Three once-weekly injections of intra-articular hyaluronic acid improve short-term quality of repair cartilage following microfracture.

Objective: To measure the value of intra-articular viscosupplementation in the treatment of chondral injuries with microfracture.

Design: Controlled laboratory study.

Methods: In 36 New Zealand white rabbits, a 3-mm full-thickness chondral lesion was created in the weight-bearing surface of the medial femoral condyle. A microfracture of the same lesion was then done. At 1 week, the 36 rabbits were divided into 3 groups: 12 rabbits in group 1 received an intra-articular injection of hyaluronic acid once a week for 3 weeks; 12 rabbits in group 2 underwent an intra-articular injection of hyaluronic acid once a week for 5 weeks; and 12 rabbits in group 3 served as controls, receiving an intra-articular injection of saline once a week for 5 weeks. At 3 months, half the rabbits in each group were sacrificed and underwent evaluation of their cartilage repair. The remaining 6 in each group were sacrificed for evaluation at 6 months. Histological evaluation was done using the O'Driscoll histologic cartilage scoring system, and grossly by the International Cartilage Repair Society’s Cartilage Repair Assessment scoring scale.

Results: At 3 months, group 1 knees had improved gross and histologic repair of their cartilage lesion, compared to controls, and interestingly better repair than group 2. At 6 months, repair cartilage among the 3 groups was not significantly different. However, at 6 months, control knees had greater synovial inflammation and osteophyte formation than did groups 1 and 2.

Conclusions: 3 once-weekly injections of hyaluronic acid after microfracture improved short-term cartilage repair and reduced generalized joint degenerative changes.

Reviewer's Comments: Hyaluronic acid viscosupplementation has demonstrated reduced symptoms in many patients with osteoarthritis. In addition to inhibiting degenerative changes in cartilage and reducing inflammation, it may provide chondrogenic differentiation of embryonic mesenchymal cells. Another group that would have been interesting to study would be cartilage defects treated with hyaluronic acid or saline without microfracture. Viscosupplementation with chondroprotective agents shows promise in the treatment of cartilage injuries. The exact molecular structure, timing, and amount still need to be further elucidated. (Reviewer-John H. Wilckens, MD).

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Keywords: Articular Cartilage Lesions

Print Tag: Refer to original journal article
Acute arthroscopic Bankart repairs in first-time anterior shoulder dislocations provide excellent long-term stability in young active patients.

**Objective:** To review the long-term follow-up of arthroscopic Bankart repairs in first-time dislocations.

**Design:** Case series.

**Methods:** Over a 6.5-year period, the authors performed an arthroscopic Bankart repair acutely on 49 shoulders that sustained a first-time shoulder dislocation. Repair was done with 8-mm bioabsorbable tacks (Suretac, Smith & Nephew). Long-term follow-up consisted of Single Assessment Numeric Evaluation (SANE), Rowe shoulder score, the American Shoulder and Elbow Surgeons (ASES) score, Western Ontario Shoulder Instability (WOSI) score, Simple Shoulder Test (SST), and the Short Form-36 questionnaire. Activity level was assessed by the Tegner scale and Army Physical Fitness Test (APFT), which includes push-ups, sit-ups, and a 2-mile run.

**Results:** 40 of 49 shoulders were available for follow-up at a mean of 11.7 years (range, 9.1 to 13.9 years), an almost 82% follow-up rate. This study group consisted of 37 men and 2 women. Average age at surgery was 20.3 years, and at final follow-up, 32.0 years. Mean SANE score was 91.7, WOSI 371.7, Rowe score 25.3, and ASES 90.9. Mean SST Score was 11.1. These patients rated their shoulder at a mean of 93.3% (range, 40.0% to 105.0%) to their pre-injury shoulder. APFT mean score was 282.2 (out of 300.0). Five patients reported 8 recurrent dislocations at a mean of 37.4 months (range, 6.0 to 81.0 months) after surgery. Three of these patients had a revision capsulorrhaphy. Eight additional patients reported subluxation episodes, with 1 requiring revision surgery. All episodes of redislocations occurred after a significant injury during athletic activity.

**Conclusions:** Only 14% of patients undergoing acute arthroscopic Bankart repair sustained a redislocation at long-term follow-up.

**Reviewer's Comments:** This is an excellent article that describes the natural history of acute arthroscopic Bankart repairs in first-time shoulder dislocations. At a mean follow-up of 37 months, this same cohort reported very similar excellent clinical results and a 12% recurrent instability rate. While acute arthroscopic repair is clearly better than non-operative treatment of first-time dislocation, is it better than open or arthroscopic repair of Bankart lesions in recurrent shoulder dislocations? Most first-time dislocations can be managed through a playing season. Does delaying arthroscopic repair affect ultimate outcome? Time for recurrent subluxation was 22 months, and dislocation was 37 months. Results did not deteriorate with time. I might add that these stabilizing procedures were done with first-generation, simple-to-use Suretac. I'm not sure how much more these newer, more expensive arthroscopic anchors have improved results. (Reviewer-John H. Wilckens, MD).

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Keywords: Initial Anterior Shoulder Dislocation

Print Tag: Refer to original journal article
Untreated incidental chondral injuries found at time of anterior cruciate ligament reconstruction do not appear to affect long-term clinical results.

**Objective:** To determine the effect of untreated incidental chondral lesions on long-term results of anterior cruciate ligament (ACL) reconstructions.

**Design:** Case series.

**Methods:** Over a 5-year period, the authors performed 586 ACL reconstructions. Of these, 51 had a grade III or IV Outerbridge chondral lesion of the articular surface. This formed the study group. The control group consisted of age- and gender-matched ACL reconstructions that had no articular lesions. Patients underwent similar mini-arthroscopy ACL reconstruction with the central third of the patellar tendon. Chondral lesions were left untreated. Follow-up was conducted at 10- and 15-year follow-up with Lysholm score, Tegner activity scale, and International Knee Documentation Committee (IKDC) score. Patients also underwent KT-1000 arthrometry and plain radiography in standing posteroanterior, lateral, and Merchant views.

**Results:** The study group consisted of 29 males and 14 females with a mean age of 28 years (range, 16 to 43 years). Mean time from injury to surgery was 3.0 months (range, 0.5 to 10.0 months). Mean lesion size was 2.1 cm² (range, 0.5 to 4.0 cm²). Thirty-one lesions were located on the medial femoral condyle, 11 on the lateral femoral condyle, 3 on the trochlea, 3 on the lateral tibial plateau, 2 on the patella, and 1 on the medial tibial plateau. Of 51 study patients, 42 were available for follow-up at 10 years compared to 41 controls. At 15 years, 36 study patients were available compared to 35 controls. At 10-year follow-up, there were no objective statistical differences by IKDC, Lysholm, and Tegner scores between groups. Only the mean total IKDC subjective score was significantly lower in the lesion group. At 15-year follow-up, there were no statistical differences in objective or subjective outcomes by IKDC, Lysholm, and Tegner scales. Both groups demonstrated no difference in radiologic findings. At 10- and 15-year follow-up, the lesion group had 1 severely abnormal, 3 abnormal, 12 nearly normal, and 15 normal x-rays compared to 4 abnormal, 10 nearly normal, and 17 normal results in the control group. Location of chondral lesion did not affect outcome scores. Both groups demonstrated similar stability.

**Conclusions:** High-grade lesions incidentally found at time of ACL reconstruction, left untreated, did not affect long-term results.

**Reviewer’s Comments:** This is a valuable long-term follow-up study of ACL reconstructions. Incidental grade III and IV lesions in this setting of ACL reconstruction did well. The relatively acute setting of the reconstruction, with blood in the joint, and reduced activity may have contributed to the healing of these traumatic chondral lesions in this relatively young population. Eleven patients in the study group had additional knee surgery (compared to 9 in the control group). It would have been interesting to have the authors comment on the articular lesions on their second look. (Reviewer-John H. Wilckens, MD).

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Keywords: Anterior Cruciate Ligament Injuries

Print Tag: Refer to original journal article
Double-bundle anterior cruciate ligament reconstruction is a significantly more expensive procedure than single-bundle reconstruction without a demonstrated clinical advantage.

**Objective:** To determine the economic impact of converting from single-bundle (SB) to double-bundle (DB) anterior cruciate ligament (ACL) surgery.

**Design:** Economic analysis.

**Methods:** Using 2008 actual costs in U.S. dollars of allografts, fixation devices, and operating room (OR) time, the authors developed 5 economic scenarios converting 50% of ACL reconstructions to DB ACL reconstructions. Scenario 1 consisted of only the additional cost of proximal and distal fixation. Scenario 2 consisted of scenario 1 plus 30 minutes additional OR time. Scenario 3 consisted of scenario 1 plus 1 soft tissue allograft. Scenario 4 consisted of scenario 1 plus 2 soft tissue allografts. Finally, scenario 5 consisted of 100% conversion to DB, scenario 3, and 30 minutes extra OR time. This was measured against the cost of revision ACL reconstruction using 2 models: (1) 4% revision rate for failed SB reconstruction at 4 years after index reconstruction and $20,000 for the revision; and (2) 4% revision rate for DB reconstruction at a mean time of 2 years at a cost of $40,000 for revision. The authors applied these economic models to the estimated 200,000 ACL injuries that occur annually in the United States.

**Results:** With only 50% conversion rates of ACL reconstructions in scenario 1, the additional cost is $362 per procedure; additional costs for scenario 2 is $962 per case, for scenario 3 is $1862, for scenario 4 is $3362, and for scenario 5 is $3962. To offset additional costs of DB, the DB surgery had to reduce the revision rate of ACL surgery from 4.0% to 1.5%. Depending on the scenario, the annual cost to U.S. health care ranged from $36 million to $792 million.

**Conclusions:** Widespread conversion to DB ACL reconstruction will add significant cost to the health care system in the U.S.

**Reviewer's Comments:** This is a very intriguing article that every sports medicine surgeon should read. The authors are to be applauded for highlighting the additional cost to the health care system without demonstrated benefit. Their numbers are relatively conservative. DB advocates claim better biomechanics, and this theoretically will yield better clinical long-term results, specifically lower revision rates and fewer late arthritis cases. DB reconstructions to date have not demonstrated decreased need for revision. The biggest risk for failure to a well-done ACL reconstruction, SB or DB, is a re-injury. A SB or DB reconstruction not done well has an increased risk of failure. The DB is significantly more difficult technically, with a steep learning curve, and requiring more than the authors' assumed 30 minutes of OR time. This model does not claim to address the theoretical benefit and economic impact of a well-done DB ACL reconstruction on posttraumatic arthritis. In this climate of economic downturn and closer scrutiny of health care dollars, surgeons should revisit their surgical practice. I would encourage more investigators to measure the economic impact of emerging technology.

(Reviewer-John H. Wilckens, MD).

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Keywords: Anterior Cruciate Ligament Reconstruction

Print Tag: Refer to original journal article
What Are the Risks of Using a Far Anteromedial Portal for ACL Reconstruction?

Nakamura M, Deie M, et al:

Arthroscopy 2009; 25 (May): 481-487

Increasing the knee flexion angle increases the distance to the common peroneal nerve and posterior articular cartilage of the lateral femoral condyle.

**Background:** There has been a rise in popularity of use of medial portals for drilling the femoral tunnel in anterior cruciate ligament (ACL) reconstructions.

**Objective:** To assess the risk of injury to the common peroneal nerve and the posterior articular cartilage of the lateral femoral condyle when using a far anteromedial portal.

**Design:** Cadaveric laboratory study.

**Methods:** The authors used 10 cadaveric knees that were free from malalignment or flexion contracture. Mean age of the knees was 72.6 years; mean height was 161.6 cm. The authors identified the anatomic footprint of the anteromedial (AMB) and posterolateral (PLB) bundles of the ACL, as well as the common peroneal nerve and the posterior articular cartilage of the lateral femoral condyle in 10 cadaveric knees. They created a portal 2 cm medial to the standard anteromedial portal, immediately superior to the medial meniscus when the knee was flexed to 90°. The authors then drilled a pin through this portal to the anatomic central point of the AMB and PLB at 70°, 90°, and 110° of knee flexion. They looked at the exit point of the pin through the lateral femoral condylar cortex. They measured this point to the shortest distance to the common peroneal nerve and the articular cartilage of the posterior lateral femoral condyle.

**Results:** The authors found that the shortest mean distance to the common peroneal nerve when drilling the AMB occurred when the knee was flexed to 70°. When drilling the AMB, distances were 10.0 mm at 70°, 16.0 mm at 90°, and 23.6 mm at 110°. When drilling the PLB, distances were 6.3 mm at 70°, 11.8 mm at 90°, and 22.7 mm at 110°. The authors also found an increase in the distance to the posterior articular cartilage of the lateral femoral condyle with increased flexion. When drilling the AMB, distances were 5.1 mm at 70°, 13.0 mm at 90°, and 23.0 mm at 110°. Distances for the PLB were -0.8 mm at 70°, 5.6 mm at 90°, and 16.6 mm at 110°. The authors also examined mean femoral tunnel length at the 3 flexion angles. When drilling the AMB, the femoral tunnel length was 28.3 mm at 70°, 33.2 mm at 90°, and 40.4 mm at 110°. When drilling the PLB, tunnel length was 27.3 mm at 70°, 31.9 mm at 90°, and 39.3 mm at 110°.

**Conclusions:** Increasing knee flexion angles decreases the risk to the common peroneal nerve and posterior articular cartilage of the lateral femoral condyle when drilling the AMB and PLB through the far anteromedial portal.

**Reviewer’s Comments:** This article highlights the need for meticulous attention to detail when drilling tunnels through an accessory medial portal. Of particular concern is potential damage to the posterior articular cartilage, particularly at 70° of knee flexion. In addition, it is striking that tunnel length is so dependent on knee flexion angle. (Reviewer-Nathaniel P. Cohen, MD).

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Keywords: Far Anteromedial Portal

Print Tag: Refer to original journal article
MRI can accurately identify osteoarthritis of the knee in patients who may not appear to have it on clinical and radiographic exam. Use of MRI is an effective aid with surgical decision-making.

**Background:** While clinical examination and weight-bearing radiographs are traditionally used for diagnosing osteoarthritis (OA) of the knee, they are often most useful in advanced disease. Options for diagnosis for patients with joint-line pain and minimal OA changes on radiographs include MRI and diagnostic arthroscopy.

**Objective:** To evaluate the usefulness of a preoperative MRI with joint line pain in the knee.

**Design:** 2-part prospective study.

**Participants/Methods:** The authors initially performed MRI examinations on 100 randomly selected patients who were scheduled to undergo arthroscopic examination. Patients all underwent scanning with a 1.5-T MRI in 3 planes. Two radiologists graded the articular cartilage on the trochlea, patella, femoral condyles, and tibial plateaus based on the classification of Vallotto. Patients were assessed arthroscopically using the Outerbridge classification system. A positive result occurred when the MRI grade matched the Outerbridge classification. In part 2 of the study, the authors prospectively assessed 618 patients with suspected meniscal or articular pathology. All patients were clinically and radiographically assessed. The surgeon recorded the most likely diagnosis and whether patients would undergo arthroscopy. Following the initial consultation, patients underwent MRI and additional consultation with knee specialists.

**Results:** In part 1 of the study, the authors found identical grading on 490 of 600 (84.2%) surfaces for MRI and arthroscopy. Seventy-seven lesions differed by 1 grade, 12 lesions differed by 2 grades, and 3 lesions differed by 3 grades. MRI was sensitive in 83.2% of cases and specific in 94.3%. The sensitivity was lowest for the medial and lateral tibial plateau; this rose for grade III and IV lesions. At initial evaluation, all 618 patients were deemed to have a lesion amenable to arthroscopic treatment. MRI assessment agreed with this in 477 patients; these patients' correct diagnosis was confirmed at arthroscopy. In 141 (22.8%) patients, MRI altered clinical management. For example, 14 patients were found to have advanced degenerative joint disease (DJD) and underwent arthroplasty, while 50 were found to have moderate osteoarthritis (OA) and underwent non-operative treatment. Twenty-two patients suspected to have isolated DJD were found to have an unstable meniscus and underwent subsequent meniscectomy with clinical relief.

**Conclusions:** MRI can accurately identify OA of the knee in patients who may not appear to have it on clinical and radiographic exam. Use of MRI is an effective aid with surgical decision-making.

**Reviewer's Comments:** This study seems to justify use of MRI preoperatively. This article highlights that clinical and radiographic examination are not completely foolproof. MRI can be a useful adjunct. As cost containment becomes a bigger issue, there may be pressure brought to bear on use of MRI preoperatively for arthroscopic meniscectomy. Saving a potential surgery not only benefits the patient, it may also be cost-effective. (Reviewer-Nathaniel P. Cohen, MD).

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**Keywords:** MRI
Longer duration of symptoms decreases amount of improvement following anterior transposition for cubital tunnel syndrome.

**Background:** The most appropriate choice for surgical treatment of cubital tunnel syndrome remains controversial.

**Objective:** To compare clinical outcomes of submuscular and subcutaneous ulnar nerve transposition at the elbow.

**Participants/Methods:** 88 patients who had undergone surgical treatment for cubital tunnel syndrome were identified retrospectively; 25 with submuscular and 24 with subcutaneous transposition responded to the invitation to return for examination. All patients had confirmatory electrodiagnostic studies preoperatively. All patients were modified McGowan stage II or III, had diminished 2-point discrimination preoperatively, and were a minimum of 2 years out from surgery. Submuscular transpositions were performed with Z-lengthening of the flexor-pronator fascia and postoperative splinting for 2 weeks. Subcutaneous transpositions used a flap of fascia from the flexor-pronator mass to maintain the anterior transposition and were not immobilized. Patients were brought in for clinical exam of sensory and motor recovery after being identified. Subjective results were also determined.

**Results:** There were no significant differences in subjective or objective outcomes between patients who underwent submuscular versus subcutaneous transposition. Sensory and motor functions were significantly improved postoperatively in both groups. Patients who had symptoms for >6 months before surgical treatment had a significantly poorer prognosis.

**Conclusions:** Patients with McGowan stage II or III cubital tunnel syndrome had significant improvement in subjective and objective clinical measures whether they underwent submuscular or subcutaneous ulnar nerve transposition. Patients with >6 months of symptoms before surgical treatment had poorer results regardless of surgical technique.

**Reviewer's Comments:** The major weaknesses of this study are its retrospective design and lack of validated subjective and objective outcomes measures. Still, this retrospective study helps support what other recent research efforts suggested, namely, that there is likely little, if any, clinically significant difference between the multiple surgical options for cubital tunnel syndrome. Prospective, randomized controlled trials (PRCTs) in the neurosurgery literature, especially, have led clinicians to reconsider whatever is their routine procedure of choice for cubital tunnel, with most of these articles suggesting that simple decompression is equivalent or superior to other more complicated interventions with regard to risk-benefit ratio. Many surgeons continue to perform their procedure of choice as they await further well-designed PRCTs to define evidence-based recommendations. This current study also supports the notion that longer duration of symptoms may lead to poorer clinical outcomes in patients with cubital tunnel syndrome. (Reviewer-Kenneth R. Means, Jr, MD).

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Keywords: Cubital Tunnel Syndrome

Print Tag: Refer to original journal article
Preoperative CT scans of apparently isolated capitellum fractures may help with identification of associated injuries and preoperative planning.

**Background:** Apparently isolated fractures of the capitellum are typically more complex than initially appreciated.

**Objective:** To determine early and long-term results of operative treatment of capitellum and trochlea fractures.

**Participants:** 30 consecutive patients at a level I trauma center with classifiable fractures of the capitellum and trochlea.

**Methods:** 27 patients were followed for a minimum of 12 months, while 14 returned for long-term evaluation a median of 17 years after injury. Median age at the time of early and late evaluation was 40 and 52 years, respectively. Fractures were classified using 3 different classification schemes based on plain radiographs and intraoperative findings. Early evaluations were performed with the Broberg and Morrey Functional Rating Index. Patients who returned for late follow-up were evaluated with the Mayo Elbow Performance Index, the Broberg-Morrey score, the American Shoulder and Elbow Surgeons score, and the Disabilities of the Arm, Shoulder, and Hand score.

**Results:** All capitellum fractures involved at least a portion of the trochlea. Of patients, 67% had 1 or more subsequent surgical procedure. At the time of early follow-up, the median amount of flexion was 128°, with a median 20° flexion contracture and a median Broberg-Morrey score of 93. Patients who returned for long-term follow-up had a median of 139° of flexion, with a median flexion contracture of 28° and a median Broberg-Morrey score of 95. Median pronosupination was 180° at both follow-up times. Nine of 14 patients who returned for late follow-up had radiographic signs of arthrosis. There were 11 patients for whom both early and late follow-up data were available. In this group, there was no significant difference between early and late median arc of elbow flexion-extension or pronosupination. The early Broberg-Morrey score for this group was 94, while the late score was 95.

**Conclusions:** The large majority of partial articular fractures of the lateral humeral column actually involve fracture of the trochlea along with the capitellum. Although arthrosis developed in most patients, overall motion, function, and pain level were good, and there were no late reconstructive procedures. The results of operative treatment seem to be durable over time.

**Reviewer's Comments:** This study lends further support to the growing body of literature noting that apparently isolated fractures of the capitellum are in fact typically more complex. Preoperative CT scans for these injuries can help identify the more complex fracture patterns and aid in preoperative planning. The authors of this study note its limitations; namely, with its retrospective design; treatment with older and varied surgical techniques, technologies, postoperative protocols; and involvement of a large number of surgeons. Also, long-term data are likely more relevant for those who sustain these injuries when they are younger, as many older patients at the time of initial injury had died at the time of long-term follow-up. (Reviewer-Kenneth R. Means, Jr, MD).

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Keywords: Capitellum & Trochlea

Print Tag: Refer to original journal article
Cervical disk replacement next to previous fusion gives good early clinical results, but long-term results are needed.

**Background:** Anterior cervical discectomy and fusion (ACDF) is a well-established procedure with a high success rate. Problems of adjacent segment degeneration and limitation of range of motion, however, still exist. Cervical total disk replacement (TDR) has been shown to result in equivalent symptomatic relief when compared to ACDF, with improved range of motion and a lower incidence of adjacent level disease. There is no previous major study evaluating results of TDR adjacent to previous ACDF.

**Objective:** To evaluate short-term clinical and radiographic outcomes of cervical disk replacement adjacent to previous successful ACDF and to compare outcomes in patients with primary TDR.

**Design:** Prospective multicenter study.

**Participants/Methods:** 126 patients underwent primary TDR using porous coated motion (PCM) artificial cervical disk ("primary" group); 26 patients underwent the same procedure at a level next to a previous successful fusion ("adjacent to fusion" group). All patients were part of a study under a U.S. Federal Drug Administration Investigational Device Exemption trial looking at safety and effectiveness of the PCM device. Indications for TDR were radicular or myelopathic symptoms from a single cervical level that failed non-operative treatment. All patients were followed for 2 years looking at serial radiographs, complications, Neck Disability Index (NDI), and visual analog scale (VAS) scores.

**Results:** No significant demographic differences were seen between groups; 74% of primary and 81% of adjacent to fusion patients were seen at 1-year follow-up. Surgery time, blood loss, and rates of postoperative dysphagia were similar in both groups. Reoperation rates with conversion to ACDF were done in 1.6% of primary patients and 7.7% of adjacent to fusion patients. NDI and VAS scores improved significantly in both groups and were similar between groups. Radiographic analysis showed significantly higher rotation and translation at the replaced disk level in the adjacent to fusion group.

**Conclusions:** Total disk replacement adjacent to previous cervical fusion provides reasonable short-term outcomes with theoretical advantages over additional fusion by preserving motion and potentially decreasing risk of adjacent level degeneration.

**Reviewer's Comments:** This is the first large study looking at cervical TDR next to previous ACDF. Outcomes were comparable to those of primary disk replacement. This study gives a spine surgeon a good alternative when treating a patient with cervical radiculopathy or myelopathy and previous fusion or 2-level disease with varying degrees of severity. Increased rates of reoperation and greater motion at the implant level are likely due to adjacent fusion altering the kinematics of the spine. Limitations include low number of patients in the adjacent to fusion group and short-term follow-up. Longer-term studies with greater numbers of patients will be needed to fully understand outcomes of this procedure. (Reviewer-Vladimir Sinkov, MD).

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**Keywords:** Cervical Disk Replacement

**Print Tag:** Refer to original journal article
Induced ischemia of the femoral head usually does not lead to severe disruption of growth of the upper femoral growth plate.

**Background:** Legg-Calvè-Perthes disease is a classic example of vascular damage to the proximal femoral epiphysis. It is common knowledge that the growth plate is altered in patients with Perthes disease. It is believed that this is because the nutrition or blood supply to the growth plate is, in part, from the epiphysis. **Objective:** To assess effects of disruption of the blood supply to the upper femoral epiphysis in terms of both the growth and the shape of the capital femoral growth plate. **Design:** Basic histological study in a piglet model. **Methods:** 65 piglets were studied. Ischemic necrosis was created to resemble Perthes by placing a suture around the femoral neck at age 4 to 6 weeks. Piglets were studied in a variety of ways using portions of these subjects up to 8 weeks after suture was applied. Hypoxia was studied by a special staining chemical called Hypoxyprobe. Chondrocyte viability was studied using lactate dehydrogenase. The shape and growth of the femoral neck and growth plate were studied at varying intervals up to 8 weeks using x-ray and cut sections. **Results:** Only 12% of growth plates at 4 weeks and 25% at 8 weeks had severe disturbance. Only cells closest to the epiphysis were actually hypoxic. The femoral neck continued to grow. There was a difference, however, in that it was wider and did not grow as tall as the other side. The growth plate itself was actually wider on the ischemic side, compared to the normal side, which tended to become thinner with age. Normal organization and growth were seen in the proliferative zone of the growth plate. **Conclusions:** Most growth plates remained alive and were able to grow nearly normally, despite complete disruption of blood supply to the epiphysis. This means that classic concepts of growth and nutrition of the growth plate of the upper femur may not accurately describe this area. The authors state that this is consistent with the literature showing that <30% of patients with Perthes have major interference with growth of the femoral neck. **Reviewer’s Comments:** This was an informative study that helps improve our understanding of both normal nutrition to the growth plate and alterations seen in Perthes disease. To some degree, the growth plate depends on having avascular and hypoxic zones. This watershed area is what stimulates cell death and calcification of the cartilage. It may be extremely resistant to induced hypoxia. Probably, alterations in Perthes are even less extreme because the ischemic event is more subtle than a complete ligature around the femoral neck. I am curious what makes the femoral neck become broader after ischemia. Possibly, it follows compression-induced flattening of the epiphysis. Improved understanding of the pathogenesis at work in this disease may help us understand the etiology of this still mysterious disorder. (Reviewer-Paul D. Sponseller, MS, MD).
Outcomes at adulthood are similar between patients with fibular hemimelia treated with amputation in childhood versus those treated with limb preservation and reconstruction.

**Background:** Fibular hemimelia is the most common form of longitudinal limb deficiency. It typically presents with a short limb, small foot, some lateral rays missing, and a tendency to equinovalgus alignment. Amputation and limb lengthening are the 2 major options.

**Objective:** To assess long-term outcomes of 2 procedures in terms of quality of life, physical function, general health, and burden of care.

**Design:** Retrospective study.

**Participants/Methods:** Patients who had either amputation, lengthening, or reconstruction for fibular hemimelia were studied. They were included if they were aged ≥21 years at follow-up. Procedures went back as far as 1950. Patients with other major anomalies were not included. Assessment included questionnaires on quality of life, depression inventory, Short Form-36, and the American Academy of Orthopaedic Surgeons Lower Limb Questionnaire. There were 28 control subjects with no lower limb anomalies who agreed to complete the questionnaires.

**Results:** Of 248 patients identified who had the appropriate diagnosis and age, 62 completed the study. There were 36 patients who had an amputation and 26 who underwent lengthening. The group that underwent lengthening started out with more fibular preservation and had more rays on the foot as a whole. Those who had undergone lengthening had a mean of 6.3 procedures compared with 2.4 in those who had an amputation. Those who had reconstruction had more than half a year in the hospital, which is 3 times the figure for those who had amputation. The amputee group had a higher score on the Job Satisfiers scale of the Quality of Life Questionnaire. Otherwise, there was no difference between groups in any of a number of measures. No patient in either group showed signs of depression. Both groups had an above-average quality of life compared to adult controls.

**Conclusions:** Final function and shape of the foot or knee could not be assessed by phone. Other studies have shown that a younger age at amputation was associated with a better quality of life. This is the subject of an ongoing study. There is no clear superiority of one treatment over another.

**Reviewer’s Comments:** Amputation is often suggested for more severe deformities in this spectrum, with >30% shortening of the fibula or severe equinovalgus of the foot with more than 1 to 2 rays missing. Patients with amputation functioned as well or slightly better than the reconstructed group despite having a more deficient lower limb to begin with. I look forward to future studies comparing gait efficiency in the 2 groups. (Reviewer-Paul D. Sponseller, MS, MD).

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Keywords: Fibular Deficiency

Print Tag: Refer to original journal article
Open reduction and pinning of unstable SCFE may be done with a low risk of avascular necrosis.

**Background:** Loder et al coined the term "unstable" slip to distinguish those patients with an increased risk of avascular necrosis (AVN), defined by the inability to bear weight due to the degree of pain. These patients have at least a 25% risk of AVN, but it may be as high as 49%.

**Objective:** To report the results of open reduction in an attempt to produce a less traumatic replacement in the hope of lowering the rate of AVN. The authors also fixed the slip with smooth Steinmann pins.

**Design:** Retrospective therapeutic study, level IV evidence.

**Participants/Methods:** Over a 19-year period, the authors treated 64 patients with unstable slipped capital femoral epiphysis (SCFE) by this method under care of 8 different orthopaedic surgeons at their center in Stuttgart, Germany. These patients were treated by open reduction, ideally within 24 hours after symptom exacerbation. From an anterior Watson-Jones approach, the effusion or hematoma is evacuated and a central K-wire is introduced just to the physis. The surgeon's finger is placed upon the metaphysis and this guides the reduction while an assistant maneuvers the limb into flexion, abduction, and internal rotation. The surgeon attempts to reduce only the acute portion of the slip. Incomplete reduction was accepted in this study.

**Results:** The patients were almost evenly divided between 20 mild, 24 moderate, and 20 severe slips. In total, 83% of patients had blood in the hip, while 17% had only rose-colored fluid. The follow-up was excellent, with all seen for at least 1 year and 64 beyond that having a mean of 4.9 years follow-up. Three patients had AVN, for a rate of 4.7%; 2 of these had a delay of >24 hours from acute worsening of symptoms. By comparison, 75% of the whole series had been treated within 24 hours of onset. There was no relationship of AVN to degree of slip when comparing moderate and severe degrees of slip. The Iowa hip scores were quite good, with a mean of 94 of 100 points at final follow-up. The 3 patients with AVN were treated with osteotomy or cheilectomy.

**Conclusions:** The authors point out that this rate of AVN is even lower than that reported for traction, which is 6% to 17%. They feel that both the control and gentleness of the reduction as well as pressure relief by capsulotomy are the keys to the results of this procedure.

**Reviewer's Comments:** All of us are quite afraid of AVN in overweight adolescents. Dr Parsch is known as a leading proponent of this approach. His results are quite good. However, his definition of unstable slip depends on ultrasound findings of fluid rather than weight-bearing. Also some of the slips he showed as severe would be considered moderate here. We do not know if the excellent results shown here are due to the capsulotomy, the method of open guided reduction, or the small size of the K-wires. (Reviewer-Paul D. Sponseller, MS, MD).

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**Keywords:** Slipped Capital Femoral Epiphysis

**Print Tag:** Refer to original journal article
Results of Revision RTSA Inferior to Those From Other Indications

Reverse Total Shoulder Arthroplasty. Gerber C, Pennington SD, Nyffeler RW:


Despite the high complication rate associated with reverse total shoulder arthroplasty, it is a powerful tool in shoulder surgery and offers restoration of function to patients who previously were not candidates for other treatments.

Discussion: Although once virtually banned from use, the reverse total shoulder arthroplasty (RTSA) design has proved superior in patients with advanced glenohumeral disease in the face of a deficient rotator cuff. Indications for the procedure continue to evolve. Rationale: Although current designs of RTSA prostheses vary in detail, they are all based on the key design elements proposed by Grammont in 1987: (1) The prosthesis must be inherently stable; (2) The weightbearing part must be convex, and the supported part must be concave; (3) The center of the sphere must be at or within the glenoid neck; and (4) The center of rotation must be medialized and distalized. Indications & Contraindications: Indications for RTSA include unacceptable pain and dysfunction in a patient with glenohumeral joint disease or pseudoparalysis in elevation and/or abduction and an irreparable tear of the rotator cuff. Contraindications include axillary nerve deficit, infection, neuroarthropathy, and substantial glenoid bone defects.

Results: RTSA has been shown to reliably restore overhead elevation in patients with massive rotator cuff tear and cuff tear arthropathy. Rheumatoid arthritis of the shoulder may be amenable to RTSA. The most important prerequisite is appropriate glenoid bone stock. In elderly patients with acute 3- and 4-part fractures, the overall results are comparable to hemiarthroplasty, although they appear to depend less on tuberosity healing than those of hemiarthroplasty. Despite the striking improvement in pain, forward flexion, and Constant score, revision surgery with RTSA is rife with complications, and results are inferior to those obtained for other indications. Complications: The complication rate of RTSA is approximately 3 times that of conventional arthroplasty. Deep infection has been shown to occur in 5% of primary RTSAs. This could be due to the potential space that is created by the design of the implant. Glenoid loosening has been observed in 4% of prostheses followed for 2 years. Inferior scapular notching is common, may be prevented by placing the glenoid component in a caudal position, and has uncertain clinical ramifications. Instability has been demonstrated in 3.4% of primary cases of RTSA. Instability occurs anteriorly when the arm is positioned in extension and internal rotation.

Conclusions: Despite the high complication rate associated with RTSA, it is a powerful tool in shoulder surgery and offers restoration of function to patients who previously were not candidates for other treatments. Reviewer's Comments: This is an excellent review of a rapidly developing subject. Judicious patient selection and preoperative counseling on functional expectations are keys to this procedure. (Reviewer-Carl H. Wierks, MD).

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Keywords: Reverse Shoulder Arthroplasty

Print Tag: Refer to original journal article
No Significant Differences Between SR, DR Rotator Cuff Repair Techniques

A Prospective Randomized Clinical Trial Comparing Arthroscopic Single- and Double-Row Rotator Cuff Repair: Magnetic Resonance Imaging and Early Clinical Evaluation.

Burks RT, Crim J, et al:


This prospective randomized evaluation of single-row compared with double-row rotator cuff fixation did not show a significant difference in outcome in terms of clinical or MRI results.

Background: Double-row (DR) arthroscopic rotator cuff repair has become more popular, and some studies have shown better footprint coverage and improved biomechanics of the repair when compared to a single-row (SR) technique. Whether these new DR techniques are capable of delivering superior results compared with SR techniques has not been established.

Objective: To assess whether a DR rotator cuff anchor repair gives superior clinical and MRI results compared to an SR anchor repair.

Design: Randomized controlled trial; level of evidence, 1.

Participants/Methods: 40 patients (mean age, 56.5 years; range, 41 to 81 years) with full-thickness rotator cuff tears documented by MRI that were repairable with either a SR or DR rotator cuff repair technique were included in the study. None of the patients had undergone prior surgery or had a tear of the subscapularis. Patients were randomized to either SR or DR rotator cuff repair at the time of surgical intervention. SR repairs were performed using simple sutures and double-loaded anchors. DR repairs had the lateral row performed in a similar fashion as the SR repairs, and the medial row was repaired with a diamond pattern of double-loaded anchors using a horizontal mattress. Patients were followed with clinical scores (UCLA, Constant, Western Ontario Rotator Cuff Index [WORC], Single Assessment Numeric Evaluation [SANE], American Shoulder and Elbow Surgeons [ASES]), as well as range of motion, internal rotation strength, and external rotation strength. MRI studies were performed on each shoulder preoperatively, and then 6 weeks, 3 months, and 1 year after repair.

Results: Mean anteroposterior tear size by MRI was 1.8 cm. No patients were lost to follow-up, and all completed the 1-year evaluation. A mean of 2.25 anchors for SR and 3.2 for DR were used. There were 2 re-tears at 1 year in each group. There were 2 additional cases that had severe thinning in the DR repair group at 1 year. MRI measurements of footprint coverage, tendon thickness, and tendon signal showed no significant differences between the 2 repair groups. At 1 year, there were no differences in any of the postoperative measures of motion or strength. At 1 year, mean WORC, Constant, ASES, UCLA, and SANE scores showed no significant differences between groups.

Conclusions: No clinical or MRI differences were seen between patients repaired with a single-row or double-row rotator cuff repair technique.

Reviewer's Comments: This study is limited by its small sample size (n=40), short follow-up (1 year), and inclusion of mainly small to medium sized tears. It would be interesting to see if the results were the same if a transosseous equivalent double-row repair was studied, and if larger tears comprised a greater percentage of those repaired. (Reviewer-Adam J. Farber, MD).

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Keywords: Rotator Cuff Anchor Repair

Print Tag: Refer to original journal article
Recurrence Trauma Most Common Cause of RRACL Repair Failures

Repeat Revision of Anterior Cruciate Ligament Reconstruction: A Retrospective Review of Management and Outcome of 10 Patients With an Average 3-Year Follow-Up.

Wegrzyn J, Chouteau J, et al:

In this study, there was a 70% good to excellent outcome result in repeat revision anterior cruciate ligament reconstruction.

**Background:** ACL reconstruction outcomes are generally successful in terms of restoration of stability and return to sports. However, the published failure rate is as high as 10% to 25%.

**Objective:** To describe management and outcomes of repeat revision ACL reconstruction (RRACL), ie, 2 revisions after a primary reconstruction.

**Methods:** From February 2003 to November 2006, 10 consecutive patients had RRACL due to failed ACL reconstruction. Failure was defined as recurrent instability and/or pain with ADLs or sports and recurrent laxity (2+ or 3+ Lachman test, positive pivot shift, and >5 mm side-to-side difference on KT-1000 measurement). Average age was 30 years (range, 17 to 48 years). Clinical and radiographic analyses were performed on all patients with a minimum 12-month follow-up after second ACL revision. Objective laxity was assessed using KT-1000 arthrometer, and IKDC scores were obtained 12 months after primary ACL reconstruction, 6 months after first revision, and at latest follow-up of second revision. Radiographs, CT scans, and MRIs were reviewed for osteoarthritis, tunnel placement, tunnel osteolysis/bone quality, additional meniscal and ligamentous injuries, as well as articular cartilage. Intraoperative data were also taken including graft choice/fixation and meniscus/cartilage status. All complications were noted. Originally, ACL rupture was isolated in 9 cases and associated with LCL rupture in 1. Primary grafts included 6 BPTBs, 3 hamstrings, and 1 synthetic. Isolated ACL ruptures were found in all primary and secondary revisions. Femoral tunnels were redirected in 2 cases and the tibial tunnel in 3 cases.

**Results:** Average follow-up after second revision was 38 months (range, 12 to 61). After the second revision, IKDC outcomes were good or excellent in 7 cases (70%). Only 2 patients returned to previous sporting activity level. Four patients had lower levels and 4 discontinued sports. Two patients (20%) had a 1+ Lachman and none had rotational laxity at latest follow-up. The KT-1000 average difference was 1.3 ± 1.9 mm and 1 patient had >5 mm difference. On radiograph, no patients had tibiofemoral or patellafemoral signs of osteoarthritic evolution, and tunnel positioning was correct in all cases after the second revision. Medial meniscus tears were seen in 8 cases and lateral meniscus tears in 3 cases. Articular lesions were seen in 7 cases (6 MFC, 1 LFC). No intraoperative or immediate postoperative complications were observed.

**Conclusions:** RRACL reconstruction resulted in 70% good to excellent results. Recurrent trauma was the most common cause of failure. As expected, the incidence of meniscus tears increased with successive ACL reconstructions (P=0.016) as well as the incidence of articular cartilage injury (P=0.0197). Bad IKDC outcomes scores were seen in patients with severe degenerative lesions (grade III or IV ICRS). I recommend it to all surgeons performing ACL reconstructions. (Reviewer-Mark Clough, MD).

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Keywords: Repeat Revision Anterior Cruciate Ligament Reconstruction

Print Tag: Refer to original journal article
The majority of patients with cam or mixed femoroacetabular impingement are able to return to pre-symptom level of sports activity after arthroscopic osteoplasty.

**Background:** Patients with femoroacetabular impingement (FAI) are being increasingly treated with hip arthroscopy and osteoplasty and/or rim recession and labral repair.

**Objective:** To investigate the ability of FAI patients to return to sporting activity after arthroscopic hip osteoplasty.

**Participants/Methods:** 53 consecutive patients (41 male, 12 female) with cam or mixed FAI were prospectively analyzed. Mean follow-up was 2.4 years (range, 2.0 to 3.2). Average age was 42 years (range, 17 to 66). All were recreational athletes with unilateral hip pain and positive impingement test. All patients were treated with arthroscopic head-neck osteoplasty and those with mixed type had acetabular rim trimming. Forty-one patients had labral resection as well. Level of sport activity was accessed with the sports frequency score (SFS). Patients were also evaluated with visual analog pain scale (VAS), hip range of motion, nonarthritic hip score questionnaire (NAHS), and alpha angle. Postoperatively, patients were allowed weightbearing as tolerated. To prevent heterotopic ossification, indomethacin was given 3 times a day for 3 weeks. No high-impact sports were allowed in the first 3 months postoperatively.

**Results:** Most patients analyzed participated in sports regularly before surgery (45 of 53). The onset of hip pain reduced their activity. Four of those 45 patients were able to maintain sporting activity preoperatively despite symptoms. At last follow-up, 31 patients had returned to full accustomed level of sports activity, and the mean SFS increased from 0.78 to 1.84 (\(P<0.001\)). Internal rotation increased from 6° (range, -20 to 45°) to 19° (range, -5 to 45°; \(P<0.001\)). Flexion improved from 107° (range, 60 to 130°) to 122° (range, 70 to 145°; \(P<0.001\)). The alpha angle, VAS, and NAHS also significantly improved (all \(P<0.001\)). Eight patients has residual positive impingement but were able to return to sports. Postoperative sports activity level (SFS) directly correlated with the clinical outcome measures of pain and function.

**Conclusions:** 68% of patients with cam or mixed FAI who underwent arthroscopic osteoplasty were able to return to previous sports activity level. The mean postoperative SFS (activity) was slightly lower (1.84) than ‘normal’ (2.0) on the SFS scale.

**Reviewer’s Comments:** The question of whether or not sporting activity can be resumed after surgery is a common one. This paper answers the question for patients involved in recreational sports. The most common sports returned to in this study were biking, hiking, swimming, and fitness/aerobics. There were several limitations of this study including lack of a control group, but I think it allows surgeons to quote data that will be helpful to patients when contemplating surgery. (Reviewer-Mark Clough, MD).

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Keywords: Femoroacetabular Impingement

Print Tag: Refer to original journal article
Nailing midshaft clavicle fractures using titanium elastic nails is associated with numerous problems and complications. The complication rate in this study is dramatically higher than previously reported in the literature.

**Background:** Clavicle fractures that require operative management have historically been treated using plate fixation. Intramedullary nailing using titanium elastic nails (TENs) has been advocated for its ease, non-invasiveness, and early return to activity.

**Objective:** To evaluate operative management of clavicle fractures with intramedullary nailing using TENs.

**Participants/Methods:** 34 patients were treated with TENs. The nail was inserted lateral to medial. Full range of motion was allowed postoperatively. In 15 of 34 patients, an end cap was used due to protocol change because of medial nail migration and insertion site pain in the first group initially treated with TENs alone. The implant was removed after evidence of fracture healing (average, 4.5 months). Patients were evaluated using the American Shoulder and Elbow Surgeons (ASES) questionnaire and Disabilities of the Arm, Shoulder, and Hand (DASH) score. Mean follow-up was 32 months.

**Results:** In 21 of 34 (62%) patients, open reduction was necessary. Factors prohibiting closed reduction were investigated and included modification of the TEN tip (flattening or bending), fracture type, and presence of transverse fracture fragments. There was no difference in the open reduction rate in the normally curved TENs group (n=20; 64%) and the flattened TENs group (n=14; 60%). Type A, B, and C fractures did not show any statistically significant difference in open reduction rate. Transverse fracture fragments were present in 24 of 25; therefore, no comparison was made to horizontally aligned fragments. Postoperative radiographs showed laterodorsal TEN penetration in 4 cases (12%). ASES scores were 97.3 ± 3.95 (range, 85 to 100) and DASH scores were 1.5 ± 3.24 (range, 0 to 12.5) at mean follow-up. The end cap group showed no medial migration (0 of 12), versus 7 of 18 without (39%; \( P < 0.05 \)), and had significantly less medial pain (\( P < 0.05 \)). Complications included 7 medial perforations with 1 recurrent brachial plexus palsy, 7 lateral penetrations, 1 TEN breakage, and 1 complete TEN dislocation. Seven additional patients had pain issues. Taken together, there was a 70% complication rate that is reduced to 49% if complications are further stratified into major and minor. Mean operative time was 44 minutes with an average fluoroscopic time of 9 minutes. There was a 36% reoperation rate.

**Conclusions:** This study demonstrates that nailing midshaft clavicle fractures using TENs is associated with numerous problems and complications. The complication rate in this study is dramatically higher than previously reported in the literature (23%). The authors make several technical recommendations including a low threshold to open reduction. They also recommend limiting range of motion for the first 3 weeks, especially in type B and C fractures.

**Reviewer's Comments:** I wonder if results would have differed if a posterior lateral incision and entry site into the clavicle had been used in addition to a postoperative period of immobilization. Caution should be used with this technique even though patients do fairly well as indicated by pain reduction and range of motion. (Reviewer-Mark Clough, MD).

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**Keywords:** Clavicle Fractures

Print Tag: Refer to original journal article
Is There a Genetic Risk for Rotator Cuff Pathology?

Evidence for an Inherited Predisposition Contributing to the Risk for Rotator Cuff Disease.

Tashjian RZ, Farnham JM, et al:


The data provided by this population database study suggest a hereditary pattern of rotator cuff disease.

**Background:** A genetic predisposition has been suggested to contribute to the risk for development of rotator cuff disease on the basis of observed family clusters of close relatives. No study to date has evaluated the familial clustering of rotator cuff disease on a population-based, multigenerational level.

**Objective:** To analyze familial relationships among individuals identified in the Utah Population Database with a diagnosis indicating rotator cuff disease.

**Methods:** The Utah Population Database contains combined health and genealogical data on >2 million Utah residents. CPT codes and ICD-9 codes entered in patient records were used to identify patients with rotator cuff disease. All patients included in the analysis had at least 3 generations of genealogical data. The authors tested the hypothesis of excess familial clustering or heritable predisposition to rotator cuff disease using 2 well-established methods: the Genealogical Index of Familiality and the estimation of relative risks in relatives. These methods were applied both to the overall study group and a subgroup of the study group diagnosed before age 40 years.

**Results:** There were 3091 patients with either rotator cuff surgery or tear diagnoses. A total of 652 patients were aged <40 years with either rotator cuff surgery or tear diagnoses. Although the overall Genealogical Index of Familiality showed a significant excess relatedness for individuals with rotator cuff disease \((P <0.001)\), the distance Genealogical Index of Familiality test showed that the excess relatedness observed was not significant when close relationships were ignored \((P =0.848)\), suggesting common familial effects that might be genetic, but might be environmental. When the 652 individuals whose rotator cuff disease exhibited itself before the age of 40 years were isolated, both the overall Genealogical Index of Familiality \((P =0.001)\) and the distance Genealogical Index of Familiality \((P =0.004)\) tests showed that significant excess relatedness was observed. These results strongly suggest a heritable contribution to predisposition to early rotator cuff disease. The relative risk of rotator cuff disease in relatives of patients diagnosed before age 40 years was significantly elevated for second-degree (relative risk, 3.66; \(P =0.0076)\) and third-degree (relative risk, 1.81; \(P =0.0479)\) relatives.

**Conclusions:** Observations of significant excess relatedness of patients and significantly elevated risks to both close and distant relatives of patients strongly support a heritable predisposition to rotator cuff disease.

**Reviewer’s Comments:** This study suggests that in the future, we may be able to identify candidate genes predisposing individuals to rotator cuff disease. Gene identification will possibly allow the development of improved treatments. (Reviewer-Adam J. Farber, MD).

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Keywords: Rotator Cuff Genetic Predisposition

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Late ACL Reconstruction Leads to Increased Risk of Cartilage, Meniscal Injury

Timing of Anterior Cruciate Ligament Reconstructive Surgery and Risk of Cartilage Lesions and Meniscal Tears.

Granan LP, Bahr R, et al:

The odds of a cartilage lesion developing in the adult anterior cruciate ligament (ACL)-deficient knee increase by nearly 1% for each month that elapses from the injury date until time of ACL reconstruction.

**Background:** There is inadequate evidence to determine when to perform surgery on anterior cruciate ligament (ACL)-deficient knees.

**Objective:** To study the association between the timing of ACL reconstruction and the risk of having meniscal tears and cartilage lesions in the ACL-injured knee.

**Participants/Methods:** All patients registered in the Norwegian National Knee Ligament Registry who had undergone primary ACL reconstruction from 2004 through 2006 were reviewed. Patients were divided into 3 different age groups according to age at time of surgery: children (age ≥16 years), young adults (age 17 to 40 years), and older adults (age ≥41 years). Logistic regression analyses were used to estimate the relationship between time from injury until ACL surgery and the risk of meniscal tears or cartilage lesions.

**Results:** 3475 patients, of which 1977 (57%) were male and 1498 (43%) female, with a mean age of 27 years (range, 12 to 67) were included in the analysis. Median time from injury to surgery was 7 months (range, 9 days to 482 months). There were 909 patients (26%) with cartilage lesions, 1638 patients (47%) with meniscal tears, and 527 patients (15%) with both cartilage and meniscal lesions. The odds of a cartilage lesion in the adult knee (age >16 years) increased by 1.006% for each month that elapsed from injury to surgery. The cartilage in young adults (age 17 to 40 years) deteriorated further with an increase in odds of 1.03% related to the aging in years of the patient. The odds for meniscal tears in young adults increased by 1.004% for each month that elapsed since injury. Presence of a cartilage lesion increased the odds of having a meniscal tear by between 1.6 and 2.0 in all patient groups.

**Conclusions:** The odds of a cartilage lesion in the adult knee increased by nearly 1% for each month that elapsed from the injury date until the surgery date, and that of cartilage lesions were nearly twice as frequent if there was a meniscal tear, and vice versa.

**Reviewer's Comments:** This study is limited by the fact that the data in the registry are dependent upon the individual surgeon submitting the data. In addition, it is impossible to distinguish asymptomatic cartilage and/or meniscal lesions that occurred at the time of ACL injury from those that occurred subsequently. In addition, this registry is not able to account for the potentially confounding variables of patient age and activity level. Nevertheless, this study gives clinicians some statistics that can be used to inform patients who may be considering delaying ACL reconstruction about the possible risks. (Reviewer-Adam J. Farber, MD).

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Keywords: Time to Anterior Cruciate Ligament Reconstruction

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Fixation with a suture button may be an acceptable alternative to screw fixation for treatment of isolated ligament injuries, providing initial reduction of diastasis equivalent to that provided by a screw.

**Background:** Successful anatomical reduction is necessary for an optimal outcome following the repair of Lisfranc injuries. The disadvantages of screw fixation include the need to remove the screws, articular damage to the involved joints, and the potential for screw breakage.

**Objective:** To compare the stability provided by a suture button with that provided by a screw when used to stabilize the diastasis associated with a Lisfranc ligament injury.

**Design:** Cadaver experimental study.

**Methods:** 14 paired cadaver feet were used. Three registration screws were placed in the medial cuneiform and the second metatarsal to facilitate diastasis measurement. All measurements were taken while applying a 35-kg load. The intact distance between the screws was recorded and then the Lisfranc ligament was sectioned. A 3.0-mm drill hole was made from the base of the second metatarsal to the medial cuneiform, and either a 3.5-mm cannulated lag screw or a suture button (TightRope repair kit; Arthrex, Naples, Florida) was placed after the diastasis was reduced with a bone clamp. Each construct was tested with and without loading.

**Results:** No significant difference was found between suture-button fixation and screw fixation ($P=0.5$). The cut, unfixed condition was significantly different from the screw fixation condition ($P=0.0001$), with a difference between means of 1.2 mm. The cut, unfixed condition was significantly different from the suture-button fixation condition ($P=0.0008$), with a difference between means of 1.0 mm.

**Conclusions:** The fixation with a suture button may be an acceptable alternative to screw fixation in the treatment of isolated ligament injuries, providing initial reduction of diastasis equivalent to that provided by a screw. A suture provides a non-rigid anatomical reduction that may be more functionally similar to the natural Lisfranc ligament than a rigid screw is. It may continue to function in place of the Lisfranc ligament if the ligament fails to heal. In addition, subsequent surgery to remove hardware before weight-bearing, as well as the problems associated with screw breakage, can be avoided.

**Reviewer’s Comments:** This was a well-designed cadaver study. It is appealing to use a fixation method that does not require subsequent removal. Even though the initial stability of the suture button appears similar to that of a screw, I wonder if it would be rigid enough to support biological healing of the Lisfranc ligament.

(Reviewer-Carl H. Wierks, MD).

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Keywords: Lisfranc Ligament Injury

Print Tag: Refer to original journal article
Patients with relatively good ankle range of motion tend to have better outcomes after reconstruction, whereas those with limited motion benefit more from total ankle arthroplasty or arthrodesis.

**Discussion:** Posttraumatic osteoarthritis is the leading cause of ankle arthritis, a debilitating condition that usually occurs in a younger patient population. Rotational ankle fractures are the primary type of injury leading to posttraumatic ankle arthritis. Distal fibular corrective osteotomy protects the progression of established ankle arthritis. **Effect of Fibular Fracture on Ankle Stability:** The distal fibula accommodates ankle motion by laterally translating 1 to 2 mm and externally rotating during ankle dorsiflexion. Small fibular displacements lead to significantly increased tibiotalar contact pressures. In the case of concomitant deltoid ligament disruption, anatomic reduction of the distal fibula provides stability by restoring the articular configuration of the tibiotalar joint. **Diagnosis:** Patients may present with insidious, progressive pain, often with swelling after activity. Pain may be intermittent or vague. Cortical irregularities or callus may be clues seen on standard radiographs. Markers for instability include asymmetry of the clear spaces on the mortise view, talar subluxation, and talar tilt >2 mm. Appropriate fibular length can be observed with an intact Shenton line of the ankle and an unbroken curve between the lateral talus and the peroneal groove of the fibula. **Management:** Not all distal fibular malunions are symptomatic. Nonsurgical management may be best for patients with acceptable levels of discomfort and low demands. Patients with relatively good ankle range of motion (>5° dorsiflexion and >15° plantar flexion) tend to have better outcomes after reconstruction, whereas those with limited motion benefit more from total ankle arthroplasty or arthrodesis. **Distal Fibula Reconstruction:** The authors' preference is to base the level of the fibular osteotomy on the stability of the syndesmosis. If the syndesmosis is stable, a low oblique osteotomy is made. This allows for manipulation without iatrogenic syndesmotic destabilization. For malunions with syndesmotic injury, a transverse osteotomy above the level of the syndesmosis is used. A tibial autograft may be placed in the space between the fibula ends created by the distraction. **Postoperative Treatment:** Non-weight-bearing is maintained for 6 to 10 weeks. CT scans may be used to follow healing. **Results:** Good and excellent clinical outcomes have varied from 67% to 92% at short to intermediate follow-up.

**Reviewer's Comments:** This is a useful article to read if you have a patient with a fibular malunion. I learned new radiographic criteria to look for when evaluating a malunion, specifically the Shenton line of the ankle and the curve between the lateral talus and the peroneal groove of the fibula. I also learned that the level of the fibular osteotomy should be based on the stability of the syndesmosis. (Reviewer-Carl H. Wierks, MD).