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Shoulder

No advantages in repairing type II superior labrum anterior and posterior (SLAP) lesion when associated with rotator cuff repair in patients over age 50: a randomized controlled trial. Franceschi F, Longo U, Ruzzini L, Rizzello G, Maffulli N, Denaro V. *Am J Sports Med.* 2008;36:247–253.

Context: Studies have had good outcomes in patients undergoing Type II SLAP repair when performed arthroscopically. In patients younger than 40 years, these lesions typically are seen with Bankart or anterior labral disorders. In patients older than 50 years, these lesions often are seen in the context of osteoarthritis or supraspinatus tendon tears. Controversy exists whether repair is indicated in these patients or tenotomy alone is sufficient to reduce biceps tendon symptoms in patients with full thickness rotator cuff tears.

Study Design and Results: Sixty-three patients were randomized to receive either arthroscopic rotator cuff and SLAP repair (Group I) or arthroscopic biceps tendon tenotomy with rotator cuff repair (Group II). Treatment groups were similar in number and demographics. Patients were followed using UCLA scores and they had an average minimum followup of 2.9 years (average, 5.2 years). Both groups showed an improvement in UCLA scores with Group II showing statistically significant improvement over Group I.

Conclusions: There seems to be no advantages in repairing Type II SLAP lesions when encountered during rotator cuff repair, and tenotomy is likely advantageous in this situation.

Comments: This study shows there are equal or better results with tenotomy over SLAP repair for Type II lesions encountered during rotator cuff repair. The study design was prospective, randomized and is among the best to determine differences between groups. Although the outcome assessment was not blinded or performed by independent examiners, the authors were able to show clear improvement of the tenotomy group for UCLA shoulder scores and ROM. Biceps tenotomy is easier to perform, inexpensive, and reduces operative time when compared with SLAP repair. In addition, the gains in ROM afforded by tenotomy indicate that combining SLAP repairs and rotator cuff repairs may increase capsular scar formation and contribute to diminished ROM postoperatively.

Pearls: In patients undergoing arthroscopy for rotator cuff tears, repairing concomitant labral disorders may increase stiffness postoperatively and diminish the clinical outcome. Biceps tenotomy is reproducible, requires no healing in a synovial fluid environment, and is inexpensive. In addition, when patients have symptoms develop after rotator cuff repair, discerning whether the labrum has not healed appropriately or the rotator cuff is the cause of recurrent symptoms can be challenging. Performing a tenotomy in this setting allows for an easier diagnosis when recurrent symptoms arise.

Shoulder strength after open versus arthroscopic stabilization. Hiemstra LA, Sasyniuk TM, Mohtadi NG, Fick GH. *Am J Sports Med.* 2008;36:861–867.

Context: Traditional open techniques of anterior capsulolabral repair have required incision of the subscapularis

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muscle to gain access to the glenohumeral joint. With arthroscopic surgery, the subscapularis muscle is not formally incised and therefore, may be less prone to muscular injury and atrophy after surgery. It has been postulated in this study that patients undergoing arthroscopic surgery will have less weakness than those undergoing an open, tendon splitting procedure for the same disorder.

Study Design and Results: A randomized controlled trial was used for this study. Forty-eight patients were randomized to either arthroscopic (24) or open (24) shoulder stabilization. Rehabilitation protocols were held standard among treatment groups. Patients were tested at a mean followup of 19.4 months using isokinetic strength testing equipment looking primarily at internal rotation. At final followup, no differences existed between the open group and the arthroscopic group regarding isokinetic testing or secondary strength measures. Strength deficits, however, were apparent in the contralateral limb in both treatment arms of this study.

Conclusions: The choice between arthroscopic or open methods for addressing anterior instability does not affect the internal rotation strength at 1 year followup. The largest determinant of muscle strength deficit that was found in this study was arm dominance.

Comments: Traditional means of repairing a Bankart lesion for anterior glenohumeral instability has been an open surgical procedure. With the advent of arthroscopy, surgeons now can perform the same procedure (with many studies showing equal success) without the morbidity of open incisions and subscapularis muscle injury. The intuitive appeal of this approach is, among others, the theoretically reduced risk of subscapularis injury. Despite these claims, this study shows that with a muscle splitting approach, there is no loss of strength in the subscapularis muscle. This study did not specifically analyze patients undergoing open Bankart repair with subscapularis detachment and repair, which is still widely performed today. Additional study examining this patient cohort may be warranted.

Pearls: The theoretical benefits of some operations at times do not appear in clinical outcome studies.

A randomized clinical trial comparing open to arthroscopic acromioplasty with mini-open rotator cuff repair for full thickness rotator cuff tears: disease-specific quality of life outcome at an average 2-year follow-up. Mohtadi N, Hollinshead R, Sasyniuk T, Fletcher JA, Chan DS, Li FX. *Am J Sports Med.* 2008;36:1043–1051.

Context: The evolution of the treatment of rotator cuff disease has been toward arthroscopic and minimally invasive interventions. The majority of this evolution has occurred without substantial scientific evidence showing efficacy. To justify widespread acceptance of minimally

invasive surgery for rotator cuff disease, appropriate comparison studies with traditional open techniques are warranted.

Study Design and Results: A randomized controlled trial was used for this study to determine the differences between an arthroscopic acromioplasty with mini-open rotator cuff repair and a traditional, open acromioplasty and rotator cuff repair for patients with full thickness rotator cuff tears. Patients were followed at intervals producing 2-year results regarding functional shoulder scores and a quality of life index. Patients with massive tears were excluded from participation in the study. Twenty-nine patients ultimately were analyzed from the open group and compared with 31 patients from the minimally invasive group. Demographics and baseline characteristics were similar between groups. At final followup, both groups were improved from baseline and were similar regarding functional outcome and quality of life index. In the early postoperative period (3 months), there was significant improvement in the mini-open group as compared with the open treatment group.

Conclusions: Whether a traditional open technique or a minimally invasive approach is used during rotator cuff repair, patient outcomes were significantly improved at 1 and 2 years after surgery with no significant difference between groups. A minimally invasive approach showed significant improvements in the early postoperative period; however, this advantage was not maintained during final analysis.

Comments: The current trend in rotator cuff surgery is toward minimally invasive surgery, whether it is arthroscopic or mini-open rotator cuff repair. This trend has occurred ahead of evidence-based medicine showing equal efficacy. Potential advantages of minimally invasive approaches include decreased morbidity associated with deltoid detachment, less pain postoperatively, quicker rehabilitation, and motion gains. The current study showed equal efficacy of a mini-open approach to that of traditional methods of repair, and reinforced the concept that less invasive surgery may benefit patients in the early postoperative period.

Pearls: The theoretical benefits of some operations (in this case, more rapid recovery) at times do appear in clinical outcome studies.

The addition of rotator interval closure after arthroscopic repair of either anterior or posterior shoulder instability: effect on glenohumeral translation and range of motion. Mologne T, Zhao K, Hongo M, Romeo A, An K, Provencher M. *Am J Sports Med.* 2008;36:1123–1131.

Context: Many surgeons advocate rotator interval closure after arthroscopic anterior or posterior stabilization

to reduce capsular volume and inhibit excessive glenohumeral translation. Controversy exists regarding whether interval closure improves glenohumeral stability and whether every patient undergoing surgery for instability should have interval closure performed.

Study Design and Results: This study was a controlled laboratory study using anterior and posterior instability shoulder models. Fourteen cadaveric specimens were analyzed in anterior and posterior instability models. Group I (seven shoulders) were first vented and subluxated anteriorly, then underwent anterior capsulolabral repair, and ultimately underwent interval closure and were analyzed at each step of intervention. Group II (seven shoulders) were tested in similar fashion using a posteriorly vented and subluxated model. Parameters measured included: external and internal rotation at neutral, external and internal rotation at 90° abduction, posterior and anterior translation at neutral rotation, anterior translation at 90° abduction and external rotation (Group I), posterior translation at 90° flexion and internal rotation (Group II), and sulcus testing in neutral. After analysis, it was found that posterior instability was significantly improved by capsulolabral repair but not by rotator interval closure. Anterior instability was improved by capsulolabral repair and interval closure. Interval closure did not improve sulcus stability; however, it did result in diminished ROM in external rotation in the neutral and abducted glenohumeral positions.

Conclusions: In a shoulder model, rotator interval closure improved anterior instability but had no significant effect on posterior instability after capsulolabral repair. Interval closure does not appear to improve inferior glenohumeral instability as traditionally thought; however, it does contribute to a significant loss of ROM in external rotation.

Comments: Treatment of glenohumeral instability traditionally has been aimed at restoring the length tension relationship of the capsulolabral complex to the glenoid rim. The aim of surgical reconstruction is restoration of full ROM while still conferring stability to the glenohumeral joint. In some instances, stability is achieved at the expense of motion and may be clinically indicated for patients with patulous joint capsules or those in whom previous reconstruction attempts have failed. The routine use of rotator interval closure is likely not necessary in posterior instability, and may adversely affect motion in patients with anterior instability. The question of interval closure in multidirectional instability also is called into question given the findings that inferior instability was not corrected with interval closure.

Pearls: Although added stability can be achieved with interval closure in the abducted and externally rotated position, this comes at a cost to ultimate motion gains and

may limit functional outcome. Thus, each patient warrants an individualized approach to surgical reconstruction and routine use of interval closure is likely not warranted.

Elbow

Biomechanical analysis of medial collateral ligament reconstruction grafts of the elbow. Prud'homme J, Budoff J, Nguyen L, Hipp J. *Am J Sports Med.* 2008;36:728–732.

Context: The objectives of any surgical reconstruction are to provide stability to the joint while providing for the strongest ligament substitute that closely matches that of the native structure. Although the palmaris tendon is the most widely used graft in ulnar collateral ligament (UCL) surgery, no biomechanical studies have shown superiority of this graft over any other for consideration in this procedure.

Study Design and Results: Ten cadaveric elbows were used in a controlled laboratory study. The elbows were cyclically loaded to produce 3-mm and 5-mm elongation in the intact state and after UCL reconstruction using the docking technique. Four graft choices were compared with the native state: palmaris, gracilis, patellar tendon, and semitendinosus. The final analysis showed there was no difference in load to 3-mm or 5-mm elongation among all of the grafts studied. Each graft was significantly weaker than the native MCL.

Conclusions: Larger tendon grafts used for UCL reconstruction do not seem to confer any biomechanical advantage over thinner grafts. This supports the widespread use of palmaris longus tendon for UCL reconstruction of the elbow.

Comments: This study sought to analyze the biomechanical load to elongation and stiffness of commonly used grafts for UCL reconstruction using the docking technique. The majority of surgeons who perform UCL reconstructions prefer the palmaris longus tendon for reconstruction, and this study lends support to the routine use of this graft over other tendon graft choices. One of the findings of this study is that regardless of graft choice, all of the grafts studied were significantly weaker than the native UCL. Disadvantages of this study design are the advanced age of the specimens, the fixed angle of the elbow during testing (90°), and the lack of muscular contraction to provide joint compressive force. Despite these limitations, the study was able to isolate the intact MCL and graft reconstructions that could have implications for in vivo function.

Pearls: Each graft tested here, including the popular palmaris tendon, was significantly weaker than the native MCL, suggesting, perhaps, that the efficacy of this operation depends on rehabilitation and strengthening of the surrounding tissues.

Knee

Anterior Cruciate Ligament

A 10-year prospective trial of a patient management algorithm and screening examination for highly active individuals with anterior cruciate ligament injury: Part 1, outcomes. Hurd W, Axe M, Snyder-Mackler L. *Am J Sports Med.* 2008;36:40–47.

Context: Determining the optimal management for the many people who sustain anterior cruciate ligament injuries every year is daunting. Whether to proceed with surgical reconstruction or conservative management often is based on parameters that are highly subjective and that may not predict ultimate success of treatment. There is a cohort of patients who cope with their injury who may respond favorably to nonoperative management (therefore the designation of these patients as so-called “copers”); and identifying these patients early after diagnosis may obviate the need for surgical reconstruction.

Study Design and Results: This study is a cohort study and patients were followed prospectively after they were diagnosed with an ACL tear. Patients were actively involved in IKDC Level I or II sports at the time of their injury. Patients were evaluated for concomitant injury, unresolved impairments, and had a screening examination to formulate a management algorithm by identifying individuals as noncopers (poor potential for nonoperative treatment) or potential copers (good potential for nonoperative care). Three hundred forty-five patients ultimately were eligible for the algorithm as they did not have concomitant injuries or unresolved impairments. One hundred ninety-nine of these patients were deemed noncopers based on their inability to pass the screening examination (hop test, self assessed knee function score). This left 146 patients who were allocated as potential copers and 88 patients ultimately agreed to participate in a rehabilitation program. At latest followup, 25 patients from this group had not undergone ACL reconstruction.

Conclusions: The algorithm outlined in this article provides a tool for prospectively identifying patients who may be candidates for delaying surgical reconstruction or who wish to pursue nonoperative care.

Comments: One challenging task for all surgeons is identification of patients who would benefit most from surgical intervention. With regard to ACL surgery, the majority of patients who wish to remain active and participate in running, pivoting, or jumping sports, will require surgical reconstruction. Identifying patients who are candidates for nonoperative management while still maintaining an active lifestyle can be challenging. This study is one of the first to attempt to prospectively follow patients to see how effective a screening examination is at

identifying these patients. The challenges of this problem are many as outlined in the algorithm, with a majority of patients opting out of rehabilitation for an opportunity at higher function and a stable knee. Future goals of this research would be to identify specific parameters in patients who successfully coped with their injury, and attempt to recreate this environment for the potential noncopers.

Pearls: Some believe that the ACL is needed to prevent secondary tears of the medial meniscus. The ability to cope with an ACL tear may not be related to the ability to avoid a later meniscal tear.

A randomized controlled trial comparing the effectiveness of functional knee brace and neoprene sleeve use after anterior cruciate ligament reconstruction. Birmingham TB, Bryant DM, Giffin JR, Litchfield RB, Kramer JF, Donner A, Fowler PJ. *Am J Sports Med.* 2008;36:648–655.

Context: Functional knee braces are commonly prescribed with significant cost to the healthcare system after anterior cruciate ligament reconstruction (ACLR). No studies to date have documented clear advantages of these braces after ACLR.

Study Design and Results: This study used a randomized controlled trial to evaluate whether patients who had functional knee braces had improved outcomes over those who wore a neoprene knee sleeve following ACLR. Sixty-five patients ultimately were evaluated in the knee sleeve group and 62 patients were evaluated in the functional knee brace group. Baseline demographics between groups were similar and randomization was achieved with a computer-generated randomization list. At final followup, there were no differences in treatment groups regarding quality of life measures, KT-1000 arthrometer difference, hop test, and Tegner activity scale; however, patients who wore the functional brace reported higher ratings of confidence in the knee than those wearing the neoprene sleeve. Adverse events were not significantly different among groups.

Conclusions: The routine use of off-the-shelf functional knee braces after ACLR does not improve clinical outcome at 1 and 2 year followups over a neoprene knee sleeve.

Comments: The use of a functional knee brace did not improve clinical outcome when compared with neoprene sleeve use after ACLR in this study. These findings are in agreement with prior studies that have found no differences in bracing versus no bracing after ACLR and with studies that have shown little to no benefit of bracing for people with ACL deficiency. The randomized controlled design of this study allows for direct comparisons to be made between the groups. The study was not powered to determine recurrence or failure rates during bracing; it was designed to evaluate only clinical outcome at 2 years

followup. One of the drawbacks to the study is that patients were not evaluated with the IKDC instrument, a validated outcomes measure that has been widely accepted for evaluating patients after ACLR.

Pearls: That patients who wore functional braces reported higher ratings of confidence in the knee than those wearing the neoprene sleeve may be a placebo effect: patients cannot be blinded to which treatment they received.

Meniscus/Articular Cartilage

Characterized chondrocyte implantation results in better structural repair when treating symptomatic cartilage defects of the knee in a randomized controlled trial versus microfracture. Saris D, Vanlauwe J, Victor J, Haspl M, Bohnsack M, Fortems Y, Vandekerckhove K, Almqvist F, Claes T, Handelberg F, Lagae K, van der Bauwhede J, Vandenuecker H, Yang K, Jelic M, Verdonk R, Veulemans N, Bellemans J, Luyten F. *Am J Sports Med.* 2008;36:235–246.

Context: The management of articular cartilage lesions in the knee is problematic. When left untreated, articular lesions can predispose patients to osteoarthritis, which is a significant cause of disability worldwide. Traditional techniques of microfracture have attempted to stimulate healing through bone marrow stem cells, producing a repair “fibrocartilage” that is less durable than articular cartilage but may provide pain relief in a significant number of patients. Newer, regenerative technologies have been developed such as autologous chondrocyte implantation (ACI) and a modification of that technique, namely, characterized chondrocyte implantation (CCI), to combat this difficult problem in hopes of improving outcomes.

Study Design and Results: This study was a multicenter trial evaluating isolated femoral condyle articular cartilage defects that were Grade III or IV (Outerbridge staging). All lesions treated ranged in size from 1 cm to 5 cm². A randomized controlled trial evaluating the efficacy of CCI versus microfracture was used and outcomes were assessed at 1 year histologically and clinically (KOOS score). Baseline demographics were similar between groups with 61 patients in the microfracture group and 57 patients allocated to the experimental (CCI) group. Blinding was used during the histologic analysis. Histologically, the CCI group had a better structural repair over microfracture at the time measured. Clinical outcomes at 12 and 18 months using the KOOS score were comparable to those of microfracture. Both groups had significant improvement over preoperative scores. The incidence of postoperative adverse events was small and similar between groups.

Conclusions: At short-term followup, CCI appears to be equivalent to microfracture regarding clinical outcome; however, the histologic analysis confirms a better structural repair which could have implications for long-term knee function.

Comments: This article is one of few comparing new regenerative technologies with traditional methods of repairing articular cartilage defects of the knee. This work builds on the work of ACI, using characterized chondrocytes over the undifferentiated chondrocytes used in prior studies (ACI). The authors found equivalent results between this current technology and microfracture, indicating that it can be used safely and with little risk to the patient. Although the structural repair was better than microfracture, the cartilage from the lesion was still characterized as “hyaline like” and not true hyaline cartilage. Long-term studies are needed to see if the structural superiority of CCI translates into better long-term outcome.

Pearls: This study shows the safety of characterized chondrocyte implantation and equal efficacy when compared with clinical outcome of microfracture for articular cartilage defects of the knee. The higher cost of CCI is justified only if long-term outcomes are better; and although the CCI group had a better structural repair over microfracture when examined histologically, this may not translate into better long-term outcomes. The theoretical benefits of some operations at times do not appear in clinical outcome studies.

Patellofemoral Joint

Role of the vastus medialis obliquus in repositioning the patella: a dynamic computed tomography study. Lin YF, Lin JJ, Jan MH, Wei TC, Shih HY, Cheng CK. *Am J Sports Med.* 2008;36:741–746.

Context: One of the most vexing problems treated by sports medicine physicians is patellofemoral pain syndrome. An important part of most treatment algorithms involves strengthening of the vastus medialis (VMO) to realign the patellofemoral joint for patients with malalignment. It is unknown if the morphologic features of VMO correlate to patellar malalignment in patients with patellofemoral pain syndrome.

Study Design and Results: One hundred twelve patients with patellofemoral pain syndrome underwent serial CT at 0°, 15°, and 30° knee flexion with the quadriceps contracted and relaxed at each flexion angle. Cross-sectional measurements of the VMO were performed as were measurements of patellar malalignment (lateral shift, patellar tilt). The data showed there was a significant correlation between patellar malalignment and VMO cross-sectional areas at 0° and 30° knee flexion. The VMO was found to be

more predictive of patellar tilt than lateral shift and the final analysis showed that the VMO accounted for only 7.8% to 13% of patellar malalignment in this study.

Comments: Although this study lends support to strengthening of the VMO to help address patellar malalignment, it shows that the overall etiology of malalignment is complex and only partially accounted for by VMO contraction and strength. Lateral shift of the patella was not as significantly correlated as tilt in this study and the contribution of the VMO to patella alignment during high knee flexion angles is not significant. The study did not simulate weightbearing activities nor isolate the VMO exclusively but rather the entire quadriceps mechanism. Only correlations between muscle size and patella alignment could be inferred, which does not necessarily address the insertion and relative strength of the contraction across subjects.

Pearls: Many factors can contribute to the development of patellofemoral pain: hip external rotation strength, bone geometry, limb alignment, and soft tissue restraints. VMO strengthening should be included in a program of rehabilitation, but should not be the only ingredient.

Foot and Ankle

Arthroscopic autologous chondrocyte implantation in osteochondral lesions of the talus: surgical technique and results. Giannini S, Buda R, Vannini F, Di Caprio F, Grigolo B. *Am J Sports Med.* 2008;36:873–880.

Context: Autologous chondrocyte implantation (ACI) has shown promise in restoring “hyaline like” cartilage to articular cartilage defects in the knee. Good clinical outcomes have been achieved in the knee when compared with traditional methods of repair (microfracture). One of the difficulties in applying this technology to the ankle is the difficulty of implantation and the need for malleolar

osteotomy to gain adequate access to articular cartilage lesions. This study examines a novel way of addressing these lesions using traditional ACI methods.

Study Design and Results: This study was a case series of 46 patients with posttraumatic talar dome lesions who underwent an all-arthroscopic ACI procedure. The first procedure consisted of cartilage harvest surrounding the lesion and the cultured chondrocytes were implanted on a Hyalograft C scaffold for later implantation through specially designed arthroscopic equipment (second procedure). Patients were followed clinically with the American Foot and Ankle Society (AOFAS) score for 3 years. Three patients underwent repeat arthroscopy with cartilage harvest for analysis. At 3 years followup, the mean AOFAS score had improved from 57.2 preoperatively to 89.5. This result was significant and related to age of the patients and previous cartilage operations. Histologic analysis showed “hyaline like” cartilage in the three subjects studied.

Comments: This study evaluated a technique that is commonly performed for articular cartilage lesions of the knee. Traditional methods of addressing articular lesions of the ankle have been drilling or microfracture, with occasional need for malleolar osteotomy for deep posteromedial lesions. In this technique, all of the lesions were able to be addressed arthroscopically owing to the scaffold construct and special arthroscopic instrumentation. This certainly diminishes the morbidity associated with this technique. One drawback to this study is the lack of comparison to a control group of patients who underwent a procedure such as microfracture.

Pearls: Good results at short and intermediate followup with ACI in talar dome lesions were seen. However, this costly procedure requires a second operation, therefore, widespread use of this technique must go beyond “good results” and have better long-term efficacy when compared with those of microfracture. No studies to date have had such superior long-term results.