AMERICAN HEALTH CONSULTANTS®

SPORTS MEDICINE REPORTS™

The essential guide to developments in sports medicine and orthopaedics

American Health Consultants Home Page—http://www.ahcpub.com

CME for Physicians—http://www.cmeweb.com

PCL Inlay a Better Way?

ABSTRACT & COMMENTARY

Synopsis: *PCL reconstruction with a tibial inlay technique resulted in significantly more stable knees with less graft damage upon cyclic loading as compared to the trans-tibial tunnel technique.*

Source: Bergfeld JA, et al. A biomechanical comparison of posterior cruciate ligament reconstruction techniques. *Am J Sports Med*. 2001;29(2):129-136.

Pcl reconstruction techniques are generally known to produce results that are less predictable than the results achieved with ACL reconstructions. In an effort to improve the clinical results, techniques have been developed to better reproduce the femoral attachment anatomy using a double-bundle graft. A trans-tibial tunnel, however, is not anatomic and can be difficult to reproducibly position with arthroscopic methods. A tibial inlay technique has recently been introduced that attaches the graft to a trough on the back of the tibia at the anatomic insertion. Proponents suggest that this avoids the "killer turn" the graft otherwise must make as it exits a posteriorly directed tibial tunnel and turns toward the femoral attachment. This inlay technique hasn't really been tested in the lab the way the other PCL techniques have until this study by Bergfeld and colleagues at the Cleveland Clinic.

Six pairs of cadaver knees were tested for displacement in a custom device with a posteriorly directed load. Each knee was tested while intact, after PCL sectioning, and after reconstruction with either a trans-tibial or tibial-inlay method. Ipsilateral bone-tendon-bone grafts were used with interference fixation in tunnels and screw and washer fixation for the inlay. Measurements were performed at 0, 30, 60, and 90° of flexion and at neutral, internal, and external tibial rotation.

The tibial-inlay group had the most stable knees under all conditions. After 72 cycles of repetitive loading, both graft systems stretched, but the inlay group still approximated the laxity of the intact PCL knee. However, the tunnel group was significantly

Volume 3 • Number 6 • June 2001 • Pages 41-48

INSIDE

more lax than both the inlay group and the intact knee. Moreover, gross inspection of the retrieved grafts demonstrated significantly more thinning and damage to the tendon of the tunnel group where the graft makes the "killer turn."

■ COMMENT BY DAVID R. DIDUCH, MS, MD

This paper clearly provides excellent evidence in support of the tibial inlay technique for PCL reconstruction. For myself, and I am sure many of the readers, we just can't get the PCL reconstructions to stay tight. Initially stable knees tend to stretch with time to a one plus or worse exam. Many factors could play a role, including loss of fixation, stretch of allograft, or nonanatomic fixation. Bergfeld et al provide sound evidence here that the "killer turn" is a major culprit. This is a problem that the new 2 bundle techniques don't address. The tibial inlay technique prevents this problem, and this paper demonstrates that it results in a more stable knee. This is true initially and more importantly with repetitive loading.

Bergfeld et al are to be commended on a solid study with sound methods and statistics. The only shortcoming could have been the older age of cadaver specimens and that the same knee was not reconstructed both ways but rather compared to the contralateral knee. They compensated somewhat with cement augmentation of graft fixation to ensure that fixation slip was not the difference. Now we have biomechanical and anatomic evidence of an advantage of the inlay technique. Next we need clinical studies. Anecdotally, I have been impressed with tighter knees with the inlay technique and have made the switch. The surgical methods for this new approach need to be disseminated next as the back of the knee is not a place orthopaedic surgeons often go on purpose. ❖

Sports Medicine Reports, ISSN 1524-0991, is published monthly by American Health Consultants, 3525 Piedmont Rd., NE, Bldg. 6, Suite 400, Atlanta, GA 30305.

VICE PRESIDENT/GROUP PUBLISHER: Donald R. Johnston.

EDITORIAL GROUP HEAD: Glen Harris.

MANAGING EDITOR: Robin Mason.

ASSOCIATE MANAGING EDITOR: Neill Larmore.

SENIOR COPY EDITOR: Robert Kimball.

MARKETING PRODUCT MANAGER: Schandale Kornegay.

GST Registration Number: R128870672.

Periodical postage pending at Atlanta, GA.

POSTMASTER: Send address changes to ***Sports Medicine Reports***, P.O. Box 740059, Atlanta, GA 30374.

Back issues: $33. Missing issues will be fulfilled by Customer Service free of charge when contacted within one month of the missing issue's date.

AMERICAN HEALTH CONSULTANTS™
THOMSON HEALTHCARE

Subscriber Information

Customer Service: 1-800-688-2421.

Customer Service E-Mail Address: customerservice@ahcpub.com

Editorial E-Mail Address: robert.kimball@ahcpub.com

World-Wide Web: http://www.ahcpub.com

Subscription Prices

United States
$249 per year (Student/Resident rate: $100).

Multiple Copies
1-9 additional copies: $179 each. 10-20 copies: $159 each.

Canada
Add GST and $30 shipping.

Elsewhere
Add $30 shipping.

Accreditation

American Health Consultants (AHC) designates this continuing medical education (CME) activity for up to 20 hours of category 1 credit toward the AMA Physician's Recognition Award.

Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

This CME activity was planned and produced in accordance with the ACCME Essentials.

AHC is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

For CME credit, add $50.

Questions & Comments

Please call **Robin Mason,** Managing Editor, at (404) 262-5517; or e-mail: robin.mason@ahcpub.com or **Robert Kimball,** Senior Copy Editor, at (404) 262-5513; or e-mail: robert.kimball@ahcpub.com between 8:30 a.m. and 4:30 p.m. ET, Monday-Friday.

Statement of Financial Disclosure

In order to reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, we disclose that Dr. Diduch serves as a consultant to DePuy Orthotech. Dr. Tasto serves on the surgical advisory boards of Arthrocare, Orthopedic Biosystems Limited, and receives royalties from Don Joy Dr. Griffin, Dr. Gunther, Dr. Harner, Dr. Holmes, Dr. Miller, Dr. Perrin, Dr. Schenck, and Dr. Slauterbeck report no consultant, stockholder, speaker's bureau, research, or other financial relationships with companies having ties to this field of study.

Results of Medial Patellofemoral Ligament Reconstruction in the Treatment of Patellar Dislocation

ABSTRACT & COMMENTARY

Synopsis: *Reconstruction of the medial patellar ligaments with hamstring grafts improved stability following patella dislocation, but not without some complications.*

Source: Drez D Jr., et al. Results of medial patellofemoral ligament reconstruction in the treatment of patellar dislocation. *Arthroscopy.* 2001;17(3):298-306.

This study presents the results of medial patellofemoral and medial patellotibial ligament reconstruction using either autogenous hamstring graft (semitendinosus graft in 6 patients and semitendinosus and gracilis graft in 5 patients) or fascia lata graft (3 patients). Fifteen patients (10 men and 5 women) were included in this study. The patients' average ages were 22 years (range, 14-52 years) at the time of surgery. All sustained an initial traumatic patellar dislocation, and 7 had subsequent multiple dislocations. One patient underwent lateral release as well as ligament reconstruction. The remaining patients underwent reconstruction only.

Reconstruction was accomplished by first harvesting the autologous graft material and finding its center. The center of the graft was then affixed to the superomedial border of the patella with a No. 2 nonabsorbable braided suture and a suture anchor, while the superior "arm" of the graft used to replace the medial patellofemoral ligament was sutured to the periosteum

of the adductor tubercle with the knee in full extension and the inferior "arm" anchored to the tibial periosteum approximately 1.5 cm distal to the joint line, mimicking the medial patellotibial ligament.

At follow-up (mean, 31 months; range, 24-43 months), patients were assessed by a subjective self-assessment questionnaire, the Tegner evaluation, the Fulkerson functional knee score, and the Kujala questionnaire. Additionally, patients underwent physical examination and radiographic evaluation of the involved extremity.

On subjective evaluation, 93% of patients believed the procedure had improved their knee. The mean Fulkerson score for this group was 93 (range, 80-100); the mean Kujala score was 88.6 (range, 57-100); and the postoperative Tegner score averaged 6.7 compared with 6.8 preoperatively. Only 3 patients had a normal physical examination; 10 had patellofemoral crepitus; 1 had medial facet tenderness; 1 had medial patellar hypermobility; and 9 had some quadriceps atrophy. Drez and colleagues also reported that 4 out of 15 patients lost flexion when compared with the uninvolved knee.

COMMENT BY LETHA Y. GRIFFIN, MD, PhD

In the last 5 years, there has been a heightened interest in the role of the medial patellofemoral ligament as a key stabilizing ligament of the patellofemoral joint. The medial patellotibial ligament is felt to function less effectively in this role. Prior to the late 1990s, most surgical procedures for recurrent dislocations of the patellar centered around releasing tight, lateral structures, and imbricating laxity in the vastus medialis obliquus muscle and superficial medial retinaculum, alone or in combination with a distal bony realignment procedure. The medial patellofemoral ligament was infrequently addressed.

It should be emphasized that this subset of patients consisted of a majority of males (10 males and 5 females) whose initial dislocation was traumatic in nature. All subjects had a normal quadriceps' angle. These patients were not young teenage girls with marked hyper-mobile patellae and significant flattening of the trochlear groove who sustained dislocations with minimal traumatic events. In fact, Drez et al mention that they do not recommend medial patellofemoral ligament reconstruction alone in patients with an abnormal quadriceps angle. This point probably deserves greater emphasis than being buried in one of the last paragraphs of Drez et al's discussion.

One should also note that the average follow-up time for patients in this study was only 31.5 months. One could question whether this is adequate time to assess the development of secondary degenerative changes due to abnormal patella tracking or increased patellofemoral forces following a stabilization procedure. Moreover, the fact that 4 of the 15 patients had a residual flexion loss is significant and needs further study before one would wish to recommend widespread adoption of this technique. ❖

What Happens When Absorbable Meniscal Repair Devices Resorb?

ABSTRACT & COMMENTARY

Synopsis: *PDS-based implants lost holding strength by 12 weeks, while PLA-based devices retained the same strength over 24 weeks.*

Source: Arnoczky SP, Lavagnino M. Tensile fixation strengths of absorbable meniscal repair devices as a function of hydrolysis time. *Am J Sports Med*. 2001;29(2):118-123.

All-inside meniscal repair techniques have been popularized by the availability of various absorbable implants. However, little is known about how these implants behave as they start to resorb. Dr. Arnoczky, who is well known for his studies on pull-out strength for repairs of the meniscus, performed an experiment assessing the effects of hydrolysis on these various devices.

All of the commonly used and currently available implants were compared in a bovine, fresh, meniscal model. A standardized tear was made and then repaired, with one of the implants before being soaked in a saline buffer in vitro for various time points up to 24 weeks. Load to failure was assessed at each time point and compared to the initial fixation strength.

Arnoczky and Lavagnino found that the initial repair strength of the Bionx meniscal arrow was basically equal to that of the vertical mattress suture. This implant maintained its strength over the entire testing period of 24 weeks. The same was said for the other PLA-based implants including the Linvatec BioStinger and the Innovasive Clearfix screw, although both of these had only approximately two-thirds of the holding strength of the Bionx arrow. The S-D-sorb staple had the weakest holding power, and this was nearly completely gone shortly after 12 weeks. Similarly, the

PDS-based implants, including the Mitek Meniscal Repair System and the 2-0 PDS suture, both lost all holding power by 12 weeks as they more rapidly absorbed. Also, they noted that culture time did not affect the integrity of the meniscal tissue, as initial load to failure was the same for a new tear in a meniscus that had been soaked for the same 24 weeks.

COMMENT BY DAVID R. DIDUCH, MS, MD

Science is gradually catching up with the popularity for all-inside meniscal repair techniques. There is still a paucity of clinical papers or animal studies with results for all of these implants that are available. Arnoczky is to be congratulated for objectively evaluating these implants and specifically examining how they behave as they start to resorb. As they are all designed to resorb, this is an important issue that needs to be addressed.

An important finding is that the PDS-based implants are basically gone before 3 months. This may be inadequate for healing. Another important finding is that the PLA-based implants do not lose strength up to basically 6 months. This is another important finding but has to be balanced against concerns that these implants remain in the joint an extended period of time and can cause secondary problems if they became loose or brush up against the chondral surface. The pull-out strength for the arrow was superior to the other implants tested and basically equivalent to the vertical mattress suture. Whether this is clinically significant is unproven. A major unanswered question is how strong is strong enough to hold the meniscus repair and allow healing. Other unanswered questions are: how long does healing take and how long must these devices be present? Certainly, the answer to that varies for an isolated meniscal repair in which the tear may only partially heal at best, and permanent implants such as suture should be optimal, compared to concurrent ACL reconstruction with the ideal healing environment. One previous study demonstrated that the repair strength of the meniscus is only 26% of normal at 12 weeks.[1] This prompts me to move toward permanent, nonabsorbable suture material for isolated meniscal repairs when the healing environment is suboptimal. In my mind, these absorbable and easy-to-use all-inside devices are best reserved for when an ACL reconstruction is performed concomitantly and the healing environment is optimal. ❖

Reference

1. Roeddecker K, et al. Meniscal healing: A biomechanical study. *J Surg Res*. 1994;56:20-27.

Open Rotator Cuff Repair: The Gold Standard

ABSTRACT & COMMENTARY

Synopsis: *Long-term follow-up confirms that open rotator cuff repairs are successful, and this should be the gold standard to compare arthroscopic cuff repair.*

Source: Cofield RH. Surgical repair of chronic rotator cuff tears. A prospective long-term study. *J Bone Joint Surg Am*. 2001;83-A:71-77.

As arthroscopic rotator cuff repair becomes more popular, it is important to have a standard with which to compare results. This paper provides that standard. Cofield and colleagues report long-term (average, 13.4-year follow-up) results on 105 patients who underwent open rotator cuff repair and were followed prospectively. No patients in the cohort were lost to follow-up, although 16 died for unrelated causes during the study period. The majority of the repairs were tendon-to-bone and included an acromioplasty in all patients and distal clavicle resection in just more than half of the patients. There were 16 small tears, 40 medium tears, 38 large tears, and 11 massive tears. Cofield et al report satisfactory pain relief in 96 shoulders, and significant improvement in motion and strength. Not surprisingly, less successful results were reported with larger tears. Cofield et al report an 80% excellent or satisfactory outcome at an average of more than 13 years after open rotator cuff surgery.

COMMENT BY MARK D. MILLER, MD

Although initial reports of arthroscopic rotator cuff repairs are encouraging, it is important to recognize how high of a standard this paper presents. Note that this is a prospective, long-term study with a preponderance of large chronic tears. Many of the repairs that are done arthroscopically are self-selected to be smaller, more acute tears in younger patients. Note also that the early reports of arthroscopic cuff repairs are short-term, retrospective studies. My personal concern with arthroscopic repairs are based upon the fact that good grasping sutures in the cuff (such as with the modified Mason-Allen stitch) are simply not possible with arthroscopically placed sutures and arthroscopic knot tying. Newer devices that use tacks or other anchoring devices in lieu of suture anchors introduce another possibility for arthroscopic cuff repair that presents additional advantages and disadvantages that need to be thoroughly

investigated before they can be recommended. Unfortunately, as in other areas of sports medicine, technical "advances" outpace our ability to adequately test these devices and techniques. However, as this paper clearly points out, it is important to be well versed in classic procedures that have a proven track record before discarding all of the ten-blades in your surgicenter! ❖

Tissue Engineering: A Real Tendon Transfer

ABSTRACT & COMMENTARY

Synopsis: *An animal model using a collagen scaffold derived from porcine small intestine was shown to successfully repair a defect in the infraspinatus tendon of the shoulder.*

Source: Dejardin LM, et al. Tissue-engineered rotator cuff tendon using porcine small intestine submucosa. Histologic and mechanical evaluation in dogs. *Am J Sports Med.* 2001;29(2):175-184.

This award winning (2000 o'donoghue sports Injury Research Award) study by Dejardin and associates from Michigan State University evaluated the healing potential of a collage scaffold in the repair of an infraspinatus tendon defect. In this study, both a healing model in the adult dog and cadaveric evaluation of the adult dog infraspinatus tendon were used to evaluate the regenerate potential of porcine small intestine submucosa (SIS) as a collagen scaffold in the management of large rotator cuff defects. This collagen scaffold is now clinically available, as an orthobiologic implant, as Restore© (Depuy, Warsaw, IN) for rotator cuff repair. Sixteen adult dogs underwent bilateral infraspinatus tendon elevation with the left tendon replaced with a 15 × 50 × 1 mm, 10-ply SIS implant (experimental side), while the right tendon was sutured back to its original insertion site (sham operation). Five cadaveric specimens were mechanically tested to evaluate immediate repair strength. Eight dogs were sacrificed at 3 and 6 months and were tested both histologically (3 dogs) or mechanically (5 dogs). An additional 4 pairs of canine shoulders were used to evaluate histologic appearance and the mechanical strength of the normal infraspinatus tendon.

The SIS graft is prepared from pathogen-free pigs whose small intestines are processed mechanically and chemically to remove the mucosal, serosal, and muscular layers as well as cellular materials. The implant is further processed to reduce the bioburden (number of organisms on the implant), as well as to eliminate potential immunogenic properties. Processed SIS is a 0.1 mm thick sheet composed of more than 90% protein (cross-linked collagen). To produce a graft of sufficient mechanical strength, each SIS implant is manufactured using 10 individual layered sheets of processed SIS.

SIS-regenerated tendons appeared grossly similar, but slightly thinner than the contralateral sham-operated tendons. The SIS regenerated tendon however spanned the entire defect and presented a palpable tissue throughout the regenerate site. Gross appearance and mechanical strength mimicked those of the sham-operated tendons and native infraspinatus. Tissue ingrowth occurred without histologic evidence of foreign body or immune-mediated reactions or soft tissue adhesions. Although the ultimate strength of the SIS-regenerated tendon was significantly less than that of native infraspinatus tendons, it was similar to that of the repair tendon at both 3 and 6 months healing. In conclusion, the SIS collagen scaffold appeared to create a reliable tissue-engineered replacement of the rotator cuff in an animal model. This study suggests that the SIS implant served as a temporary scaffold for host tissue ingrowth and eventual tissue (rotator cuff) regeneration.

COMMENT BY ROBERT C. SCHENCK, Jr., MD

As discussed in last month's issue of *Sports Medicine Reports*, tissue engineering in orthopaedic surgery is creating new avenues of treatment. This study explored the ability to regenerate the rotator cuff tendon, a clinical area of limited options, that is until now. Tissue engineering is focused on the ability to induce tissue regeneration, the creation of identical tissue to that lost or injured, and can be contrasted to repair which restores the damaged area with a functional but different tissue. It is in regeneration that tissue engineering is directed through the use of 3 components: cells, scaffolds, and growth factors. These mechanisms create new tissue and are described with the suffix "genesis."[1] For tissue regeneration to occur successfully, it usually requires at least 2 of the 3 components. However, regenerate can occur with 1 of the 3, as seen in this study, if performed in a normal host bed.

The indications for the Restore© SIS scaffold in the repair of rotator cuff defects are still being defined but require a basic understanding of tissue engineering principles for proper patient application. Having such a scaffold available is a remarkable advance in the treatment of musculoskeletal defects and injuries. I would predict that the indications for the use of this implant would

expand with the creation of different sizes and thickness of the orthobiologic implant. The presence of a normal host bed, in my opinion, is key to the successful use of this graft. The clinician must evaluate patient applicability on both long-standing clinical concepts of shoulder surgery (preoperative stiffness vs full range of motion), and newer tissue engineering principles (which of the 3 components—cells, scaffold, or growth factors—are available). A chronic massive cuff tear, with tendon retraction and scarring, limited vascularity, and poor shoulder range of motion, is probably not the ideal patient for this implant. Nonetheless, there are many soft tissue defect problems in orthopaedic surgery, which will find a successful indication for such new tissue engineering implants as the SIS patch used in studies by Dejardin and associates.[2] Finally, thinking of the legal difficulties involved in the past with pedicle screw fixation, the clinician must be careful with the use of the SIS implant to follow manufacturers' recommendations and FDA indications in order to avoid issues of off-label use.

In summary, the successful implantation of a collagen scaffold in the dog model has led to a clinically applicable orthobiologic implant now available for rotator cuff repair. Tissue engineering is taking hold of orthopaedic surgery. ❖

References

1. Schenck RC. Strategic strategies: Contemporary tissue engineering. Medscape, 2001.
2. Dejardin LM, et al. Use of small intestinal submucosal implants for regeneration of large fascial defects: An experimental study in dogs. *J Biomed Mater Res.* 1999; 46:203-211.

Optimizing Stretching for Injury

ABSTRACT & COMMENTARY

Synopsis: *Static stretching has a positive short-term effect on muscle length that is lost when stopped.*

Source: Willy RW, et al. Effect of cessation and resumption of static hamstring stretching on joint range of motion. *Journal of Orthopedic and Sports Physical Therapy.* 2001;31(3): 138-143.

The purpose of this study was to address 2 basic questions regarding the "best" way to perform static stretching. Specifically, does static stretching have an effect at all on muscle length (as measured by range of motion)? If so, does that positive effect last over a specific period of time? Eighteen college-age subjects (mean age, 21 years; 12 males, 6 females) volunteered for the study. Selection criteria included short hamstrings (defined as a knee angle of less than 160° with the hip at 90° while the patient is supine). Both right and left lower extremities were included in the study. The study lasted 16 weeks and variables controlled for during that time included lower extremity stretching and other exercise during the course of the study. The first 6-week period was the initial stretching period, followed by a 4-week cessation period that was in turn followed by a resumption of a stretching period for 6 weeks. Flexibility measurements were performed at the end of each period. These measures were performed with the patient supine as previously described. Hip and knee positions were verified with goniometry. Stretching was performed for 30 sec × 2 with 30 sec of rest in between. Results indicated that during the first stretching period, there was a significant ($P < .05$) increase in knee range of motion (143 ± 11.1° to 152 ± 9.4°). However, this range was not maintained during the cessation period. The third resumption of stretching resulted in an increase in range of motion similar to the initial stretch period.

COMMENT BY CLAYTON F. HOLMES EdD, PT, ATC

Stretching is one of the most common interventions used in sports and sports medicine. While this intervention has long been thought to be effective in prevention of an initial injury and as part of the treatment of sports injuries, relatively little consistency exists with regard to application of stretching. Characteristics that are often varied include: when (pre- and/or postexercise or treatment); how much (repetitions and sets); how long to hold a stretch (5 seconds, 30 seconds, etc); how often (daily, etc) and type (static, ballistic, etc). In addition, questions exist with regard to how long a positive effect lasts. The results of this study indicate that any positive effect of static stretching appears to be relatively short-term in nature. The implications with regard to exercise prescription are clear. Anyone prescribing stretching as a preventive measure or after an injury should realize that the stretching should become a habit of the athlete—one that continues throughout the athlete's career and, hopefully, beyond. It is critical to note that this study does not report that the stretching had no effect. In fact, the opposite is true. The stretching regimen did have a positive effect on knee range of motion after each stretching period. This finding is consistent with previous literature.[1] It should also be noted that Willy and colleagues used a protocol that has been previously described in the litera-

ture. For example, 30 seconds does seem to be the optimal time with which to hold a static stretch.[2] In addition, it should be noted that previous literature has reported that length gains can be maintained by stretching as little as once a week.[3] ❖

References

1. Bandy WD, Irion JM. The effect of time on static stretch on the flexibility of the hamstring muscles. *Physical Therapy.* 1994;74:845-852.
2. Bandy WD, et al. The effect of time and frequency of static stretching on flexibility of the hamstring muscles. *Physical Therapy.* 1997;77:1090-1096.
3. Wallin D, et al. Improvement of muscle flexibility. A comparison between two techniques. *Am J Sports Med.* 1985;13:263-268.

Distal Biceps Tendon Rupture: A Historical Perspective and Current Concepts

ABSTRACT & COMMENTARY

Synopsis: *Distal biceps tendon ruptures require repair, through a one- or two-incision approach, to restore proper function.*

Source: Bernstein AD, et al. Distal biceps tendon ruptures: A historical perspective and current concepts. *Am J Orthop.* 2001;(3):193-200.

This study by bernstein and colleagues is a nice review of the etiology, clinical evaluation, and treatment of ruptures of the distal insertion of the biceps brachii. An overview of the anatomy of this muscle is also included.

The biceps is the most powerful supinator of the forearm but also aids the brachialis in forearm flexion. Most distal ruptures are traumatic in origin, although pre-existing degenerative changes in the tendon, as well as chronic inflammation, have been suggested as contributing factors. This injury is typically seen in the dominant arm in men, 40-50 years of age. It is not commonly seen in athletes. Patients typically report hearing a pop and having pain and swelling following forced extension of the flexed elbow. On physical examination, diagnosis is confirmed by the absence of the palpable biceps tendon in the anticubital fossa. Supination weakness is also evident.

Operative correction is recommended, although complications following the procedure are not uncommon and include paresthesias, heterotopic ossification, and the development of radioulnar synostosis.

COMMENT BY LETHA Y. GRIFFIN, MD, PhD

Distal biceps tendon ruptures are not as commonly encountered as proximal ruptures of the long head of the biceps. However, unlike proximal ruptures where, except in a select group of young athletes, conservative management is the rule, distal tendon ruptures necessitate operative correction with reattachment of tendon to the radial tuberosity. This is because there are 2 proximal origins but just 1 distal insertion for the biceps.

Various techniques for this repair have been described. Some investigators recommend using a 1-incision technique, whereas others have recommended 2 incisions in an attempt to avoid complications secondary to injury to the median or radial nerves during the dissection. In the 1-incision technique, exposure is by an anterior incision, through which not only is the biceps tendon found but the radial tuberosity is also exposed. In the 2-incision technique, exposure of the radial tuberosity is through a posterior-lateral approach. Recently, with the development of suture anchors, which decrease the need for extensive exposure of the radial tuberosity, there has been renewed interest in repairing the tendon through a single anterior incision.

The only large series of this injury occurring in athletes (primarily weight lifters) was reported by D'Alassandro and colleagues. In that study, all patients were able to return to full unrestricted activity, although there was an average loss of flexion endurance of 20%. As with other procedures around the joint, postoperative rehabilitation is important in restoring full function to the extremity. ❖

CME Questions

33. Compared to the trans-tibial method, the tibial inlay method of PCL reconstruction resulted in:

a. looser knees.
b. tighter knees only initially.
c. tighter knees initially but not after cyclic loading.
d. tighter knees initially and after cyclic loading with less graft damage.

34. Distal biceps tendon ruptures:

a. occur most commonly in females.
b. can be treated conservatively when seen in the nondominant extremity.
c. if not repaired may result in significant range of motion deficits.
d. occur more commonly in athletes than in the general population.
e. are typically traumatic in origin.

35. The medial patellofemoral ligament:

a. may play a significant role in maintaining patellar stability.
b. may be injured in traumatic patellar dislocations.
c. can be restructured using autologous hamstring tendons as a free graft.
d. All of the above

36. For all-inside meniscal repair devices, the PDS-based implants were basically gone without any holding strength by:

a. 3 weeks.
b. 6 weeks.
c. 12 weeks.
d. 24 weeks.

37. Long-term results of open rotator cuff repairs:

a. are universally poor, and all rotator cuff tears should be repaired arthroscopically.
b. are average, with only 50% satisfactory to excellent outcomes.
c. are good, with 80% satisfactory to excellent outcomes.
d. are excellent, with 90% or more satisfactory to excellent outcomes

38. Tendon regeneration using the porcine small intestine submucosa primarily provides tissue regeneration through which of the following tissue engineering concepts?

a. Collagen scaffolds
b. Stem cells
c. Growth factors
d. Stem cells and growth factors

In Future Issues:

When Should the AC Joint Be Addressed with an Acromioplasty?