

Rehabilitation Protocol for Anterior Cruciate Ligament Reconstruction

Orthopedic Services by Stephen M. Howell, MD

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Lodi Memorial

Brace-Free Rehabilitation Protocol for Anterior Cruciate Ligament Reconstruction

Using Double-Looped Semitendinosus and
Gracilis Tendon Graft (DLSTG) and
Tibialis Allograft
by Stephen M. Howell, M.D.



Stephen Howell, MD

Dr. Howell is a board-certified orthopedic surgeon with more than three decades of experience as a clinician, researcher, and innovator in total knee replacement (TKR), anterior cruciate ligament (ACL) reconstruction, and meniscal surgery.

Dr. Howell has trained physicians on five continents and worked together with industry experts to pioneer an exciting approach to total knee replacement called kinematic alignment. Ranked in the top three percent of California surgeons for his outcomes, Dr. Howell has published more than 140 scientific articles that have advanced the understanding and treatment of patients with degenerative arthritis of the knee and tears of the anterior cruciate ligament and menisci. Research in the U.S., China and Korea has shown that his kinematic alignment technique has better pain relief, function, bending of the knee, and a more normal feeling knee than the traditional mechanical alignment.

Truly a leader in his field, Dr. Howell is known for his professional manner and care for his patients. He graduated with his medical degree from Northwestern University and completed his orthopedic residency at Thomas Jefferson University. A retired military professional, Dr. Howell proudly served our country during such critical times as Operation Desert Storm.

Goal

To restore range of motion (ROM), strength, and confidence to the knee while protecting the anterior cruciate ligament (ACL) graft from stretching or rupturing.

Facts

- Transformation of the graft into a strong and durable ligament requires four months.
- A graft that stretches or ruptures during this time period is not repairable.
- This protocol must be followed to prevent injury to the ACL graft.
- Any deviation from this regimen may unnecessarily compromise your final result.

Reminder

When you and I agreed to reconstruct your torn ACL you willingly committed yourself to a four month, brace-free, self administered, rehabilitation program. You must understand that the end-result depends to a great extent on your discipline, motivation, and perseverance in performing the exercise program. Without your commitment and energy, the surgery might fail to meet your expectations. With your cooperation and dedication you have an excellent chance to regain the strength, stability, and confidence in your knee that you had before your injury.

Many patients are too busy with the demands of work and family to participate in formal physical therapy requiring regular attendance at inconvenient times during the day. Fortunately, in the majority of cases, rehabilitation can be done at home, at the health club, or while traveling in a hotel gym using a stationary bicycle, pool, and exercise equipment. The following exercise program should be followed daily on your own to achieve the goals expected at the end of each time interval. This detailed protocol has been designed as a reference specifically for you, and your trainer or physical therapist.

Timing of Three Follow-Up Visits

We are going to carefully monitor your progress at each of these visits and provide you with clear goals that you should strive to accomplish by the next visit.

WEEK 2

WEEK 8

WEEK 16

Your Rehabilitation Program

WEEKS 0-2

1. **WEIGHT BEARING:** Bear weight on the operated leg as tolerated and use your crutches as needed. Crutches may be discarded when the knee is comfortable enough to walk on.
2. **RANGE OF MOTION:** Regain motion using towel extension flexion and extension exercises and prone stretching. You should be able to freely move your knee from 0 to 90 degrees by 10-14 days after surgery.
3. **STRENGTHENING:** None
4. **WOUND CARE:** You may shower 48 hours after surgery if there is no drainage from the wounds. If drainage does occur, keep the wound dry and covered. If it doesn't stop within 5 days of surgery, call the office. Do not soak the knee in a bathtub, hot tub, or swimming pool until after the staples are removed. Bruises that appear down the leg and into the calf and foot three to seven days after the operation are normal.
5. **GOAL:** By two weeks the knee should move from 0 to 90 degrees and will still be sore, stiff, swollen, and bruised. You should feel ready to go to the gym.

WEEKS 2-8

1. **WEIGHT BEARING:** You should walk without crutches.
2. **RANGE OF MOTION:** Continue to regain motion using towel extension flexion and extension exercises and prone stretching.
3. **STRENGTHENING:** Start walking, swimming, biking, and going to the gym or health club. On the bike, begin with the seat elevated without resistance on the wheel. Lower the seat as motion increases and add resistance as tolerated. Try to bicycle twice a day for 10 to 15 minutes. Once you are comfortable on the bike you may use any other exercise machine. Use low weight/high repetitions (25 reps/3 sets) when using weight machines. Skip exercises that cause swelling, pain, and limitation of motion in the knee; focus on those that don't.
4. **GOAL:** By eight weeks the range of motion of the reconstructed knee should equal the other knee. Slight fluid or swelling may persist. Your knee should feel well enough to resume light jogging, golf, shooting baskets, and agility training (i.e. forward and backward running, and sideways running or cross-over drills).

WEEKS 8-16

1. **STRENGTHENING:** Continue to use any exercise equipment available to you in your home, gym, and health club. Increase the weight and resistance on the exercise machines. It's safe to run on a level surface; increase the distance first and then the speed.
2. **GOAL:** By 16 weeks the knee should feel well enough to resume full unrestricted activities and sports including tennis, racquetball, football, baseball, softball, basketball, soccer, wrestling, volleyball, skating, boxing, and water and snow skiing.

FINAL EVALUATION AT 16 WEEKS

1. **CLINICAL EVALUATION:** Activity level, level of pain, fluid, motion, thigh circumference, and stability will be measured and assessed.
2. **COMMENT:** If the knee is stable, pain and swelling are minimal, and the leg is strong, then full return to work and sports are permitted. Restoring confidence in your knee may take six months or more and requires use of the knee in the sport that you desire to return to.

Answers to Common Questions

Q: How long will I be in the hospital?

A: Surgery is performed as an outpatient. Patients go home 4-5 hours after surgery after walking with crutches. If you have your own crutches please bring them to the hospital with you.

Q: How long does the surgery take to perform?

A: The surgery usually requires 30-40 minutes to perform. Repairing or removing a torn meniscus adds another 15-20 minutes.

Q: When can I drive a car?

A: You may resume driving when you feel safe and confident behind the wheel, which may take 1-2 weeks or longer. Do not drive when taking pain pills.

Q: When can I return to work or school?

A: Motivated people who sit or have a desk job can usually return to work 7-10 days after surgery. Construction workers require 2-4 months depending on the demands of the job.

Q: What is the success rate of the surgery?

A: The success depends on the extent of any other damage to the knee at the time of ACL reconstruction such as meniscal tears, articular cartilage injury, arthritis, and other ligament tears. Approximately 95% of patients with a tear of just the ACL and no other injuries can return to full unrestricted activities without any brace.

Q: Can I re-injure the graft?

A: Yes, re-injury is possible. Remember that you tore your own natural ligament, so it is theoretically possible to rupture your graft. Fortunately, rupture of the graft is uncommon. You are just as likely to tear the ACL in the other knee than to re-tear your reconstructed ligament.

Q: Inform me about using an allograft tendon from a donor instead of my tendon.

A: The advantage of an allograft is that it is less painful and does not weaken the muscles of the leg like taking a tendon from your body to use as an ACL graft. The risk of the allograft is that there is a low risk of disease transmission and the failure rate can be higher when the graft is treated with irradiation or chemicals. We use non-irradiated, non-chronically treated allograft from musculoskeletal transmission that does not lose function over 7 years. See the following.



Understanding Allografts:

What they are and the role they'll play in your surgery

Mission statement

MTF is a non-profit service organization dedicated to providing quality tissue through a commitment to excellence in education, research, recovery and care for recipients, donors and their families.



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You have a surgery coming up...

and your doctor will be using an allograft in your procedure. What is an allograft?

An allograft is a bone, ligament, cartilage, tendon or section of skin that is transplanted from one person to another.

Every year in the United States, doctors use more than a million allografts to help...

- athletes who need knee reconstruction
- people suffering from back pain
- cancer patients who need tumor surgery

These are just a few examples. Surgeons have used allografts successfully—in all kinds of procedures—for decades. Allografts have improved millions of people's lives. Your doctor thinks an allograft is a good choice for you, too.

Where do allografts come from?

Allografts come from donors—people who died in accidents or from sudden illnesses. Many times, just one donor's gift can help a lot of people.

Donating tissue is a wonderful thing for someone to do. But it's also important for you to know that not every donor is accepted. The bones, cartilage, tendons, skin and ligaments they donate need to be healthy. So, every donor is carefully screened by medical professionals. If the donor's tissue is suitable, it is cleaned, processed and tested for sterility before it is sent to your doctor.

Can my doctor use my own tissue for my surgery?

Yes, but many doctors prefer to use donated tissue (allografts). When a doctor uses your own tissue (called an autograft), it has to come from another part of your body, which usually means a second surgical site and possibly more pain and recovery time.

Allografts are available, safe, and ready to use. There's no need for a second surgery, so your recovery and healing will be easier.

Your allograft will come from the Musculoskeletal Transplant Foundation (MTF)—the largest tissue bank in the country. MTF is a non-profit organization and is highly respected in the medical community. Your doctor chose MTF because of our strong reputation and the quality and safety of our allografts.

Are allografts safe?

Yes. Since 1987, MTF has provided almost 4.2 million allografts from nearly 80,000 donors. MTF has an exceptional safety record because we are directed by surgeons from world-renowned hospitals, universities and medical institutions. These surgeons set MTF's high standards and oversee which donors are accepted.

Want to know more?

If you have more questions about allografts, ask your doctor, visit MTF's website at mtf.org or call **1.800.433.6576**.

The Effect of Graft Tissue on Anterior Cruciate Ligament Outcomes: A Multicenter, Prospective, Randomized Controlled Trial Comparing Autograft Hamstrings With Fresh-Frozen Anterior Tibialis Allograft

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Purpose: To compare the results and outcome of anterior cruciate ligament (ACL) reconstruction using autogenous hamstring tendon versus fresh-frozen allograft anterior tibialis tendon. **Methods:** A prospective randomized study was conducted from September 2002 to October 2006. We randomized 147 patients to undergo ACL reconstruction with either autogenous hamstring or fresh-frozen allograft anterior tibialis tendon. Of these patients, 102 (69%) completed a minimum of 2 years' follow-up. There were 54 patients in the hamstring group (73% of those originally enrolled in the group) and 48 patients in the allograft group (66%). All patients underwent standardized subjective and objective evaluation with functional outcome assessments (International Knee Documentation Committee [IKDC]), and standardized radiographs were also obtained. **Results:** The mean age was 32.0 years for the autograft group and 33.3 years for the allograft group. There was no difference in stability between the 2 groups ($P > .05$). The mean IKDC subjective score was 91.0 for the autograft group and 90.9 for the allograft group ($P > .05$). The functional IKDC scores for the autograft group were normal in 46 patients (85%), nearly normal in 7 patients (13%), and severely abnormal in 1 patient. For the allograft group, the functional IKDC scores were normal in 43 patients (90%) and nearly normal in 5 (10%) ($P > .05$). There were 4 reoperations in the allograft group and 3 reoperations in the autograft group. No patient underwent revision ACL surgery or planned to undergo revision surgery because of instability in either group during the study period despite the 1 patient in the autograft group with a pivot shift and a maximum manual KT measurement (MEDmetric, San Diego, CA) of 5 mm. **Conclusions:** The use of fresh-frozen anterior tibialis allograft (non-treated) for ACL reconstruction produced similar subjective and functional outcomes at 24 months' minimal follow-up compared with patients undergoing ACL reconstruction with autograft hamstring tendon. **Level of Evidence:** Level II, prospective comparative study.

With the advent of improved fixation devices and more exacting tunnel techniques, hamstring tendon and tibialis allografts for anterior cruciate ligament (ACL) reconstruction continue to grow in popularity.^{1,2} Many clinical studies comparing the outcomes of hamstring and bone-patellar tendon-bone (BPTB) grafts for ACL reconstruction show similar outcomes.²⁻⁶ Despite the high success rates with autograft tissues, some surgeons continue to favor allograft use to avoid all harvest-site morbidity.

The effectiveness of allografts, however, remains controversial based on the current body of literature. Retrospective case-control studies and systematic reviews predominate the current body of literature, with these studies showing few to no control groups regarding graft preparation, types of allografts, tunnel

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Anterior laxity and patient-reported outcomes 7 years after ACL reconstruction with a fresh-frozen tibialis allograft

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Abstract

Purpose After reconstructing a torn ACL with a soft tissue allograft, the long-term healing process of graft maturation following the short-term healing process of graft incorporation into the bone tunnels might lead to recurring instability and concomitant decreases in the activity level, function, and patient satisfaction. Relying on roentgen stereophotogrammetric analysis (RSA), the primary purpose was to determine whether anterior laxity increased and whether patient-reported outcomes declined between 1 and 7 years for a particular graft construct, surgical technique, and rehabilitation programme.

Methods Eighteen of 19 patients, who participated in an earlier RSA study which extended to 1 year after the surgical procedure, were contacted 7 years after the surgical procedure. An examiner, different from the treating surgeon, measured anterior laxity under 150 N of anterior force using RSA in 16 patients and obtained outcome scores in 17 patients. One patient moved abroad and could not be contacted. One patient reinjured his reconstructed ACL and was excluded.

Results The average increase in anterior laxity of 1.5 ± 2.1 mm between 1 and 7 years after surgery was not

significant ($p = 0.08$), and the average increase in anterior laxity of 2.7 ± 2.3 mm between the day of surgery and 7 years was significant ($p < 0.001$). There were no significant declines in activity (median Tegner score, 6 at 1 year, 6 at 7 years), function (average Lysholm score, 94 at 1 year, 91 at 7 years), and subjective satisfaction (average International Knee Documentation Committee score, 90 at 1 year, 87 at 7 years) between 1 and 7 years after surgery.

Conclusion In demonstrating that the ACL graft construct remains functional in the long term, this study supports the use of a fresh-frozen tibialis allograft in patients with an average age of 37 years at the time of surgery when used in conjunction with a surgical technique which avoids roof and PCL impingement, uses slippage-resistant fixation devices, and allows brace-free, self-paced rehabilitation.

Level of evidence IV.

Keywords Anterior cruciate ligament · Roentgen stereophotogrammetry · Long-term follow-up · Ligamentization · Graft maturation

Introduction

An increase in anterior laxity following anterior cruciate ligament (ACL) reconstruction is worrisome because it can cause recurrent instability, and a reduction in activity level, function, and patient satisfaction [7]. The causes of an increase in anterior laxity are several and can be broadly categorized as short term, which extends over the period of graft incorporation into the bone tunnels and is limited to 3–4 months [29, 39], and long term which extends over the period of graft maturation beyond 3–4 months.

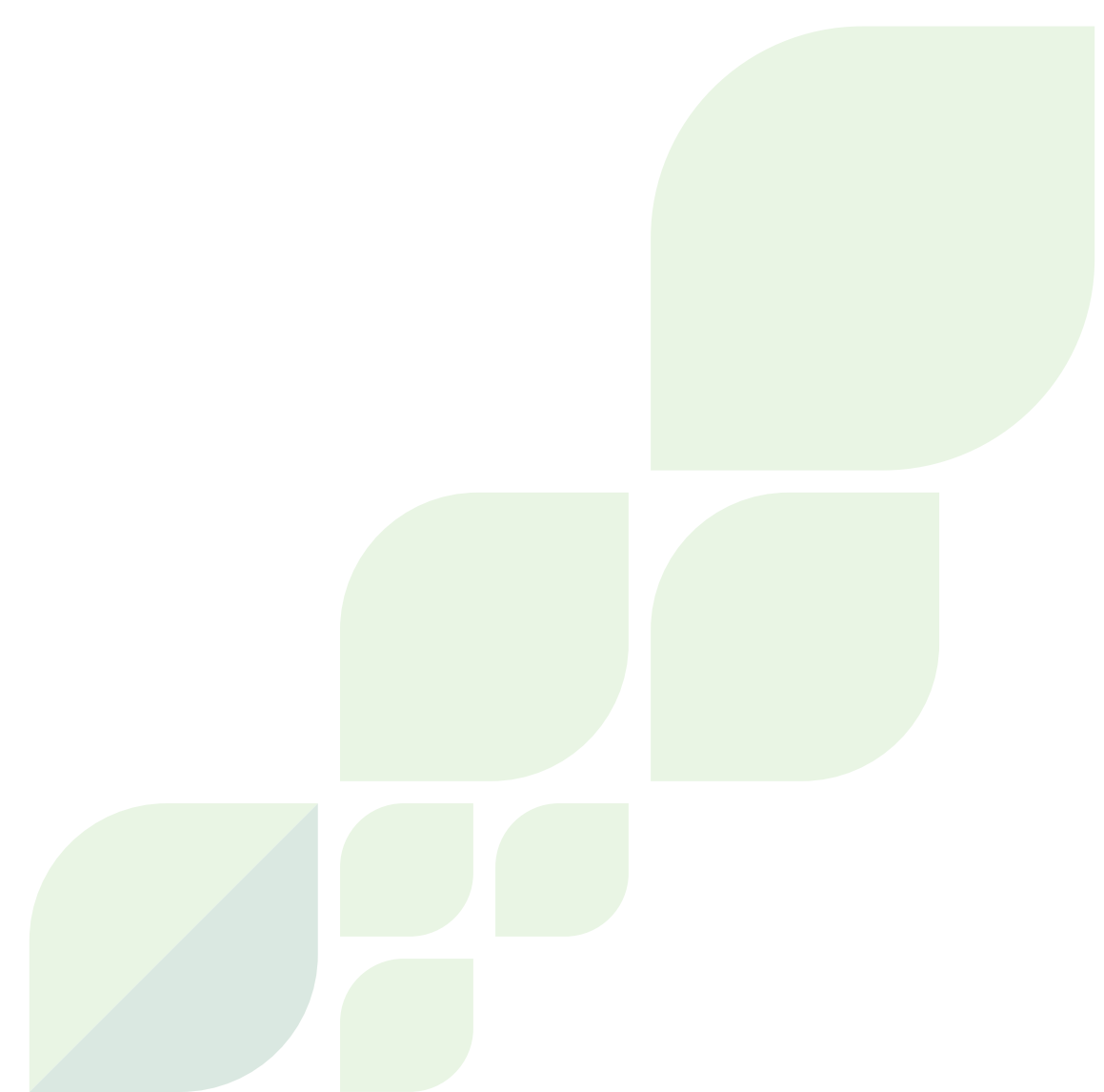
Focusing on soft tissue allografts, depending on the graft construct, surgical technique, and rehabilitation regimen,

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