

# Internal Bracing (IB)

**Johannes BARTH & Esteban Lobos Centeno**



CENTRE  
OSTÉO-ARTICULAIRE  
DES CÈDRES



# Disclosure

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1. Royalties from Move Up and SBM
2. Consulting income from Arthrex, Move-Up and SBM
3. I am a surgeon!



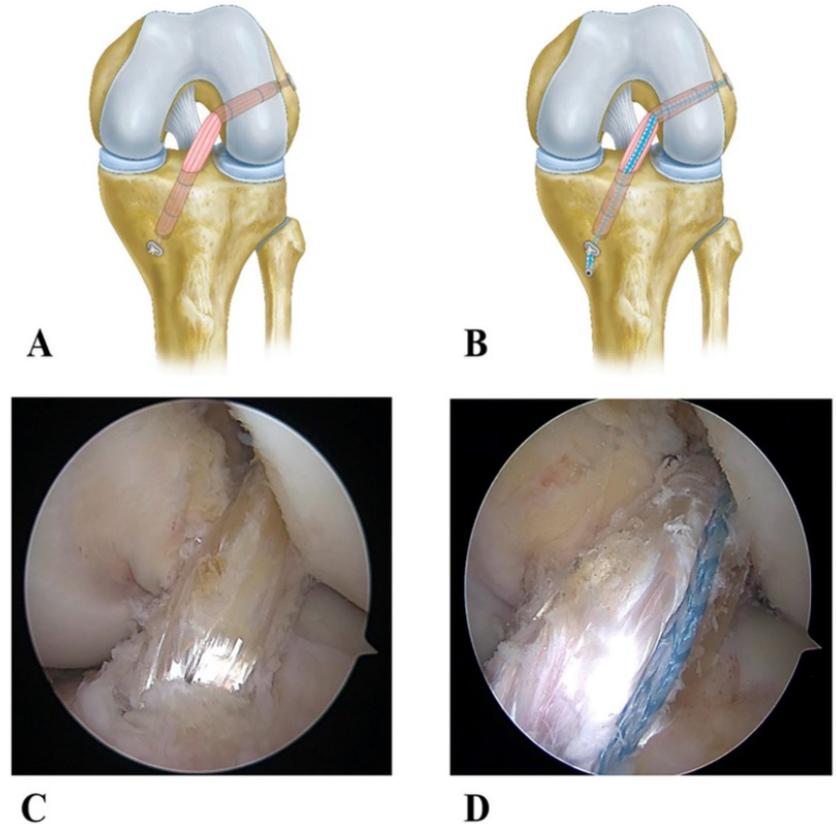
**10<sup>th</sup>**

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## Internal brace augmentation reconstruction versus standard anterior cruciate ligament reconstruction: a randomised controlled clinical trial study protocol

Wenhao Lu <sup>1</sup>, Di Liu,<sup>1</sup> Zijun Cai,<sup>1</sup> Linyuan Pan,<sup>1</sup> Wenqing Xie <sup>1</sup>, Hongfu Jin,<sup>1</sup> Xu Liu,<sup>1</sup> Yusheng Li,<sup>1,2</sup> Wenfeng Xiao<sup>1,2</sup>

BMJ 2023



# But IB seems to be important in ACL-repair

## Is There a Role for Internal Bracing and Repair of the Anterior Cruciate Ligament?

### A Systematic Literature Review

Carola F. van Eck,<sup>\*†</sup> MD, PhD, Orr Limpisvasti,<sup>†</sup> MD, and Neal S. ElAttrache,<sup>†</sup> MD  
*Investigation performed at Kerlan Jobe Orthopaedic Clinic, Los Angeles, California, USA*

**AJSM 2017**

- IB
- biological augmentation (bone marrow access by drilling tunnels or microfracture)
- PRP & scaffold tissue

may increase  
the success rate  
of ACL repair



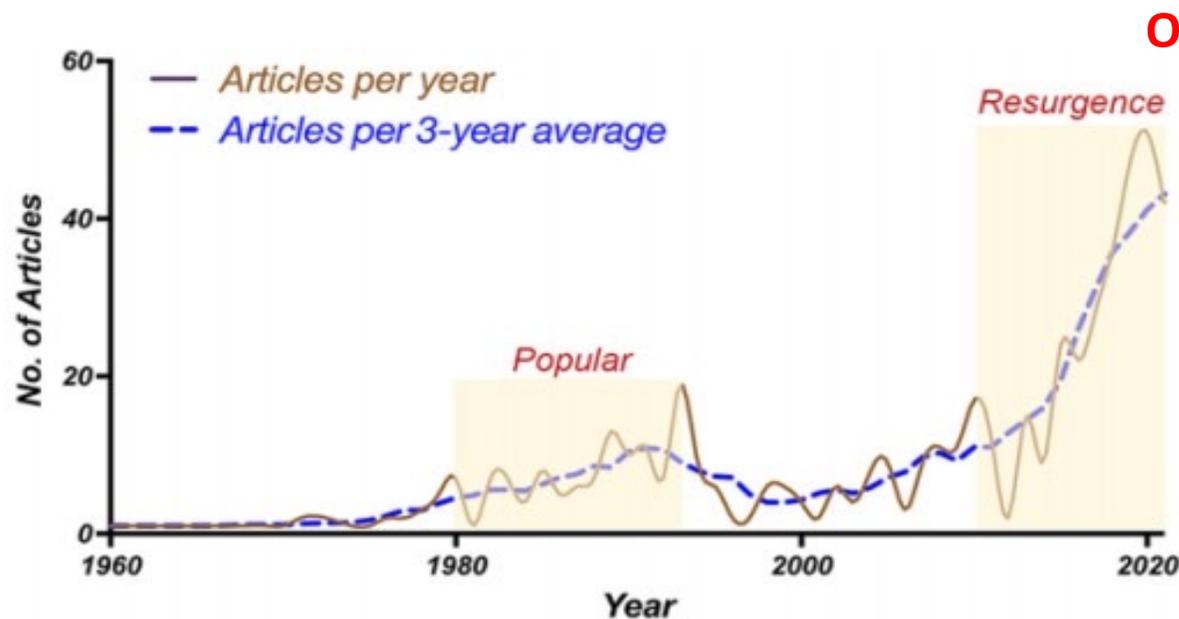
# ACL repair : a new nugget or an old devil ?

## Trends in Anterior Cruciate Ligament Repair

### A Bibliometric and Visualized Analysis

Jinfei Li,\* BS, Benjamin Rothrauff,<sup>†</sup> MD, PhD, Shuyi Chen,\* BS, Shuying Zhao,\* BS, Zhaoxi Wu,\* BS, Qi Chen,\* BS, and Jinshen He,\*<sup>‡</sup> MD

*Investigation performed at the Department of Orthopaedic Surgery, Third Xiangya Hospital of Central South University Changsha Hunan China*



#### Research on ACL repair

- comes from a small number of authors and corresponding institutions
- the top sports medicine journals have an interest in this topic



# ACL repair : the onset of the story

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## RUPTURED CRUCIAL LIGAMENTS AND THEIR REPAIR BY OPERATION.<sup>1</sup>

BY A. W. MAYO ROBSON, F.R.C.S.,  
OF LEEDS,

Consulting Surgeon to the General Infirmary at Leeds.

Ruptured Crucial Ligaments and their Repair by Operation

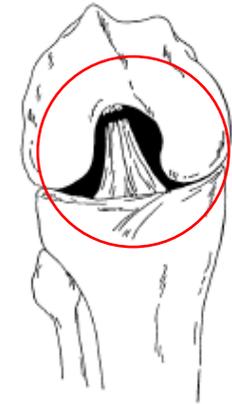
Robson AW. *Ann Surg* 1903



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# ACL repair : popular in proximal avulsion



A



B



C



D

Reinsertion of the anterior cruciate ligament or primary ligamentous plasty?

Heim U, Bachmann B, Infanger K. *Helv Chir Acta*. 1982

Knee function following suture of fresh tear of the anterior cruciate ligament.

Strand T, Engesaeter LB, Mølster AO, et al. *Acta Orthop Scand*. 1984

Repair and reconstruction of rotatory instability of the knee.

Simonet WT, Sim FH. *Am J Sports Med*. 1984

Acute uncomplicated anterior knee instability. 2-5 year follow-up of surgical treatment.

Kühne JH, Theermann R, Neumann R, Sagasser J. *Unfallchirurg*. 1991

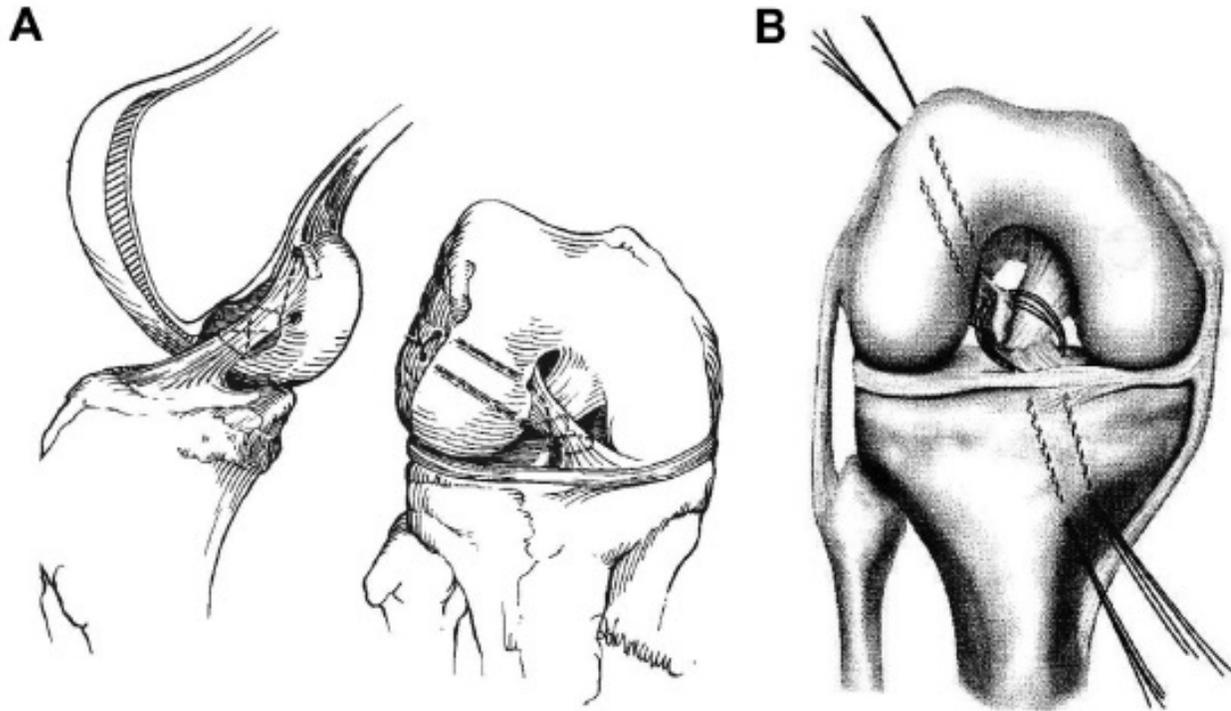
The long-term follow up of primary anterior cruciate ligament repair. Defining a rationale for augmentation. Sherman MF et al. *Am J Sports Med* 1991

Late results following proximal reinsertion of isolated ruptured ACL ligaments.

Genelin F, Trost A, Primavesi C, Knoll P. *Knee Surg Sports Traumatol Arthrosc*. 1993

The primary cruciate ligament suture is the method outdated? Results in follow-up of 58 patients Bräm J, Plaschy S, Lütolf M, Leutenegger A. *Z Unfallchir Versicherungsmed*. 1994

# But abandoned due to the inconvenience



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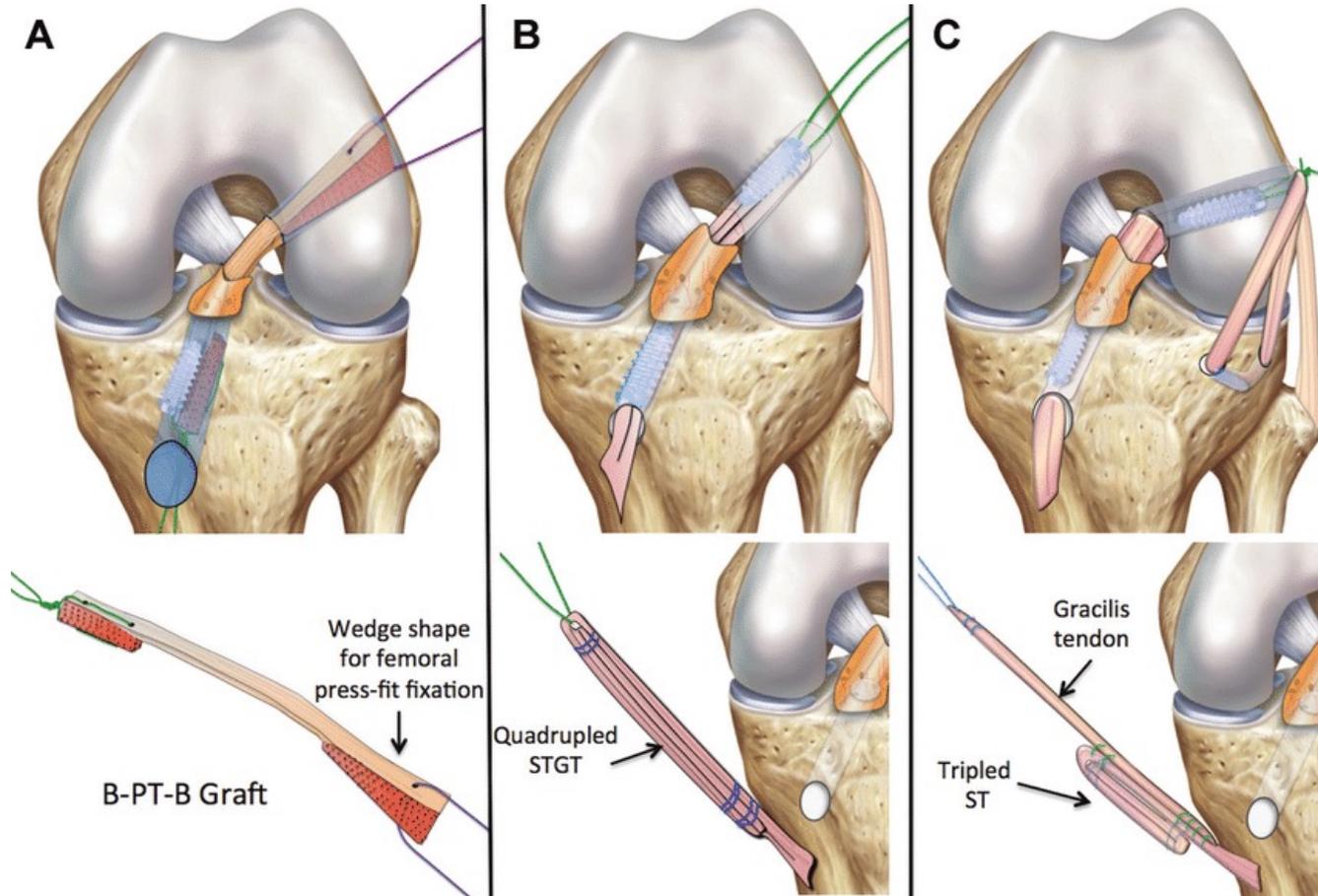


Isolated tear of the anterior cruciate ligament: 5-year follow-up study

Feagin JA, Jr., Curl WW. *Am J Sports Med* 1976



# Competition in favor of ACL reconstruction

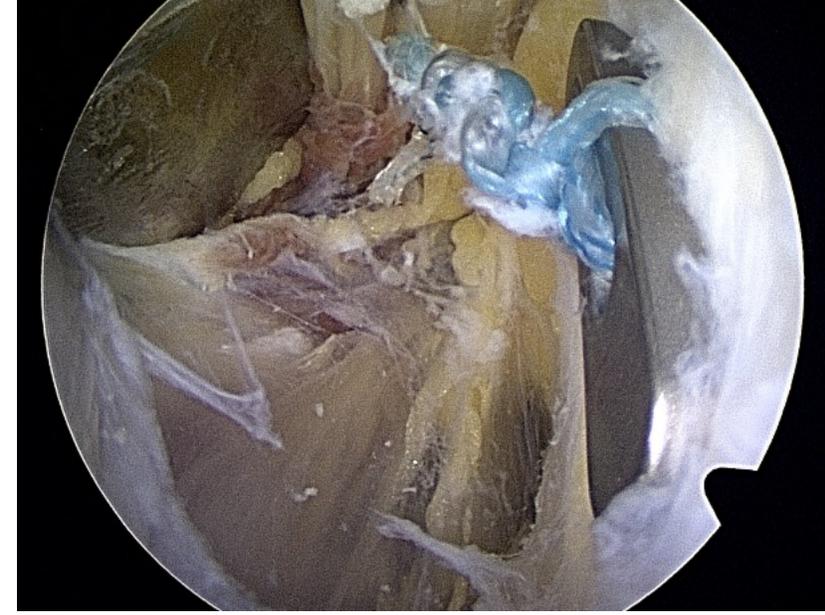
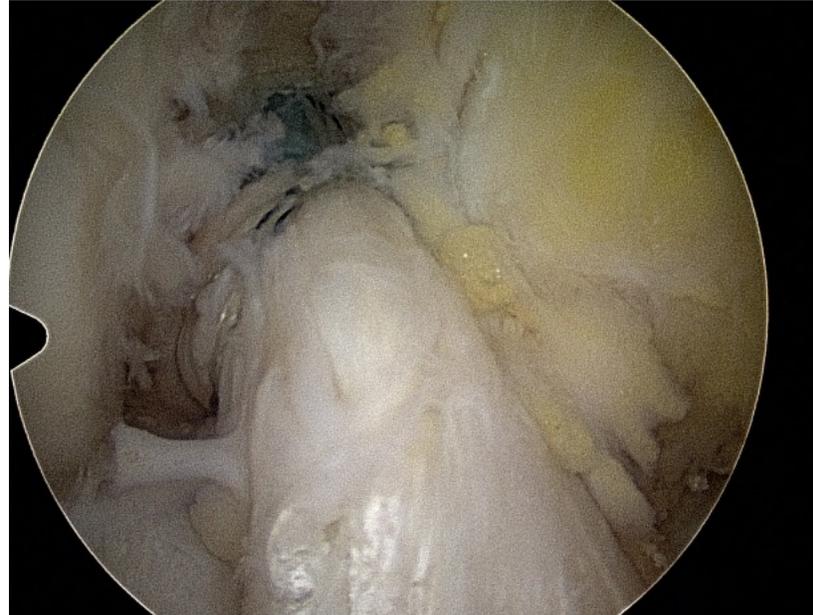
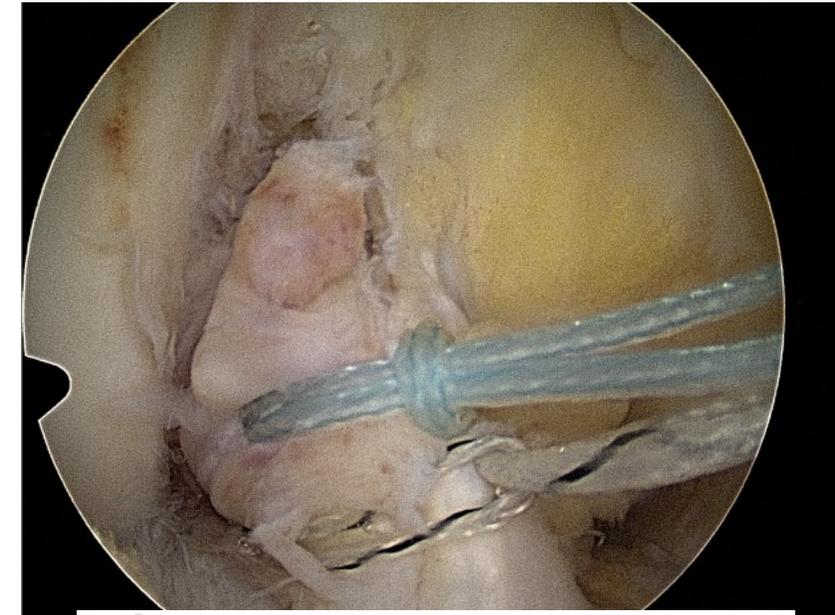


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# Resurgence with technologic improvements

Arthroscopy / quality of the suture / IB / fixation devices



# Cortical suspensory device vs direct repair



**Dr. Gordon MACKEY**



**Dr. Greg DIFELICE**

Anterior Cruciate Ligament Repair with Internal Brace Ligament Augmentation.

Wilson WT, Hopper GP, Byrne PA, MacKay GM.

Surg Technol Int 2016

Primary Repair of the Anterior Cruciate Ligament: A Systematic Review.

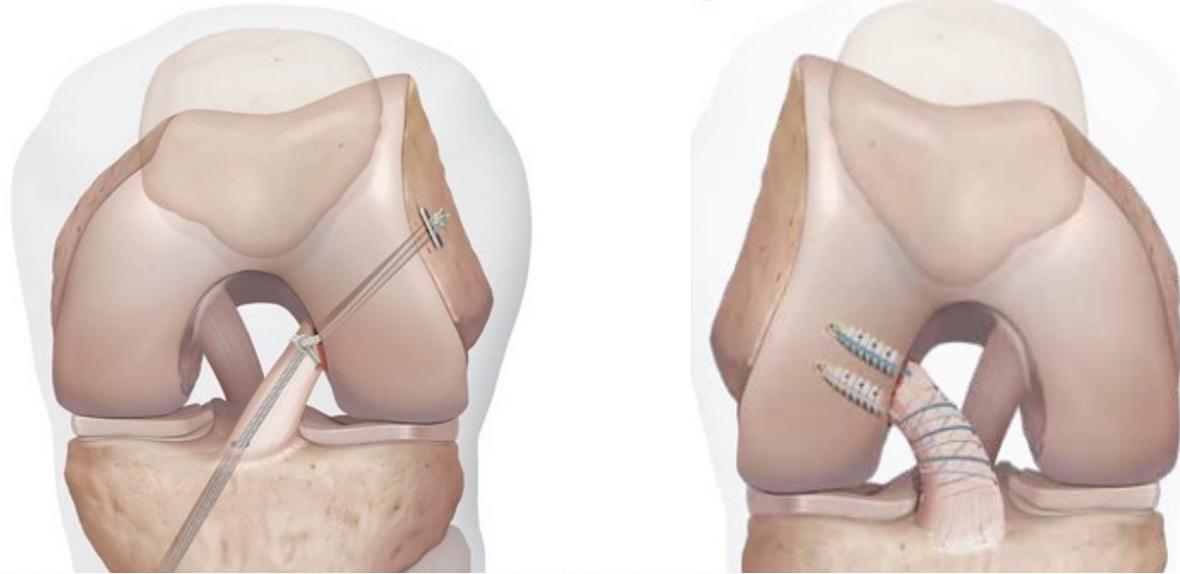
Taylor SA, Khair MM, Roberts TR, DiFelice GS.

Arthroscopy 2015



# Biomechanical advantage for CSB

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**Cortical suspensory button fixation has superior biomechanical properties to knotless anchor suture in anterior cruciate ligament repair: a biomechanical study**

Thun Itthipanichpong<sup>1</sup>, Napatpong Thamrongskulsiri<sup>2</sup>, Pairat Tangpornprasert<sup>3</sup>, Chanyaphan Virulsri<sup>3</sup>, Danaithep Limskul<sup>1</sup>, Somsak Kuptniratsaikul<sup>1</sup> & Thanathep Tanpowpong<sup>1</sup>✉

**Nature 2023**



# Clinical results of ACL-repair reinforced / IB

Anterior cruciate ligament repair with internal brace  
augmentation: A systematic review



W.T. Wilson<sup>a,b,\*</sup>, G.P. Hopper<sup>b</sup>, M.S. Banger<sup>a</sup>, M.J.G. Blyth<sup>b</sup>, P.E. Riches<sup>a</sup>, G.M. MacKay<sup>c</sup>

**The Knee 2022**

- Re-rupture rate 10.4%
- Good subjective scores and clinical laxity testing



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# Is it clinically pertinent to use a stronger IB?

Check for updates

Traditional suture tape versus multiple high-strength sutures for augmentation of anterior cruciate ligament primary repair: A time-zero biomechanical study

Thun Itthipanichpong<sup>a</sup>, Puchong Kulrat<sup>a</sup>, Danaithep Limskul<sup>a</sup>, Thanathep Tanpowpong<sup>a</sup>, Chanyaphan Virulsri<sup>b</sup>, Pairat Tangpornprasert<sup>b</sup>, Somsak Kuptniratsaikul<sup>a</sup>, Napatpong Thamrongsuksiri<sup>c,\*</sup>

**Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehab and Technology 2024**



# What we know

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## Augmentation with Fibertape Leads to Biomechanically Superior but Similar Clinical Outcomes in ACL Surgeries: Systematic Review and Meta-analysis

Balgovind S. Raja<sup>1</sup>  · Manit Arora<sup>2</sup>  · Aditya K. S. Gowda<sup>1</sup>  · Vikas K. Maheshwari<sup>1</sup>  · Anil Regmi<sup>1</sup> 

**Indian Journal of Orthopaedics 2023**

- Biomechanical superiority in terms of ultimate strength, stiffness, cyclic displacement, and elongation of graft
- Clinical relevance of IB still has to be proven



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# My experience

## How to Succeed in Arthroscopic Anterior Cruciate Ligament Primary Repair? Step-by-Step Technique



Manuel Ignacio Olmos, M.D., Bertrand Sonnery-Cottet, M.D., and Johannes Barth, M.D.

### Arthroscopy technique 2019

**Table 1.** Indications and Contraindications for Arthroscopic Primary ACL Repair With Suture Augmentation

Indications	Contraindications
No age limit to date	Midsubstance and intraligament ACL tears (Sherman III or IV)
Proximal (femoral) avulsion tears (Sherman I or II)	Retracted proximal tear or partial tear <sup>13</sup> (however, concomitant partial ACL repair with graft augmentation is still possible)
Partial ACL tear	Poor tissue quality
Sufficient length and tissue quality	ACL revision surgery
Acute rupture	
Chronic proximal avulsion tears of the ACL reattached to the PCL	
Isolated ACL injuries	

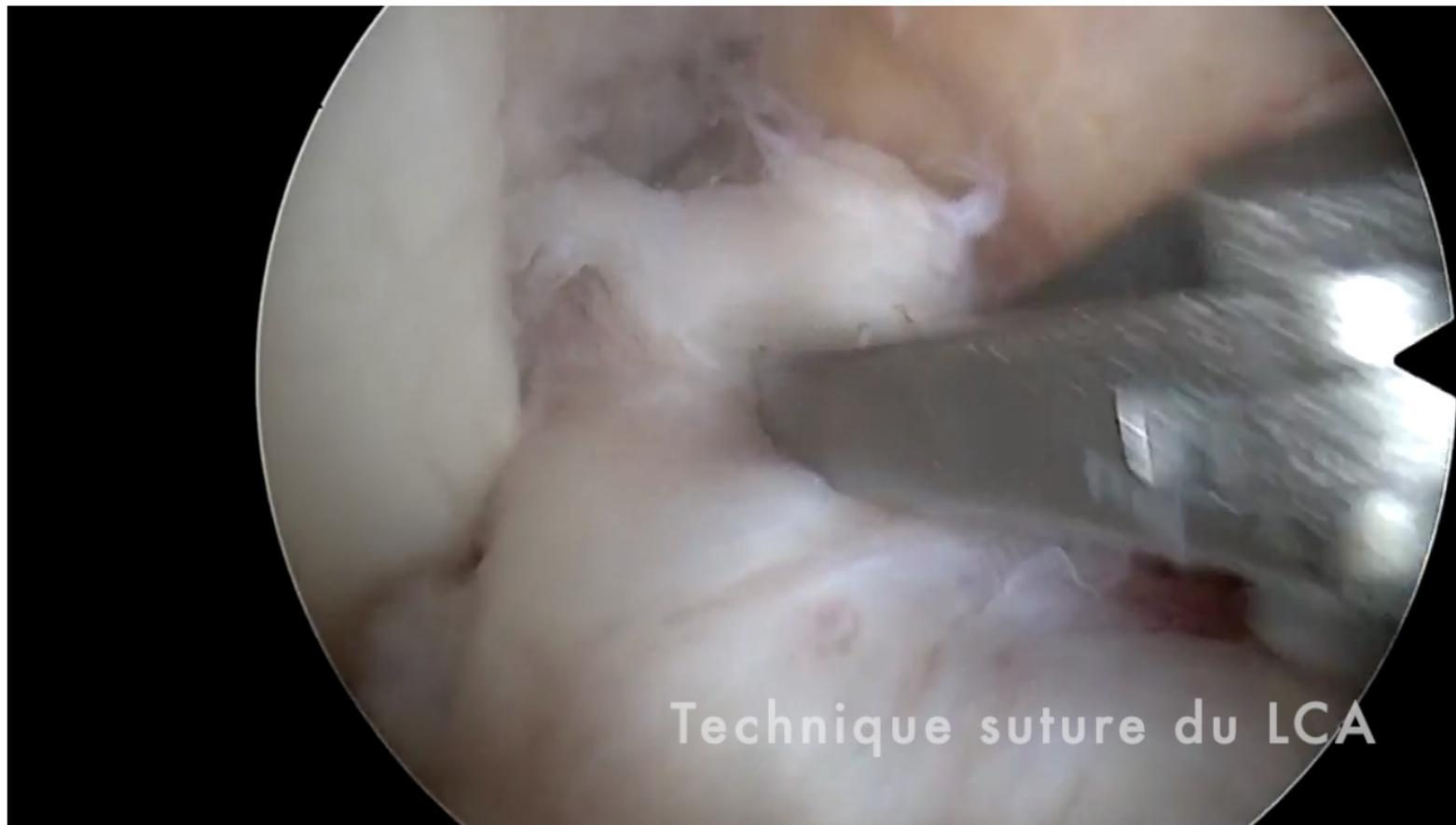
PCL, posterior cruciate ligament.



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# Technique



How to succeed an arthroscopic ACL primary Repair ? Step by step technique  
Olmos M, Sonnery-Cottet B and Barth J. *Arthroscopy technique* 2018



# Results of ACL repairs

## The Minimal Clinically Important Difference, Patient Acceptable Symptom State, and Clinical Outcomes of Anterior Cruciate Ligament Repair Versus Reconstruction

### A Matched-Pair Analysis From the SANTI Study Group

Alexandre Ferreira,\* MD, Adnan Saithna,<sup>†</sup> MD , Alessandro Carrozzo,<sup>\*\*‡</sup> MD, Sylvain Guy,\* MD  
Thais Dutra Vieira,<sup>\*§</sup> MD , Johannes Barth,<sup>||</sup> MD, and Bertrand Sonnerly-Cottet,\* MD 

**AJSM 2022**

Re-rupture rate in ACL-repair= 5.3% (FU=30mo)



- ACL Repair non-inferior to reconstruction
  - knee laxity parameters
  - subjective IKDC
- ACL repair > ACL reconstruction
  - hamstring strength at 6 months
  - FJS-12 scores

- ACL repair failure rates significantly higher than reconstruction in patients < 21



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# In conclusion

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- **Significant technological improvements for ACL repair to compete with reconstruction**
- **ACL repair is a valuable option for proximal ACL avulsion > 25 y**
- **Biomechanical properties of IB protect the suture**
- **But clinical relevance of IB still has to be proven**



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# Thank you!

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