Primary ACL Repair

Randy Schwartzberg, M.D.

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Anterior Cruciate Ligament Reconstruction using One-Third of the Patellar Ligament, Augmented by Extra-Articular Tendon Transfers

BY WILLIAM G. CLANCY, JR., M.D.*, DEVON A. NELSON, M.D.*, BRUCE REIDER, M.D.*, AND RAJESH G. NARECHANIA, M.S.*, MADISON, WISCONSIN

1983

J B & J S
The Journal of Bone and Joint Surgery
Prior to this... a plethora of procedures for ACL tears
One technique...

Primary ACL Repair
Primary surgical treatment of anterior cruciate ligament lesions*

JOHN L. MARSHALL,† DVM, MD, FACS, RUSSELL F. WARREN,‡ MD, FACS, AND THOMAS L. WICKIEWICZ,§|| MD

• Average 29 month f/u
• Good results
The Isolated Tear of the Anterior Cruciate Ligament. Lieutenant Colonel John A. Feagin 48, Dr. Howard G. Abbott 49, and Dr. Joseph R. Rokous 50 presented their findings in sixty-four cases of isolated tear of the anterior cruciate ligament diagnosed at operation in sixty-two patients at the United States Military Academy between 1965 and 1971.

**AAOS Annual Meeting**

- ACL repair in military cadets
- 25/30 good results at 2 years
Isolated tear of the anterior cruciate ligament: 5-year follow-up study

JOHN A. FEAGIN, JR., M.D., COLONEL, AND WALTON W. CURTIS, M.D., MAJOR

1976

Poor results at mid-term follow-up

Consider tendon transfer or synthetic substitute.
Poor Results with Mid-term Follow-up of Same Cohorts

Suture of fresh ruptures of the anterior cruciate ligament: A 5-year follow-up
Magnus Odensten, Jack Lysholm & Jan Gillquist

Primary suture of the anterior cruciate ligament A 6-year follow-up of 74 cases
Lars Engebretsen, PÅL Benum & Svein Sundalsvoll
Poor Results with Long-Term Follow-up

Primary surgical treatment of anterior cruciate ligament ruptures
A long-term follow-up study

NORMAN KAPLAN, MD, THOMAS L. WICKIEWICZ,* MD, AND RUSSELL F. WARREN, MD

T. Strand · A. Mølster · M. Hordvik · Y. Krukhau

Long-term follow-up after primary repair of the anterior cruciate ligament: clinical and radiologic results after 15–23 years postoperatively

FOLLOW-UP OF THREE OPERATIVE TECHNIQUES FOR THE TREATMENT OF ACUTE RUPTURES OF THE ANTERIOR CRUCIATE LIGAMENT

BY JON OLAV DROGSET, MD, TORBJORN GRANTVEDT, MD, PhD, OLE RASMUS ROBAK, MD, ANDERS MØLSTER, MD, PhD, ANNJA T. VISET, MD, AND LARS ENGBREITSEN, MD, PhD

Isolated Tears of the Anterior Cruciate Ligament

Over 30-Year Follow-up of Patients Treated With Arthroscopy and Primary Repair

COL (ret) Dean C. Taylor,*† MD, CPT Matthew Posner,‡ MD, COL (ret) Walton W. Curl,§ MD, and COL (ret) John A. Feagin,‖ MD

1990

2005

2006

2009

Unstable knees with osteoarthritis
Why does the ACL not work well when sutured together like other ligaments and tendons in the body?
Proposed Reasons…

- Mop end tears
- Inability to securely repair
- Hyaluronic acid
So, ACL repair is forgotten...
jettison into an era of ACL reconstruct
Years of grafts & techniques...
ACL reconstruction has stood the test of time...
Imperfections of ACL reconstruction...

- Graft harvest site morbidity
- Persistent instability
- Proprioception
- Knee arthritis
Could preserving the native ACL improve on this?
Series of questions to ask...
1st Question

Does the ACL have the potential to heal?
Ruptured ACL capable of expressing type 1 collagen
Matrix degrading enzymes not expressed
Histological Changes in the Human Anterior Cruciate Ligament After Rupture

BY M. M. MURRAY, M.D., S. D. MARTIN, M.D., T. L. MARTIN, M.D., AND M. SPECTOR

Characteristics of healing seen in other dense connective tissues...

- Fibroblast proliferation
- Revascularization
What prevents the ACL from healing?
Compare the ACL & MCL

VS.
MCL forms scaffold of fibrinogen & growth factors

ACL forms no scaffold
Collagen/PRP scaffold placed in ACL

MCL

Untreated ACL

Scaffold ACL

ACL healing approximated MCL healing
Current thoughts...

- ACL has healing potential
- ACL lacks scaffold necessary to heal
Surgeons see ACL healing not infrequently...
A Potential Breakthrough in ACL Surgery

Bridge-enhanced ACL repair allows doctors to use a sponge soaked with the patient’s blood to repair a torn ACL rather than replacing it with a tendon from another part of the patient’s body.
What is it?

- Bovine collagen scaffold
- Sutured into ACL tear
- Suspension button fixation construct
- Blood injected into scaffold at end
The Bridge-Enhanced Anterior Cruciate Ligament Repair (BEAR) Procedure

An Early Feasibility Cohort Study

Martha M. Murray,*† MD, Brett M. Flutie,† BA, Leslie A. Kalish,‡ ScD, Kirsten Ecklund,∥ PhD, Braden C. Fleming,∥ PhD, Benedikt L. Proffen,† MD, and Lyle J. Micheli,† MD

- First phase human clinical study
- FDA approved IDE
- 20 patients
- BEAR vs hamstring autograft ACLR
- Non-randomized
Selection Criteria

- Ages 18-35
- Injury < 1 month prior to surgery
- Minimum 50% of ACL length attached to tibia
Results

• 3 month follow-up
• No Lachman test differences
• All constructs intact by MRI
Next steps...
Can ACL repair minimize the development of arthritis?
Use of a Bioactive Scaffold to Stimulate Anterior Cruciate Ligament Healing Also Minimizes Posttraumatic Osteoarthritis After Surgery

Martha M. Murray,* MD, and Braden C. Fleming,†‡§ PhD

• ACL repair vs reconstruction in pigs
• Less OA at 12 months with repair
Oodles more work required for mid-substance ACL tears...
4th question

Can we improve upon the surgeries from the 1970s?
Role of tear location on outcomes of open primary repair of the anterior cruciate ligament: A systematic review of historical studies

Jelle P. van der List*, Gregory S. DiFelice

• Review of old ACL repair studies
• Good results for proximal tears
We know that the ACL can heal.

But can we fix the proximal tears well?

Do we need a scaffold?
Gap formation following primary repair of the anterior cruciate ligament: A biomechanical evaluation

Jelle P. van der List*, Gregory S. DiFelice

- Cadaveric biomechanics study
- Suture anchor vs button fixation
- 1mm gap with cyclic loading (100 cycles)
- Max failure mean - 243 N
Addition of braided stabilizing stent to ACL repair approximated ACL stability with cyclic loading.
Proximal ACL repair has been successful…

**Primary Repair Combined With Bone Marrow Stimulation in Acute Anterior Cruciate Ligament Lesions**
Results in a Group of Athletes
Alberto Gobbi,* MD, Lyndon Bathan, MD, and Lorenzo Boldrini, MD

**Late results following proximal reinsertion of isolated ruptured ACL ligaments**
F. Genelin, A. Trost, C. Primavesi, P. Knoll

**Anterior Cruciate Ligament Preservation: Early Results of a Novel Arthroscopic Technique for Suture Anchor Primary Anterior Cruciate Ligament Repair**
Gregory S. DiFelice, M.D., Christine Villegas, M.B.S., and Samuel Taylor, M.D.
Why can current ACL repair outperform 1970s repairs?

- Selection of only proximal tears
- Arthroscopic procedure
- Modern & more secure fixation
- No cast immobilization
- Modern rehab principles
What is the prevalence of proximal ACL tears?
• Proximal tears - Type 1
• Distal remnant > 90% total length
• 16%

Age < 35 - 8%
Can we identify the proximal tears pre-op?
Repairability predicted for 90% type 1 tears
Indications for ACL Repair

- ACL avulsion from femur
- Quality ACL tissue
- The more recent... the better
Not good...
How it’s done...
Arthroscopic ACL Repair

Randy Schwartzberg, M.D.
Rehab - Same as ACL reconstruction
Rationale

- Strong/stiff suture tape fixation
- Significant ACL healing within 2 weeks
- Optimized ACL healing by 3 months
Summary
ACL tears do have the capacity to heal

Mid-substance tears need help from a scaffold
Bridge Enhanced ACL Repair (BEAR) is a promising start to ACL repair.
Proximal ACL tears can be successfully repaired now!
Thank You