

ACL Graft and Fixation Choices

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The graft-bone attachment site is the weak link in anterior cruciate ligament (ACL) reconstruction surgery because healing is slow and often incomplete. Each of the many graft options for ACL reconstruction surgery has different healing characteristics and potential. Autografts that allow bone-to-bone healing offer the best healing potential. An understanding of the biology of graft healing should give the surgeon context in graft selection and rehabilitation for ACL reconstruction.

Bone-Patella Tendon-Bone Autograft Anterior Cruciate Ligament Reconstruction

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Robert J. Schoderbek, Jr, Gehron P. Treme, and Mark D. Miller

The anterior cruciate ligament (ACL) serves an important stabilizing and biomechanical function for the knee. Reconstruction of the ACL remains one of the most commonly performed procedures in the field of sports medicine. Reconstruction of the ACL with bone-patella tendon-bone (BPTB) autograft secured with interference screw fixation has been the historical reference standard and remains the benchmark against which other methods are gauged. This article reviews the reconstruction of the ACL with BPTB autograft including the surgical technique, rationale for BPTB use, and outcomes.

Primary Anterior Cruciate Ligament Reconstruction Using Contralateral Patellar Tendon Autograft

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K. Donald Shelbourne, Bavornrat Vanadurongwan,
and Tinker Gray

Primary ACL reconstruction using a contralateral patellar tendon autograft is an effective means of achieving symmetrical range of motion and strength after surgery. When the graft is harvested from the ipsilateral knee, the rehabilitation for the ACL graft and for the graft-donor site are different and have opposing goals. Rehabilitation for the ACL graft involves obtaining full range of motion, reducing swelling, and providing

the appropriate stress to achieve graft maturation. Rehabilitation for the graft-donor site involves performing high-repetition strengthening exercises to regain size and strength, best achieved when begun immediately after surgery.

Principles for Using Hamstring Tendons for Anterior Cruciate Ligament Reconstruction

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Keith W. Lawhorn and Stephen M. Howell

The use of autogenous hamstring tendon as a graft source for anterior cruciate ligament (ACL) reconstruction continues to gain in popularity. The low harvest morbidity and excellent biomechanical graft properties coupled with improved fixation of soft tissue grafts are all reasons for excellent clinical outcomes of ACL reconstruction using hamstring tendons. In addition, surgeon awareness of the complications associated with poor tunnel placement and more exacting tunnel placement techniques help prevent roof and posterior cruciate ligament impingement and contribute to the successful outcomes of hamstring ACL constructs.

Quadriceps Tendon—A Reliable Alternative for Reconstruction of the Anterior Cruciate Ligament

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Joseph P. DeAngelis and John P. Fulkerson

Anterior cruciate ligament (ACL) reconstruction surgery with the central third quadriceps tendon can yield a stable, high-functioning knee with little associated morbidity. Both the quadriceps tendon-patellar bone graft and the free tendon graft are reported to produce good to excellent outcomes at more than 2 years of follow-up. The decreased donor-site morbidity and absence of anterior knee pain suggest that the quadriceps free tendon autograft offers a reliable, pain-free, low-morbidity autograft alternative in ACL reconstruction. Recent data suggest that this graft may be the least morbid of the currently used ACL autograft reconstruction alternatives.

Allograft Safety in Anterior Cruciate Ligament Reconstruction

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Steven B. Cohen and Jon K. Sekiya

Allograft tissue seems to provide an excellent option for reconstruction of the ACL in the primary and revision setting. Although in general the risks of using allograft tissue in ACL reconstruction are low, the consequences of complications associated with disease or infection transmission or of recurrent instability secondary to graft failure are large. Surgeons should provide patients with the information available regarding allograft risks and should have thorough knowledge of the source and preparation of the grafts by their tissue bank before implantation for ACL reconstruction.

Fresh-Frozen Allograft Anterior Cruciate Ligament Reconstruction**607**

Matthew L. Busam, John-Paul H. Rue, and Bernard R. Bach, Jr

Reconstruction of the anterior cruciate ligament provides consistently good to excellent results allowing return to work and sport. Allograft tissue is an alternative to autografts when appropriate donor tissue is not available or its use is not advisable for other reasons. The technique and results for allograft use are similar to those for autograft, making its use appropriate in a variety of clinical scenarios. This article reviews the indications for allograft ACL reconstruction, graft options, and technique for allograft use.

Freeze-Dried Allografts for Anterior Cruciate Ligament Reconstruction**625**Mahir Mahirogullari, Cristin M. Ferguson,
Patrick W. Whitlock, Kathryne J. Stabile, and Gary G. Poehling

Freeze-dried allografts represent a viable and functional alternative to fresh-frozen allograft and autograft constructs. Compared with fresh-frozen allograft constructs, freeze-dried soft tissue allograft constructs have many advantages including limited immunogenicity, ease of graft storage, comparable mechanical properties of soft tissue constructs, and the potential for improved biologic incorporation. This article reviews the fundamental processing of freeze-dried allografts and summarizes the clinical and basic science studies supporting the safe and effective use of freeze-dried allograft constructs for anterior cruciate ligament reconstruction. It also discusses potential directions of future research on tissue-engineered anterior cruciate ligament constructs using freeze-dried tendon constructs.

Soft Tissue Allograft and Double-Bundle Reconstruction**639**

Samir G. Tejwani, Wei Shen, and Freddie H. Fu

The anterior cruciate ligament (ACL) is composed of two functional bundles, the anteromedial and posterolateral. Multiple biomechanical and clinical studies have demonstrated that the posterolateral bundle plays a critical role in rotatory stability of the knee. Anatomic double-bundle reconstruction of the ACL best restores knee function and kinematics when the ACL is ruptured. For double-bundle ACL reconstruction, the use of allograft is safe, minimizes graft harvest morbidity, expedites recovery, and is associated with successful clinical results in short-term follow-up.

Clinical Outcomes of Allograft Versus Autograft in Anterior Cruciate Ligament Reconstruction**661**

Geoffrey S. Baer and Christopher D. Harner

Anterior cruciate ligament (ACL) injuries are the most common complete ligamentous injury to the knee. The optimal graft should be

able to reproduce the anatomy and biomechanics of the ACL, be incorporated rapidly with strong initial fixation, and cause low graft-site morbidity. This article reviews the literature comparing the clinical outcomes following allograft and autograft ACL reconstruction and examines current issues regarding graft choice.

Peripheral Versus Aperture Fixation for Anterior Cruciate Ligament Reconstruction

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Michael J. Elliott and Christopher A. Kurtz

Because both the young and aging population are showing increasing interest in sports participation, the number of sports related injuries and in particular anterior cruciate ligament (ACL) injuries have been increasing. Because of these injuries much time and energy has been focused on ACL reconstruction in order to return these individuals to their optimal level of participation in their sport. This article explores and reviews the concepts of ACL fixation location and how this affects the ultimate outcome of this reconstructive procedure.

Biomechanics of Intratunnel Anterior Cruciate Ligament Graft Fixation

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Neal C. Chen, Jeff C. Brand, Jr, and Charles H. Brown, Jr

Interference screw fixation of bone-patellar tendon-bone grafts now is considered the standard against which all ACL graft-fixation techniques are compared, but mechanical fixation of the ACL graft in the bone tunnels is the weak link in the early postoperative period. This article discusses some of the limitations of in vitro biomechanical studies and reviews variables that influence the tensile properties of intratunnel fixation methods for bone-tendon-bone and soft tissue grafts.

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