



Val d'Isère 2014

## Revisited anterolateral anatomy The anterolateral ligament



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Knee Society 2012



## The role of the anterolateral ligament in tibial exposure for TKA An anatomic and histologic study

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ANATOMIE ET HISTOLOGIE DU LIENANTEROLATERAL DU GENOU  
Neyret, Magnussen, Vincent, Servien, Lustig  
24 novembre 2012  
Lyon, France: Elsevier  
Droits de diffusion: Professeur NEYRET



One or more of the authors of the next presentation have identified potential conflicts of interest with Tornier



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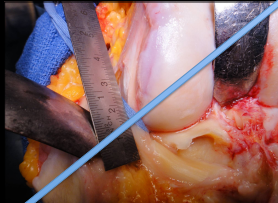



Proper balancing of the knee is critical to successful, durable total knee arthroplasty

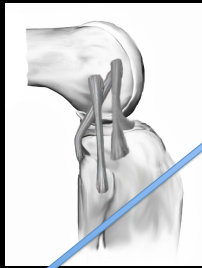


As an adjunct to performing appropriate bone cuts, selective soft tissue releases are an important tool for arthroplasty surgeons.

While techniques for medial release are often described, ...



...less attention is paid to the lateral compartment where releases may need to be performed in the case of valgus knees.



The anterolateral ligament of the knee is a structure in the lateral knee connecting the lateral femoral condyle with the lateral meniscus and tibial plateau.



## The Anterolateral Ligament

### Materials and Methods

The incidence of the ligament was determined in 30 consecutive patients undergoing total knee arthroplasty (TKA) for medial compartment osteoarthritis.

The anatomy and histology were evaluated using 10 cadaveric knees.



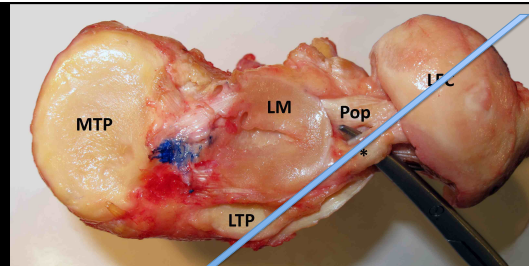
## The Anterolateral Ligament

### Results

The anterolateral ligament was noted to be present in all 40 knees (30 patients undergoing TKA and 10 cadavers).

In all cases it was noted to take origin near or on the popliteus tendon insertion and insert into the LM and tibial plateau near Gerdy's tubercle 5 mm from the articular surface.

The average length of the structure was 34 mm and the average diameter was 8.2 mm.

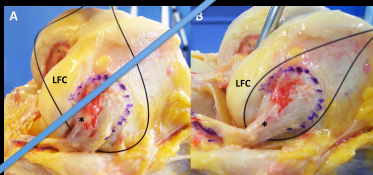


A superior view of the tibial plateau of a left knee of an intra-operative view of a left knee demonstrating the anterolateral ligament (\*) inserting onto the lateral meniscus (LM), which has been elevated, and the lateral tibial plateau (LTP). The lateral femoral condyle (LFC) is labeled.



## The Anterolateral Ligament

Histologic analysis revealed a discrete structure with a fibrous core surrounded by synovial. Fibers blended with the popliteus at its origin and with the lateral meniscus as it passed distally.



## Discussion


The most significant findings of this study are that the anterolateral ligament is a distinct structure containing dense collagenous tissue and the remarkable consistency of the structure. All forty specimens (30 patients undergoing TKA and 10 cadavers) demonstrated the presence of the ligament.



### Discussion

Previous descriptions of this structure in the literature are inconsistent. Some authors have described the ligament as an independent structure,\* while others see it as a part of the iliotibial band.\*\*


- \* Terry GC, *Am J Sports Med.* 1996;
- \* Sanchez AR, *Sport Med Arthrosc.* 2006
- \*\* Vieira EL, *Arthroscopy.* 2007



### Discussion

There is agreement in the literature that a femoral insertion iliotibial band exists\*\*\*

- \* Vieira EL, *Arthroscopy.* 2007
- \* Fairclough JJ *Anat.* 2006




### Significance

The anterolateral ligament may play a role in preventing anterior tibial translation following ACL injury.

The role, if any, of this structure in meniscal stability and the pathology of meniscal tears remains unclear


- \* Terry GC, *Am J Sports Med* 1993
- \* Hughston JC, *J Bone Joint Surg* 1976
- \* Hughston JC, *J Bone Joint Surg Am.* 1976
- \*\* Binfield PM, *Injury.* 1993
- \*\* Fetzler GB, *J Knee Surg.* 2009
- \*\* Nikolic DK. *KSSTA* 1998



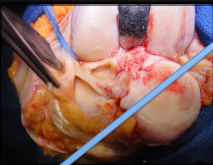
### Conclusions

The anterolateral ligament is consistently present. It is a fibrous structure that takes origin near the popliteus tendon insertion on the femur and inserts on the lateral meniscus and lateral tibial plateau.

It likely plays a role in the pathogenesis of the Second fracture and may contribute to knee stability in the ACL deficient knee by resisting anterior tibial translation and serve to stabilize the lateral meniscus.




### Significance




This structure may be at risk when exposing the lateral tibial plateau and removing the meniscus


Further work is required to investigate the role of this structure as a contributor to lateral soft tissue contracture in valgus knees and its contributions to knee stability following TKA.



### Conclusions



The anterolateral ligament is a consistent, ligamentous structure in the anterolateral knee.



**Clinics Review Articles**

**CLINICS IN SPORTS MEDICINE**

**Anatomic ACL Reconstruction**

**EDITORS**  
 Thomas R. Fu  
 Robert M. Luzzo  
 Marc D. Miller

**ACL Reconstruction and Extra-articular Tenodesis**

V. Duthon, M.D., Robert A. Magnuson, M.D., Serge Servien, M.D., Philippe Neyret, M.D.

**KEYWORDS**  
 • ACL reconstruction • Extra-articular tenodesis • ACL, tendon

**KEY POINTS**  
 • Anatomic ACL reconstruction is the preferred method for ACL reconstruction.  
 • The procedure is performed by a minimally invasive approach.  
 • The procedure is performed by a minimally invasive approach.  
 • The procedure is performed by a minimally invasive approach.

**V. DUTHON, R. M. MAGNUSON, E. SERVIEN, Ph. NEYRET**  
 ACL reconstruction with extra-articular tenodesis  
**E. H. Fu, V. M. Sahl, M.D. Miller**  
 Clinics in Sports Medicine on Anatomic ACL Reconstruction, Elsevier, Philadelphia Pennsylvania USA, Janvier 2013, pp 141 - 153

**Abstract**  
 The authors consider the place of extra-articular reconstruction in the treatment of anterior cruciate ligament (ACL) deficiency. Consideration is given to the historical and current use of extra-articular reconstruction in the treatment of ACL deficiency. The authors discuss the advantages and disadvantages of extra-articular reconstruction in the treatment of ACL deficiency. The authors discuss the advantages and disadvantages of extra-articular reconstruction in the treatment of ACL deficiency. The authors discuss the advantages and disadvantages of extra-articular reconstruction in the treatment of ACL deficiency.

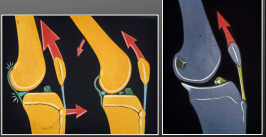
**Individual Anatomy**

**Fu's Concept**

**Historical perspective**

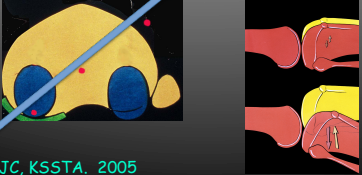
- Rupture of the anterior cruciate ligament (ACL) frequently results in knee instability that can limit function, damage other intra-articular structures, and hasten the development of osteoarthritis.

Oiestad BE. Am J Sports Med. 2009  
 Louboutin H. Knee. 2009  
 Neuman J. Am J Sports Med. 2008



**Historical perspective**


- The most commonly tested components of instability include anterior tibial translation and anterolateral rotatory instability, with most patients exhibiting a combination of both during running and cutting activities.



Waite JC, KSSTA. 2005

**Historical perspective**

- Numerous surgical techniques have been developed over the years to restore stability to the ACL deficient knee.



McCulloch J. Knee Surg. 2007

**Historical perspective: Technique**

Lemaire 1967 & 1983	Hughston 1983	Mac Intosh & Darby 1976	Ellis 1976	Loose 1978
Boutquet	Muller 1983	Andrews 1983	Imbert 2000	


These early isolated extra-articular procedures failed to adequately control anterior tibial translation, and results were not ideal.

Amirault JD. J Bone Joint Surg Br. 1988

**Historical perspective**

- Intra-articular reconstruction techniques then gained popularity as surgeons demonstrated frequent return to sports and good medium-to-long-term results.

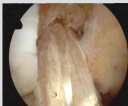
Hanytsiak BT. Am J Sports Med. 2008  
 Jarvela T. Int Orthop. 1999  
 Lebel B. Am J Sports Med. 2008  
 Roe J. Am J Sports Med. 2005  
 Shelbourne KD. Am J Sports Med. 2009



### Historical perspective

- However, a subset of patients still reported instability after reconstruction, possibly due to the persistent rotatory instability noted with vertical graft positioning.

Lee MC. Arthroscopy. 2007  
 Loh JC. Arthroscopy. 2003  
 Scopp JM. Arthroscopy. 2004  
 Woo J.L. J Bone Joint Surg Am. 2002



A single ACL graft "high" in the notch is good but not enough  
 Aglietti, JBJS-A 04  
 Freedman, AZSM 03

### Historical perspective

- Significant work has gone into more anatomic placement of ACL grafts and the development of double-bundle reconstruction techniques in an effort to better control rotational instability

Colombet P. Arthroscopy. 2006  
 Ferretti M. Arthroscopy. 2007  
 Muneta T. Arthroscopy. 1999  
 Musaki V. Arthroscopy. 2003  
 Zamp T. Am J Sports Med. 2008

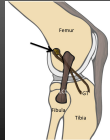


Anatomic reconstruction: 2 bundles

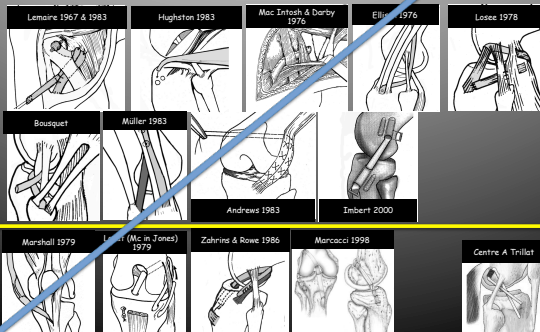
### Historical perspective

- Augmentation of an intra-articular ACL reconstruction with a lateral extra-articular reconstruction has been suggested as an alternative method of restoring rotational stability in these patients.

Goertzen M. Rev Chir Orthop. 1994  
 Lerat J. Rev Chir Orthop. 1997.  
 Naves FR. J Bone Joint Surg Am. 1991



### Historical perspective: Technique

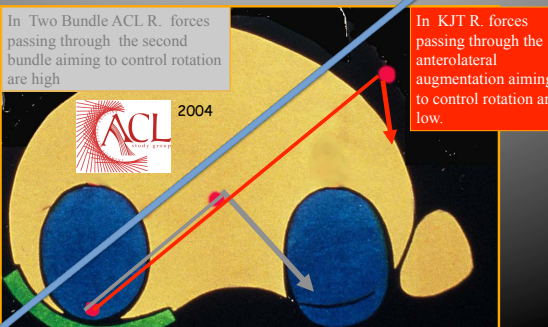


Lemaire 1967 & 1983, Hughston 1983, Macintosh & Darby 1976, Ellis 1976, Loose 1978, Brusquet, Muller 1983, Andrews 1983, Imbert 2000, Marshall 1979, (McIn Jones) 1979, Zahra & Rowe 1986, Mancosi 1998, Centre A Trillat

### Historical perspective

- There are several theoretical advantages of such an approach.
- First, the extra-articular position of the graft provides a longer lever arm than an intra-articular graft, allowing rotational control with minimal stress on the graft.

### Historical perspective



In Two Bundle ACL R. forces passing through the second bundle aiming to control rotation are high

In KJT R. forces passing through the anterolateral augmentation aiming to control rotation are low.

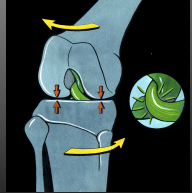
ACL 2004

### Historical perspective

- Second, the extra-articular graft position obviates the need to place 2 grafts (anteromedial and posterolateral bundles) in the notch, which can be technically challenging, especially in smaller knees.

### Historical perspective

- Finally, the addition of a lateral extra-articular graft has been shown to decrease forces on intra-articular reconstructions.



Engbretsen L. Am J Sports Med. 1990

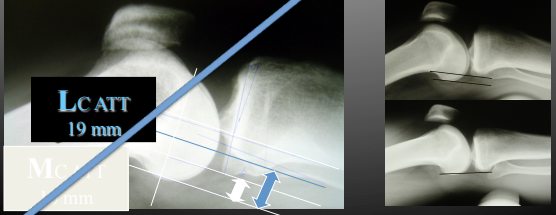
### Indications 1

- An **explosive pivot shift** characterized by significantly increased anterior tibial translation in the lateral compartment. Excessive anterior tibial translation in the lateral compartment may be poorly controlled by an intra-articular graft alone. We have found that the addition of this procedure in these patients leads to decreased subjective instability post-operatively.

Lerat JL. Rev Chir Orthop. 1997

### Indications 1

Lerat -Moyen 2002 JBJS Br      Telos 14 kg



### Indications 1

Post-op

4.6 $\pm$ 1.3

2.0 $\pm$ 4.2

Diff stress XRrays Lateral compartment

Legend: ■ KJ    ■ KJT

### Indications 2

We consider extra-articular augmentation in patients who plan to return to **collision sports such as rugby or football** after ACL reconstruction. The additional constraint may serve to protect the intra-articular ACL graft when it is exposed to excessive loads in such sports.

Noyes FR. J Bone Joint Surg Am. 1991  
 Davis DS. J Orthop Sports Phys Ther 1997  
 Segond P. Progrès Med. 1879  
 Terry GC. Am J Sports Med. 1993  
 Engbretsen L. Am J Sports Med. 1990

### Indications 3

- In young patients under 20 Y where there is a high risk of re-rupture

?

### Indications 4

- In cases of **revision ACL reconstruction**. It has long been noted that objective control of laxity is worse in revision cases.

Carson EW. J Knee Surg. 2004  
 Noyes FR. Arthroscopy. 1994  
 Uribe JW. Clin Orthop Relat Res. 1996

Colombet P, Neyret P. Rev Chir Orthop. 2007

### Indications 4

Knee Surg Sports Traumatol Arthrosc  
DOI 10.1007/s00141-013-0765-9

KNEE

**Revision ACL reconstruction: influence of a lateral tenodesis**

Christophe Trojani · Philippe Beaulis · Gilles Bard · Christophe Bussière · Vincent Chassagny · Patrick Dijan · Frédéric Dubrana · François-Paul Eklicch · Jean Abdi

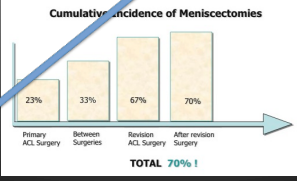
**Conclusion** This study shows a significant improvement in the IKDC score after revision ACL reconstruction. The association of a lateral extra-articular tenodesis with the intra-articular graft increases knee stability after revision ACL reconstruction; however, this additional procedure does not significantly alter the IKDC score at follow-up.

**Level of evidence** Retrospective case series, Level IV.

### Indications 4

...especially in cases of meniscal loss. A large multicenter study has demonstrated improved stability in revision cases when lateral extra-articular augmentation is used.

**Cumulative incidence of Meniscectomies**

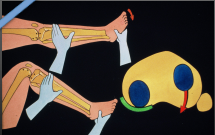


Category	Incidence (%)
Primary ACL Surgery	23%
Between Surgeries	33%
Revision ACL Surgery	67%
After revision Surgery	70%
<b>TOTAL</b>	<b>70%!</b>

Trojani, Ph Neyret al, KSSTA, 2011

### Contraindications 1

- ACL deficiency and an associated posterolateral corner injury.** The addition of a lateral extra-articular augmentation may actually fix the tibia in a postero-laterally subluxated position if the postero-lateral structures are not intact. Even after reconstruction of these structures, we do not recommend concurrent extra-articular augmentation.



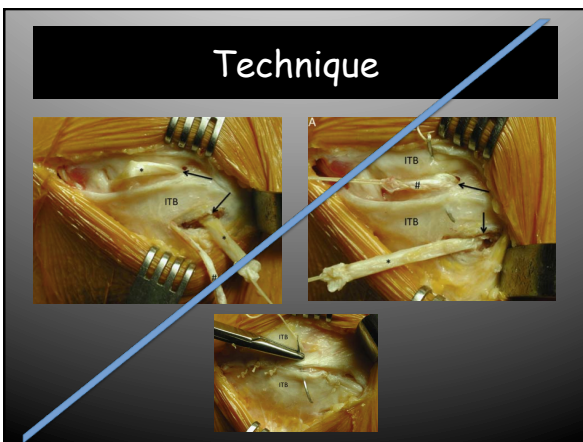
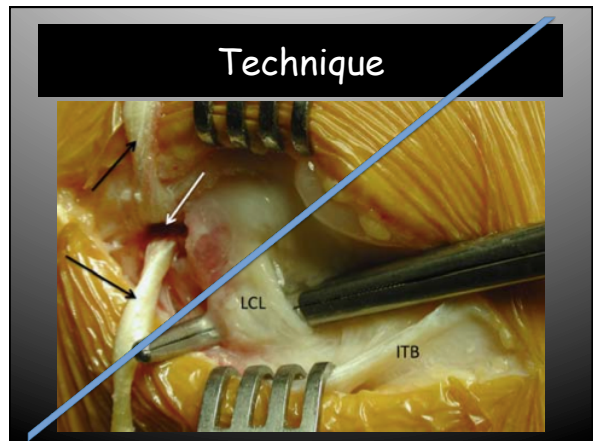
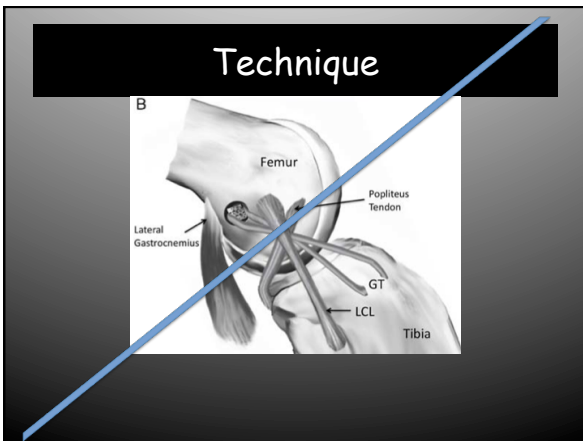
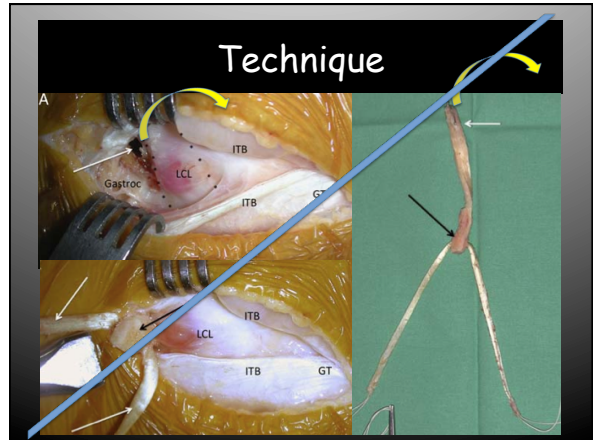
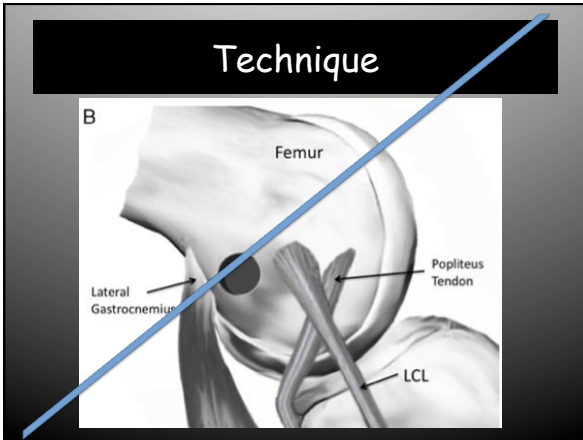
### Contraindications 2

- Lateral extra-articular augmentation is also contraindicated in skeletally immature patients, as there is high risk for physeal injury.

**Extraarticular Reconstruction in the Anterior Cruciate Ligament Deficient Knee**

Arthur J. Bergfeld, John A. Bergfeld

Pearl AJ, Bergfeld JA. Champaign, IL: Human Kinetics; 1992  
 Pearl AJ, Bergfeld JA. Extraarticular Reconstruction in the Anterior Cruciate Ligament Deficient Knee. Champaign, IL: Human Kinetics; 1992.



### POSSIBLE CONCERNS AND FUTURE OF THE TECHNIQUE

- The chief criticism of this technique is that rather than reconstructing normal anatomy, as may be performed with a double-bundle ACL reconstruction, a **non anatomic restraint** is to prevent anterolateral tibial rotation. Although effective in controlling rotation, there has been concern that the lateral compartment may be in fact over-constrained, possibly leading to the premature development of osteo-arthritis.

**Purmin J, Verdonk P, Selmi T, Massin P, Neyret P.** Long-term follow-up of 24.5 years after intra-articular anterior cruciate ligament reconstruction with lateral extra-articular augmentation. *The American Journal of Sports Medicine* 2010; 38: 1094-1102

Beynon BD., *Am J Sports Med.* 2005



### POSSIBLE CONCERNS AND FUTURE OF THE TECHNIQUE

Journal of Anatomy

**The anterolateral ligament of the human knee: an anatomic and histologic study**

**Anatomy of the anterolateral ligament of the knee**

Labels: MTP, LM, P, LFC, Popliteus Tendon, Anterolateral Ligament (ALL), Geny's Tubercle, Posterior Cruciate Ligament.

### POSSIBLE CONCERNS AND FUTURE OF THE TECHNIQUE

Labels: LFE, DT, PFL, ALL, GT.

### Revisited anterolateral anatomy

#### The anterolateral ligament

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