Electromechanical Delay of the Knee Flexor Muscles Is Impaired After Harvesting Hamstring Tendons for Anterior Cruciate Ligament Reconstruction.

Ristanis S, Tsepis E, et al:


There is significant electromechanical delay in the hamstrings 2 years after ACL reconstruction using autologous semitendinosus and gracilis tendons.

**Objective:** To determine the effect on hamstring function in anterior cruciate ligaments (ACLs) reconstructed with semitendinosus (ST) and gracilis (G) tendons.

**Design:** Case-control study.

**Participants:** The study group was comprised of 12 patients 2 years after ACL reconstruction with quadruple-strand ST and G hamstring autograft. This group had no concomitant injuries to their knees.

**Methods:** Patients underwent isokinetic testing with a Biodex dynamometer with surface EMG electrodes. Each subject was asked to perform a maximally isometric contraction on cue with 1-minute rest between contractions. These same patients underwent similar testing of their normal contralateral leg. Additionally, 12 healthy individuals matched for age, size, gender, and activity level were selected as a control group and underwent similar testing.

**Results:** The 12 study individuals had a successful reconstruction, with a maximum manual displacement on KT-1000 side-to-side difference of 1.3 mm. They had a median Lysholm score of 92, a Tegner score of 7, and an International Knee Documentation Committee score of normal. The reconstructed knee had electromechanical delay (EMD) in the ST and the biceps femoris compared to the contralateral leg. The EMD for the ST in the reconstructed knee was 0.112 ± 0.037 seconds compared to 0.087 ± 0.031 seconds in the contralateral knee. The EMD for the biceps femoris was 0.106 ± 0.043 seconds in the reconstructed knee compared to 0.083 ± 0.033 seconds in the contralateral leg. Similar differences were noted between the reconstructed knee and the healthy controls.

**Conclusions:** 2 years after successful ACL reconstruction with hamstring autograft, patients continued to demonstrate EMD in the hamstrings of their reconstructed knee.

**Reviewer’s Comments:** The authors did a similar study in patellar bone-tendon-bone reconstructed patients, looking at EMD in the extensor mechanism, but they found none. Because the authors demonstrated delay in the biceps femoris muscle tendon group, the delay was more than just post-surgical scarring suspected in the ST. Was the EMD clinically significant? The hamstrings are ACL agonists, and delays have been indicted as a risk factor for ACL injury. Can the EMD be successfully rehabilitated? (Reviewer-John H. Wilckens, MD).

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Keywords: Hamstring, ACL Reconstruction

Print Tag: Refer to original journal article
Massive, retracted rotator cuff tears can produce a traction neuropathy of the suprascapular nerve, contributing to their symptomatology.

**Objective:** To review the anatomy, pathophysiology, diagnosis, and treatment of suprascapular neuropathy.

**Design:** Review article. **Anatomy & Pathophysiology:** The suprascapular nerve provides motor innervation to the supraspinatus and infraspinatus muscles. It also provides sensory input to the acromioclavicular and glenohumeral joints and coracoacromial ligament. It traverses laterally through the suprascapular notch under the transverse scapular ligament. The suprascapular artery and vein pass over this ligament. At this point, the nerve is just 3.0 cm medial to the supraglenoid tubercle. After innervating the supraspinatus muscle, the nerve continues laterally through the spinoglenoid notch under the spinoglenoid ligament, 2 cm medial to the glenoid rim, innervating the infraspinatus muscle. The nerve is particularly sensitive to traction and compression at the suprascapular and spinoglenoid notches. In addition to scapular fracture, repetitive vigorous overhead activity can kink, rub, or stretch the nerve. Perilabral cysts can compress the suprascapular nerve. Suprascapular neuropathy can be seen in scapular and rim fractures, rotator cuff tears, labral tears, and shoulder instability.

**Diagnosis:** Patients with suprascapular neuropathy may have pain and/or weakness. Sometimes the neuropathy may be latent. In addition to the dull ache laterally and posteriorly, pain can radiate to the neck and lateral arm, and be made worse with internal rotation and cross-over adduction. In patients with demonstrative atrophy and/or weaknesses of the infraspinatus and/or the supraspinatus muscle, the weakness is dependent on the location of the injury (above or below the spinoglenoid notch). MRI and EMG/nerve conduction velocity are the most productive additional tests to help identify and locate the origin of the suprascapular neuropathy.

**Treatment:** Most stretch injuries to the scapular nerve will resolve, although they may take up to 12 months. While compression lesions to the suprascapular nerve can be initially treated nonoperatively, if symptoms have persisted for >6 months, surgical treatment is recommended to minimize permanent injury to the nerve. Surgical treatment consists of decompression of the nerve at the area of entrapment. Historically, this has been done with an open decompression, but advance arthroscopic skills allow some surgeons to decompress the nerve arthroscopically. Additional portals are needed in addition to knowing the anatomy of this area. Compressive lesions from periarticular labral cysts can be aspirated with a higher recurrence rate than arthroscopic cyst decompression and labral tear repair. While repair of massive, retracted rotator cuffs should un-kink the suprascapular nerve, persistent neuropathy symptoms may justify further work-up and treatment.

**Conclusions:** Suprascapular neuropathy is not an uncommon cause of shoulder symptoms that may coexist with other shoulder pathologies.

**Reviewer’s Comments:** The authors provide a simple-to-read and easy-to-understand review of suprascapular neuropathy. They summarize their work in a nice algorithm to help diagnose and manage these patients. I recommend this excellent article to any surgeon taking care of shoulder complaints. (Reviewer-John H. Wilckens, MD).
Total knee arthroplasty allows golfers to continue to enjoy golf after surgery.

**Objective:** To determine the effect of total knee arthroplasty (TKA) on a golfer's return to the game.

**Design:** Case series.

**Methods:** 1630 consecutive patients who underwent TKA over a 5-year period were identified. The authors sent surveys to these patients to determine activity level and sport participation after TKA; 151 patients identified themselves as active golfers. These patients underwent a second survey of 33 questions detailing the patient's participation in golf, including time to return to play, change in handicap, frequency of rounds, and use of a cart.

**Results:** 62% of the golfers responded to the survey. Demographically, the average age at TKA was 66 years (range, 44 to 79 years). Mean time from surgery to survey was 8.7 years (range, 6 to 12 years); 80% of the responders were male. Before TKA, 13% of the patients reported no pain while golfing compared to 86% after TKA. Average knee survey score was 44 (range, 10 to 50), with a function score 83 (range, 45 to 100). Most of the responders (91%) had played golf at least 10 years, with 66% reporting playing for >20 years. Only 2% of patients picked up golf after their TKA. Fifty-seven percent returned to golf within 6 months of their TKA. Sixty percent of the golfers continued to play as much golf as they did before TKA, 21% played more golf, and 19% played less golf than before surgery. In the immediate 12 months before responding to the survey, 33% played once a month or less; 36% played 2 to 7 times per month, and 31% played >8 times a month. Sixty-nine percent responded that TKA did not change their handicap, whereas 10% actually improved their handicap. Twenty-eight percent felt that their driving and fairway woods were easier after TKA, and 20% found their driving and sand play harder. Sixty-two percent could drive the ball the same, and 10% could drive it further after TKA. Thirty-one percent of the responders received specific golf advice from their surgeon. Of those who gave advice, 59% recommended restricting walking. Before surgery, 28% walked the course compared with only 14% after TKA. Fifty-four percent of the golfers enjoyed the game just as much after surgery, and 40% enjoyed it more.

**Conclusions:** TKA allows golfers to continue to play and enjoy the game of golf as much as they did before surgery.

**Reviewer's Comments:** This was a very enjoyable article with a lot of useful information to share with golfers who are considering TKA. The authors found it interesting that surgeons generally advised their patients to walk after TKA. Walking the course provides some cardiac exercise and has improved health benefits. The golf swing places more forces across a TKA than walking. While there are many reasons for a golfer to use a cart, TKA should not be one of them. (Reviewer-John H. Wilckens, MD).

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Keywords: TKA, Golf, Exercise

Print Tag: Refer to original journal article
Hip Arthroscopy -- Poor Prognostic Sign in Athletes Undergoing Hip Arthroscopy

Hip Arthroscopy in Athletes. 10-Year Follow-Up.
Byrd JWT, Jones KS:


Hip arthroscopy for sports-related hip pathology provides durable good long-term results except for arthritis.

Objective: To review the long-term results of hip arthroscopy in athletes.

Design: Case series.

Participants/Methods: The author identified 50 patients who underwent hip arthroscopy with a minimum of 10-years of follow-up. Of these 50 patients, 15 presented with hip symptoms during athletic activity. These patients underwent 3-portal supine hip arthroscopy of the central or intra-articular portion of the hip joint. Postoperatively, patients underwent early range of motion and weight bearing as tolerated, usually needing crutches for 7 days. After 2 months, patients were allowed a gradual return to athletic activity. Patients were followed up at 1, 3, 12, 24, 60, and 120 months with exam and a modified Harris hip score.

Results: Of the 15 patients (11 men, 4 women) who developed hip symptoms with sporting activity, the average age was 31.7 years (range, 14 to 70 years). Nine patients were recreational athletes, 4 were high school athletes, and 2 were college athletes. The most common sports that caused hip symptoms included football (3), tennis (3), basketball (2), and golf (2). Diagnoses included chondral injury (8), labral tear (7), arthritis (5), loose body (1), synovitis (1), and avascular necrosis (1). There was 100% follow-up on all 15 patients at 10 years. Mean modified hip score preoperatively was 51 points (range, 18 to 96). At final follow-up, the score was 96 (range, 81 to 100), a median overall improvement of 45 points. Of the 15 patients, 13 were able to return to their previous level of sport at a mean of 3 months postoperatively. However, 2 patients did not return to sports activity for 4 years. One patient had recurrent symptoms and underwent 2 additional procedures. Five patients underwent total hip arthroplasty (THA) at an average of 73 months (range, 4 to 119 months) after initial hip arthroscopy. All 5 of these patients had arthritic changes noted at the time of hip arthroscopy. There were no complications in this cohort of 15 patients.

Conclusions: Hip arthritis is a poor prognostic sign in athletes undergoing hip arthroscopy.

Reviewer’s Comments: This is a review of an experienced hip arthroscopist’s earliest patients with at least 10 years of follow-up. Early hip arthroscopy addressed mechanical, central region causes of pain. According to the modified Harris hip score, these early patients did very well if they did not have arthritis. The authors appropriately state that modified hip score may not be the best or most sensitive measure of hip function in athletes. With the evolution of hip imaging and arthroscopic techniques, it is important to determine if similar improvement in hip function can be realized with symptomatic femoral acetabular impingement. I would also point out that the senior author is an experienced pioneer in hip arthroscopy. (Reviewer-John H. Wilckens, MD).

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Keywords: Hip Arthroscopy, Athletes, Arthritis

Print Tag: Refer to original journal article
What Is Role of PRP in ACL Reconstructions With Allograft?

Has Platelet-Rich Plasma Any Role in Anterior Cruciate Ligament Allograft Healing?
Nin JRV, Gasque GM, et al:

Arthroscopy 2009; 25 (November): 1206-1213

Administration of platelet-rich plasma does not appear to affect tendon healing in allograft ACL reconstruction.

**Background:** Platelet-rich plasma (PRP) contains a number of growth factors, including platelet-derived growth factor (PDGF), that have been shown to enhance healing. There has been increasing interest in using PRP in a number of orthopaedic applications. However, no level I studies have been performed showing the efficacy of PRP use.

**Objective:** To examine the effects of PRP use on the immediate and short-term outcomes of anterior cruciate ligament (ACL) reconstruction with allograft.

**Design:** Prospective, randomized, double-blind study (Level of Evidence, I).

**Participants/Methods:** 100 patients undergoing an ACL reconstruction with patellar tendon allograft were randomized into either a study group using PRP augmentation or a control group. All patients underwent ACL reconstruction with patellar tendon allograft. One hour before surgery, all patients had 40 mL of blood removed. This was centrifuged to allow for a highly increased platelet concentrate in serum. The mixture was then centrifuged again, and this concentrate was added to calcium chloride to activate growth factor release. A gel was ultimately formed. All ACL reconstructions were performed in a similar fashion, using patellar tendon allograft with cross-pin fixation. In the PRP group, the ligament was covered with gel and sutured over itself. The rest of the gel was placed inside the tibial tunnel after fluid flow had stopped. Postoperatively, all knees underwent an accelerated rehabilitation program. Patients were followed up at 3, 6, and 12 months postoperatively and then at yearly intervals. Patients were followed up with clinical examination and the International Knee Documentation Committee (IKDC) score. MRI was performed at 6 months to assess graft incorporation. Inflammatory measures, including C-reactive protein (CRP) and knee swelling, were assessed in the immediate postoperative period.

**Results:** Both groups were similar in their demographics, additional procedures performed, and follow-up. In the initial postoperative period, there were no significant differences in CRP or clinical signs of knee effusion. No significant differences were found in IKDC score, knee motion, KT-1000, or muscle torque at final follow-up. There were no differences in MRI evidence of graft healing between the 2 groups.

**Conclusions:** The authors found no benefit from PRP administration in ACL reconstructions with allograft patellar tendon.

**Reviewer's Comments:** This well-designed study shows that, with the techniques used, PRP administration did not demonstrate an effect on healing or biomechanical properties of ACL allograft reconstruction. It may be that there are no differences because PRP does not have an effect, or there may be other reasons. There may be other conditions in which healing is more of an issue than in ACL reconstructions (for example, rotator cuff repair). (Reviewer-Nathaniel P. Cohen, MD).

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Keywords: ACL Reconstruction, Platelet-Rich Plasma

Print Tag: Refer to original journal article
There are biomechanical differences in the various soft-tissue augmentation devices that are currently commercially available.

**Background:** There is an interest in using tissue augmentation for repair of chronic tendon tears. Current tissue augmentation devices include allograft, synthetic, and xenograft materials.

**Objective:** To evaluate the biomechanical properties of soft-tissue augmentation materials that are commercially available. The authors hypothesized that the devices would exhibit biomechanical differences.

**Design:** Laboratory study.

**Methods:** 7 commercially available soft-tissue augmentation devices were used: GraftJacket Max Force and GraftJacket Max Force Extreme (both acellular dermal matrix allografts); SportMesh (a knitted polyurethane fabric); OrthAdapt (a cross-linked equine pericardial xenograft); Allopatch HD 1 and 2 (allograft from fascia lata); and RC Allograft (freeze-dried rotator cuff allograft). All of the devices were cut into 2 x 5 cm strips. At least 9 specimens per device were tested. These were kept hydrated as per the manufacturers’ instructions. Specimens were tested in an Instron machine with 30 cycles from 5 N to 50 N at 12.5 mm/sec after a 5 N preload. A pull to failure was then performed. Displacement (both cyclical and permanent), the percentage of elastic displacement, stiffness, tensile modulus (stiffness normalized by graft thickness), and ultimate load-to-failure strength were recorded. In addition, the authors tested the retention strength of a simple vertical suture in the devices if there was enough material in a single pull to failure.

**Results:** Total elongation was statistically significantly greatest in the SportMesh. The GraftJacket MaxForce Extreme and the Allopatch HD 2 showed greater elongation than the RC Allograft. The percentage of elastic displacement did not vary between augmentation devices. Stiffness was greatest in the GraftJacket MaxForce Extreme and was significantly greater than in the 2 least stiff devices (OrthAdapt and SportMesh). The modulus of elasticity was highest in the OrthAdapt and was statistically greater than in the Allopatch HD 2, RC Allograft, and SportMesh. Load to failure was weakest in the OrthAdapt and SportMesh and was significantly less than that of the other devices. The GraftJacket MaxForce Extreme had the greatest suture retention strength, which was significantly greater than that of GraftJacket MaxForce, RC Allograft, SportMesh, and OrthAdapt.

**Conclusions:** There are biomechanical differences in the various soft-tissue augmentation devices that are currently commercially available.

**Reviewer’s Comments:** There is a great deal of controversy surrounding soft-tissue augmentation devices. They are used for either providing biomechanical stability or as scaffolds for ingrowth of tissue. Previous patches did not show any improvement in clinical outcomes after rotator cuff repair, although studies with the GraftJacket appear promising. There is a difference between the devices, although I am not sure which biomechanical property is the most important. My hunch is that stiffness will probably be the most important value for the repetitive loading seen with rotator cuff repair. (Reviewer-Nathaniel P. Cohen, MD).

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Keywords: Soft-Tissue Augmentation; Tendon Repair

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Ulnar styloid fractures do not affect subjective outcomes after ORIF of a distal radius fracture in the setting of a stable DRUJ.

**Background:** The management of ulnar styloid fractures associated with distal radius fractures is controversial, especially in the setting of a stable distal radioulnar joint (DRUJ).

**Objective:** To evaluate the outcomes of ulnar styloid fractures in the setting of open reduction internal fixation (ORIF) of distal radius fractures without DRUJ instability using validated patient-rated outcomes.

**Design/Participants:** This prospective cohort involved 144 consecutive distal radius fracture patients treated with ORIF using a volar locking plate.

**Methods:** After fixation of the distal radius, the DRUJ was examined for instability in the neutral, prone, and supine positions. Patients with an unstable DRUJ were excluded. Those without DRUJ instability had no treatment of any associated ulnar styloid fractures regardless of fragment size or displacement. The prospective cohort patients completed the Michigan Hand Outcomes Questionnaire (MHQ) at 6 weeks and at 3, 6, and 12 months. Postoperative therapy was the same for all patients and involved hand therapy starting at 1 week, the use of a removable splint, and active wrist range of motion. Ulnar styloid fractures, if present, had displacement and fragment size measured on the initial postoperative visit radiographs.

**Results:** 88 patients had associated ulnar styloid fractures; 56 patients did not. These 2 study groups did not significantly differ in demographic or injury characteristics. Using regression analysis, the presence of an ulnar styloid fracture, regardless of size or displacement, was not an independent predictor of MHQ score, adjusting for other covariates. Also, whether the styloid fracture went on to union or nonunion did not predict MHQ score.

**Conclusions:** Patient-rated outcomes are not affected by ulnar styloid fractures in those with a stable DRUJ after ORIF of a distal radius fracture with a volar locking plate.

**Reviewer’s Comments:** This prospective prognostic study does much to answer a clinically relevant question that has been controversial for decades. Some surgeons and authors have recommended fixation of ulnar styloid fractures based on the fragment size and/or displacement, regardless of the amount of DRUJ instability. This study suggests that, based on patient-rated outcomes, the presence of an ulnar styloid fracture may not be important in the setting of a distal radius fracture that has been treated with ORIF using a volar locking plate. This is in line with the algorithm that the majority of surgeons at our hand center use: if the DRUJ is stable after distal radius fixation, then ulnar styloid fractures are typically left alone. One weakness of the study, as pointed out by a commentary in the same journal, is that the definition of DRUJ instability is subjective, as it typically is in clinical practice. An agreed upon, objective, and perhaps radiographic criterion for determining DRUJ instability without the need for CT scan or other advanced radiographic techniques would be useful for clinical and research practices. Also, the study did not report any objective measures such as range of motion, strength, or distal radius radiographic parameters after fixation, although these are thought to have minimal effect on subjective patient outcomes. (Reviewer-Kenneth R. Means, Jr, MD).

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Keywords: Ulnar Styloid, Distal Radius Fractures

Print Tag: Refer to original journal article
Anterior lumbar surgery in obese patients results in a longer incision and time of surgery but does not increase the risk of perioperative outcome or complications.

**Background:** Obesity has recently become more prevalent among patients presenting with low back pain. Previous trials have established that obesity is a risk factor for higher complication rates in posterior lumbar surgery. No previous study has specifically looked at obesity and the anterior lumbar approach.

**Design:** Prospective review.

**Methods:** Consecutive patients undergoing anterior lumbar surgery were included in the study. All approaches were retroperitoneal and were performed by a single vascular access surgeon. The use of monopolar electrocautery was avoided in the retroperitoneal space. Patients with a body mass index (BMI) >30 kg/m² were considered obese. Intraoperative data and the rates of intraoperative and postoperative complications were recorded.

**Results:** 74 patients were included in the study; 33 were obese, and 41 were non-obese. Demographics, the number of operative levels, type of surgery, and location of the incision were similar in the 2 groups. There were more comorbidities in the obese group. Obese patients also had significantly longer duration of exposure and entire surgery, longer incision, and greater depth from skin to fascia and from fascia to spine. Total blood loss, postoperative narcotic use, time to ambulation, length of stay, and rates of perioperative complications were similar in both groups. There were 4 iliac vein lacerations, equally divided between groups. All lacerations were repaired primarily. There was 1 serosal tear in a non-obese patient, resulting in ileus lasting 6 days. No reports of deep venous thrombosis or retrograde ejaculation in male patients were seen.

**Conclusions:** Despite a longer duration of surgery and longer incision, obesity did not result in poorer perioperative outcomes after anterior lumbar surgery.

**Reviewer's Comments:** This study is the first to analyze perioperative outcomes in obese patients undergoing anterior lumbar surgery. The authors’ results are encouraging, suggesting that obesity does not pose additional risks during procedures involving this approach. The number of patients was not very large, however. The incidence of major complications in anterior lumbar approaches is quite small. With greater numbers of patients in each group, it would be easier to pick up differences in the incidence of major vessel, bowel, or ureteral injury. In addition, the surgeon involved in this study at the Hospital for Joint Diseases is very experienced with the procedure and has a meticulous technique. The results may be different in a community hospital, where such approaches are performed less often. Another study involving a larger number of patients and several approach surgeons is needed for definitive conclusions regarding the risks that obesity may cause during an anterior lumbar approach. (Reviewer-Vladimir Sinkov, MD).

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Keywords: Anterior Lumbar Approach, Obesity, Safety

Print Tag: Refer to original journal article
The most common organism causing infections in health care settings is *Staphylococcus aureus* at 30%. Thirty percent of the population is colonized with *S. aureus*. Four percent of health care workers are colonized with methicillin-resistant *S. aureus* (MRSA). There are 2 kinds of MRSA: community acquired and hospital acquired. Hospital-acquired MRSA seems to be more virulent. Modifiable risk factors are numerous. Rheumatoid arthritis is a modifiable risk factor. Drugs used may increase bleeding, which is a risk factor for infection. Corticosteroids can increase the risk of infection. HIV can also increase the risk of infection, especially if the CD4 count is <200 or the viral load is >10000/mL. Diabetes is well known to increase infection rates. This seems to be not only due to impairment of the patient’s underlying biology, but also because perioperative hyperglycemia may be a separate risk for infection. Poor preoperative nutrition is also a risk factor. Studies have shown that preoperative total lymphocyte count of <1500 mm3, serum albumin <3.5 mg/dL, or serum transferrin <226 can be associated with increased risk of surgical site infection (SSI). Preoperative nutritional supplementation should be considered. Vitamins A, C, zinc, and copper should be given at daily recommended levels. Obesity also increases the risk of infection, according to clinical research. A recent study put the increase at 6 times baseline for total knee replacement and 4 times baseline for total hip replacement. This factor is not modifiable in the short term but is in the medium to long term for elective procedures. This is something that patients should be informed about. Smoking also increases the risk of infection. Nicotine can increase microvascular vasospasm and cause tissue hypoxia. In addition, the carbon monoxide in cigarettes binds to hemoglobin to form carboxyhemoglobin. This has a high affinity for oxygen and can decrease tissue oxygen delivery. Preoperative staphylococcal nasal colonization increases the risk of a staphylococcal SSI by at least 2 times. Some surgeons have recommended the use of chlorhexidine baths for 5 days before surgery. Others have used topical mupirocin to the nares of carriers. It is not known whether screening and treating all patients can decrease the risk of SSI. Lower urinary tract infections preoperatively have been associated with an increased risk of deep wound infections in some but not all orthopaedic studies. Postoperative urinary infections have been associated with increased SSI in some, but not all, studies. **Reviewer's Comments:** In summary, SSIs seem to have numerous potential causes, potentiating factors, and opportunities for prevention. I enjoyed this article and found many pearls that can hopefully assist my patients. (Reviewer-Paul D. Sponseller, MS, MD).
Patient safety initiatives were actually begun by orthopaedic surgeons. The “sign your site” programs were first advanced by the Canadian Orthopaedic Association in 1993 and by the American Academy of Orthopaedic Surgeons (AAOS) in 1994. Rather than focusing on a specific type of medical error, the focus is on a systematic approach to care delivery. The most visible is the Joint Commission on Accreditation of Healthcare Organizations Universal Protocol (since 2005), which involves 3 components (patient identification, surgical site marking, and a time out). The North American Spine Society advocates a site marking for the spine (includes marking the back with the surgeon’s initials and the levels to be operated upon). Medical error was defined as an event that a respondent would not like to have happen again. In a survey of American and Canadian orthopaedic surgeons, 50% had experienced a medical error within their sphere of care in the prior 6 months, and 2% had experienced ≥3 events, with most of these errors occurring in the operating room. The most common error categories involved equipment in 30%, communication in 26%, and technical problems in 13%. The realization that the operating room is the most high-yield chance to limit medical errors led to the AAOS initiative, the “Highly Reliable Operating Room.” This will move away from the "name, blame, and shame" treatment of individuals to a team approach. It will also recommend a “crew” approach as a concept to allow any member of the team to speak up on quality or safety. It will also recommend using the World Health Organization operating room checklist, which involves a sign-in, time-out, and sign-out section. Sign-in involves identifying the patient, his/her consent, marking the site, and checking for allergies and airway problems. Time-out (prior to incision) involves confirmation of the procedure, position, and “checks,” such as thrombosis prophylaxis. Sign-out involves instrument and sponge counts and discussion of postoperative management plans.

Reviewer’s Comments: A systems approach to assuring that misses are minimized can ensure a reliable result for patients and surgeons. That seems to be what we are learning by applying standardized steps to clinical care. Patient safety has become a much discussed topic in the last decade. This symposium in the Journal of Bone and Joint Surgery American reviews the current status of patient safety and discusses the next steps. I reviewed this article because of the broad importance of this topic in the current medical arena. We still have room for improvement and must take the actions necessary for change for the good of our patients and our profession. (Reviewer-Paul D. Sponseller, MS, MD).

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Keywords: North America, Patient Safety

Print Tag: Refer to original journal article
Is There an Easier Solution for Obese Adolescents With Blount Dz?

Treatment of Adolescent Tibia Vara With Hemiepiphysiodesis: Risk Factors for Failure.
McIntosh AL, Hanson CM, Rathjen KE:

Adolescents with Blount disease have a high risk of hemiepiphysiodesis failure in the treatment of tibia vara if they are ≥14 years of age and have a BMI ≥45 kg/m2.

Objective: To assess the results of hemiepiphysiodesis for the treatment of tibia vara in adolescents.
Participants/Methods: All patients who had tibia vara after age 10 years treated with hemiepiphysiodesis and at least 2 years of follow-up at Texas Scottish Rite Hospital were followed to assess risk factors for failure. The surgery consisted of an open complete epiphysiodesis with bone curettage at least 1 cm of the growth plate of the proximal tibia laterally. Some patients also had hemiepiphysiodesis of the distal femur at the surgeon's discretion.
Results: The procedure was judged unsuccessful in 66% of cases using a final result of zone 1 or 2 as a measure of success. Risk factors for failure included age ≥14 years and body mass index (BMI) ≥45 kg/m2. On the whole, the medial proximal tibial and lateral distal femoral angles improved a few degrees for the entire series. The chance of success was also highly related to the medial axis deviation. Failures were "only" 25% for zones 1 to 2, 50% for zone 3, and 90% for zone 4. Angulation was a stronger predictor than age, as many failures occurred at all ages. Bilateral cases had a higher risk of failure. Race did not seem to be a predictive factor.
Conclusions: Body mass index, severity of angulation, and age appear to be predictive factors for success of hemiepiphysiodesis in adolescent Blount's disease. This procedure should be offered with care to patients having multiple risk factors or severe initial deformity. The authors caution that their study was limited by the variable inclusion of a distal femoral epiphysiodesis. They also state that a larger study size would be needed to give more precise guidelines for weight and severity.
Reviewer's Comments: This was an excellent study. The difference in patient morbidity, complications, and recovery between osteotomy of the proximal tibia and hemiepiphysiodesis is dramatic. This difference is magnified in the obese patient; even more so when the problem is bilateral. Many of these patients require a rehabilitation hospital stay after an osteotomy. This study begins to tell us that in patients presenting with a moderate axis deviation falling within the confines of the knee, with obesity short of the morbid category and a BMI <45, the chances of success may make a hemiepiphysiodesis worth doing. For patients with a less favorable profile, the chance of failure is >50% and it should be discussed whether the procedure is worthwhile. There are other techniques, such as guided growth with plates, that also merit separate study.
(Reviewer-Paul D. Sponseller, MS, MD).

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Keywords: Adolescent Tibia Vara, Hemiepiphysiodesis, Failure, Risk Factors

Print Tag: Refer to original journal article
The results of myelomeningocele, or spinal dysraphism, are still relatively common in our era, occurring in over 1:5000 live births in the United States. Myelomeningocele produces numerous sequelae in the skeletal system.

Objective: To review the prevalence of orthopaedic disorders and the options for treatment.

Design: Retrospective review of the author’s database as well as literature review; Level IV.

Methods: The spina bifida database at the author’s hospital in Heidelberg, Germany, was reviewed; the data covered 862 patients.

Results: The spinal problems seen were predominantly kyphosis and scoliosis. Some spine deformity was seen in over 80% of patients with levels above L3. Scoliosis was the most common. The authors recommend a thorough approach. Bracing does not work in this population and is poorly tolerated. The authors compared their results with posterior versus combined fusion. They recommend an anterior and posterior fusion with instrumentation of both approaches. This increased the fusion rate and overall correction percent. Final mean correction in the authors’ series was 50%, but this spanned several decades. It is also recommended to fuse to the sacrum in patients who have a curve extending into the distal lumbar region or who are rigid and require the extra distal cantilever force used to correct the spine. The authors recommend fusing the spine in some lordosis so that the seating surface is oriented properly. A focal thoracolumbar kyphosis called a gibbus is present in >5% of these children. It can be collapsing or very rigid. Rigid kyphosis can severely shorten the trunk. The effect of this is to place the ribs on the femurs, which can cause pressure sores and impair respiratory function. Bracing has a very poor record of control because of the posterior bony prominence and the risk of skin breakdown. The authors recommend the Warner and Fackler technique. This consists of inserting an intrasacral rod in the first sacral foramen on each side so that it rests on the anterior aspect of the sacrum. A few of the more rigid vertebral segments will need to be resected at the apex. Enough bone can be resected to allow the spine to straighten without tension. Fusion is done only over the apex so that the rest of the spine can continue to grow along the rods. They report 33 such procedures. There were 2 rod breakages and some infections in this series. The rod breakages were seen mostly in patients with significant residual kyphosis in the unfused segment, so the authors recommend restoring the sagittal plane as straight as possible.

Reviewer’s Comments: This was an interesting article that provided a very organized approach utilized by a center that sees a lot of these patients. It also reflects the changes over time. The current approach to the spine is probably more posteriorly-based in the U.S., but it would be interesting to see if this provides equivalent results. I recommend this to all who care for spina bifida patients. (Reviewer-Paul D. Sponseller, MS, MD).
Bone Void Fillers for Femoral Defects in Revision ACL Surgery?

Biomechanical Evaluation of a 1-Stage Revision Anterior Cruciate Ligament Reconstruction Technique Using a Structural Bone Void Filler for Femoral Fixation.

Vaughn ZD, Schmidt J, et al:

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In this biomechanical cadaveric study, using a calcium phosphate bone void filler in the setting of femoral tunnel widening during ACL reconstruction provides load to failure strength similar to that of native bone.

Background: The use of a calcium phosphate cements as bone void fillers may provide a possible solution to avoid staged revision anterior cruciate ligament (ACL) reconstruction in the setting of bone loss or tunnel malposition.

Objective: To evaluate the biomechanical properties of calcium phosphate cement as a structural bone void filler in the setting of femoral bone loss associated with revision ACL reconstruction.

Design: Biomechanical cadaveric study.

Materials/Methods: 11 matched pairs of fresh-frozen adult human cadaveric knees (n=22; age range, 43 to 65 years) were tested in this study. The intact ACL was removed from all knees, and a standard autologous bone-patellar tendon-bone (BPTB) graft was harvested. The control specimens were treated with autograft BPTB ACL reconstructions fixed with bioabsorbable interference screws. The contralateral knee of each pair had a large bone void created in the femur to simulate tunnel widening. This defect was filled with calcium phosphate cement (Callos Impact; Skeletal Kinetics, Cupertino, CA) and allowed to solidify. Then a standard femoral tunnel was drilled through the bone void filler and native bone; the BPTB graft was then secured with fixation identical to that of the control specimens. In all specimens, the tibia was removed, leaving only the ACL graft intact and fixed to the femur. All specimens were then potted and tested in an MTS machine for load to failure. Loading occurred in a vertical tensile fashion at 50 mm/minute until failure. Failure was defined as loss of fixation including pullout of the graft or interference screw, fracture of femur, or rupture of graft.

Results: There was no significant difference in the mean load to failure between the control group (312 N) and the calcium phosphate cement group (301 N) (P =0.80). There was no significant difference in the mean stiffness between the control group (39.5 N/mm) and the calcium phosphate cement group (39.1 N/mm) (P =0.50). All failures occurred at the femoral-sided bone block with destruction and fragmentation of the bone block itself; there were no instances of screw pullout or disruption of the structural bone void filler.

Conclusions: The calcium phosphate cement technique may allow surgeons to perform a single-stage revision ACL reconstruction in the presence of femoral tunnel widening and avoid the need for a staged procedure.

Reviewer's Comments: This study suggests that initial fixation strength provided by the calcium phosphate cement is similar to that of native bone. But, what happens in vivo during the incorporation process? In vivo animal studies and controlled clinical studies in humans are needed to validate the efficacy of this technique. In addition, as the authors stated, this study was underpowered to statistically prove equivalence of the 2 groups. (Reviewer-Adam J. Farber, MD).

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Keywords: ACL Reconstruction, Revision, Calcium Phosphate Cement, Tunnel Widening

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When compared to normal knees, single-bundle ACL reconstruction (with the femoral tunnel at either the 10 o'clock or the 11 o'clock position) is unable to restore tibial rotational kinematic values to normal during pivoting maneuvers.

**Background:** It has been proposed that a more horizontal placement of the graft can address abnormal rotational knee movement after a reconstruction of the anterior cruciate ligament (ACL).

**Objective:** To identify in vivo whether a more horizontal placement of the femoral tunnel during ACL reconstruction can restore knee rotational kinematics back to normal, during highly demanding dynamic activities.

**Participants/Methods:** 30 patients were evaluated in this study. Ten of the patients (mean age, 28 years) had previously undergone ACL reconstruction with a bone-patellar tendon-bone (BPTB) graft, with the femoral tunnel in the 11 o'clock position, 10 patients (mean age, 30 years) had previously undergone ACL reconstruction with a BPTB graft with the femoral tunnel in the 10 o'clock position, and 10 patients (mean age, 29 years) were healthy controls with no history of ACL injury or reconstruction. Kinematic data were obtained using an 8-camera optoelectronic system sampling at 50 Hz. This system was used to capture the movements of 15 reflective markers placed on selected osseous landmarks of the lower limbs and the pelvis. Tibial translation and rotation were evaluated while the patients performed 2 different maneuvers: (1) descending from a stairway, they made foot contact and then pivoted 90° on the landing and (2) jumping from a platform, landing with both feet on the ground, and pivoting 90° on the right or left lower limb.

**Results:** For both maneuvers, anterior tibial translation following ACL reconstruction was similar to translational values seen in the unaffected contralateral lower limbs and those in the control subjects regardless of the location of the femoral tunnel. However, ACL reconstruction, regardless of location of the femoral tunnel, was unable to restore tibial rotational stability during the dynamic activities evaluated compared to the unaffected contralateral lower limbs and those in the control subjects ($P <0.05$). When tibial rotation was compared between the 2 ACL reconstruction groups, positioning the femoral tunnel at the 10 o'clock position resulted in slightly decreased tibial rotation, but these differences did not reach statistical significance ($P >0.3$).

**Conclusions:** When compared to healthy controls or contralateral unaffected knees, ACL reconstruction (with the femoral tunnel at either the 10 o'clock or the 11 o'clock position) was unable to restore tibial rotational kinematic values during pivoting maneuvers.

**Reviewer's Comments:** This study is limited by the fact that the kinematic data rely on surface markers. Future gait analysis studies assessing single-bundle versus double-bundle reconstruction techniques would be interesting. (Reviewer-Adam J. Farber, MD).

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Keywords: ACL, Femoral Tunnel, Tibial Rotation, Kinematics, Gait Analysis

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Following an ACL injury, increased age, male gender, and increased surgical delay are all associated with an increase in both the frequency and the severity of injuries to the menisci and the articular cartilage.

**Objective:** "...to determine the association between patient sex, age at the time of surgery, and surgical delay (the time between an injury and anterior cruciate ligament [ACL] reconstruction) with the frequency and location of meniscus and articular cartilage lesions seen at the time of the ACL reconstruction."

**Design:** Retrospective database review.

**Participants/Methods:** 1104 patients (431 females and 673 males; mean age, 26 years, age range, 12 to 56 years) who underwent ACL reconstruction performed by a single surgeon between 1988 and 2002 were included in this study. No patient had other knee ligamentous injuries or prior ACL reconstruction surgery. Meniscal, chondral, and ligamentous pathology seen at the time of surgery was recorded on anatomic maps; these maps were retrospectively reviewed and correlated with patient demographic data obtained from the patient’s medical chart.

**Results:** Overall, 65% of the patients had documented meniscal injuries, and 43% had femoral chondral injuries. Gender, age, and time to surgery influenced the presence and location of both meniscal and chondral pathology. Meniscal injuries were more commonly found in male patients (71%) as opposed to female patients (56%) (P =0.0005). In addition, combined medial and lateral meniscal injuries were more common in male patients (20%) as opposed to female patients (11%) (P =0.002). High-grade (grades 3 and 4) chondral injuries of the medial femoral condyle were more common in male patients (49% vs 35%), but low-grade (grade 1) chondral injuries of the medial femoral condyle were more common in female patients (29% vs 16%). Both isolated lesions of the medial femoral condyle and multiple chondral lesions throughout the knee were more common in the older (≥25 years) patients (24.2% vs 13.3%; P =0.004 and 7.7% vs 1.3%; P =0.0001, respectively). After adjusting for age, patients who had a surgical delay of <3 months were less likely to have a medial meniscus injury than were those who had a longer delay (8% compared with 19%; P =0.0006). Time from injury to surgery >12 months was associated with an increased incidence of any chondral injury (60% vs 47%; P =0.003), a large chondral injury, and a grade-3 chondral injury of the lateral femoral condyle.

**Conclusions:** Meniscal and chondral injuries seen at the time of ACL reconstruction are more common in older patients, male patients, and patients with a longer duration from injury until surgery.

**Reviewer’s Comments:** This is a well-done study that provides a wealth of information. The data provided in this study are useful to understand when evaluating and interpreting other studies that do not address the role and influence of age, gender, and time to surgery. (Reviewer-Adam J. Farber, MD).
During ACL reconstruction, independent tunnel drilling produces more anatomic tunnels than does a transtibial drilling technique.

**Background:** In anterior cruciate ligament (ACL) reconstructive surgery, the femoral tunnel is commonly drilled via the tibial tunnel using a transtibial method. The placement of both tunnels can be compromised because of the coupled drilling of the tibial and femoral tunnels. Some authors recommend drilling the 2 tunnels independently.

**Objective:** To compare the ability of ACL grafts (produced by transtibial drilling and independent tunnel drilling) to recreate the anatomic insertions of the ACL and to restore translational and rotational stability of the knee.

**Design:** Controlled laboratory study.

**Materials/Methods:** 10 matched pairs of cadaveric knees (mean age, 67 years; age range, 36 to 88 years) underwent bone-patellar tendon-bone ACL reconstructions using either a conventional transtibial drilling method or an independent drilling method for drilling the femoral tunnel. One knee of a pair was reconstructed with the conventional transtibial drilling technique, and the opposite knee was reconstructed with the independent drilling technique, or both (R/L) assigned to either the conventional transtibial or independent were alternated between pairs of knees. The location of the femoral and tibial tunnels was recorded. Each knee underwent biomechanical tests with the ACL intact, removed, and reconstructed. An image-guided navigation system was utilized for measuring motions and directing tunnel placements for the independent drilling method. The system also measured knee flexion, anterior-posterior tibial translation, and internal-external tibial rotation.

**Results:** The transtibial drilling method was used to place 7 tibial tunnels in the posterior third of the tibial footprint and 3 tibial tunnels in the central third of the tibial footprint. The transtibial drilling method placed all 10 tunnels in the proximal third of the femoral footprint, which resulted in more ACL grafts that were more vertical than the native ACL. In contrast, the independently drilled tibial ($P<0.001$) and femoral ($P<0.01$) tunnels were more anatomic in their respective footprints and less vertical. Conventional transtibial reconstruction reduced anterior translation, but not to normal. In contrast, reconstruction by the independent drilling technique restored normal anterior translation for all loading conditions. Conventional transtibial reconstructions restored normal internal rotation with combined anterior force plus internal rotation, but not with internal rotation. Independent drilling reconstructions restored normal internal rotation for all loading conditions. **Conclusion:** During single-bundle ACL reconstruction, an independent drilling method can produce tunnels that position the ACL graft more anatomically and thus restore translational and rotational stability to the knee better than a graft produced by a transtibial drilling method.

**Reviewer's Comments:** This biomechanical study confirms the results of many previous such studies. Future clinical trials are needed to see whether these differences result in improved clinical outcomes and decreased failure rates. (Reviewer-Adam J. Farber, MD).

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Keywords: ACL Reconstruction, Transtibial Drilling, Independent Drilling

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Nonoperative treatment of distal biceps tendon ruptures can yield acceptable outcomes. Patients typically have reduced supination strength, but not necessarily functional limitations or weakness in elbow flexion.

**Background:** There is little information in the literature on the outcomes of nonoperative treatment of distal biceps tendon ruptures.

**Objective:** To assess the outcomes associated with distal biceps tendon ruptures treated by nonoperative measures.

**Design:** Retrospective case-series.

**Participants/Methods:** 18 patients (16 men and 2 women; median age, 50 years; age range, 35 to 74 years) with 20 distal biceps tendon ruptures were included in the study cohort. All patients were treated nonoperatively, either because they declined surgery (17 patients) or because of a delayed presentation (1 patient). Treatment consisted of physical therapy, including active and passive range-of-motion exercises, and, when tolerated, a strengthening program was added. Outcome measures included strength measurements (both supination strength and elbow flexion strength) and validated functional outcomes scoring systems (Broberg and Morrey Functional Rating Index, the Mayo Elbow Performance Index (MEPI), and the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire). A BTE machine was used to measure the isometric strength of forearm supination and elbow flexion in both upper extremities. Data were compared with historical controls compiled from numerous previously published series of patients treated with surgical repair.

**Results:** The median duration of follow-up was 38 months (mean, 59 months; range, 11 to 146 months). At final follow-up, the median supination strength of the injured arms was 63% (mean, 74%) when compared to the contralateral arm. This was significantly less than the supination strength of the historical control group that underwent surgical repair (median, 92% and mean, 101%; \( P =0.002 \)). At final follow-up, the median elbow flexion strength of the injured arm was 93% (mean, 88%) compared with the contralateral arms. This was similar to the elbow flexion strength of the historical control group, which underwent surgical repair (median, 95% and mean, 97%; \( P =0.164 \)). All patients had full range of motion with 1 exception that had underlying arthritis. Patients had satisfactory functional outcomes as measured by the validated scoring systems. The median score on the Broberg and Morrey Functional Rating Index was 85 (out of 100), the median MEPI score was 95 (out of 100), and the median DASH score was 9 (0 to 100, with lower scores being better). All patients returned to work and performed their pre-injury job without restriction (unless they had been previously unemployed or disabled). The median time to return to full duty was 7 weeks (mean, 12 weeks).

**Conclusions:** Nonoperative treatment of distal biceps tendon ruptures can yield acceptable outcomes. Patients typically have reduced supination strength, but not necessarily functional limitations or weakness in elbow flexion.

**Reviewer’s Comments:** This study is limited by its retrospective nature and lack of current controls. This information is useful in counseling patients who are nonsurgical candidates or those unwilling to undergo surgery. (Reviewer-Adam J. Farber, MD).

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Keywords: Elbow, Distal Biceps, Tendon Rupture, Nonoperative

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In the treatment of type II SLAP lesions, both standard suture anchor repair techniques and knotless anchor repair techniques have similar initial fixation strength.

**Background:** Traditionally, superior labral anterior posterior (SLAP) lesions have been repaired with suture anchors using arthroscopic knot-tying techniques. Recently, knotless anchors have been designed that can be used to repair SLAP lesions. No biomechanical studies have been performed examining glenohumeral motion after SLAP repair using knotless anchors.

**Objective:** To evaluate the effect on glenohumeral motion and kinematics as well as the initial fixation strength of 2o different arthroscopic repair techniques for type II SLAP lesions: (1) a knotless anchor repair and (2) a repair with a standard suture anchor and arthroscopic knot-tying.

**Design:** Biomechanical cadaveric study.

**Materials/Methods:** 6 matched pairs of fresh-frozen male cadaveric shoulders (mean age, 60.2 years) were utilized in this study. Specimens were dissected and potted for biomechanical testing. Each specimen underwent 3 stages of experimentation. Rotational range of motion, glenohumeral translation, and glenohumeral kinematics throughout the range of motion were recorded for intact glenohumeral joints with arthroscopic portals, shoulders with arthroscopically created type II SLAP tears, and shoulders that had undergone arthroscopic repair of the type II SLAP lesions with either a knotless repair technique or with a simple suture repair technique. The knotless repair was performed using two 3.5-mm Bio-PushLock anchors (Arthrex) and a vertical mattress suture configuration. The simple suture repair was performed with two 3.0-mm Bio-SutureTak anchors (Arthrex). In each technique, 1 anchor was placed anterior to the biceps tendon and the other anchor was placed posterior to the biceps tendon. After all biomechanical testing was complete, the repair constructs were loaded to failure.

**Results:** There was a statistically significant increase in rotational range of motion in association with the creation of a type II SLAP tear ($P<0.036$) that returned to intact levels after both types of repairs. After repair of the SLAP lesion, there was no significant difference in glenohumeral translation or kinematics with either repair technique. There were no statistically significant differences between stiffness, energy absorbed, load at 2 mm of displacement of the labrum from the glenoid, yield load, and ultimate load of the 2 repairs. Simple suture repairs failed most commonly by knot breakage (n=5), and knotless repairs failed by suture slippage around the anchor (n=5).

**Conclusions:** In the treatment of type II SLAP lesions, both standard suture anchor repair techniques and knotless anchor repair techniques restore glenohumeral rotation. In addition, both techniques have similar initial fixation strength.

**Reviewer's Comments:** This study is limited by the age and small number of specimens and by the fact that it is a biomechanical cadaveric study with time-zero data only. In addition, the suture configuration (vertical mattress versus simple sutures) may impact the repair strength. Nonetheless, this technique warrants future clinical studies to see if the results are equivalent to current methods. (Reviewer-Adam J. Farber, MD).

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Keywords: SLAP Lesion, Labrum, PushLock, Knotless, Biomechanics

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For primary ACL reconstruction, there is no difference in re-rupture rate, laxity, or functional outcomes for patients who receive HB versus BTB autografts.

**Background:** Previous studies comparing hamstring (HM) tendon autograft to bone-patellar tendon-bone (BTB) autograft for anterior cruciate ligament (ACL) reconstruction have been confounded by differences in graft fixation techniques.

**Objective:** To conduct a randomized controlled trial comparing the outcomes of ACL reconstructions performed with BTB and HS tendon autografts with identical fixation.

**Design:** Randomized controlled trial.

**Methods:** 64 patients (11 men and 53 women; mean age, 22 years) with complete ACL tears who underwent ACL reconstruction at 1 military institution between 2000 and 2003 were included in this study. Patients with concomitant ligamentous injury or full-thickness chondral injury were excluded. Graft selection was performed in a randomized manner; 32 patients had autograft HS tendons and 32 patients utilized BTB. Graft fixation was identical for all 64 patients and involved an EndoButton and interference screw on the femoral side and an interference screw and screw and washer on the tibial side. All patients underwent identical postoperative rehabilitative protocols. A return to sports was allowed no earlier than 6 months postoperatively. All patients underwent postoperative digital x-rays, which were analyzed for tunnel location and orientation using a software program. Outcome measures included re-rupture rate, physical examination findings, isokinetic strength measurements, KT-2000 measurements, and validated functional scoring instruments.

**Results:** The mean final follow-up was 36 months. Both groups were similar in terms of age, gender distribution, time from injury to surgery, and concomitant meniscal and chondral pathology. The rate of graft rupture did not differ between the HM group (n=4; 12.5%) and the BTB group (n=3; 9.4%) (P =0.71). There was no significant difference (P =0.51) in coronal tibial tunnel angle between the BTB and HS grafts, but there was a significant difference (P =0.03) for the coronal tibial tunnel angle between the 7 participants whose graft ruptured and the patients whose grafts were intact. Graft rupture correlated with more horizontal tibial tunnel orientation. The overall average Tegner score was 6.8 for the BTB group and 5.3 for the HS group (P =0.04). There were no significant differences in KT-2000 measurements, kneeling pain, range of motion, or isokinetic peak torque between the 2 groups. In addition, there were no significant differences between the 2 groups in International Knee Documentation Committee scores, Single Assessment Numeric Evaluation scores, Lysholm scores, or Knee Injury and Osteoarthritis Outcome scores.

**Conclusions:** For primary ACL reconstruction, there is no difference in re-rupture rate, laxity, or functional outcomes for patients who receive HM versus BTB autografts.

**Reviewer's Comments:** This is an excellent study that provides useful information for when you are counseling patients regarding graft selection. Surgeons can select autografts based upon patient preference and surgeon comfort and can expect similar results regardless of HM or BTB. (Reviewer-Adam J. Farber, MD).
The lateral stress test is more accurate than the external rotation stress test in predicting syndesmotic instability.

**Background:** No quantitative anatomical study has compared the methods of making stress radiographs to determine syndesmotic diastasis of the ankle.  

**Objective:** To compare the accuracy of 2 different intraoperative stress tests used for the detection of ankle syndesmotic injuries.  

**Materials/Methods:** 14 fresh-frozen human cadaveric specimens (7 pairs; 1 male and 6 females; mean age, 73 years) without ankle ligamentous or osseous pathology were utilized in this study. Specimens were divided into 2 groups in an effort to re-create ligamentous pathology found in patients with Weber B and Weber C injuries. In the first group, the anterior inferior tibiofibular ligament (AITFL) was divided first, and these specimens were classified as "Weber B." A Weber C injury was then simulated by division of the interosseous membrane 10 cm proximal to the syndesmosis. Finally, in this group, the deltoid ligament was divided and the injury was classified as "Weber C plus deltoid ligament." In the second group, the deltoid ligament was divided first, followed by division of the AITFL, and the injury was designated as "Weber B, plus deltoid ligament." AP ankle x-rays were obtained prior to dissection and after each structure was transected. Radiographs were obtained while performing an external rotation stress test and while performing a lateral stress test (a version of the Cotton test). Tibiofibular overlap, tibiofibular clear space, and medial clear space were measured on each x-ray.  

**Results:** In the Weber C group, the tibiofibular clear space was >5 mm in 14% of the specimens on the external rotation stress test and in 86% of the specimens on the lateral stress test ($P <0.05$). With additional dissection of the deltoid ligament, the number of specimens with a tibiofibular clear space >5 mm remained the same on the external rotation stress test, but increased to include all specimens on the lateral stress test. During the external rotation stress test, significant increases in the medial clear space were observed for the sectioned deltoid ligament group ($P <0.05$) and the Weber B, group with isolated AITFL injuries ($P <0.05$). Tibiofibular overlap measurements did not clearly indicate the presence of syndesmotic injury on either stress test.  

**Conclusions:** "For the detection of syndesmotic instability after an ankle fracture, this cadaver study supports the use of the lateral stress test and examination of the tibiofibular clear space on stress radiographs." Medial clear space widening seen on external rotation stress can suggest syndesmotic injuries or the presence of an isolated deltoid ligament injury.  

**Reviewer’s Comments:** This study provides useful information for interpreting the results of intraoperative stress radiographs of the injured ankle. Future clinical studies are needed to make guidelines to translate the findings of intraoperative stress radiography into treatment recommendations. (Reviewer-Adam J. Farber, MD).
Utilizing the arthroscopic tibial inlay double-bundle tibial technique for PCL reconstruction achieves better stability.

**Background:** Conventional posterior cruciate ligament (PCL) reconstruction utilized transtibial fixation. Unfortunately, this predisposes the graft to a "killer turn." Biomechanical studies have shown superior results with a tibial inlay technique. There is also biomechanical evidence to support a double-bundle construct as opposed to focusing on reconstructing the anterolateral bundle alone.

**Objective:** To compare the clinical results of arthroscopic tibial inlay single-bundle and double-bundle techniques with those of the conventional transtibial single-bundle technique for PCL reconstruction.

**Design:** Retrospective cohort study; level of evidence III.

**Participants/Methods:** The inclusion criteria for the study were isolated posterior knee instability of greater than grade 2 (>10 mm), an uninjured contralateral knee, no previous surgery on the affected knee, and no fracture around the knee. Twenty-nine patients who had undergone an isolated PCL reconstruction met the above inclusion criteria and had been followed for >24 months were the subjects of the study. Eight patients were treated with the transtibial single-bundle technique (Group T), and 21 patients underwent the arthroscopic tibial inlay technique. The latter group included 11 single-bundle procedures (Group I1) and 10 double-bundle procedures (Group I2). A single surgeon performed all surgeries and an Achilles tendon allograft was used in all cases.

**Results:** Measured with Telos stress radiography, the mean side-to-side differences in posterior tibial translation were 5.6 ± 2.00 mm in Group T, 4.7 ± 1.62 mm in Group I1, and 3.6 ± 1.43 mm in Group I2. While a significant difference was noted between Groups I2 and T (P =0.023), no significant difference was observed between Groups I1 and T (P =0.374). No difference was found between the groups in regards to final knee flexion, and none of the patients had an extension deficit at final follow up. The mean postoperative clinical Lysholm score was significantly improved compared with the preoperative score in all 3 groups, but no difference was found between the groups. Two intraoperative complications occurred in the arthroscopic inlay group. In one patient, the cylindrical bone plug broke during screw fixation in the tibial tunnel. The other complication was a rupture of the suture securing the bone plug during the tensioning procedure.

**Conclusions:** The authors prefer to use the arthroscopic tibial inlay double-bundle technique for PCL reconstruction because with that method, better stability can be achieved.

**Reviewer's Comments:** This study contributes valuable clinical information to the mounting body of literature on PCL reconstruction. The most valuable finding is that the clinical Lysholm scores improved similarly despite which construct was used. I wonder if the double-bundle construct creates enough additional stability to justify its added technical difficulty. (Reviewer-Carl H. Wierks, MD).
Increased activity level after ACL reconstruction and allograft use are risk factors for ACL graft failure, both independently and especially in combination.

**Objective:** To evaluate activity level after anterior cruciate ligament (ACL) reconstruction and graft type as risk factors for ACL graft failure.

**Design:** Case-controlled study.

**Participants/Methods:** 21 patients with ACL graft failure were identified from the Multicenter Orthopedic Outcomes Network (MOON) database over a 2-year period. In addition, 42 age- and sex-matched controls, who underwent successful ACL reconstruction by the same surgeon, were selected as controls. All patients underwent ACL reconstruction with the same technique. Graft selection was based upon patient preference and was either an irradiated allograft tibialis tendon or a 4-stranded autograft gracilis/semitendinosus. In addition, identical postoperative rehabilitation protocols and return-to-play guidelines were used for all patients. Progression from one phase to the next was based on achieving functional criteria rather than the time elapsed since surgery. These patients were studied with logistic regression analysis to evaluate the role of postoperative activity level and graft type, both independently and in combinations, as risk factors for ACL graft failure. Activity level was reported utilizing a Marx activity score, which is a validated activity score. A higher activity level was defined as a Marx score ≥13 and a lower activity level was defined as a Marx score ≤12.

**Results:** Of the 322 patients in the database, graft failure occurred in 5 patients with autografts (3.70%) and 16 patients who had allografts (8.56%). Among the case patients, the median time to graft failure was 11.6 months after the initial ACL reconstruction. For all cases, the median Marx score at the time of graft failure was 16, while the controls had a median Marx score at 12 months after ACL reconstruction of 12. Those with a higher activity level had 5.53 greater odds of ACL graft failure than did those with a lower activity level at the time of graft failure (odds ratio [OR], 5.53; *P* =0.03). Patients with an allograft had 5.56 greater odds of ACL graft failure than patients with an autograft (OR, 5.56; *P* =0.009). Also, there was a multiplicative interaction between higher activity level and allograft for much greater odds of ACL graft failure. After controlling for gender and age, for patients with high activity levels after ACL reconstruction, those with an allograft had a 14.10 times the odds of those with an autograft of graft failure.

**Conclusions:** Increased activity level after ACL reconstruction and allograft use are risk factors for ACL graft failure, both independently and especially in combination.

**Reviewer's Comments:** This study confirms what I have been taught; patients who have allograft ACL reconstructions often feel better quicker and therefore progress through rehabilitation faster and are more active; therefore, they subject themselves to re-rupture more often. It would be interesting to repeat a similar study with time-based rehabilitation protocols and using non-irradiated allografts or different types of grafts to see if the results differ. (Reviewer-Adam J. Farber, MD).

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Keywords: Anterior Cruciate Ligament Graft Failure, Activity Level, Graft Type

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