shoulder arthroscopy. The presence of distension usually rules out a full-thickness tear but does not exclude partial-thickness articular-sided tearing. The lack of distension should definitely lead the surgeon to carefully look for a rotator cuff tear if it is not obvious at initial inspection. This sign is limited in its subjective interpretation. As the authors note, this sign may not be useful in a different setting, such as in the beach-chair position or with the use of an arthroscopic pump. (Reviewer-Adam J. Farber, MD).

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Subpectoral biceps tenodesis with an interference screw appears to resolve anterior shoulder pain and biceps symptoms in patients treated for symptomatic biceps tendinosis.

Objective: To evaluate the clinical outcomes of subpectoral biceps tenodesis using an interference screw in patients with symptomatic biceps tendinosis.

Design: Prospective case series.

Methods: Between 2002 and 2005, 50 patients underwent subpectoral biceps tenodesis by a single surgeon for a diagnosis of biceps tendinosis refractory to nonoperative treatment. Concomitant arthroscopic rotator cuff repairs with subacromial decompression was performed in 24 patients (59%). Complete follow-up examinations at 1 year were performed in 41 of 50 cases (82%). Patients were evaluated using: biceps apex difference, pain scores, and a variety of outcome measures including Rowe score, American Shoulder and Elbow Surgeons (ASES) score, Simple Shoulder Test (SST), Constant Murley (CM) score, and Single Assessment Numeric Evaluation (SANE) score.

Results: Follow-up averaged 29 months (range, 12 to 49 months). The mean scores were 86 for Rowe, 81 for ASES, 9 for SST, 87 for CM, and 84 for SANE. All clinical outcome measures demonstrated a statistically significant improvement at follow-up when compared with the preoperative scores. There was 1 failure (pull-out of the tendon from the bone tunnel) that resulted in a "Popeye" deformity on physical examination. The mean value for biceps apex distance was 0.15 cm, with 35 of 41 patients demonstrating no difference on physical examination. Not one of the 41 patients reported pain in the intertubercular groove. At arthroscopy, lesions of the rotator cuff were identified in 31 patients. The mean ASES score was significantly greater in patients without rotator cuff lesion (89.2) than in those with rotator cuff lesion (78.0). The mean SST score was significantly greater in patients without rotator cuff lesion (10.6) than in those with rotator cuff lesion (8.8).

Conclusions: Subpectoral biceps tenodesis with an interference screw is a viable treatment option for symptomatic biceps tendinosis. This technique appears to resolve anterior shoulder pain and biceps symptoms. However, outcomes are less favorable in patients with coexisting rotator cuff lesions.

Reviewer's Comments: This study is limited by the lack of a control/comparison group, by the heterogeneous group of patients included, and by the concomitant procedures performed. (Reviewer-Adam J. Farber, MD).

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Keywords: Symptomatic Biceps Tendinosis, Subpectoral Biceps Tenodesis

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AC Joint Capsule Stabilizes Joint, Especially in AP Direction

Relative Contribution of Acromioclavicular Joint Capsule and Coracoclavicular Ligaments to Acromioclavicular Stability.

Dawson PA, Adamson GJ, et al:

J Shoulder Elbow Surg 2009; 18 (March-April): 237-244

The acromioclavicular (AC) joint capsule is important in AC joint stability, especially in the anterior-posterior direction. Resection of the distal clavicle may increase instability of the AC joint.

Background: To date, it appears that the acromioclavicular (AC) joint capsule primarily resists AC joint motion in the anterior-posterior (AP) plane, and the coracoclavicular (CC) ligaments primarily resist AC joint motion in the superior-inferior (SI) direction. However, there are no direct comparisons of the biomechanical characteristics or relative contribution of these structures to AC joint stability. Objective: To determine the role of the CC ligaments and the AC joint capsule in stabilizing the AC joint. Methods: The study used 6 pairs of fresh-frozen cadaveric shoulders (mean age, 53.7 years). The scapula and clavicle were dissected free of all soft tissue. The only remaining structures were the clavicle, scapula, coracoacromial ligament, CC ligaments, and the AC joint capsule. AP and SI translations of the AC joint were quantified with AC joint compressions of 10N, 20N, and 30N, and with translational loads of 10N and 15N. After native specimen testing was completed, either the CC ligaments or the AC joint capsule was transected. If the CC ligaments were cut on one shoulder, the AC joint capsule was cut on the paired contralateral shoulder. The data collection sequence outlined for the native shoulders was then repeated for the shoulders with either cut CC ligaments (isolated AC joint capsule) or with cut AC joint capsule (isolated CC ligaments). Results: In general, the AC joint capsule cut condition allowed more AP translation than did the CC ligaments cut condition or the native state. In general, the cut CC ligaments condition allowed more SI translation than did the cut AC joint capsule condition or the native state. Compression significantly decreased translation in both planes. Discussion: The results of this study are supported by recent studies and anatomical knowledge. For the sports medicine physician considering reconstruction of the AC joint, the important information gained from this study is that (1) resection of the distal clavicle may have a detrimental effect in terms of instability; and (2) repair of the AC joint capsule, in addition to the CC ligaments, may be beneficial because the AC joint capsule is important in joint stability, especially in the AP direction. Reviewer's Comments: This study provides interesting information and lends support to the notion of avoiding a distal clavicle resection if surgery is indicated for AC instability. Future studies may assess the effects of a distal clavicle resection in this model and the effects of surgical reconstructive procedures. (Reviewer-Adam J. Farber, MD).

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Keywords: Shoulder Biomechanics, Acromioclavicular Joint

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As the imaged extremity increases in cross-sectional area and tissue density or as it gets closer to the radiation source, there is a precipitous amplification in the radiation to which both the patient and the surgeon are exposed.

**Background:** In most medical disciplines, c-arm fluoroscopy is being used. However, no data are available regarding potential radiation exposure to medical personnel or patients during use of large-c-arm and mini-c-arm fluoroscopy.

**Objective:** To evaluate patient and surgeon radiation exposures under a variety of conditions during use of large-c-arm and mini-c-arm fluoroscopes to image a cadaver ankle specimen in a simulated surgical procedure.

**Methods:** Standard and mini-c-arm fluoroscopes were used to image a cadaver ankle specimen, which was suspended on an adjustable platform. A series of 13 film-badge dosimeters were mounted onto individual arrays that were fixed to an adjustable jig. Dosimeters were mounted at specific positions and angulations to detect direct and scatter radiation. Testing was conducted under various scenarios that altered the proximity of the specimen and the radiation source. A variety of exposure data was captured under various conditions ranging from a best-case to a worst-case scenario, as might be encountered in a procedural setting. For the worst-case scenario, the specimen was placed within 2 inches of the radiation source. For the best-case scenario, the jig was adjusted so that the specimen was nearly in contact with the image intensifier. The third scenario involved placing the specimen at an equal distance from the radiation source and the image intensifier.

**Results:** With all configurations tested, measurable exposure during use of the large-c-arm fluoroscope was considerably higher than during use of the mini-c-arm fluoroscope. With all of the configurations tested, patient exposure during use of the large-c-arm fluoroscope was approximately double that seen during use of the mini-c-arm fluoroscope. Patient and surgeon exposure was notably amplified when the specimen was positioned closer to the x-ray source. The exposure values that were measured during ankle fluoroscopy were consistently higher than the exposure values that have been recorded previously during hand or wrist imaging.

**Conclusions:** Tissue density and the shape of the imaged extremity determine the radiation exposure levels for both the patient and surgeon during c-arm fluoroscopy. When larger body parts are imaged or when the extremity is positioned closer to the x-ray source, the radiation exposure levels will probably be higher. When possible, use the mini-c-arm fluoroscope rather than the large-c-arm. Radiation exposure can be limited by following known dose-reducing recommendations and by strictly adhering to all protective measures, including use of a lead garment.

**Reviewer’s Comments:** This study provides interesting data that should not be ignored. These findings should be passed along to all orthopaedic trainees. (Reviewer-Adam J. Farber, MD).

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**Keywords:** Radiation Exposure, Fluoroscopy

**Print Tag:** Refer to original journal article
During shoulder arthroplasty, repair of a subscapularis release with lesser tuberosity fleck osteotomy provides superior biomechanical ultimate strength compared to standard tenotomy.

**Objective:** To report the biomechanical and clinical results of the double-row fixation technique with lesser tuberosity osteotomy for subscapularis repair during total shoulder arthroplasty (TSA).

**Design:** Biomechanical study and retrospective review.

**Methods:** 15 cadaveric shoulders (mean age, 53 years) were used in the biomechanical portion of this study. All musculature was removed from the shoulders except the subscapularis. The specimens were subdivided into 2 groups. Shoulders in group 1 underwent standard tenotomy of the subscapularis (5 shoulders) with subsequent tendinous suture repair. For the shoulders in group 2, the subscapularis was released with a bony fleck of the lesser tuberosity with repair of the subscapularis tendon insertion through bone tunnels at the osteotomy site (10 shoulders/5 matched pairs). In group 2, five osteotomies were repaired with single-row heavy nonabsorbable sutures and five with an additional double-row. Repairs were subjected to cyclical loading at 180 N for 400 cycles, increasing by 180 N to failure. A retrospective clinical review of 100 consecutive patients who underwent dual-row repair of the subscapularis fleck osteotomy following TSA was also performed with minimal follow-up of 24 months (mean follow-up, 31 months).

**Results:** Both single-row (430 N) and double-row (466 N) fixation of the fleck osteotomy were significantly stronger than tenotomy suture repair (252 N). There was no significant difference between single-row and double-row ultimate strengths, although there was a trend toward stronger repair with the dual-row technique. During cyclic loading, visual assessment of the osteotomy techniques revealed more secure fixation with the dual-row repair technique, with respect to gross rotational motion. Beyond 300 N, there was gross rotational motion present in each of the single-row specimens. There was no gross rotational motion present in any of the dual-row specimens until ultimate failure. At final clinical review, the lift-off test was rated as normal in 79%. The belly press was rated as normal in 86%, and 82% were able to tuck in their shirts.

**Conclusions:** Subscapularis release with fleck osteotomy provides superior biomechanical ultimate strength compared to standard tenotomy. Clinical results of this dual-row technique showed good restoration of subscapularis integrity for activities of daily living.

**Reviewer's Comments:** This study lacks a control group in the clinical arm of this study. Future controlled clinical trials are needed to confirm the superiority of this technique, but the results of this study seem promising. In addition, the authors did not test tendon-to-bone tenotomy repair techniques. (Reviewer-Adam J. Farber, MD).

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Keywords: shoulder Arthroplasty, Subscapularis Repair

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