This sports medicine specialty update is based on scientific publications and organizational proceedings from September 2007 to August 2008. It includes a brief review of important research from the three premier sports medicine journals, namely, *The Journal of Bone and Joint Surgery* (American Volume), *The American Journal of Sports Medicine*, and *Arthroscopy*. In addition, the scientific presentations from the annual and Specialty Day meetings of the American Academy of Orthopaedic Surgeons (AAOS), the American Orthopaedic Society for Sports Medicine (AOSSM), and the Arthroscopy Association of North America (AANA) were reviewed, with any pertinent material included in this update.

**Knee**

**Anterior Cruciate Ligament**

The anterior cruciate ligament is perhaps the most extensively researched and frequently reconstructed ligament, and it continues to be a major focus of research in sports medicine. Clinical outcomes, biomechanics, and surgical techniques have received the majority of recent attention related to anterior cruciate ligament reconstruction. Along with immediate restoration of stability, the long-term outcomes of anterior cruciate ligament reconstruction are of the utmost importance, yet many questions remain unanswered. The restoration of normal knee kinematics is thought by many to be the most critical aspect of obtaining good long-term results, and this has fueled an explosion of studies on double-bundle anterior cruciate ligament reconstruction. The prevention of abnormal rotation is the proposed advantage of this reconstruction method. In addition to functional outcomes, the impact of improved kinematics on the development of osteoarthritis remains to be seen.

Multiple graft options are available for anterior cruciate ligament reconstruction. The most commonly used grafts are bone-patellar tendon-bone and hamstring autografts. The improvements in fixation devices for soft-tissue grafts have popularized the use of hamstring autografts in recent years, and prospective studies have shown equivalent functional outcomes in association with bone-patellar tendon-bone and hamstring autografts. Many surgeons base their graft selection on minimizing harvest-site complications. The literature has shown substantial complications in association with the use of bone-patellar tendon-bone autograft, including anterior knee pain, pain with kneeling, loss of extension, and poorer recovery of quadriceps strength. The use of hamstring autograft avoids these complications but has been reported to result in weakness of knee flexion and internal rotation, which may be crucial for certain athletes who rely on these important hamstring functions for optimum performance. Sensory deficits resulting from injury to branches of the saphenous nerve during hamstring harvest have been reported. It has been well documented that the hamstring tendons regenerate, but the function of regenerated tendons has been called into question as the tendon often heals in a non-anatomic position more proximally on the medial tibial plateau. A thorough understanding of donor-site morbidity is essential to prevent performance deficits in the athletic population.

To completely eliminate harvest-site morbidity, the use of allograft for primary reconstruction is becoming increasingly popular. The use of allograft in revision settings and multiple-ligament reconstructions will continue to be necessary as autologous tissue may not be available in these situations. The outcomes of allograft reconstructions have been mixed, with some studies showing equivalent outcomes compared with autograft and others showing increased laxity and more frequent graft failure with long-term follow-up. Although allografts provide tensile strength similar to autograft tissue, there are biological differences in revascularization, cell viability, and healing of allografts to host bone. These factors are also dependent on sterilization methods. A basic science study recently showed delayed revascularization and recellularization as well as decreased mechanical properties of allografts.

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To avoid notch impingement. Many surgeons use the posterior cruciate ligament, the medial tibial eminence, and the free edge of the anterior horn of the lateral meniscus to guide tunnel placement, but there continue to be large variations in the orientation of the tibial tunnel. Computer navigation has been proposed as a way to optimize accurate tunnel placement in anterior cruciate ligament reconstruction. A randomized controlled trial comparing manual and computer-guided placement of the tibial tunnel showed no significant differences between the two groups. This finding is consistent with previous findings related to tibial tunnel placement guided by computer navigation, which is associated with increased surgical time and cost. Improvement in clinical outcomes must be weighed against these factors, and further investigation is necessary to validate the routine use of computer navigation for anterior cruciate ligament reconstruction.

Revision surgery after failed anterior cruciate ligament reconstruction remains a substantial challenge in the field of sports medicine. Failures occurring in the early postoperative period (within six months) are most often due to improper surgical technique, whereas late failures are commonly associated with trauma. Errors in tunnel placement, failure of graft incorporation, and failure to recognize associated injuries are well-documented causes of failure. Graft tensioning is a controversial technical aspect of anterior cruciate ligament reconstruction, with no consensus among surgeons with regard to the ideal tension. Inadequate tension results in a nonfunctional graft and an unstable knee. Recent studies have investigated overtensioning of anterior cruciate ligament grafts, which can lead to decreased motion and poor graft vascularization. An overtensioned graft may also lead to increased femorotibial contact pressures with hypothesized long-term damage to cartilage. When revision surgery is necessary, meticulous preoperative planning is essential to avoid intraoperative complications. In a recent case series, sixty-three revisions were evaluated after a mean duration of follow-up of seventy-two months. Restoration of knee stability with good or excellent results was achieved in most patients, but 25% required a repeat revision, a rate much higher than that for primary reconstructions. Return to sports activity was also much less predictable after revision surgery. Patients should be properly advised regarding outcomes and expectations when discussing revision anterior cruciate ligament reconstruction.

The development of osteoarthritis in anterior cruciate ligament-deficient and reconstructed knees has long been a subject of debate. While the short-term goal of anterior cruciate ligament reconstruction is to provide a stable, functional knee and to allow a return to sports activity, the long-term goal is to protect other knee structures, namely, the meniscus and cartilage, from further damage. The protection of the meniscus with anterior cruciate ligament reconstruction is well-established, but long-term studies on the development of arthritis have yet to provide definitive answers. The previously referenced study on revision anterior cruciate ligament surgery
emphasized the important relationship between the chronicity of instability and the development of arthritis. On the average, patients without arthritic changes had an unstable knee for twenty-two months whereas patients with arthritic changes had an unstable knee for fifty-six months. These late arthritic changes were independent of cartilage injury at the time of surgery. This finding may indicate that there is cumulative damage to cartilage with prolonged instability and that timely restoration of stability may prevent or delay the onset of arthritis. The presence of a bone bruise also has been implicated as a possible factor contributing to the development of arthritis. A long-term, prospective cohort was evaluated for the development of arthritis at a minimum of twelve years after sustaining a bone bruise at the time of the initial injury. All bone bruises had resolved at the time of follow-up, and no correlation between the presence of an initial bone bruise and the development of cartilage lesions or arthritis was found. The relationship between arthritis and anterior cruciate ligament-injured knees remains unknown, and long-term, prospective, controlled studies are needed to clarify the issue.

Rehabilitation of the knee after anterior cruciate ligament reconstruction is paramount to successful outcomes, especially the return to the pre-injury level of athletic competition. The use of functional knee braces after reconstruction is controversial, and studies have shown mixed results. In a randomized controlled trial of 127 reconstructed knees, the use of a functional knee brace was compared with a simple neoprene sleeve. There were no significant differences between the brace and sleeve groups in terms of outcome measures, laxity measurements, or functional tests at one and two years of follow-up. Graft rerupture rates were equal between the two groups as well. Accelerated rehabilitation programs can allow return to sports activity in as little as four months, although most surgeons prefer six months. An accelerated program should only be considered for highly motivated athletes with access to skilled, monitored physical therapy. Surgeons also may want to consider backup graft fixation methods to avoid early fixation failure with aggressive, early rehabilitation. The concept of neuromuscular rehabilitation is important to protect the reconstruction as well as the health of the knee joint as a whole. Joint forces and kinematics are dependent on proprioception, balance, and compensation patterns, requiring a program that incorporates all of the components of neuromuscular control. Rather than a predetermined time to return to activity, monitored progression of functional tests allows safer return to sports.

**Posterior Cruciate Ligament**

Despite the recent increase in research, our understanding of injury and treatment of the posterior cruciate ligament is considerably less than that of the anterior cruciate ligament. The majority of research is biomechanical, and good clinical outcomes and comparative studies are lacking. There is still considerable debate regarding the natural history of posterior cruciate ligament injuries, the surgical indications, and the best methods for reconstruction. The diagnosis of these injuries requires a careful history and physical examination as well as proper radiographic assessment. A recent cadaver study investigated the accuracy of stress radiographic techniques for the grading of isolated and combined posterior cruciate ligament injury, with the 30° and 80° Telos tests (Telos GmbH Laubscher, Holstein, Switzerland) being most accurate for distinguishing between the different grades of posterior knee laxity. This is an important tool for helping to determine treatment strategy for these injuries. It is generally accepted that acute, isolated grade-I and II injuries should be treated nonoperatively, but debate regarding isolated grade-III injuries persists. Reconstruction of the posterior cruciate ligament in cases of combined ligament injuries is necessary, and the timing of these reconstructions is crucial, emphasizing the need for timely and accurate diagnosis of multiple-ligament injuries of the knee.

Surgical treatment for posterior cruciate ligament deficiency remains controversial. As is the case for the anterior cruciate ligament, the posterior cruciate ligament consists of two anatomic bundles, and the need to reconstruct one or both of the bundles has been the topic of considerable research. The added complexity of the double-bundle procedure has yet to be justified by the documentation of any clinical advantage as compared with single-bundle reconstruction, and high-powered comparison studies are needed to provide answers. The tibial fixation technique remains a matter of surgeon preference. Proponents of the inlay method have cited a more anatomic tibial insertion site and avoidance of the so-called killer turn, a sharp angle at the proximal margin of the tibial tunnel associated with the transtibial technique that is theorized to contribute to graft elongation or failure. These proposed advantages have not been substantiated by clinical outcomes. Regardless of the technique used, the restoration of posterior knee stability can be unreliable, with altered knee joint biomechanics and contact stresses. The association between posterior knee instability and the development of medial compartment osteoarthritis has been observed in previous studies. An investigation of the effect of increased tibial slope on posterior tibial translation in posterior cruciate ligament-deficient knees was performed in a cadaver model. Increasing the slope by an average of 4.6° with an osteotomy caused the resting position of the knee to shift anteriorly, and posterior sag was reduced when the knee was subjected to axial loads. This biomechanical evidence supports the use of osteotomies for the treatment of chronic posterior cruciate ligament deficiency, but clinical data to support this technique have not been published.

The role of the posterior cruciate ligament in knees with multiple ligamentous injuries has generated much interest as the failure to recognize concomitant ligamentous injuries has been implicated in the failure of posterior cruciate ligament reconstructions. Previous research has demonstrated...
that residual laxity following posterior cruciate ligament reconstruction is commonly related to missed and untreated injuries of posterolateral structures. These complex patterns of injury are notoriously difficult to diagnose, and correlating physical examination findings with indications for treatment in cases of multiple-ligament injuries is extremely challenging to the sports medicine physician. A study was recently performed to better define the physical examination characteristics of isolated posterior cruciate ligament and combined ligamentous injuries. In a cadaver model with sequential resection of the posterior cruciate ligament and posterolateral structures, a finding of grade-III posterior laxity on physical examination, or >10 mm of posterior translation on stress radiographs, correlated with posterolateral corner injury in addition to posterior cruciate ligament disruption. These findings suggest that isolated posterior cruciate ligament reconstruction may be insufficient to restore stability when these findings are present.

**Posterolateral Corner**
The posterolateral corner of the knee continues to receive substantial attention as unrecognized injuries to these structures have dire clinical consequences. The incidence of these injuries is likely underreported, and these injuries often are the result of high-energy mechanisms. Consequently, these structures are rarely injured in isolation and are usually diagnosed as part of a multiple-ligament knee injury. The importance of recognizing an associated neurovascular injury or compartment syndrome cannot be overstated. A prospective magnetic resonance imaging study was recently performed in an attempt to define the prevalence of posterolateral corner injuries in patients with an acute knee injury and a hematoma. A total of 331 consecutive patients were evaluated over a ninety-day period. The prevalence of posterolateral corner tears was 9.1%, and 87% of those with posterolateral tears had multiple ligamentous injuries. Surgical treatment of these injuries is accomplished with use of multiple techniques. Primary repair is only possible if attempted very early (two to three weeks) after the injury, and reconstruction is often needed to restore stability. Commonly, the lateral collateral ligament, popliteus tendon, and popliteofibular ligament are reconstructed with use of various methods. Tunnel convergence in patients undergoing multiple-ligament reconstructions remains a substantial concern. Some surgeons favor a two-stage approach to multiple-ligament reconstructions, with acute repair of the posterolateral corner being followed by cruciate reconstruction after motion is restored. In patients with chronic posterolateral corner injuries, varus malalignment can predispose to the failure of ligament reconstruction. A prospective clinical trial assessed functional outcomes for patients with posterolateral corner deficiency and genu varus who were managed initially with a medial opening-wedge osteotomy. Eight of twenty-one patients had substantial improvement after the osteotomy and did not require subsequent ligament reconstruction, and the final outcome scores for patients requiring reconstruction were significantly worse than those for patients managed with osteotomy alone. That study emphasizes the need to address all pathoanatomic factors in this complex injury pattern in order to avoid the failure of major reconstructive efforts.

**Meniscus**
Although our understanding of the function of the meniscus continues to improve, the treatment of meniscal injuries remains a substantial challenge. Research efforts have elucidated the biomechanical role of the meniscus in stability, load distribution, and shock absorption as well as its contributions to the nutrition of articular cartilage, joint lubrication, and proprioception. Because of these diverse functions, preservation of the meniscus is important in order to optimize the long-term health of the knee. Methods of repair, replacement, and substitution of meniscal tissue continue to evolve, but the indications for these procedures often are not met, and partial meniscectomy remains among the most common procedures performed in orthopaedic surgery. The predictors of short-term recovery after arthroscopic partial meniscectomy were recently investigated. Age, body mass index, the depth of meniscal excision, and involvement of one or both menisci were not associated with patient recovery over time, but female sex and the extent of osteoarthritis were associated with a significantly slower rate of recovery throughout the first year postoperatively. This information can help to plan the practical aspects of short-term recovery after this very common procedure.

The gold standard for meniscus repair remains the inside-out technique with vertical mattress sutures. It is well known that anterior cruciate ligament reconstruction at the time of meniscus repair improves healing rates, and this factor must be taken into consideration when evaluating the literature on meniscal repair. While the development of all-inside meniscus-repair devices has made this procedure technically easier, the indications for repair based on tear pattern and location must be followed to avoid high failure rates and additional surgery. Numerous all-inside devices are currently available, and the clinical efficacy and complications of these devices have been well documented in recent years. A clinical trial of 280 meniscal repairs in patients undergoing concomitant anterior cruciate ligament reconstruction demonstrated similar outcomes in association with three commonly used all-inside devices after an average duration of follow-up of two years. The success rates, based on clinical examination and symptoms, were 92.4% for the FAST-FIX device (Smith and Nephew Endoscopy, Andover, Massachusetts), 87% for the T-Fix device (Acufex Microsurgical, Mansfield, Massachusetts), and 86.5% for the RAPIDLOC device (DePuy Mitek, Raynham, Massachusetts). Chronicity, the length or location of the tear, and patient age did not affect clinical outcomes. Of note, grooving of the medial condyle by the “top hat” of the RAPIDLOC device was...
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observed in two of six patients undergoing repeat arthroscopy because of failure. Further investigation is needed to determine any clinical consequences of this finding. While many studies have evaluated the healing of repair on the basis of clinical symptoms, the question of clinically silent failures remains. When imaging studies are used to evaluate healing, a wide range of results, including partial healing of the meniscus, are demonstrated. The functional implications of these findings remain unknown. A recent study evaluated fifty-three meniscal repairs (including thirty-one repairs in knees undergoing concomitant anterior cruciate ligament reconstruction) with computed tomographic arthrograms at six months postoperatively. Following the repairs, which were performed with use of all-inside, outside-in, or hybrid techniques, 58% of the menisci completely healed, 24% partially healed, and 18% failed, with a significant reduction in the width of the repaired tissue. The authors emphasized the importance of removal of fibrous tissue and tear-site abrasion along with stable fixation with nonabsorbable suture to optimize meniscal repair.

Despite advances in meniscal repair, many injuries result in irreparable tears. The long-term outcomes of total meniscectomy are notoriously poor. Meniscal replacement can be indicated for young patients with persistent pain, normal alignment, stable ligaments, and healthy cartilage who have had a failure of conservative management. Allograft transplantation is an established option, but it is a technically demanding procedure that recent research has shown to be heavily dependent on proper sizing and insertion technique. Tissue-engineered implants have been developed and studied in the laboratory for years, and a clinical trial of the collagen meniscus implant was recently published. That prospective, randomized, multicenter, controlled trial, in which the collagen meniscal implant was compared with partial meniscectomy, was conducted as part of a Phase-II feasibility study to confirm the safety and to establish the efficacy of the implant. This implant is a tissue-engineered scaffold that enables host-tissue ingrowth and requires a meniscal rim for attachment. Second-look arthroscopy, which was performed for 141 patients who had received the implant, revealed that the new tissue was well integrated and stable, with no failures due to lack of healing to the host meniscal rim. Both the acute group (no previous surgery) and the chronic group (previous meniscal surgery) were studied at a mean of fifty-nine months of follow-up. In the chronic group, patients who had received the implant regained significantly more of their lost activity and tear-site abrasion along with stable fixation with nonabsorbable suture to optimize meniscal repair.

Patella

Disorders of the patellofemoral joint are very common among young athletes. Acute trauma, overuse injuries, and malalignment problems cause alterations in the delicate balance of this complex articulation. A careful physical and radiographic evaluation is imperative to determine any biomechanical factors to which the instability or pain can be attributed. Because of the wide array of surgical treatments for these disorders, an accurate diagnosis is essential to define the correct indications for these diverse problems.

While the treatment of patellar instability remains controversial, the medial patellofemoral ligament is now generally accepted as the primary soft-tissue restraint to lateral displacement of the patella, leading to an increase in proximal realignment procedures in recent years. Although nonoperative treatment of initial patellar dislocations is recommended, persistent instability is a common complaint. A randomized trial compared the operative and nonoperative treatment of primary acute patellar dislocation in patients younger than sixteen years of age. Operative treatment consisted of a lateral release, either alone or in combination with direct medial repair. This method of initial operative repair did not improve the long-term outcome, and the recurrent dislocation rates were nearly identical. The authors identified a positive family history and contralateral patellofemoral instability as risk factors for recurrence. Another study, in which nonoperative treatment of primary dislocation of the patella was compared with operative treatment with use of anchor-based reattachment of the medial patellofemoral ligament to the adductor tubercle, showed that this procedure was of no benefit for reducing the rate of recurrent dislocation or improving functional outcome in patients thirteen to thirty years of age.

Some surgeons advocate medial patellofemoral ligament reconstruction instead of direct repair because the pattern of injury to the medial ligamentous structures appears to be variable and intraoperative isolation of these structures is difficult. Recent research has focused on the alteration of patellofemoral contact pressures with overtensioning of the reconstruction and the possible development of patellofemoral arthritis. In a recent case series with a mean duration of follow-up of 11.9 years, only two of twenty-four knees had definite progression to moderate arthritis, 88% of the knees had a good or excellent clinical outcome, and two knees had recurrent instability. Further research is needed to determine the best method for restoring stability and improving clinical outcomes.

Shoulder

Rotator Cuff

The treatment of rotator cuff disorders continues to improve, and these injuries are among the most common reasons for evaluation by a sports medicine physician. The rotator cuff remains the topic of intense research, and our understanding of cuff tears and their treatment has grown enormously as a result of these efforts. An evaluation of the recent literature
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reveals that the outcomes of arthroscopic rotator cuff repair have become equivalent to those of open and mini-open techniques. This is likely due to improved familiarity and skill with arthroscopic methods as well as to continued advances in implant materials and surgical devices that facilitate arthroscopic repair. Many surgeons prefer to perform an arthroscopic subacromial decompression combined with a mini-open rotator cuff repair. In a randomized controlled trial of sixty-three patients, the results of open acromioplasty and rotator cuff repair were compared with arthroscopic acromioplasty and mini-open rotator cuff repair after an average duration of follow-up of twenty-eight months. No differences in outcome scores were found at one and two years after surgery, but a significant difference was demonstrated at the three-month follow-up in favor of the arthroscopic mini-open repair group. This finding is representative of the less-invasive nature of arthroscopic procedures and is consistent with previous findings that good results are obtained with both open and arthroscopic methods.

The method of fixation for rotator cuff repair has received much attention in recent years. The goal of repair at the time of surgery is to provide maximum initial strength and to provide a large tendon-bone contact area. The strength of the repair must withstand displacement and gap formation until healing of the tendon to bone is complete. A large contact area is necessary to restore the normal anatomic rotator cuff footprint, which covers a large portion of the tuberosity. These concepts led to double-row and transosseous-equivalent suture methods. Numerous biomechanical studies have shown superior initial strength in association with the double-row repair. Recently, two studies demonstrated the importance of including humeral rotation when assessing the biomechanical strength of repair methods. One study demonstrated that double-row repairs performed significantly better than single-row repairs, particularly when cyclic loading was measured with humeral internal and external rotation. Another study revealed that dynamic external rotation resulted in greater gap formation anteriorly than posteriorly following suture tendon-bridging repair, but overall, no difference was found in terms of gap formation, stiffness, or ultimate load to failure between the suture tendon-bridge and double-row methods. Despite the advantages of double-row techniques seen in the laboratory, significant advantages in clinical outcomes have not been consistently demonstrated. It appears that the greatest advantage of double-row repairs is seen in association with large tears. A recent study with a two-year follow-up demonstrated improved outcomes for tears of >3 cm that were repaired with a double-row method and demonstrated no difference between single and double-row repairs for tears of <3 cm.

Advanced repair methods continue to evolve, and the ability to perform more complex repairs reflects improvements in surgical devices and implant systems. Orthopaedic surgeons are constantly bombarded with new designs and materials, and objective evidence on the performance of these various devices can be difficult to find. An excellent evaluation of suture, anchor materials, eyelet designs, and knotless designs was provided in a recent update. That update is essential reading for all surgeons employing these devices in their clinical practice, as efforts to simplify techniques should not compromise the biomechanical properties or clinical performance of the repair construct. For example, a biomechanical investigation of a knotless double-row construct revealed significantly poorer performance when a knotless medial row was compared with medial row knots. Another study evaluated lateral row fixation and demonstrated that suture-anchor techniques had higher individual failure rates as compared with transosseous suture techniques and that the mode of failure for anchor techniques was at the anchor-bone interface whereas transosseous failures occurred because of suture failure. Clearly, more research is needed to determine the clinical impact of these laboratory findings as the relationship of cuff integrity to functional outcome has been debated in the literature. In a recent case series, twenty-five patients who had been managed with a transosseous-equivalent suture-bridge technique underwent evaluation of repair-site integrity with use of magnetic resonance imaging one year postoperatively. Magnetic resonance imaging demonstrated an intact repair site in 88% of the patients, independent of tear size. Clinical studies with more patients and higher levels of evidence are needed to clarify these issues.

Multiple factors affect the outcomes of treatment of rotator cuff disease. Understanding tear patterns at the time of repair is essential to restoring the normal anatomy of the cuff insertion and decreasing tension at the repair site. A prognostic case series defined the frequency of various tear patterns and described a classification scheme that encompassed 97% of the 193 tears that were studied. The degree of muscle atrophy and the extent of fatty infiltration of the muscle in cases of chronic tears are important considerations related to the ability to repair chronic, massive rotator cuff tears as these factors are associated with higher failure rates and poorer clinical outcomes. This underscores the need for early diagnosis and treatment of rotator cuff tears to prevent these changes in the musculotendinous unit.

The contribution of suprascapular neuropathy as a cause of pain and weakness in patients with massive retracted tears was recently explored. In six patients with electromyographic evidence of suprascapular nerve palsy preoperatively, complete or partial arthroscopic repair of the cuff tear resulted in resolution of the nerve palsy on nerve-conduction studies after six months and significant pain relief and functional improvement at one year of follow-up. That study had severe limitations, and further research is needed to determine if repair of massive retracted cuff tears can lead to improvements in terms of pain and function by improving suprascapular nerve function.

Glenoid Labrum
Instability of the shoulder is a common problem in patients presenting with abnormal shoulder function. The uncon-
strained nature of the joint allows an extraordinary range of motion but can result in excessive laxity, causing damage to the labrum and the capsuloligamentous restraints. The treatment of a primary dislocation of the shoulder has been a topic of continuous debate as the etiologic factors, pathology, and prognosis are highly variable among various patient groups. Research in previous years suggested that younger male patients may experience an unacceptably high rate of recurrent dislocation and poorer functional scores in association with nonoperative management, whereas the rate of recurrent instability decreases among older patients participating in less-high-risk activities. Among studies evaluating nonoperative management, the necessity for immobilization and the method of immobilization have been questioned. A recent long-term study (duration of follow-up, twenty-five years) investigated the natural history and prognostic factors for patients forty years of age and younger who received conservative management with and without immobilization for the treatment of a primary anterior dislocation\textsuperscript{36}. Overall, 43% of the patients had no additional episodes of dislocation, with a nonrecurrence rate of 28% in the twelve to twenty-two-year age group, a 44% rate in the twenty-three to twenty-nine-year age group, and a 73% rate in the thirty to forty-year age group. The authors also reported that half of the shoulders in the youngest age group became stable over time, providing a basis for initial nonoperative management. They found no difference in prognosis when immobilization for three to four weeks was compared with immediate mobilization, and they found no association between athletic activity and the risk of recurrence.

Advances in surgical stabilization procedures reflect the increased understanding of the pathoanatomy of shoulder instability, specifically, the detached anteroinferior aspect of the glenoid labrum and capsuloligamentous structures (Bankart lesion). The decision to perform open as opposed to arthroscopic stabilization depends on surgeon experience, with arthroscopic procedures showing equivalent success rates in recent years. A randomized trial comparing arthroscopic examination and lavage with arthroscopic Bankart repair for the treatment of primary dislocation demonstrated a 76% reduction in risk of further dislocation for the repair group\textsuperscript{37}. The functional scores, patient satisfaction, and return to contact sports were also significantly higher for the repair group as compared with the group managed with lavage alone. The authors concluded that there is a treatment benefit in association with repair of a primary dislocation, but they did not recommend routine prophylactic repair for all primary dislocations because patients managed without repair in whom the shoulder remained stable over time had no functional disadvantage. A thorough discussion with patients regarding prognosis, the risk of complications, and the expectations for return to sports is essential to tailor the correct treatment plan for each individual. As materials and implants evolve, the clinical outcomes associated with their use must be followed. A recent trial comparing nonabsorbable and absorbable sutures for the treatment of shoulder instability demonstrated no difference in outcomes at two years of follow-up\textsuperscript{38}. Laboratory investigations of various stabilization techniques are a continued focus of published research. Reduction of shoulder volume with an arthroscopic method recently demonstrated effects comparable with those of open methods, with possible implications for the arthroscopic treatment of multidirectional shoulder instability\textsuperscript{39}. A study on the effect of rotator interval closure on anterior and posterior instability in a cadaver model showed no improvement in terms of posterior or inferior instability after interval closure, with the expected loss of external rotation associated with this technique\textsuperscript{40}. This finding is contrary to those of previous published reports, and further investigation is necessary to elucidate the role of interval closure in reducing instability.

Multiple factors must be addressed to provide the optimal treatment of an unstable shoulder. Recent literature has reflected an emphasis on the evaluation of bone deficiency in patients with shoulder instability. Clinically relevant bone defects include the engaging Hill-Sachs lesion and the “inverted pear” glenoid, both of which result in unacceptably high rates of recurrent instability when treated arthroscopically. If a deficiency of >25% of the inferior part of the glenoid exists, a bone augmentation procedure is indicated. This has led to the resurgence of the Latarjet procedure and the development of other open procedures to address the osseous deficiency often associated with recurrent dislocations. A study in which the glenoid index as determined with three-dimensional computed tomography was used to evaluate glenoid defects showed that 96% of the cases needing an osseous procedure were predicted with three-dimensional computed tomography\textsuperscript{41}. This represents an important diagnostic tool for preoperative planning, although it requires computed tomography scans of both shoulders to calculate the glenoid index. A recent case series evaluating the results of a modified Latarjet procedure for recurrent instability reported a 4.9% rate of recurrence after a mean duration of follow-up of fifty-nine months\textsuperscript{42}. Another series investigated the outcomes associated with the use of an anatomically modeled bicortical iliac crest graft for glenoid reconstruction after recurrent dislocation\textsuperscript{43}. The authors reported no recurrent instability and good functional scores after a mean duration of follow-up of 106 months. These studies validate the use of open bone-restoring procedures in cases in which soft-tissue reconstruction alone is insufficient to provide stability.

The diagnosis and treatment of lesions involving the superior labrum and biceps anchor are subjects of continued interest to the sports medicine specialist. Accurate diagnosis of superior labrum anterior and posterior (SLAP) tears is a difficult problem as multiple physical examination tests exist, with only modest sensitivity and specificity for any single test when used in isolation. A suspicion for these lesions should be high in young patients with pain and/or clicking during overhead activities. Current recommendations favor the use of
multiple physical examination tests along with patient history, demographic data, and magnetic resonance arthrography to define these subtle lesions. A randomized controlled trial evaluated outcomes in patients over the age of fifty years who had type-II SLAP lesions and rotator cuff tears. A comparison between patients who underwent SLAP lesion repair and rotator cuff repair and patients who underwent rotator cuff repair and biceps tenotomy revealed no advantages to including the SLAP lesion repair in this patient population. The relationship between rotator cuff and biceps tendon pathology continues to be a gray area, and the indications for tenotomy as opposed to tenodesis in this setting have yet to be definitively determined.

Acromioclavicular Joint
Traumatic disruption of the acromioclavicular joint is a common injury in the athletic population. The coracoclavicular ligaments are key stabilizing structures of the acromioclavicular joint, and a multitude of techniques to reconstruct these ligaments have been described. Controversy over treatment of the acute type-III acromioclavicular separation continues, but current recommendations support nonoperative treatment of these injuries, with surgical treatment being reserved for chronic injuries for which conservative treatment has failed. The classic Weaver-Dunn reconstruction with use of the coracoclavicular ligament is still commonly performed, but weak initial suture fixation to the clavicle in some cases has led to techniques involving suture anchors and allograft or autograft tendon reconstructions. These methods have shown superior biomechanical strength in the laboratory. A number of recently published case series involving suture anchors and tendon reconstructions have shown good recovery of strength and motion, with no loss of reduction. Prospective, randomized comparison studies are lacking, and no consensus on the preferred technique exists.

Cartilage
The treatment of articular cartilage defects is controversial. These injuries have a poor capacity to heal spontaneously and often lead to early osteoarthritis. There are many treatment options that attempt to restore pain-free function over the long term, but no single method has consistently proved to be superior. The major anatomic foci of these techniques are the knee and ankle, where substantial disability can result from articular cartilage injuries. Treatment options include marrow stimulation techniques (microfracture), osteochondral autograft plug transfer, osteochondral allograft, and autologous chondrocyte implantation. While each of these methods can lead to good results, they are also associated with drawbacks. Autograft plug transfer replaces the defect with normal hyaline cartilage, but restoring a congruent articular contour is difficult and the harvest site can produce persistent pain. Osteochondral allografts are generally indicated for larger defects and those associated with substantial subchondral bone loss, but matching the normal contour is difficult and questions regarding chondrocyte viability with various preservation techniques persist. Recent studies have suggested that fresh allografts, which maintain viable chondrocytes, incorporate well into host bone and do not cause immune rejection. Further research is needed to elucidate the role of allograft restoration of cartilage defects.

Microfracture has provided good clinical results, and the procedure is inexpensive and easy to perform. The major drawback of this procedure is healing of the defect with fibrocartilage, which is far less durable than the native hyaline cartilage. The development of regenerative techniques to restore hyaline cartilage, such as autologous chondrocyte implantation, has been the subject of extensive research in recent years. This technique requires two operations, requires compliance with an extensive postoperative rehabilitation program, and is very expensive. Moreover, the regenerated cartilage is described as “hyaline-like,” calling into question its long-term durability. A randomized study in which autologous chondrocyte implantation was compared with microfracture of the femoral condyle showed no significant clinical or radiographic differences between the two groups after five years of follow-up. At the time of the two-year follow-up, histological specimens were collected and graded, and no correlation was found between histological quality and clinical outcome, although no patient with predominantly hyaline cartilage had clinical failure at the five-year mark. This result suggests that microfracture may be a better first-line procedure than autologous chondrocyte implantation is because of the low cost and simplicity of the procedure. In another randomized controlled trial, characterized chondrocyte implantation (ChondroCelect; TiGenix, Leuven, Belgium) was compared with microfracture. Characterized chondrocytes are an expanded population of cells that express a marker that is predictive of the capacity to form hyaline-like cartilage, with greater homogeneity and optimal potency of each cell batch. At one year after treatment, clinical outcome was similar for both treatments, but characterized chondrocyte implantation was associated with regenerated tissue that was histologically superior to that of microfracture. Long-term follow-up is necessary to determine if the structural advantages of this tissue result in improved clinical outcomes.

The intra-articular administration of local anesthetic has received much attention in the recent literature. Because of the popularity of outpatient surgery for many sports medicine procedures, alternative methods of pain control have been developed, including the pain pump, which continuously infuses local anesthetic to the operative site. Reports of chondrolysis associated with use of the pain pump have called into question the safety of this modality. Although bupivacaine has been implicated in most investigations, a report on lidocaine toxicity was recently published. Cultured bovine chondrocytes and osteochondral cores were treated with 1% or 2% lidocaine for fifteen, thirty, or sixty minutes and were compared with buffered saline solution treatment with regard...
to chondrocyte viability. Results showed dose and time-dependent effects of lidocaine exposure for both the cultured chondrocytes and the osteochondral plugs. To determine if ropivacaine may be a safer alternative to bupivacaine, a study comparing their effects on human chondrocytes was conducted. Full-thickness cartilage explants and cultured chondrocytes were treated with saline solution, 0.5% ropivacaine, or 0.5% bupivacaine for thirty minutes. Chondrocyte viability was significantly greater after treatment with ropivacaine as compared with bupivacaine in both the cartilage explants and the cultured chondrocytes. These laboratory results suggest that ropivacaine is a safe alternative, but clinical correlation is necessary. Moreover, multiple studies have questioned the efficacy of pain relief with use of the pain pump, and some have concluded that interscalene block is equally effective for pain relief following arthroscopic shoulder surgery, without the concerns for cartilage damage. More research is necessary, but on the basis of the current literature, the use of bupivacaine for intra-articular analgesia should be avoided.

**Hand and Wrist**

Disorders of the hand and wrist are common among athletes, but few studies pertaining to the treatment of these injuries are found in the sports medicine literature. The current focus remains on arthroscopic treatment for injuries of the wrist, including dorsal wrist impingement syndrome, ulnar-sided wrist pain, and tears of the triangular fibrocartilage complex. Techniques for arthroscopic repair of the triangular fibrocartilage complex continue to evolve, and most of these injuries are still treated by hand surgeons. It has been demonstrated recently that an ulnar positive variance is associated with increased cell death in degenerative triangular fibrocartilage complex lesions, which may explain why this anatomic variant has been associated with poorer outcomes after arthroscopic repair. Techniques to normalize ulnar variance are likely necessary to avoid failed repair in this patient population.

Injuries to the ulnar collateral ligament of the elbow results in markedly decreased performance in throwing athletes. The anterior band of the ulnar collateral ligament experiences tremendous stresses during the late-cocking and early-acceleration phases of throwing, resulting in stretching, attenuation, or rupture of the ligament. Numerous previous reports have documented the efficacy of reconstruction of the ulnar collateral ligament for return to throwing sports. The results of a new hybrid reconstruction technique, combining the advantages of the docking technique for proximal fixation with the improved biomechanical characteristics of distal interference screw fixation, were published this year. This method lessens the risk of fracture of the medial epicondyle, while restoring the native, narrow insertion of the ligament through a single distal tunnel. After a mean duration of follow-up of thirty-six months, nineteen of twenty-two patients had an excellent result, with two cases of ulnar neuritis. These results are similar to those associated with other published techniques, and the authors concluded that this technique is especially useful for revisions and cases of sublime tubercle insufficiency.

**Elbow**

Lateral epicondylitis is a very common diagnosis among athletes, especially football players. However, no recent studies on the treatment of these injuries have been published in the sports medicine literature. Research on operative and nonoperative treatment, the timing of surgery, and the impact of this injury on sport and position-specific performance is needed to guide the team physician through this difficult decision-making process.

**Hip**

The arthroscopic treatment of structural abnormalities of the hip has increased dramatically in recent years. Hip arthroscopy has been an effective treatment for labral pathology, and the osseous abnormalities leading to labral damage are now being addressed arthroscopically. Femoroacetabular impingement results from a decreased anterior head-neck offset of the proximal part of the femur (cam-type impingement) or acetabular overcoverage (pincer-type impingement), and these areas can be treated with arthroscopic osteoplasty. The diagnosis of hip abnormalities continues to evolve. Operative repair has been associated with superior outcomes in comparison with nonoperative treatment, especially with regard to the restoration of supination strength. Multiple repair methods utilizing one or two incisions and various fixation devices have been described. The anterior incision has been associated with various nerve injuries, whereas the two-incision transosseous suture approach can result in radioulnar synostosis. A biomechanical comparison of multiple fixation devices and the transosseous suture method showed initial failure loads sufficient to withstand rehabilitation techniques for all methods tested, but the ENDBUTTON (Smith and Nephew Endoscopy, Andover, Massachusetts) had a significantly higher load to failure than all other techniques did. This finding is consistent with those of previous biomechanical reports, and further clinical correlation is needed to compare the results and complications associated with these various techniques.

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Recent published long-term follow-up studies of both the arthroscopic and open methods have demonstrated remarkably similar outcomes. It appears that either surgical technique is acceptable, as long as the pathologic tissue is accurately identified and adequately resected.

The treatment of acute distal biceps ruptures continues to evolve. Operative repair has been associated with superior outcomes in comparison with nonoperative treatment, especially with regard to the restoration of supination strength. Multiple repair methods utilizing one or two incisions and various fixation devices have been described. The anterior incision has been associated with various nerve injuries, whereas the two-incision transosseous suture approach can result in radioulnar synostosis. A biomechanical comparison of multiple fixation devices and the transosseous suture method showed initial failure loads sufficient to withstand rehabilitation techniques for all methods tested, but the ENDBUTTON (Smith and Nephew Endoscopy, Andover, Massachusetts) had a significantly higher load to failure than all other techniques did. This finding is consistent with those of previous biomechanical reports, and further clinical correlation is needed to compare the results and complications associated with these various techniques.

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Injuries to the ulnar collateral ligament of the thumb are very common among athletes, especially football players. However, no recent studies on the treatment of these injuries have been published in the sports medicine literature. Research on operative and nonoperative treatment, the timing of surgery, and the impact of this injury on sport and position-specific performance is needed to guide the team physician through this difficult decision-making process.

**Elbow**

Lateral epicondylitis is a very common diagnosis among competitive and recreational athletes. Overuse, especially repetitive forearm activity and wrist extension, leads to the development of tendinosis and the formation of granulation tissue in an attempt to repair the damaged extensor tendon origin. While initial nonoperative management is the mainstay of treatment, refractory cases often require surgical intervention. Debate over the method of surgical treatment persists.
of cam-type femoroacetabular impingement has been shown to correlate with an increased offset angle, and the larger cam lesions are associated with larger areas of cartilage damage and labral detachment. Both open and arthroscopic treatment methods have been described, and case series investigating the clinical outcomes of arthroscopic treatment have shown good outcomes in the short term. Cadaver studies have confirmed that adequate osseous resection can be achieved arthroscopically, and avoiding the extensive open approach and its associated risk to the femoral head blood supply is a decided advantage of the arthroscopic technique. However, as this is a new method of treatment, no long-term results are available and direct comparison studies of the open and arthroscopic techniques have not been performed, to our knowledge.

Foot and Ankle
Injuries to the foot and ankle are common in our increasingly active population. Acute trauma or overuse can result in bone, ligament, tendon, or cartilage injuries. As mentioned previously, cartilage lesions of the ankle represent a difficult treatment challenge, and, similar to the knee, there is no consensus on the best treatment for these troublesome lesions. Recent studies have shown microfracture to be effective, but well-designed comparison studies are lacking. A number of recent studies have investigated the effects of different nonoperative treatments on chronic Achilles tendinopathy. In a randomized controlled trial, the probability for recovery was found to be significantly lower after eccentric loading than after low-energy shock wave therapy. Another randomized controlled trial evaluated three different nonoperative treatment regimens. No significant differences were found between groups treated with eccentric loading, a specifically designed heel brace, or a combination of the two methods at six, twelve, or fifty-four weeks of follow-up. These studies challenge the effectiveness of eccentric calf-loading and provide less painful alternatives that can be effective for treating these chronic injuries.

The treatment of acute Achilles tendon ruptures is also controversial. It is well established that the rerupture rate is lower in association with operative treatment, and there is also evidence that nonoperative treatment is associated with stiffness and decreased strength. Surgical treatment along with early, restricted motion has demonstrated outcomes superior to those of nonoperative treatment. A recent randomized controlled study investigated the importance of early motion after the operative or nonoperative treatment of an Achilles tendon rupture. Patients in both the operative and nonoperative treatment groups were managed with the same controlled early motion, and the authors found no significant differences between the groups in terms of plantar flexion, dorsiflexion, or calf circumference at multiple time intervals during the first year after treatment. There was also no difference between the two groups with regard to the rerupture rate, providing strong evidence that controlled early motion may be the most important part of treatment for a ruptured Achilles tendon.

Spine
The on-field treatment of spine and other neurologic injuries continues to be a focus of sports medicine physicians. The importance of recognizing concussions, and the devastating consequences of repeat episodes, continues to receive increasing attention. In particular, the second-impact syndrome, which is a minor second injury after incomplete recovery from a previous head injury, must be avoided. There are still no universally accepted guidelines for diagnosis and criteria for return to play, but a conservative approach with these serious injuries is warranted. A close working relationship with the athletic trainer is crucial to provide the safest treatment on the sidelines, and for follow-up in the training room.

Cervical spine injury is a major concern in collision sports. On-field immobilization recommendations for adult football players are well described. Recently, an investigation of the most effective cervical immobilization for youth football players was conducted. To determine if the increased head-to-torso ratio in developing children leads to increased kyphosis when placed on a spine board, the effects of helmets and pads on cervical alignment were evaluated. Thirty-one football players who were eight to fourteen years of age were evaluated radiographically while wearing both shoulder pads and helmet, no equipment, or shoulder pads and no helmet. The radiographs showed that the proper alignment was maintained when the helmet and shoulder pads were left on. Therefore, the current recommendation for youth football players is immobilization and transport with the helmet and shoulder pads left in place. Additionally, continued education on proper tackling technique is a very important part of the prevention of these potentially catastrophic injuries.

Injury Prevention
The prevention of sports injuries continues to be a major focus in our field. An increased understanding of injury risk factors, including neuromuscular factors, has led to the development of effective prevention strategies. The higher risk of anterior cruciate ligament tears in females is well documented, and the relationship of kinematic factors to anterior cruciate ligament injuries in this population has been investigated extensively. A randomized controlled study of noncontact anterior cruciate ligament injury prevention in female collegiate soccer players showed a 41% decrease in the overall rate of anterior cruciate ligament injury with use of a neuromuscular and proprioceptive training program. The PEP program (Prevent injury and Enhance Performance) consists of stretching, strengthening, plyometrics, and agility exercises to address potential deficits in strength and neuromuscular coordination of the stabilizing muscles around the knee. This program was implemented during normal practice time and without the need for special equipment, making it more feasible than many previously reported programs, and provides promising results in the reduction of noncontact anterior cruciate ligament injuries. The incidence of other injuries may not be influenced.
by prevention programs. For instance, the risk of developing overuse knee injuries and medial tibial stress syndrome was not influenced by an exercise program in a study of >1000 army recruits\(^9\). The concurrent increase in activity level combined with the exercise program likely resulted in excessive increased load, which is the underlying cause of these particular injuries. Further investigation is necessary to establish the optimal role of prevention programs for specific activities.

The increasing rate of injuries in youth baseball pitchers is another area of concern. The incidence of elbow and shoulder pain in these athletes is alarmingly high, and the number of surgical procedures used to address these injuries has increased dramatically in recent years. An increased risk of injury has been associated with the number of pitches thrown and the type of pitch thrown, specifically, the curveball. A biomechanical comparison of different types of pitches showed that in general, elbow and shoulder loads were greatest for the fastball, which suggests that the curveball may not be more harmful than the fastball for youth pitchers\(^6\). That study supports the recent focus on limiting the number of pitches rather than the type of pitch. Regardless of what type of pitches are thrown, a strict pitch count limit that includes games and practices is essential to injury prevention in youth baseball players.

**Evidence-Based Orthopaedics**

The editorial staff of *The Journal* reviewed a large number of recently published research studies related to the musculoskeletal system that received a Level of Evidence grade of I. Over 100 medical journals were reviewed to identify these articles, all of which have high-quality study design. In addition to articles already cited in this update, twenty-one additional level-I articles were identified that were relevant to orthopaedic sports medicine. A list of those articles is appended to this review following the standard bibliography. We have provided a brief commentary about each of the articles to help to guide your further reading, in an evidence-based fashion, in this subspecialty area.

**Subspecialty Certification in Sports Medicine**

Subspecialty certification in sports medicine is under the direction of the American Board of Orthopaedic Surgery (ABOS). The subspecialty certification examination has been held twice, in 2007 and 2008, and the five-year “grandfather period” for any surgeon seeking this certification will expire in 2012. After this date, applicants will be required to have completed an Accreditation Council for Graduate Medical Education (ACGME)-accredited and/or Arthroscopy Association of North America (AANA)-recognized sports medicine fellowship to sit for the examination. Current requirements to apply for the examination include ABOS certification and an active sports medicine practice with at least 115 sports medicine cases (seventy-five of which must include arthroscopy) within the previous year. A complete list of requirements, including eligible sports medicine cases, is available online at the ABOS web site (www.abos.org).

The application deadline for the 2009 examination is March 15, 2009. It must include case lists, required documents, and fees. Eligible candidates will be mailed their scheduling/admission permits in August 2009, and the examination will be administered in November 2009 at Prometric Technology Centers nationwide. The application materials are available at the ABOS web site. The AOSSM and AAOS review course for subspecialty certification in orthopaedic sports medicine will be held August 14 through 16, 2009, in Chicago, Illinois, and information on this course can be found at the AOSSM web site (www.sportsmed.org). Applications for the 2010 examination will be available online beginning in August.

**Sports Medicine Fellowships**

Sports medicine remains the most popular fellowship choice in orthopaedic surgery. This year, important changes in sports medicine fellowships are taking place. The 2008-2009 fellowship class represents the first class that requires completion of an ACGME-accredited program to be eligible for the ABOS subspecialty certification examination. Currently, eighty-five fellowships are accredited, and applicants may wish to consider this factor when choosing a fellowship given the subspecialty certification requirements discussed above. As many unaccredited fellowship programs continue to seek accreditation, applicants should contact individual programs or the ACGME to determine changes in accreditation status.

Another important change in the fellowship process this year is the establishment of a formal match for appointment year 2010. The previous match system dissolved in 2005, and a “gentleman’s agreement” among participating programs was in place last year. The formal match process combined the efforts of the AOSSM, AANA, and ABOS, and is necessary to allow applicants the opportunity to complete all offered interviews before making a final decision. At this time, ninety-four programs representing 225 positions will participate in the match, and it is hoped that participating programs and fellowship directors will honor this system to standardize the process and provide a fair system for applicants. The match will be administered by the San Francisco Match Services and utilizes the Central Application Service (CAS). Both accredited and unaccredited programs are participating, and this designation is available online at the San Francisco Match web site (www.sfmatch.org). Applicants must register directly with the San Francisco Match to participate. The deadline for submission of rank lists by programs and applicants is March 20, 2009, and match day is April 15, 2009. More information, including the match agreement, fees, and deadlines, is available at both the AOSSM and the San Francisco Match web sites.

**Upcoming Meetings**

The Seventy-sixth Annual Meeting of the American Academy of Orthopaedic Surgeons will be held February 25 through 28, 2009, in Las Vegas, Nevada, with specialty day being held on
What’s New in Sports Medicine

February 28, 2009. The annual meeting of the Arthroscopy Association of North America will be held April 30 through May 3, 2009, in San Diego, California. The annual meeting of the American Orthopaedic Society for Sports Medicine will be held July 9 through 12, 2009, in Keystone, Colorado.

References

WHAT’S NEW IN SPORTS MEDICINE


Evidence-Based Articles Related to Sports Medicine


Patients were randomized to minimal debridement of the intercondylar notch or conventional clearance of the notch for autologous hamstring anterior cruciate ligament reconstruction. All patients underwent magnetic resonance imaging postoperatively at two, six, and twelve months to evaluate revascularization of the implanted autografts. Results showed earlier revascularization of the midsubstance of the anterior cruciate ligament graft at two months in association with the minimal debridement technique. The clinical importance of this finding, however, is unclear, as no differences in clinical outcomes or examination findings were demonstrated between the groups.


The contamination rates of bone-patellar tendon-bone and hamstring autografts were evaluated with graft-tissue culture samples at different time intervals during preparation. The contamination rate before implantation was 12% overall, with no difference between the bone-patellar tendon-bone and hamstring groups, and no postoperative infections were reported. Also, no changes in protein level were demonstrated between patients with a contaminated graft and those with an uncontaminated graft. These findings suggest that in a patient with a contaminated graft, no additional treatment is necessary in the absence of clinical signs of infection.


This randomized, prospective controlled trial evaluated the effect of early as opposed to delayed anterior cruciate ligament reconstruction with hamstring autograft on postoperative range of motion and stability in young, active patients. Seventy patients were randomized into two groups, with one group undergoing surgery within three weeks after the injury and a second group undergoing reconstruction at a minimum of six weeks after the injury. The average duration of follow-up after concurrent exercise program in subjects exposed to an increase in training load: a randomized controlled trial of 1020 army recruits. Am J Sports Med. 2008;36:663-70.


Twenty men and twenty-four women with acute postero medial tibial stress fractures were randomly assigned to treatment with active or placebo capacitively coupled electric field stimulation devices for fifteen hours a day until the fractures healed. Patients also received supplemental calcium and...
were instructed to refrain from provocative training. The active and placebo groups showed no difference in terms of the time to healing. Women healed more slowly than men did. Noncompliance with rest instructions led to an increased time to healing, with optimal compliance leading to a reduced healing time. Severe stress fractures showed shortened healing time in association with active capacitively coupled electric field device use. This study shows that capacitively coupled electric field stimulation may be more efficacious for patients with a higher incentive to return to play, assuming that this patient population will be motivated to be more compliant with device use and weight-bearing restrictions during healing.


This observational study evaluated the relationship between preoperative expectation and postoperative outcome following unilateral primary repair of chronic rotator cuff tears for 125 patients. Each patient prospectively completed several limb-specific outcome instruments and SF-36 (Short Form-36) forms postoperatively and again at one year postoperatively. The results showed that greater preoperative expectations were correlated with better postoperative performance on self-assessed outcome measures. The authors noted that, unlike in previous studies, higher preoperative expectations were associated with better postoperative function and pain. This study highlights the importance of preoperative expectations on outcomes following rotator cuff repair, and it also reiterates the importance of preoperative patient counseling.


This randomized controlled trial evaluated the effect of a prophylactic eccentric training and stretching program for professional soccer players with ultrasonographic intratendinous changes of the Achilles and patellar tendons. Two hundred and nine Danish professional soccer players from twelve teams were followed over a twelve-month period. Half of the teams were randomized to a treatment group and underwent prophylactic eccentric training and stretching of the Achilles and patellar tendons during the season. The training and stretching program for patients with normal patellar tendons led to a significant reduction in the proportion of players with ultrasonographic patellar tendon changes by the end of the season. The program had no effect on normal Achilles tendons. Preseason intratendinous changes on ultrasound significantly increased the risk of tendon problems during the season. Thus, ultrasound can be used in the preseason to identify players in whom symptomatic Achilles or patellar tendon problems may develop during the season. Unfortunately, the preseason eccentric training program aimed at reducing intrasession injuries in patients with ultrasonographic changes actually was associated with an increased injury risk.


This piggyback randomized controlled trial assessed shoulder strength following open as opposed to arthroscopic stabilization for the treatment of traumatic anterior instability. The hypothesis was that patients undergoing open stabilization would have internal rotation deficits when compared with those undergoing arthroscopic repair. Forty-eight patients were randomized to either open stabilization (with a subscapularis splitting approach) or arthroscopic stabilization. All patients underwent isokinetic strength testing at one year after surgery. No significant difference in internal concentric strength at 60°/sec (the primary outcome measure) was found between the groups. Both groups had strength deficits in the treated limb as compared with the contralateral limb. This study demonstrated that internal and external rotation deficits exist following both open and arthroscopic anterior stabilization procedures. Further study is needed to determine if subscapularis tendon detachment procedures for anterior stabilization lead to increased internal rotation deficits.


The authors of this randomized controlled trial sought to determine whether the most common injuries in high-risk soccer players could be identified and subsequently prevented through the implementation of a preventive training program. Five hundred and eight players completed a questionnaire evaluating previous injury and/or limited function. From this, high-risk and low-risk groups were created. The high-risk group was randomized into an intervention group (managed with a preventive training program) and a control group. High-risk players were successfully identified with the questionnaire. There was no difference in the risk of injury between the high-risk intervention and control groups. This finding was thought to be due in large part to poor compliance with the training program by those in the intervention group.


The authors of this randomized controlled trial sought to compare closed and open kinetic chain quadriceps-strengthening programs for patients with anterior cruciate ligament deficiency. Forty-two patients were randomized into a closed kinetic chain or an open kinetic chain quadriceps-strengthening rehabilitation program. Patients were evaluated after the completion of four months of rehabilitation. Several assessment tools were used, with no difference being noted between the groups, with the exception that the open kinetic chain group had significantly greater quadriceps strength in comparison with the closed kinetic chain group. This study suggests that open kinetic chain quadriceps-strengthening rehabilitation programs may be effective for patients with anterior cruciate ligament deficiency.


The purpose of this study was to investigate the use of low-level laser irradiation combined with an eccentric exercise program for recreational athletes with chronic Achilles tendinopathy. Fifty-two recreational athletes with chronic Achilles tendinopathy were randomized into two groups. One group was treated with an eccentric exercise program and low-level laser therapy, while another group underwent eccentric exercise combined with placebo low-level laser therapy. Patients in the eccentric exercise program and low-level laser therapy group experienced faster recovery from the Achilles tendinopathy in comparison with those in the eccentric exercise combined with placebo low-level laser therapy group.


In this cohort study, a standard concentric and eccentric isokinetic assessment program was used during the preseason to identify and treat professional soccer players who had hamstring strength imbalances that may predispose them to injury. Six hundred and eighty-seven players were enrolled during the preseason, and 462 were available for follow-up. The study found that the risk of injury was, in fact, high for those individuals. Furthermore, restoring the strength profile, thus eliminating the imbalance, decreased the incidence of injury.

The purpose of this double-blind, randomized, phosphate-buffered saline solution-controlled study was to evaluate the use of three and five-injection regimens of intra-articular sodium hyaluronate for the treatment of shoulder pain. Six hundred and sixty patients with shoulder pain secondary to a variety of etiologies were enrolled, and 456 were available for follow-up at twenty-six weeks. The primary end point of the study was to achieve improvement in terms of shoulder pain at thirteen weeks. Unfortunately, this was not achieved overall. However, the authors found that both the three and five-injection regimens were successful for the treatment of persistent shoulder pain in patients with osteoarthritis. Therefore, patients with osteoarthritis who fail to respond to other conservative measures and who also are poor surgical candidates may benefit from an intra-articular sodium hyaluronan treatment regimen.


The authors of this cohort study sought to identify the knee-specific quality-of-life instruments that best detect symptoms and disabilities of the most importance to patients. One hundred and fifty-three patients with anterior cruciate ligament ruptures, isolated meniscus tears, or osteoarthritis completed the subjective portions of eleven knee-specific instruments. The Mohtadi quality-of-life instrument scored best for anterior cruciate ligament tears, with the Western Ontario Meniscal Evaluation Tool (WOMET) scoring best for meniscal tears. For osteoarthritis, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) fared best. For general knee instruments, the International Knee Documentation Committee Standard Evaluation Form and the Knee Injury and Osteoarthritis Outcome Score were both thought to contain the most items of importance to patients. This study is of great clinical research importance as its results may be used to guide clinical outcomes research for knee disorders.


In this randomized controlled trial, participants who were preparing for a recreational 4-mi (6.4-km) running event were randomized into either a control group (managed with an eight-week graded training program) or an intervention group (managed with a thirteen-week graded training program). The purpose of the study was to compare the results of either program on the incidence of running-related injury (defined as any lower extremity or back musculoskeletal complaint that would restrict running for at least one week). The thirteen-week graded program was accelerated on the basis of the 10% training rule. The study demonstrated no difference in the incidence of running-related injuries between the groups.


The purpose of this randomized controlled trial was to evaluate and compare a one-time interscalene block with a continuous catheter infusion of local anesthetic for pain control following arthroscopic surgery of the shoulder. Fifty-six patients were randomized into either a preoperative interscalene block group or a subacromial continuous infusion group. Pain was evaluated at various stages through the seventh postoperative day. Primary outcomes included pain scores, the complication rate, cost, and rescue medication intake. No difference was found between the groups in terms of any primary outcome. The authors concluded that more research could be done in this area.


This comparative meta-analysis evaluated and compared the outcomes and levels of evidence of commercially-funded studies of autologous chondrocyte implantation with those of non-commercially-funded studies. Twenty-three studies were included. No difference in clinical outcome data was found. However, it was found that commercially-funded studies had a significantly lower level of evidence in comparison with non-commercially-funded studies. These results are reassuring in that no evidence of bias between commercially-funded and non-commercially-funded studies was found. However, as a result of these findings, commercial-funding entities may seek to fund studies with potentially higher levels of evidence in the future.


This randomized trial aimed to determine whether radiofrequency-based plasma microtenotomy (microdebridement) was effective for the treatment of chronic supraspinatus tendinosis. Sixty patients were randomized to undergo either radiofrequency-based microtenotomy (with use of a bipolar radiofrequency-based probe) of the supraspinatus tendon without subacromial decompression or subacromial decompression alone. Pain and functional assessments were performed. Both approaches resulted in significant pain improvement for patients at one year after surgery. This study raises the question of whether this patient population requires such an extensive procedure as a subacromial decompression.


This prospective, double-blind, vehicle-controlled, parallel-group, randomized study evaluated the use of an investigational drug, OMS103HP, in patients undergoing arthroscopic anterior cruciate ligament reconstruction. This investigational drug product contains ketoprofen, amniotrofile, and oxymetazoline. Study outcome measures included drug safety and the ability to improve postoperative knee function and motion, to reduce postoperative pain, and to allow earlier return to work over a thirty-day period postoperatively. The drug was well tolerated, and the OMS103HP group outperformed the vehicle-treated group in all three categories.


The goal of this prospective randomized study was to assess the bio-mechanical, radiographic, and functional outcome of computer-navigated single-bundle anterior cruciate ligament reconstruction. Forty patients underwent anterior cruciate ligament reconstruction utilizing the OrthoPilot navigation system (B. Braun Aesculap, Tuttlingen, Germany), and another forty underwent reconstruction with use of a standard manual targeting technique. Assessment of the reconstruction was done with use of the KT-1000, radiographs, and the questionnaire-based Lysholm and International Knee Documentation Committee scales. The only significant difference found was more accurate femoral tunnel placement in association with the use of the navigation system.


In this randomized controlled trial, twenty-four male amateur soccer teams were randomized into an intervention group (managed with a coach-controlled rehabilitation program) and a control group. The purpose of the study was to evaluate the effect of the intervention on reducing the rate of reinjury. Analysis showed a significant reduction in injury in the intervention group for all injury locations. The greatest preventive effect was recognized during the first week of return to play, and the authors concluded that a coach-

The purpose of this meta-analysis was to generate estimates of the true incidence of anterior cruciate ligament tears as a function of sex, sports activity, and injury-reduction training. Females had a three times greater incidence of anterior cruciate ligament tears in soccer and basketball as compared with males. Injury-reduction programs were effective in soccer but not in basketball. The highest incidence of anterior cruciate ligament tears was seen in recreational Alpine skiers, but no variance by sex was found for Alpine skiers. No variance by sex was found for lacrosse players. Those at greatest risk for anterior cruciate ligament tear were found to be year-round female athletes who play both soccer and basketball, with a 5% rate of anterior cruciate ligament tears.