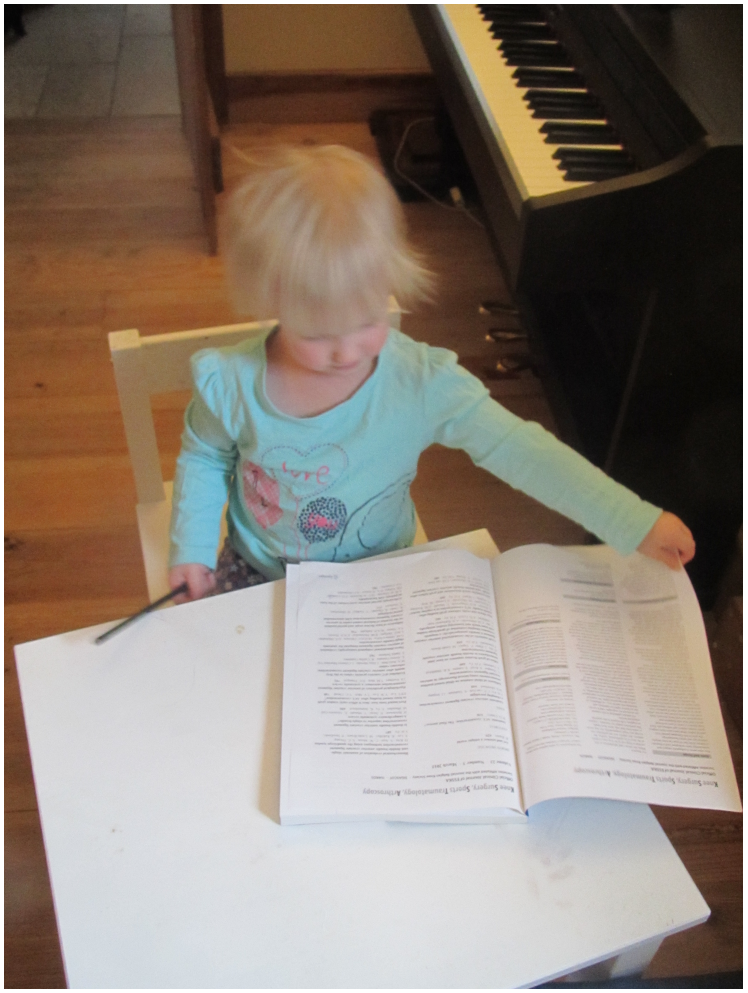
6th Advanced Course on Knee Surgery
January 31st – February 5th, 2016 Val d'Isère - France

Mechanical enhancement (Artificial reinforcement)

Mike Carmont

Val d'Isère

Literature search



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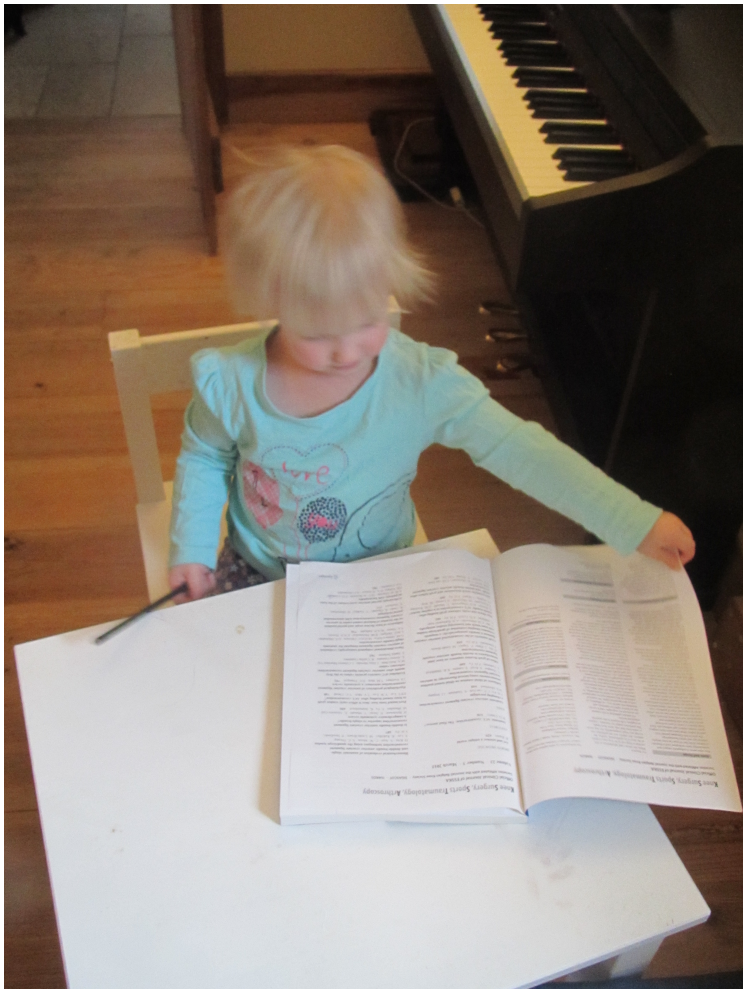

Synthetic Devices for Reconstructive Surgery of the Cruciate Ligaments: A Systematic Review

Lachlan M. Batty, M.B.B.S., Cameron J. Norsworthy, F.R.A.C.S., Nicholas J. Lash, F.R.A.C.S., Jason Wasiak, M.P.H., Anneka K. Richmond, B.Sc., and Julian A. Feller, F.R.A.C.S.

- Systematic review
- 511 papers > 85 articles
- 6 synthetic devices
  - Ligament Augmentation & Reconstructive System
  - Leeds Keio Dacron
  - Kennedy Ligament Augmentation Device
  - Gore Tex
  - Trevira

Synthetic Devices for Reconstructive Surgery of the Cruciate Ligaments: A Systematic Review

Lachlan M. Batty, M.B.B.S., Cameron J. Norsworthy, F.R.A.C.S., Nicholas J. Lash, F.R.A.C.S., Jason Wasiak, M.P.H., Anneka K. Richmond, B.Sc., and Julian A. Feller, F.R.A.C.S.

- Heterogeneity precluded meta-analysis
- Variables
  - Rate failure
    - Lowest LARS 2.6%
    - Highest Dacron 33.6%
  - Revision
    - Lowest LARS 2.6%
    - Highest Trevira 11.8%
  - Non-infective effusion & synovitis
    - Lowest LARS 0.2%
    - Highest Gore Tex 27.6%

Anterior cruciate ligament repair with LARS (ligament advanced reinforcement system): a systematic review

Zuzana Machotka[1,2†], Ian Scarborough[2*†], Will Duncan[3], Saravana Kumar[1], Luke Perraton[1]

Author (NHMRC level of evidence)	Population (sample size) [Mean age in years]	Comparison	Follow up period (months)	Post operative rehabilitation protocols
Lavoie et al. [27] (III-3)	Chronic & acute (47)[31.6]	**NA**	8-45	**NR**
Nau et al. [29] (II)	Chronic (53)[30.9]	Bone patellar bone autologous graft	2 6 12 24	Identical for both groups WB as tolerated x3/week physiotherapy sessions[#]
Liu et al. [28] (IV)	Chronic (60)[36.0]	**4SHG** autologous graft	48-52	**4SHG Group** Week 0-8: SQ, SLR, Hinged brace Week 1-3: Static step for balance Week 3: Initiated Kn F exercises Week 10: Full WB Week 12:Normal ADL, Kn F > 120° 6 months: RTS (non competitive) 9 months: RTS and all activities **LARS Group** Week 0-1: SQ, SLR, Full Kn F Week 0.5-3: WB with Crutches 2 months: RTS (non competitive) 3-4 months: RTS and all activities
Gao et al. [8] (IV)	Chronic & acute (159)[30.0]	**NA**	36-62	Week 0-1: SQ, Kn F to 90°, crutches, partial WB Week 1-2: Kn F to 120° Week 2-4: progress to full WB 1-2 months: return to full ADLs 3 months: initiate return to jogging 6 months: RTS

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Study	KOOS	IKDC	Tegner Score	Telos Stress System	KT-1000	Lysholm Scale
Lavoie et al. [27]	NS†	-	S†	NS†	-	-
Nau et al. [29]	S (12 months) NS (24 months)	NS	NS	S^ (6 months) NS (24 months)	-	-
Liu et al. [28]	-	NS	NS	-	S (48 months)	NS
Gao et al. [8]	-	S†#	NS†#	-	S†	S†

Four-strand hamstring tendon autograft versus LARS artificial ligament for anterior cruciate ligament reconstruction

Zhong-tang Liu · Xian-long Zhang · Yao Jiang · Bing-Fang Zeng

- Retrospective study
- 2003-4
  - 4SHams n=32
  - LARS n=28

- IKDC, Lysholm & Tegner tended superior & higher stability with LARS

Table 3 Postoperative knee function examination results

Group	Final IKDC rating results				Lysholm score (mean ± SD)	Tegner score (mean ± SD)
	Normal	Nearly normal	Abnormal	Severely abnormal		
4SHG (n=32)	22	6	4	0	92.1±7.9	6.2±1.6
LARS (n=28)	21	5	2	0	94.6±9.2	6.6±1.8
P value	P=0.523	P=0.259				P=0.387

Liu Int Orthop 2010

Results

J Bone Joint Surg Br. 2002 Apr;84(3):356-60.
A new generation of artificial ligaments in reconstruction of the anterior cruciate ligament. Two-year follow-up of a randomised trial.
Nau T1, Lavoie P, Duval N.

We have undertaken a randomised clinical trial comparing two methods of reconstruction of the anterior cruciate ligament in patients with chronic instability. We used an ipsilateral bone-patellar-tendon-bone autograft in 27 patients and the Ligament Advancement Reinforcement System (LARS) artificial ligament in 26. Assessment before and at two, six, 12 and 24 months after surgery, included the history, physical examination, a modified International Knee Documentation Committee (IKDC) score, the Tegner score, the Knee Injury and Osteoarthritis Outcome Score (KOOS) and instrumented laxity testing. There were no cases of reactive synovitis or of infection of the knee, and there was no difference regarding the failure rate between the two groups. The IKDC showed no significant differences between the two groups at any stage of the follow-up. The KOOS evaluation showed consistently better results in all subscales for the LARS group during the first year of follow-up. After 24 months these differences were no longer evident. Instrument-tested laxity was greater in the LARS group at all stages of follow-up, but the differences were not significant at 24 months. Our findings suggest that at follow-up at 24 months the LARS ligament seems to be a satisfactory treatment option, especially when an early return to high levels of activity is demanded.

Results

Am J Sports Med. 2002 Nov-Dec;30(6):851-6.

Anterior cruciate ligament reconstruction with and without a ligament augmentation device : results at 8-Year follow-up.

Drogset JO1, Grøntvedt T.

Ligament augmentation devices have been used in anterior cruciate ligament reconstruction since the suggestion of Kennedy et al. in 1980 that such devices would allow grafts to heal faster and more safely.

Patients who had augmentation will have better outcomes after 8 years.

Prospective randomized case control study.

Between 1991 and 1993, 100 patients were randomized to groups undergoing anterior cruciate ligament reconstruction with bone-patellar tendon-bone grafts with (49) or without (51) use of a Kennedy ligament augmentation device. Of these 100 patients, 94 were examined at an average of 8 years after surgery. Fifteen patients were excluded because of rupture in the other knee and 11 because of rerupture in the same knee.

Of the remaining 68 patients, the mean Lysholm function score was 84 in the augmentation group and 87 in the control group. There was a statistically significant relationship between preoperatively detected cartilage injury and osteoarthritis. Almost half of the patients had developed osteoarthritis. We observed no significant difference between the two groups concerning rerupture rate, Lysholm or Lachman test scores, or KT-1000 arthrometer measurements.

We found no positive long-term effects supporting the use of augmentation in anterior cruciate ligament reconstruction.

Results

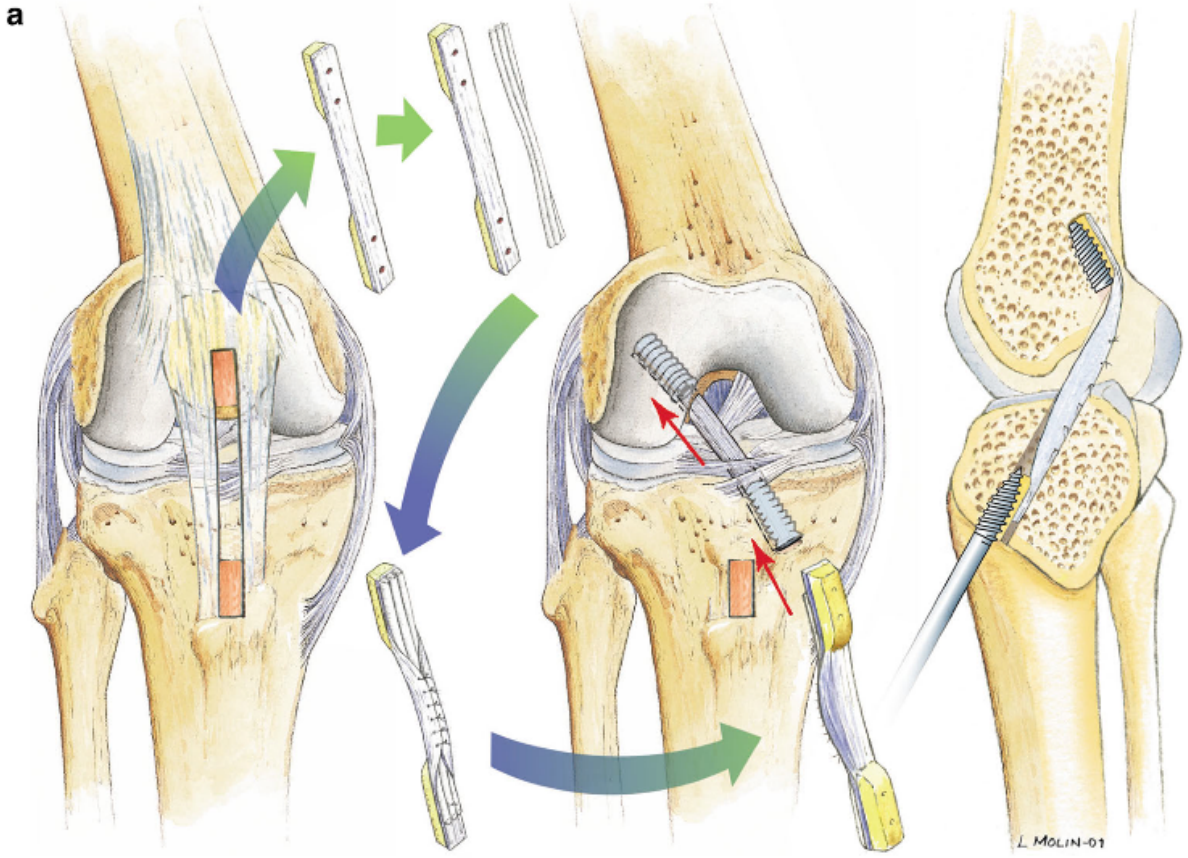
Int Orthop. 1995;19(4):229-33.
Evaluation of anterior cruciate reconstruction reinforced by the Kennedy ligament augmentation device. An arthroscopic and histological study.
Asahina S1, Yamamoto H, Muneta T, Ishibashi T, Furuya K.

Fifty anterior cruciate ligament reconstructions with the Kennedy ligament augmentation device were examined arthroscopically and histologically 6 to 61 months after operation. The autogenous segments used were the quadriceps tendon in 13 and the semitendinosus tendon, with or without gracilis, in 37. The arthroscopic findings were rated as good in 31, fair in 15 and poor in 4, and there was correlation between these grades and KT-1000 measurements. The histological findings were graded as good in 17, fair in 26 and poor in 4; these did not correlate with the arthroscopic grades but with the time interval after reconstruction. Maturation of the autogenous augmented segment was found to progress with time, but took more than 3 years to become complete.

Long-term results of a randomized study on anterior cruciate ligament reconstruction with or without a synthetic degradable augmentation device to support the autograft

Lars Peterson · Ulf Eklund · Björn Engström · Magnus Forssblad · Tönu Saartok · Anders Valentin

- Level 1 Study
- Synthetic degradable augmentation
- Atimplant AB
- n=201

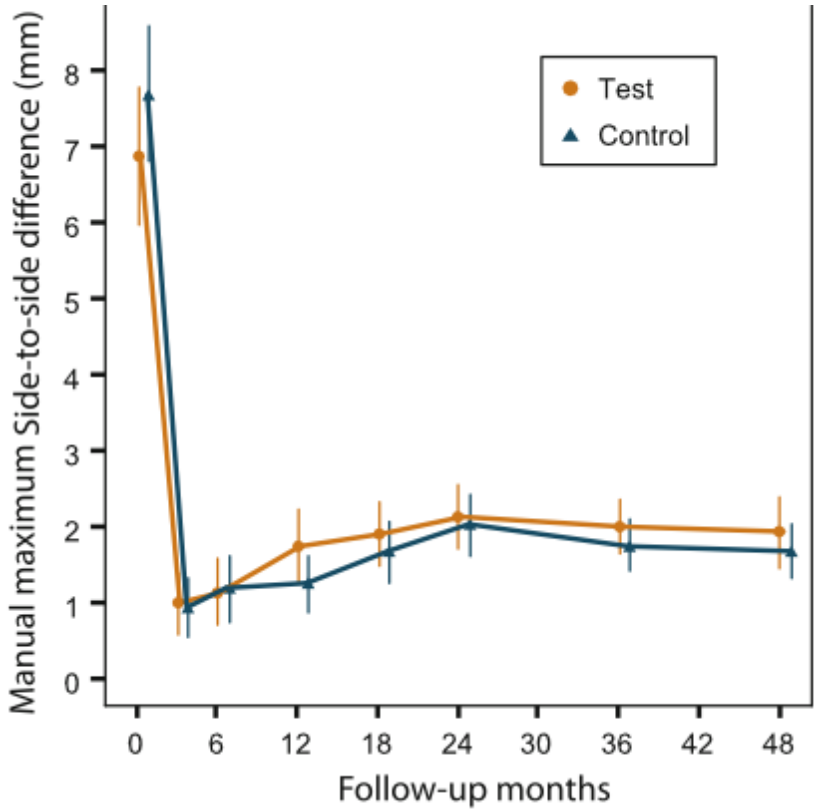


Peterson KSSTA 2014

Long-term results of a randomized study on anterior cruciate ligament reconstruction with or without a synthetic degradable augmentation device to support the autograft

Lars Peterson · Ulf Eklund · Björn Engström · Magnus Forssblad · Tönu Saartok · Anders Valentin

- Both groups higher KOOS
  - Sports & recreation
  - Knee related QoL
- 10 removal
  - 6 insufficient screw fixation
  - 4 swelling

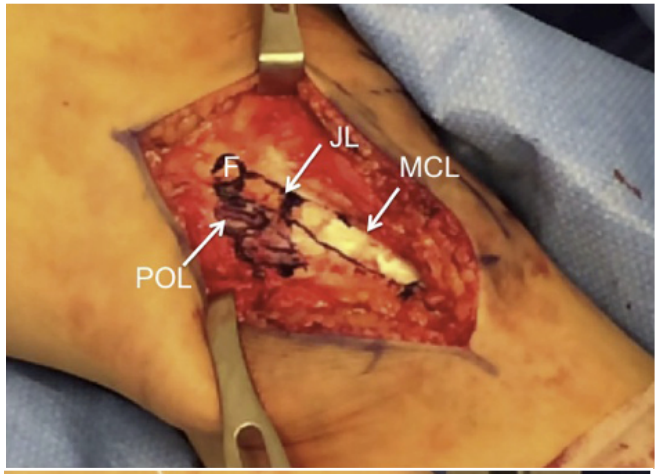


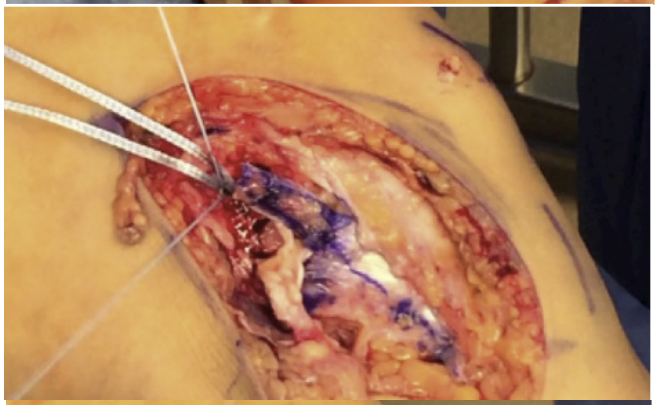
Peterson KSSTA 2014

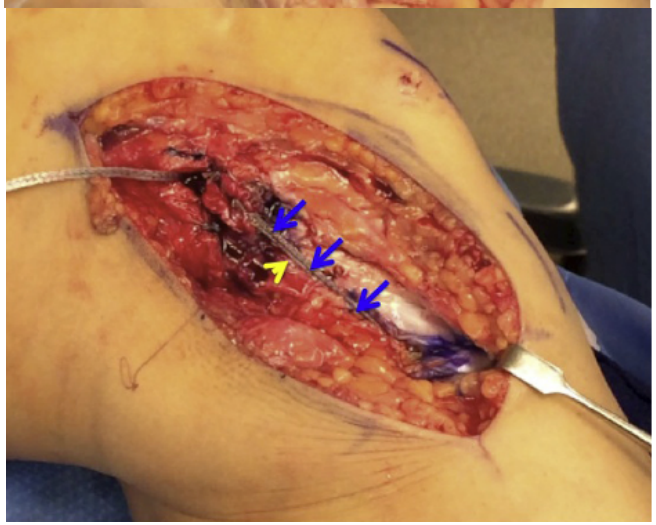
Knee Medial Collateral Ligament and Posteromedial Corner Anatomic Repair With Internal Bracing

James H. Lubowitz, M.D., Gordon MacKay, M.D., and Brian Gilmer, M.D.

- Braided UHMW Polyethylene & Polyester suture tape
- Knotless Bone Anchors
- 4.75mm PEEK Polyether Ether Ketone
- Knee tensioned 30˚ flexion & varus





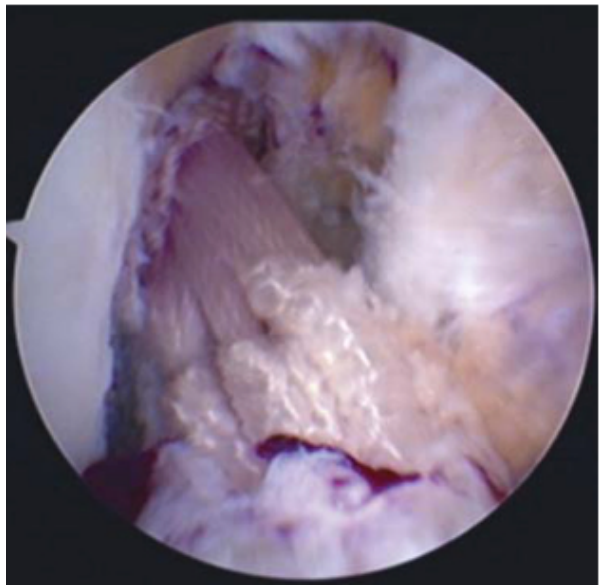


The future

Bioresorbable Scaffolds for Anterior Cruciate Ligament Reconstruction: Do We Need an Off-the-Shelf ACL Substitute?

John C. Richmond, MD and Paul P. Weitzel, MD

- Bombyx mori silkworm
- Silk fibroin, high strength protein core, Beta sheet stronger collagen
- Resorbable proeteolytic enzymatic bioresorption
- (Removal waxy coating sericin)



Bioresorbable Scaffolds for Anterior Cruciate Ligament Reconstruction: Do We Need an Off-the-Shelf ACL Substitute?

John C. Richmond, MD and Paul P. Weitzel, MD

- In vivo goat study
- 112 individual bundles silk fibroin filaments
- ≤350µm
- Abrasion resistant bone ends, UTS 2200N, YS 800N
- Outcomes comparable to behavior of B-PT-B
- Sharpey fibers
- No debris lymph nodes

Summary

- Synthetic 1st generation ACL grafts poor press
- The early outcome of 2nd generation comparable
- Not designed to undergo biological ligamentization
- Tape augment repair-Long term outcomes awaited

Editorial Commentary: **Synthetic ACL Grafts Are More Important Than Clinical Nonbelievers May Realize**

Jim Lubowitz


Merci de votre attention

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