

# pt connection

Orthopedic & Sports P.T. Assoc. OSPTA • OSPTA@Home  
Valley Outpatient Rehabilitation VOR

## ***ACL: Anterior Cruciate Ligament Surgical Options***

### **INTRODUCTION**

This second part of the ACL newsletter is dedicated to the various surgical options available for reconstructing the ACL. The third part of the ACL newsletter (Spring 2006) will discuss post operative rehabilitation for the reconstructed ACL.

Historically, the first ACL surgery was performed in 1895. Certainly, an ACL tear is not a preferred injury. However, with surgical advancements and progressive post operative rehabilitation, 98% of athletes return to their sport following surgery. In many cases, a physician's decision to send a patient to physical therapy pre-operatively, and provide support through bracing may help the patient recover more quickly or avoid surgery altogether. If the orthopedic surgeon has determined that surgery is the best option, several surgical options can be considered.

### **SURGICAL PROCEDURES**

Surgeons have a number of choices available in determining which graft is best for a patient undergoing ACL reconstruction. With few exceptions, all graft procedures have an excellent clinical result in terms of providing a 90-95% good to excellent outcome and return to a pre-injury level of sports and ADL's (activities of daily living).

Each of the available ACL graft choices require a unique harvesting technique as well as different methods for fixing the grafts in the bony tunnels. This will depend on the characteristics and properties of the tissue that is selected. With the various graft types, the choice of a graft is frequently made by the orthopedic surgeon based upon experience and the level of comfort with the technique.

Research has yet to demonstrate a "best" or perfect ACL graft. All choices have distinct advantages and disadvantages. This can be an extremely controversial topic among orthopedic surgeons. However, because the knee is unique to each patient, there are instances in which the same graft isn't best for two different patients.

This review of graft choices is presented in order to provide an understanding of the pros and cons of using various tissues for ACL reconstruction.

### **PATELLA TENDON GRAFT**

The patellar tendon bone-tendon-bone (BTB) graft has been the "gold standard" choice for ACL reconstructions since the mid-1980's. The graft has demonstrated excellent surgical outcomes consistently with a 90-95% success rate in terms of returning to a pre-injury level in sports.

The graft is harvested through a 3-4 inch long vertical incision based just along the medial border of the tendon. The middle third of the tendon is then removed longitudinally along with bone blocks in continuity at each end of the graft from the tibial tubercle and the outer surface of the patella respectively. This provides a composite bone-tendon-bone graft that has very strong insertion points of the tendon into bone.

One advantage of this surgery is that because the bone-tendon interface is quite strong, the surgeon only has to fix the block of bone in the bone tunnel rather than trying to fix the soft tissue itself.

The remaining patellar tendon regenerates over a 3-4 month period. Initially it regenerates into a thick, large tendon that slowly remodels to a more normal contour by 12-18 months postoperatively. Therefore, patellar tendon rup-

tures at the donor site are unlikely after the first few months following surgery.

One of the biggest disadvantages of the patellar tendon graft is that there may be more pain associated with this donor site than from any of the other graft choices. Consequently, there is often greater quadriceps atrophy when compared to either a hamstring graft or cadaver allograft.

Other disadvantages include: a larger incision and a permanent loss of sensation; the risk of patellar tendon ruptures; fracturing of the patella both intraoperatively and postoperatively; and increased sensitivity/tenderness that results in difficulty kneeling. Finally, many orthopedists have recently reported a significant number of patients complaining of anterior knee pain when resuming sports.

## HAMSTRING TENDON GRAFT

There are several variations on hamstring tendon grafts with respect to the tissue that is used. The use of a double combined semitendinosis and gracilis tendon graft provides the strongest tensile strength for a hamstring construct. This graft is often called a “quad” graft because there are four apparent strands to the final construct. Recently, there has been renewed interest in the use of hamstring grafts because of improvements in graft fixation techniques. Originally, fixation of the hamstring tendons was performed by placing large sutures in the ends of the graft and tying these around a screw post outside of the bone tunnels. Consequently, a period of immobilization followed by a slower rehab program is necessary in order to prevent stressing the sutures. The orthopedic surgeons were concerned that having sutures at the ends of the graft added length and elasticity to the graft while creating a “bungee cord” effect with a loss of graft stiffness. The end result could be a graft that was too loose.

Recent advancements in hamstring fixation techniques have equaled the pullout strength of the patellar tendon bone graft. The interference screws with blunt threads are designed not to cut the hamstring tendons. They are able to fix the tendon within the bone tunnel in a similar manner as the patellar tendon bone fixation. The screws can even come impregnated with hydroxyapatite, a bone growth stimulant, to encourage resorption of the screw and stimulate bone growth. This will shorten the functional length of the graft and reduce the “bungee effect”.

One advantage of a hamstring graft is a smaller incision. The initial postoperative period is easier. Since there is no disruption to the patellar tendon, there are fewer problems with knee pain during the first few months following return to sports. Additionally, the incision is located a distance from the patella which allows more comfortable kneeling by the patient.

With a hamstring graft, the quadriceps extensor mechanism isn't affected and there is less quadriceps atrophy. Many surgeons are permitting their patients to return to sports one or two months earlier than those that have a reconstruction with a patellar tendon graft. Clinical studies have demonstrated that hamstring graft patients have returned to sports within 3 to 4 months without an increase in ACL graft re-tears. However, there have not been any studies examining the tensile strength to failure of a human ACL graft at three months that would support this.

In the younger patient population that have open growth plates, the hamstring tendon graft is a good choice. There are no graft bone ends that could bridge the growth plates and lead to premature closure.

One possible disadvantage to the hamstring graft is the tissue-to-bone healing restraints. Currently, research investigations are studying the optimal healing environment for these tendons within a bony tunnel. It is presently known that soft tissue-to-bone healing occurs at a slower rate than bone-to-bone healing. Many surgeons are concerned that this fact is being ignored when patients are placed in a rehab program that is accelerated. A phenomenon known as “tunnel widening” sometimes occurs as early as 3 months following an ACL hamstring graft. Investigators believe that there may be an inflammatory reaction occurring at the soft tissue-to-bone interface. Orthopedic surgeons believe that early motion and rehab may be triggering this due to micro-motion of graft ends within the bone tunnels.

Another disadvantage of hamstring grafts is that many surgeons feel that unlike the patellar tendon, the hamstring tendons do not “grow back” after graft harvest. There are a limited number of cases in which regenerated semitendinosis tendons have been found on re-exploration of the hamstring donor site years after reconstruction. However, there will be permanent loss of hamstring strength that typically measures 10% after rehab. This could be a concern for athletes that perform hamstring-specific sports that require running backwards.

## QUADRICEPS TENDON GRAFT

This graft consists of harvesting a strip of the end of the quadriceps tendon along with a block of bone from the top surface of the patella. This tendon graft produces bone on one end and soft tissue on the other. This is similar to the patellar tendon graft. Quad tendon grafts have a thicker cross sectional area than a patellar tendon graft with about the same tensile strength. The quad tendon grafts are a good alternative for revision ACL surgeries.

The disadvantages of the quadriceps tendon graft are similar to those of the patellar tendon graft. The donor site does regenerate somewhat after surgery.

Patients do not typically get patellar tendonitis symptoms after returning to sports and are often able to kneel without pain.

## ALLOGRAFTS

Another alternative to ACL reconstruction is taking tissue from a cadaver. Patellar tendon, hamstring tendon, and Achilles tendon allografts can be used as tissue grafts and can be inserted and fixed with the same techniques as autografts.

The advantages of the allograft are well defined: no risks; no pain; no scars from the donor site; quicker surgical time; less postoperative discomfort; and a decrease in the incidence of joint stiffness and atrophy of the quadriceps muscle. Most surgeons do not routinely recommend using the allograft for a primary, first time ACL reconstruction. The allograft becomes a more favorable choice when there are limitations in a patient's own tissue availability. Often complicated multiple ligament reconstructions need several grafts in which an allograft is used in conjunction with an autograft. Additionally, revision surgery in which an autograft has already been used is another indication.

The most significant risk of an allograft is the concern of contracting an infection from the cadaveric tissue. Both HIV and Hepatitis can be transmitted through these tissues. A bacterial infection can result in the loss of the graft and lead to arthritis. Allografts aren't usually at risk for tissue rejection because there is little protein antigen in the washed grafts.

The problem with allografts is that they cannot be 100% sterilized without altering or destroying the tensile strength of the graft tissue. Radiating grafts with high enough doses to kill viruses has been shown to alter the collagen tissue and reduce the graft's tensile strength. Today, the technique most often used is the treatment of

a fresh, frozen graft in liquid nitrogen.

There have been some studies that suggest that allografts take longer to heal than a comparable autograft tissue. However, a quicker early recovery occurs because of reduced pain, less muscle atrophy, and decreased morbidity since the patient has not donated their own tissue. Patients must have a clear understanding of the healing process. It would be a misconception that an athlete can return to sports earlier using an allograft.

There have been early concerns that over time, the allograft tissues may begin to stretch. Several research studies indicate a measurable but not statistically significant increase in the "play" in the ACL graft.

A final disadvantage when choosing an allograft for ACL reconstruction relates to the cost and availability. Generally, there has been a shortage of patellar tendon allografts. This is partly because orthopedic surgeons will routinely use allografts as their first choice instead of autograft tissues that work well. Sometimes surgeons don't have access to the facilities that procure and process allografts.

## "DOUBLE-BUNDLE" TECHNIQUE

An innovative new surgical technique may closely duplicate the anatomy of the uninjured ACL and may improve stability and function beyond a conventional single bundle of tendon fibers. The ACL consists of two bundles of fibers; the anteromedial and posterolateral bundle. The posterolateral bundle is behind the anteromedial bundle and is hidden by it during surgery. Surgeons believe that the posterolateral bundle is not adequately replaced in the single-bundle surgery. The posterolateral bundle appears to be important in controlling knee rotation and the double-bundle approach should result in better outcomes for the injured athlete.

Orthopedic surgeons find that 15 to 40% of patients that have single-bundle surgery report persistent instability of the knee as well as pain.

## CONCLUSION

Techniques to reconstruct the anterior cruciate ligament have improved steadily over the past 20 years. Initially, surgeons have concentrated on developing less invasive techniques for reconstructive surgery. Now a greater emphasis is placed on the type of tissue that is harvested, fixation techniques, and producing a more anatomically correct graft by using two bundles of tendon fibers.



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## NEWS *briefs*

To schedule an appointment, please look below for the office convenient to you.

For the 3rd and 4th quarters of 2005, OSPTA's patient satisfaction rating was 99%. Clinical pathways were met 66% of the time with an average of 10 visits/diagnosis. Pain was reduced by 64%, function improved for an overall improvement of 76%.

Mr. Mark Aaron, PT offers the Sportmetric™ program to help prevent ACL injuries. Please contact Mark at the Upper St. Clair office for additional information.

OSPTA welcomes Mike Phillips, PT, Justin Deskovich, PT, and Barbara Winwood, PTA. Mike will be working at the Upper St. Clair office and as a coverage therapist in the north district. Justin will be working at the Uniontown office and as a coverage therapist in the south district. Barbara will be working at the Brownsville office.

In addition OSPTA@Home provides home health services to assist the homebound patient.

OSPTA would like to thank Mark Aaron, PT for his contribution to the newsletter.

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