

What I learnt from 30 years of ACL reconstruction

I started my residency focused on knee surgery in 74. A Trillat was professor and H Dejour associated professor.

At that time the test to diagnose an ACL insufficiency was:
the anterior drawer at 90° of flexion.

What I learnt from 30 years of ACL reconstruction

We operated patients with positive anterior drawer test and the surgery was done to try to treat it (postero medial, medial « reconstruction »)

What I learnt from 30 years of ACL reconstruction

In 1976 I visited doctor Jack Hughston in columbus (GA)
I discovered an « other world » with, to diagnose an ACL Insufficiency, 2 clinical tests:

The Jerk Test, the pivot shift.

The Lachmann Test

What I learnt from 30 years of ACL reconstruction

I understood:

- The problem for an ACL insufficiency is not in flexion but near extension
- A positive pivot shift, jerk, in internal rotation imitate a clinical instability with the same feeling for the patient.

What I learnt from 30 years of ACL reconstruction

I also understood:

- The importance of the rehabilitation program from the immediate post op to the progressive starting again sport activity.

What I learnt from 30 years of ACL reconstruction

We had a new challenge:

- try to control the positive pivot shift.
- M Lemaire started with such a procedure 10 years before but he was not an orthopedic surgeon, he was from Paris and there was no TGV at that time between the 2 cities.

We tried different procedures based on peripheral medial and lateral reconstruction, followed by an immobilization with a cast for 45 days and a difficult rehabilitation program.

We obtained poor results because we changed the anatomical insertion of peripheral structures and try to tight them

What I learnt from 30 years of ACL reconstruction

I understood that it was necessary to reconstruct the ACL

- A. Trillat started in 76 after a discussion with E. Erickson. he used the medial third of the patellar tendon kept attached distally but the result was stiffness or laxity. He stopped.
- In 1978 Franke from Berlin (east part) gave a talk at the IKS meeting in Lyon. He used free patellar tendon graft as described by Brückner.

The revelation

What I learnt from 30 years of ACL reconstruction

In 1979 we started with a new procedure:

- ACL reconstruction + antero lateral tenodesis.

Mac Injohnes (Lerat)



Free graft

- Tibial bone: tibial tunnel.
- Patellar tendon: neo ACL.
- Patellar bone: femoral tunnel.
- Quadriceps tendon: antero lateral tenodesis.

What I learnt from 30 years of ACL reconstruction

The goal of this association:

- Better control of the jerk by a limitation of the internal rotation.
- Protection of the new ligament during the ligamentization period.
- Treatment of an antero lateral acute or chronic lesion (ligamentous problem equivalent to a second fracture)



What I learnt from 30 years of ACL reconstruction

Advantages:

- Decrease of the constraints (43%) on the ACL if we do dynamic tests (Engebretsen)
- Decrease of positive dynamic test in internal rotation with a 5 years follow up.
- Better control of the anterior translation of the lateral compartment compared to the medial compartment (Moyen)

Inconvenient:

- Aggressive surgery. Problems to recover good sensations for sport activity.
- Possibility to fix the knee in external rotation in case of stiffness (not rare)

I understood that the associated antero lateral tenodesis was not indispensable.

Confirmed later on

- **Prospectives randomised studies:**
Acquier 2003, Ait Si Selmi 2002, Giraud 2006

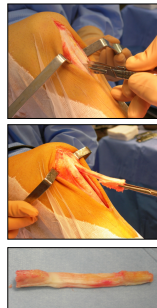
No significative difference concerning the final results

In 1985 Isolated ACL reconstruction. Open surgery

What I learnt from 30 years of ACL reconstruction

I understood that
an isolated ACL reconstruction seems enough

1989: ACL reconstruction with the PT (free)
Mid third
under arthroscopic control
Antero medial part
Out-in for the femoral tunnel.
Fixation: press fit on the femur
Interference screw on the tibia



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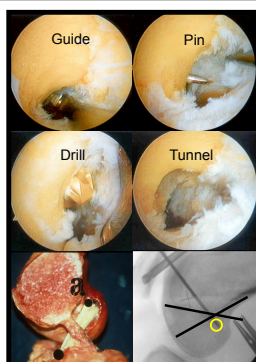


What I learnt from 30 years of ACL reconstruction

isolated ACL reconstruction.

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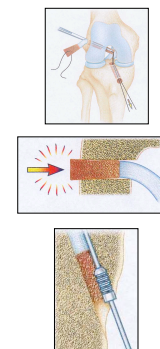
Positive non isometry



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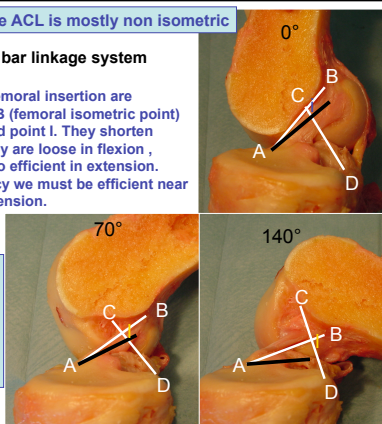


I understood that the ACL is mostly non isometric

O'Connor, 4 bar linkage system

Fibers whose femoral insertion are situated behind point B (femoral isometric point) pass always behind point I. They shorten from 0 to 140°. They are loose in flexion, tight in extension so efficient in extension. For the ACL insufficiency we must be efficient near extension.

A favorable non isometry (Antero medial fibers)



Material

We reviewed 57 patients.

1.01.92 → 31.12.92
3 years after the beginning of this technique (learning curve).

35 males (60%). 22 females (40%).
Average age at the time of surgery: 26 y. from 15 to 47 y.
Time between trauma and surgery: 21,9 M. From 15 D to 241 M.
Follow up 182 months (> 15 years).
Average age at the time of the revision: 41 y. from 30 to 62 y.

Meniscus:

Pre operative: 6 medial meniscus.
Per operative: 2 medial meniscectomy.
2 medial meniscal sutures.
Postoperative: 3 medial meniscectomy.
1 medial and lat. ectomy.

Controlateral ACL:

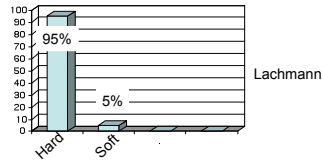
Pre operatively: 8
Post operatively: 9
Problem to evaluate the diff.

Results ACL reconstruct. BPTB. > 15 Y F.Up

Clinical laxity

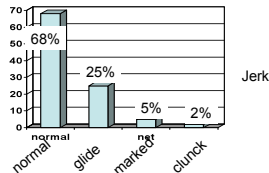
Lachmann:

- 95% hard point.
- 5% soft



Pivot shift:

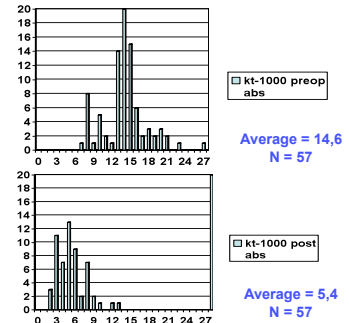
- 68% normal.
- 25% glide.
- 5% marked.
- 2% clunk.



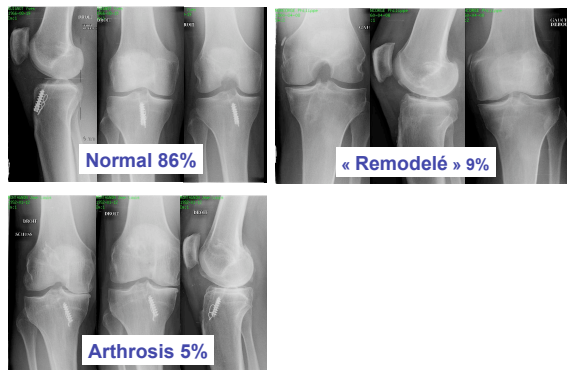
5% and 7% failures.
25% lat. hyper mob.

What I learnt from 30 years of ACL reconstruction

pre operative
and
post operative
laximetry.
Absolute value.
N= 57



What I learnt from 30 years of ACL reconstruction

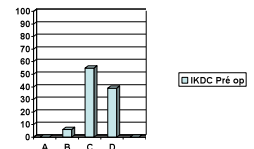


What I learnt from 30 years of ACL reconstruction

IKDC. Objective.

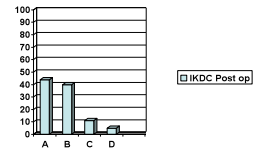
Pre operative

- A: 0%
- B: 6%
- C: 55%
- D: 39%



Post operative

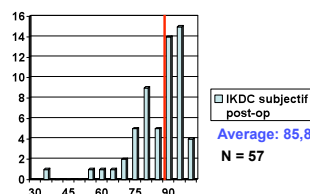
- A: 44%
- B: 40%
- C: 11%
- D: 5%



What I learnt from 30 years of ACL reconstruction

IKDC. Subjective

58% of the patients
with a score
equal or superior
to 90



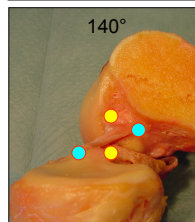
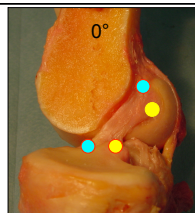
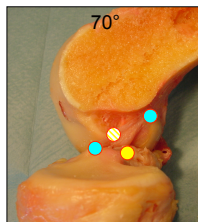
What I learnt from 30 years of ACL reconstruction

- This study confirmed what I thought 15 years ago: reconstruction of the antero medial part of the ACL (favorable non isometry) with an out-in technique using the patellar tendon is a good solution.
- My experience with the hamstrings in 96, same technique with femoral and tibial absorbable interference screws failed. (6 reconstructions for the athletes of the French ski team 5 ruptures 3 years later)
- The residual problem was the hyper mobility even if it's not really pathologic of the lateral compartment (25%) when the anterior laxity in extension is perfect.

We understood that we forgot a part
of the anatomy of the ACL

We forgot the postero lateral bundle

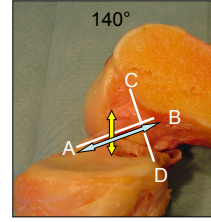
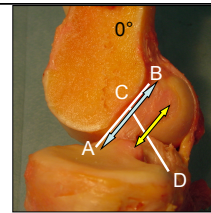
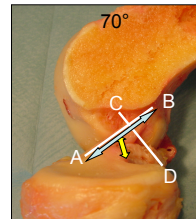
The femoral insertion of the postero lateral bundles turn around the instant center of rotation of the knee. His posterior and distal position become anterior and proximal



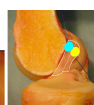
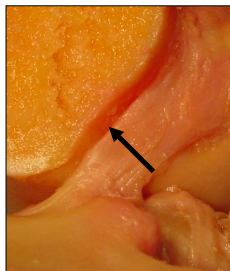
In the sagittal plan

4 bars system

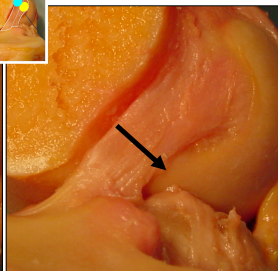
The antero medial fibers are the most isometric and the postero lateral fibers are the most non isometric. First the Insertion points move nearer from 0° to 90°. After 90° they move away



More and more isometric fibers.



More and more non isometric fibers

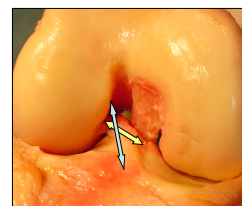


- 2 bundles:
- antero medial with the most isometric fibers.
 - postero lateral with the most non isometric fibers.

But each fiber has his proper specificity.

In the frontal plan

- The antero medial bundle has an anterior direction.
- The postero lateral bundle has an anterior et lateral direction.



Biomechanics.

• Antero medial bundle:

- Effective on the anterior tibial translation after 30° of flexion. (Lachman at 30°. Anterior drawer in flexion).
- less effective to control the rotation. (Jerk).

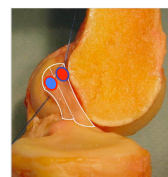
• Postero lateral:

- effective to control the recurvatum, the anterior drawer test from 0° to 20°, and the internal rotation. (recurvatum. Lachman at 10°. Jerk).
- not so effective on the anterior translation in flexion. (Anterior drawer in flexion).

Amis 1991, Gabriel 2004, Amis 2005, Zantop 2007

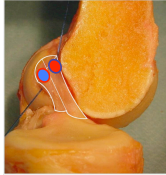
We understood that it was possible to think about a more anatomic ACL

The challenge was to do a double bundle reconstruction.



- Antero lateral bundle
- Postero lateral bundle

The challenge was to do a double bundle reconstruction.



- Rosenberg 1997
- Muneta 1999
- Franceschi 2002
- Sonnery Cottet / Chablat 2003,4 (ISAKOS-ESSKA)



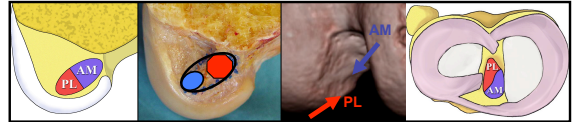
Out-in, Semi T.
But non anatomic.
(Guide in one piece).



2004:

« Anatomic reconstruction of the anteromedial and posterolateral bundles of the anterior cruciate ligament using hamstring tendon grafts. »

Yasuda K, Kondo E, Ichiyama H, Kitamura N, Tanabe Y, Tohyama H, Minami A.



The only solution in order to have a recruitment of the fibers in extension



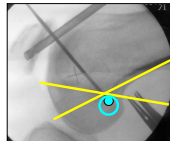
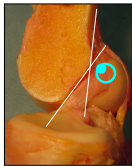
Friedrich

Femoral positioning of the bundles.

The goal: to have reliable anatomic marks.

For the antero medial bundle:

- The fundamental mark is the angle between the posterior cortex of the femur and the Blümsatt line.



- The isometric point of this bundle point is the insertion point of the anterior fibers of the ACL. The tunnel will be posterior and distal according to this mark when the knee is in extension.

Implementation of the femoral tunnel

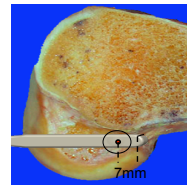
According to fiable marks

- Antero medial bundle. Out-in technique



Antero posterior positioning:

7 mm between the tip and the pin.
Possibility to have 6 mm, 8 mm, 9 mm



Orientation of the guide: 9 h.
the tip of the guide hang the lateral condyle.

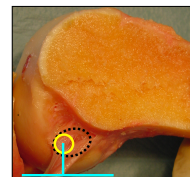


Femoral positioning of the bundles.

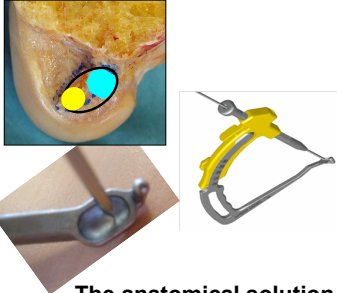
The goal: to have reliable anatomic marks.

For the postero lateral bundle

- When the knee is flexed at 90° of flexion, the postero lateral bundle is tangent to the cartilage at the level of the contact between the condyle and the tibial plateau.

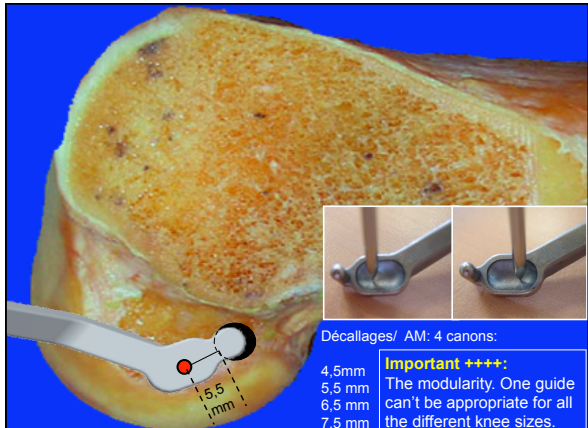


Control



- The pin is in the antero medial tunnel
- The axis between the 2 holes determines an angle of 30° with the horizontal plane, the knee at 90°.

The anatomical solution for the femur

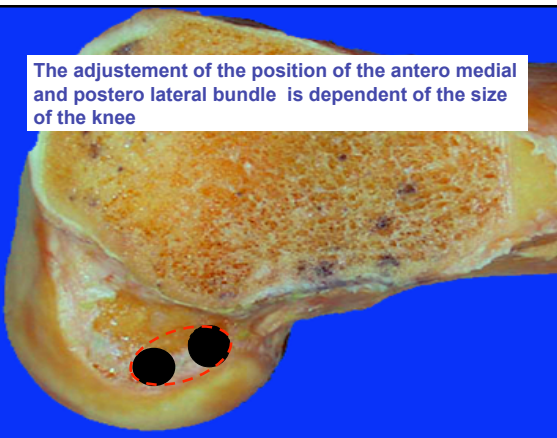


Décallages/ AM: 4 canons:

- 4,5 mm
- 5,5 mm
- 6,5 mm
- 7,5 mm

Important +++:
The modularity. One guide can't be appropriate for all the different knee sizes.

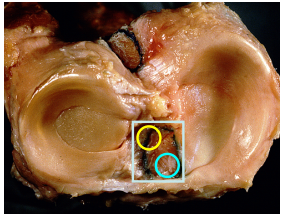
The adjustment of the position of the antero medial and postero lateral bundle is dependent of the size of the knee



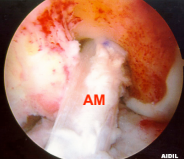
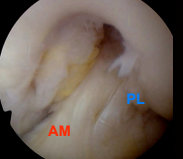
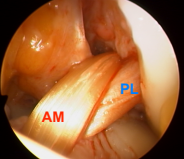
According to reliable anatomic reference marks

Medial and lateral tibial plateau (transversal)
Anterior and posterior ACL fibers (antero posterior)

In this square, the antero medial bundle is anterior and medial,
the postero lateral bundle is posterior and lateral



With these technical improvements, it seems that we are nearer to an anatomical ACL

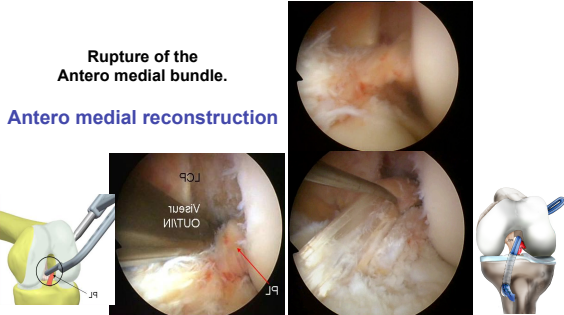




Single bundle
ACL
Double bundle

With these anatomic studies and this 2 bundles technique we start to think as other surgeons to a partial reconstruction.

Rupture of the Antero medial bundle.

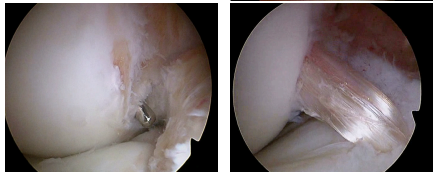
Antero medial reconstruction



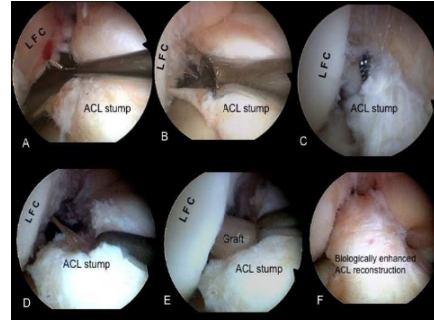
With these anatomic studies and this 2 bundles technique we start to think as other surgeons to a partial reconstruction.

Rupture of the postero lateral bundle.

Postero lateral reconstruction



The problem is the mechanical value of the supposed "intact" bundle. Importance of the biological effect of the residual tissue ?



It's too early to speak about the results of these techniques:

- 2 bundles.
- Partial reconstruction.
- Biologically enhanced ACL reconstruction.

The last 5 years are exciting concerning the ACL reconstruction. Pushed by my younger Partner I must stopped the aversion I had to use the hamstrings to reconstruct. But still now it's difficult.

Conclusions

- there is a long way since 1974 concerning the treatment of the ACL insufficiency.
- Still now we progress and the younger's have enough work for the next decade.
- My implication in the sport medicine activity has been and is a great pleasure

I'd like to thank:

- My teachers: A Trillat, H. Dejour, J Hughston.
 - My companion of the seventies: JC Puddu.
 - My younger friends (from Lyon): Philippe, Michel, David
 - My friend and partner: Bertrand.
- They stimulated me and take care of me.

