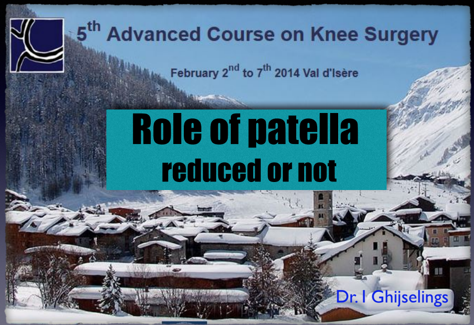
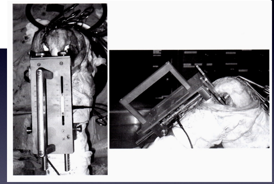


Measurement of joint gap load in patella everted and reset position during total knee arthroplasty

Nobuyuki Yoshino · Nobuyoshi Watanabe · Yoshinobu Watanabe · Yukihisa Fukuda · Shinro Takai



Flexion gap height decreases by resetting the patella

Joint gap changes with patellar tendon strain and patellar position during TKA.

Gejo R, Morita Y, Matsushita I, Sugimori K, Kimura T.
Department of Orthopaedic Surgery, Faculty of Medicine, University of Toyama, 2630 Sugitani Toyama-city, Toyama, 930-0194, Japan. rgejo@med.u-toyama.ac.jp

Balancing of the joint gap in extension and flexion is a prerequisite for success of a total knee arthroplasty. The joint gap is influenced by patellar position. We therefore hypothesized the state of the knee extensor mechanism (including the patellar tendon) would influence the joint gap. In 20 knees undergoing posterior-stabilized type total knee arthroplasties, we measured the joint gap and the patellar tendon strain from 0 degrees to 135 degrees flexion with the femoral component in position. When the patella was reduced, the joint gap was decreased at 90 degrees and 135 degrees (by 1.9 mm and 5.5 mm, respectively) compared with the gap with the patella everted. The patellar tendon strain increased with knee flexion. Patellar tendon strain at 90 degrees flexion correlated with the joint gap difference with the patella in everted and reduced positions. This suggests that in addition to the collateral ligaments, the knee extensor mechanism may have an influence on the joint gap. Therefore, accounting for extensor mechanism tightness may be important in achieving the optimal joint gap balance during total knee arthroplasty. Level of Evidence: Level IV, therapeutic study. See the Guidelines for Authors for a complete description of levels of evidence.

Patellar position changes joint gap

Gejo R, Morita Y, Matsushita I, Sugimori K, Kimura T.
Department of Orthopaedic Surgery, Faculty of Medicine, University of Toyama, 2630 Sugitani Toyama-city, Toyama 930-0194, Japan. rgejo@med.u-toyama.ac.jp

When the patella was reduced,

the joint gap was decreased compared with the gap with the patella everted.

The strain in the PT increased with knee flexion.

Influence of patellarsubluxation on ligament balancing in TKA through a subvastus approach

Wouter De Keyser, Leo Beckers

Patellar positions play an important role in fine tuning the balance of a TKA in flexion

A COMPARATIVE STUDY ON THE BIOMECHANICS OF THE NATIVE HUMAN KNEE JOINT AND TOTAL KNEE ARTHROPLASTY

Jan Victor, MD

The concept of ligament isometry is based on the assumption that ligament fibers do not change in length when the joint goes through an arc of motion. Ligament isometry is at

Conclusion

We validated a novel experimental technique for the study of dynamic ligament strains. The model demonstrates that it is possible to define the femoral, fibular, and patellar insertion sites of the sMCL, the LCL, and the MPFL on a CT scan. Our experimental model demonstrated near-isometric behavior of the sMCL. The LCL is isometric between 0° and 70° of flexion, followed by a nonsignificant trend toward slackening with deeper flexion. The MPFL is most taut in extension and gradually starts to slacken in a linear fashion from 40° of knee flexion onward to 120° of flexion. In considering the broad patellar insertion of the MPFL, the cranial part is most tight in full extension and the caudal part is most tight at 30° of flexion. Based on these findings, differential tensioning of the graft bundles in double-bundle MPFL reconstruction is advocated.

ligament fibers do not change in length

[redacted] Our experimental model demonstrated near-isometric behavior of the sMCL. The LCL is isometric between 0° and 70° of flexion, followed by a nonsignificant trend toward slackening with deeper flexion.

Acta Orthop. Belg., 2013, **79**, 250-254

ASPECTS OF CURRENT MANAGEMENT

New possible pathways in improving outcome and patient satisfaction after TKA

Hendrik P. Delport, Jos Vander Sloten, Johan Bellemans

From the Faculty of Medecine, Department of Orthopaedic Surgery and from the Faculty of Engineering Science, Section of Biomechanics, University of Leuven

Patient dissatisfaction after TKA has not been improved dramatically since the introduction of new alignment (navigation, custom guides) and balancing techniques. Orthopaedic surgeons consider the ligaments as essentially passive stabilizing structures. However, during the activities of daily living, the joints are stabilized primarily by our muscle actions that both move and stabilize the joints. Isometric motion of the joint does not cause the distance separating the bone attachments to change. The practical importance of isometry is confirmed by the fact that ligaments are elongated irreversibly if the strain exceeds

requiring revision of the prosthesis such as loosening, fracture, or infection are relatively few.

Survival analysis underestimates the problem, as pain or poor function do not necessarily lead to revision. Although improvement following TKA can be dramatic, the gains are typically less than the changes reported by patients who have had a total hip arthroplasty (*14*). Numerous studies report that only 70% to 89% of patients are satisfied after their primary TKA, and as many as 20%-30% of patients continue to endure knee pain or have problems after

a given level (5%). In ligament surgery as well as in TKA, the concept of isometry is highly important. In this paper we wish to highlight the fact that the role of the soft tissue envelope goes beyond structural and mechanical support. The presence of mechano- and nocireceptors in the structures around the human knee joint has long been reported but is underrecognised by TKA surgeons.

Lésions peropératoires du tendon poplité : causes et conséquences. Peroperative lesion of popliteus tendon: reasons and consequences. G. Demey, S. Lustig, E. Servien, P. Neyret. JDG 2010

DE SIMONE V, DEMEY G, MAGNUSSEN RA, LUSTIG S, SERVIEN E, NEYRET P. Iatrogenic popliteus tendon injury during total knee arthroplasty results in decreased knee function two to three years postoperatively.Int Orthop. 2012 Oct;36(10):2061-5.

J Arthroplasty, 2013 vol. 28(9) pp. 1528-32

Soft tissue releases affect the femoral component rotation necessary to create a balanced flexion gap during total knee arthroplasty.

Christensen, CP; Stewart, AH; Jacobs, CA

The structures that were released to balance the extension gap were recorded during 1500 consecutive TKA procedures, and the amount of femoral component external rotation (ER) necessary to balance the flexion gap was measured with a tensiometer. The amount of ER necessary to balance the flexion gap significantly decreased as more medial structures were released (1 structure=4.7°, 2=4.1°, 3=2.8°, 4 or more=1.1°, P<0.012), whereas significantly greater ER was necessary when three or more lateral structures were released (1 structure=5.3°, 2=5.5°, 3 or more=8.6°, P<0.03). Soft tissue releases affected the amount of femoral component ER necessary to balance the flexion gap, bringing into question the ability of techniques utilizing bony landmarks to properly align the femoral component in rotation.

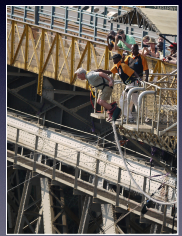
Soft tissue releases affected the amount of femoral component ER necessary to balance the flexion gap, bringing into question the ability of techniques utilizing bony landmarks to properly align the femoral component in rotation.

Ligaments

Have some elasticity but with end point

Don't contract

Ligament bowing (tenting) is filled with osteophytes ≠ ligament contraction

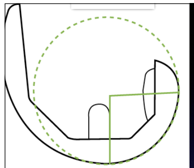


Natural height of F/E gap

What?

It's the height of the F/E gap with the PT, PCL, ACL , MCL ,LCL and PopT in anatomical position

(just the natural lenght of the ligaments without tension or releases)

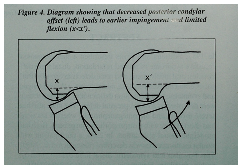


Single Radius

Why?

- Collateral ligaments are isometric
- No flexion instability
- Only a wheel turns

(if the axis is in the centre)



Posterior condylar offset

J.Bellemans JBJS 2002 84-B,50-53

Effect of tibial slope or PCL release on knee kinematics

Jojima H, Whiteside LA, Ogata K

Increasing posterior tibial slope is preferable to release of the PCL for a knee that is tight in flexion

Effects of PCL resection

Chaiyakit P, Meknavin S, Hongku N.

Mean increases of the extension gap

medial : 0.17 +/- 0.22 mm (up to 0.5 mm)
lateral: 0.25 +/- 0.37 mm (up to 1.16 mm)

Mean increases of the flexion gap

medial : 1.29 +/- 1.02 mm (up to 3 mm)
lateral: 2.09 +/- 1.12 (up to 4.66 mm)

Resection of PCL

increases the flexion gap more than the extension gap

and

lateral more than medial

The joint gap in CR vs PS

Matsumoto T, Kuroda R, Kubo S, Muratsu H, Mizuno K, Kurosaka M.

Joint gap with a reduced patella

PS knees
increased from extension to flexion

CR knees
it remained constant throughout the full range of movement.

Secrets to successful TKA

Respect the soft tissue envelope

Take off al the **osteophytes** before balancing

Balance F/E gap with **patella and PCL/ACL in place**

No ligament releases or tensioning

Preserve the **natural height** of the F/E gap

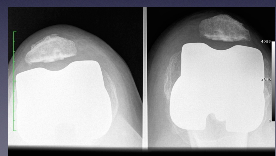
Preserve the **posterior offset**

Fill the F/E gap exactly = stability

Secrets to successful TKA

Alignment and position of the components

Femoral rotation (PF tracking)



Tibial cut is most important for the axis

Intra medullar with extra medullar control

Natural tibial slope

0° versus constitutional (varus or valgus?)

Ligament balancing and finding natural height of flexion/extension gap

With “Patella In Place Balancer”

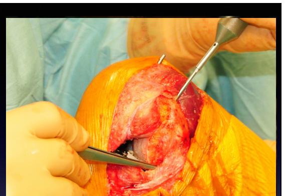
PIPB

Patella in place balancer

Dr. I Ghijselings

	TEA/Bone	FFA/Soft Tissue
Soft Tissue Releases	Measured resection Kinematic alignment	Extension First Gap Balancer
Fewer or no soft tissue releases	Shape Matching, PSI, Signature, Etc	Flexion First Gap Balancer

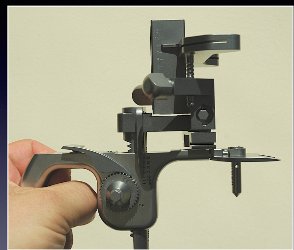
PIPB



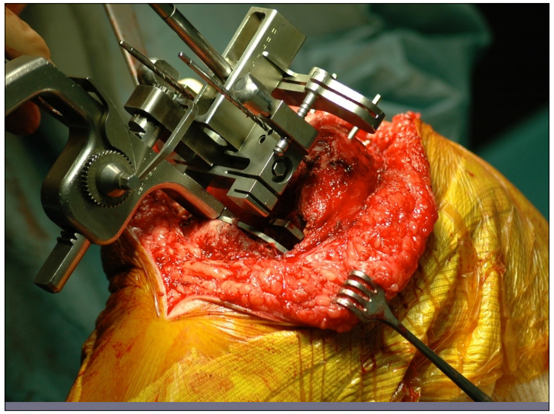
Flexion First Gap Balancers

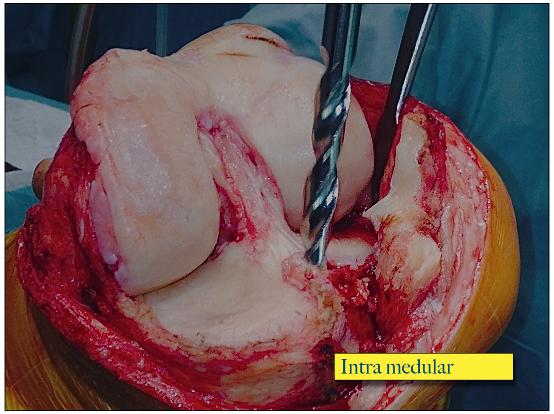
Patella everted
Ligament releases

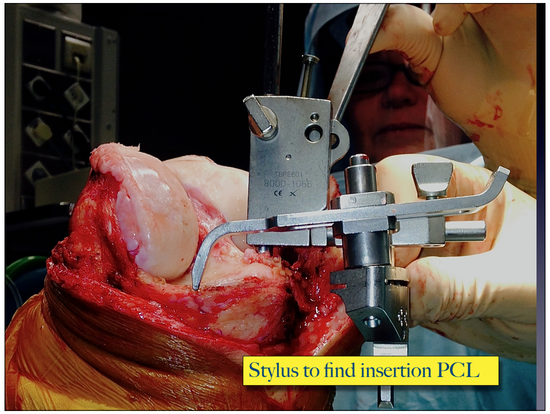
Patella in place
No ligament releases

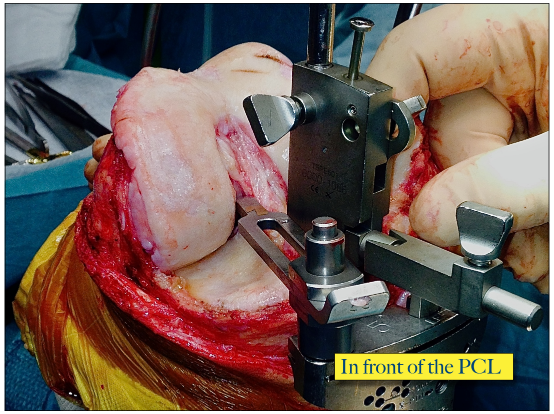


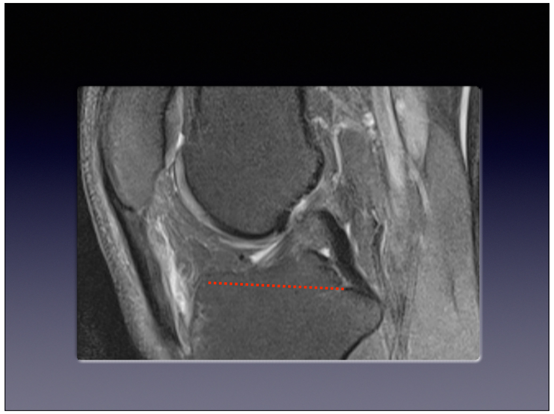
PIPB

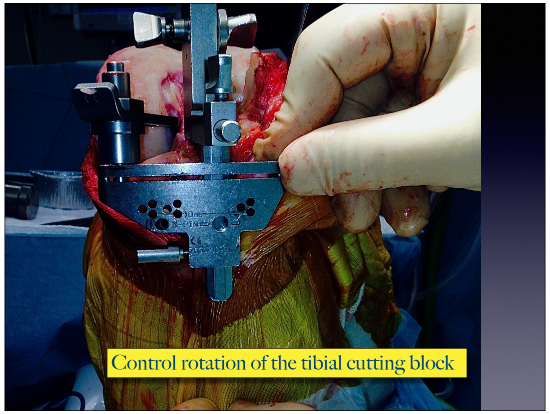



Intra medular

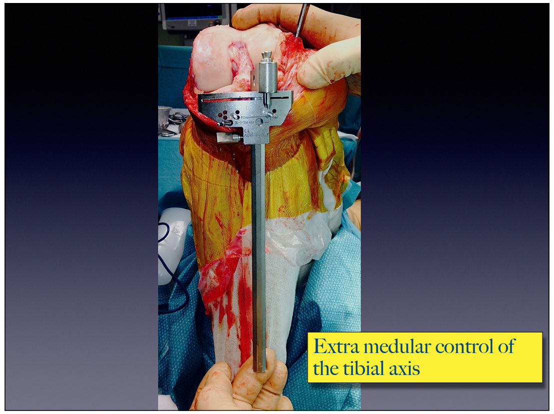

Stylus to find insertion PCL


In front of the PCL

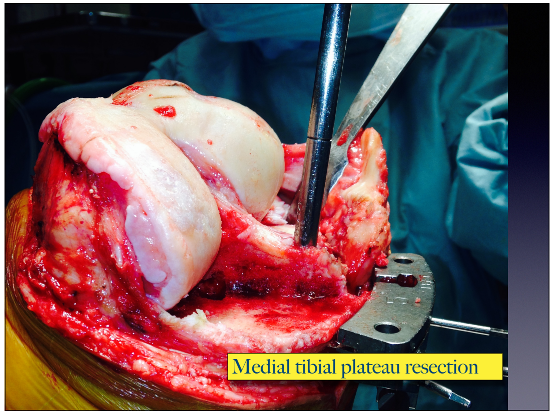


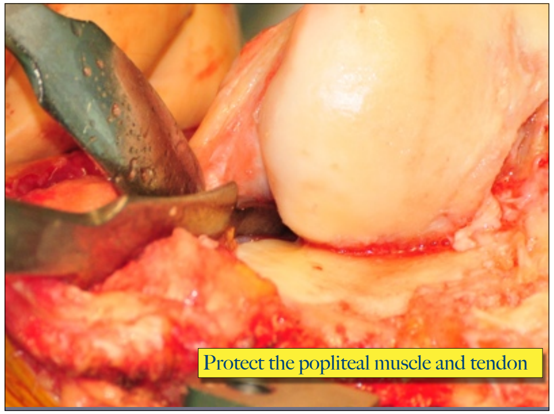

Control rotation of the tibial cutting block

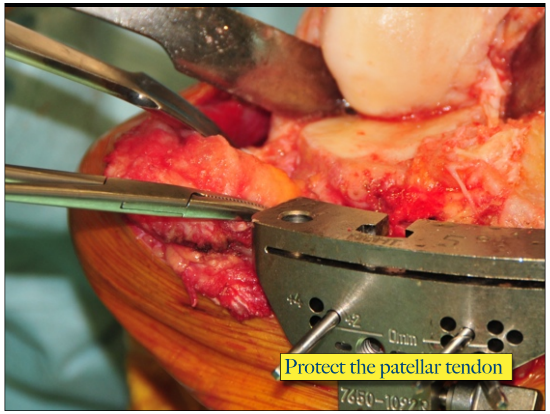

Look for the natural tibial slope

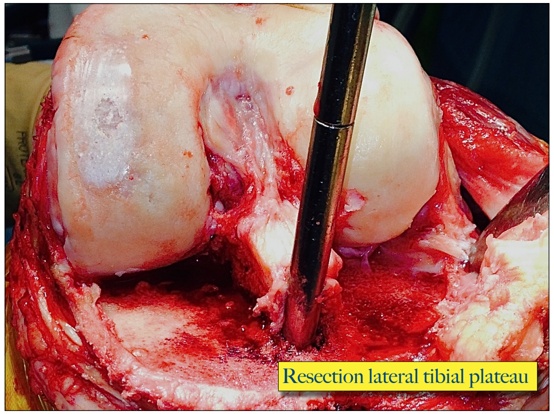

Extra medular control of
the tibial axis

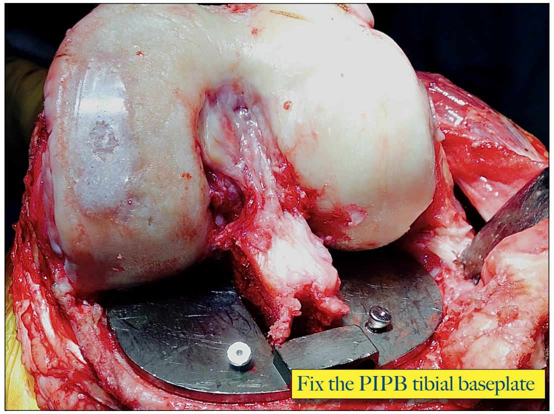

Protect MCL and PCL

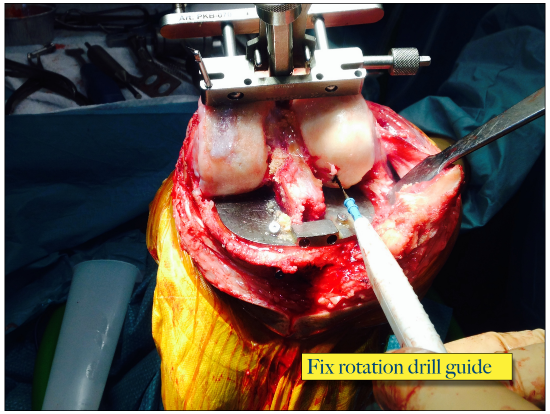

Medial tibial plateau resection

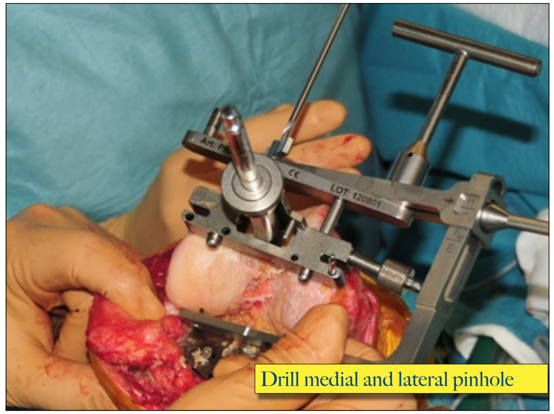

Protect the popliteal muscle and tendon

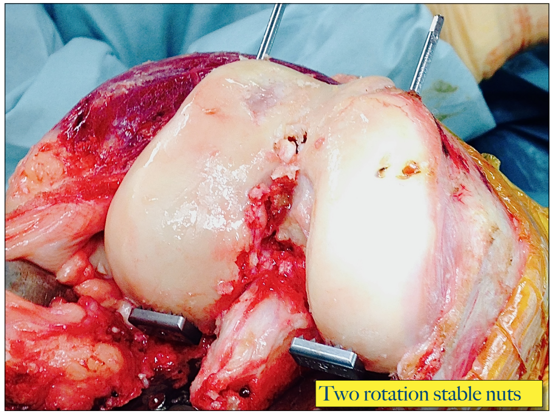

Protect the patellar tendon

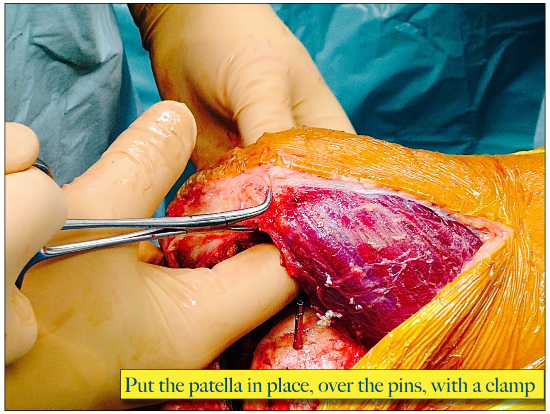

Resection lateral tibial plateau


Fix the PIPB tibial baseplate

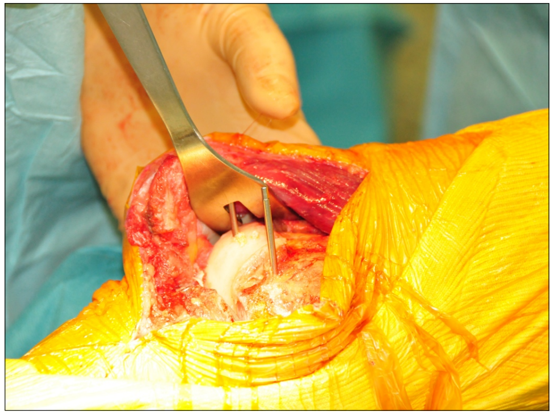

Fix rotation drill guide

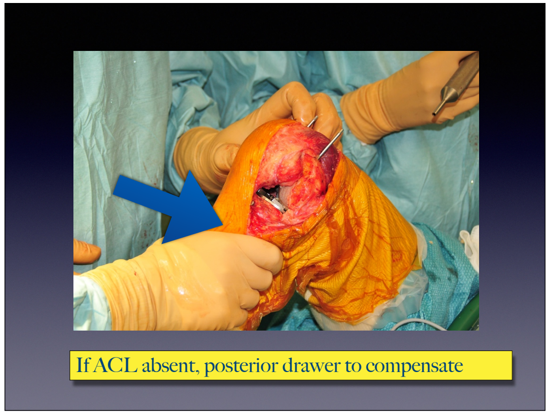

Drill medial and lateral pinhole

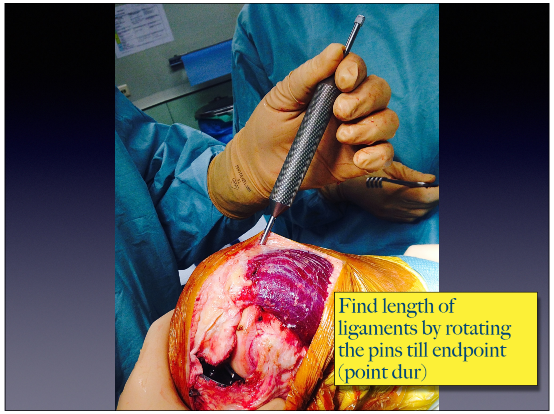

Two rotation stable nuts

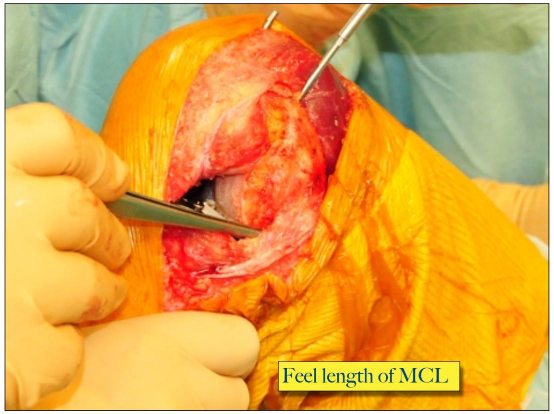

Put the patella in place, over the pins, with a clamp


Or with a special instrument

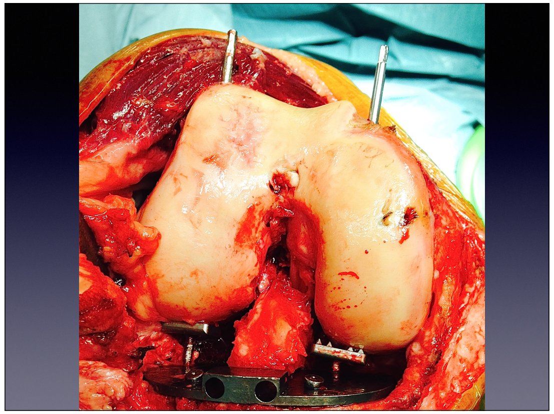


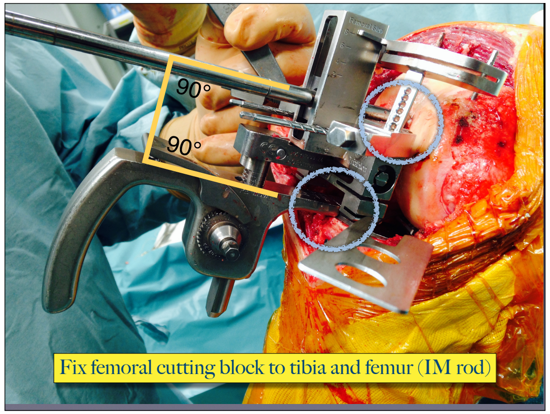

If ACL absent, posterior drawer to compensate


Find length of
ligaments by rotating
the pins till endpoint
(point dur)

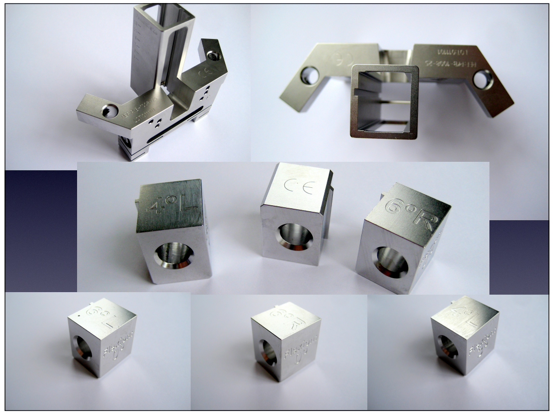

Feel length of MCL

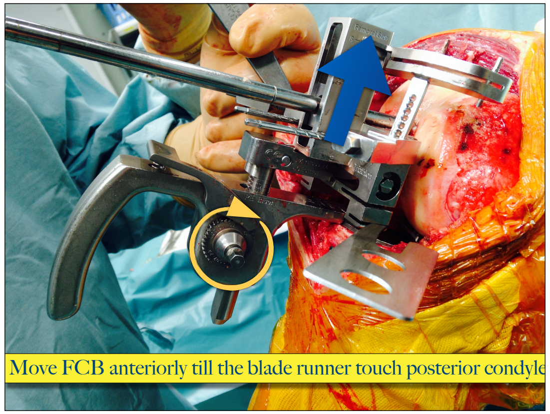

Test for flexion stability

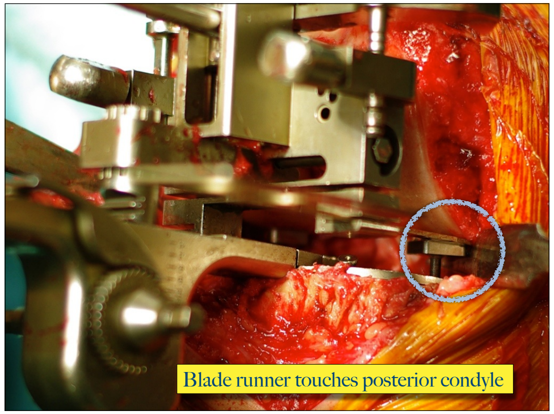


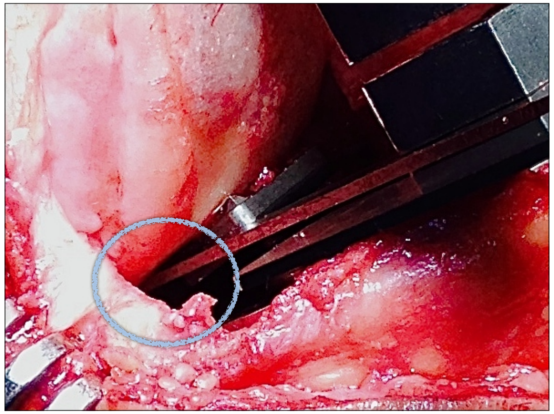

90°
90°
Fix femoral cutting block to tibia and femur (IM rod)

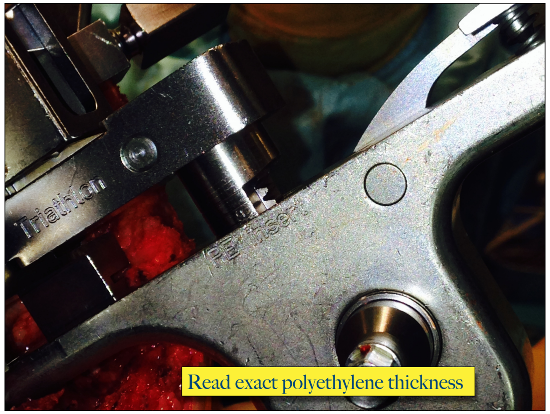

Nimbus controles valgus and rotation of femoral component



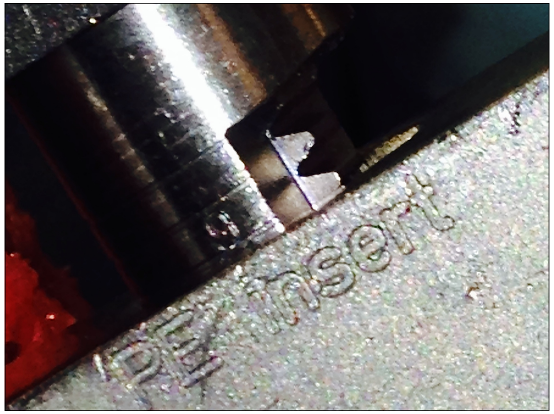

Move FCB anteriorly till the blade runner touch posterior condyl

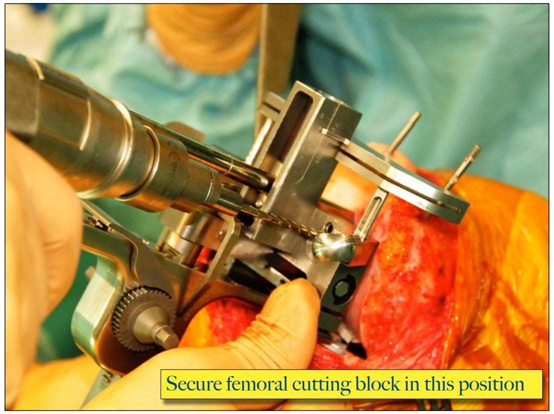

Blade runner touches posterior condyle



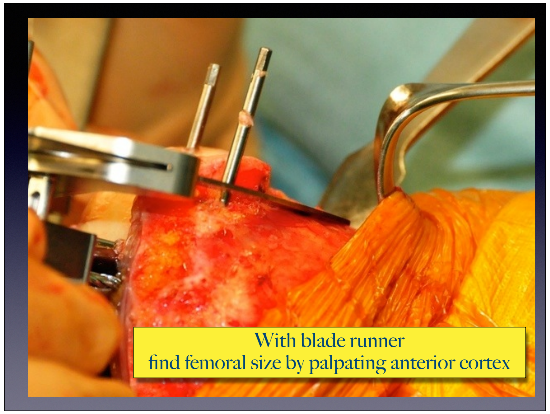


Read exact polyethylene thickness

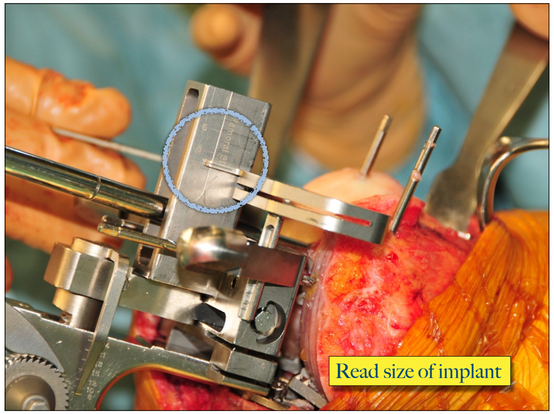




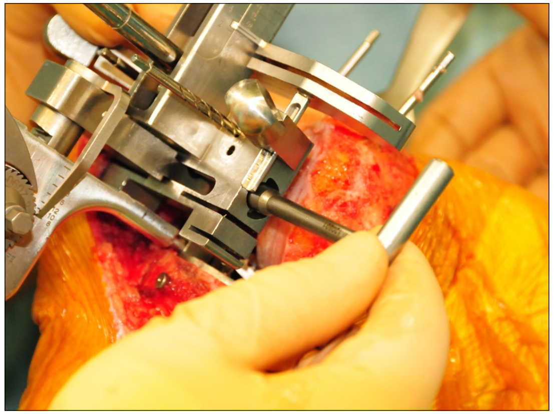
Secure femoral cutting block in this position

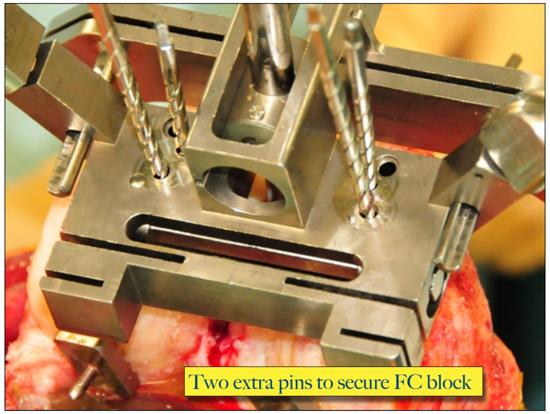


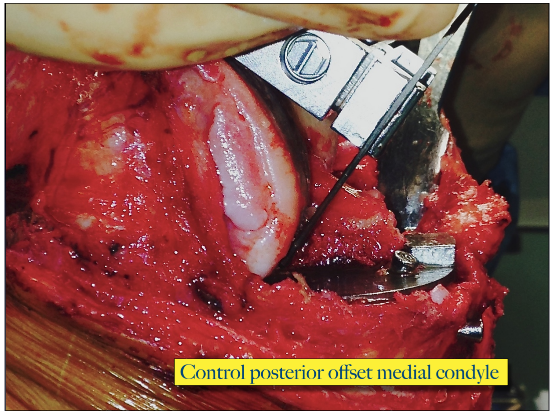
With blade runner
find femoral size by palpating anterior cortex

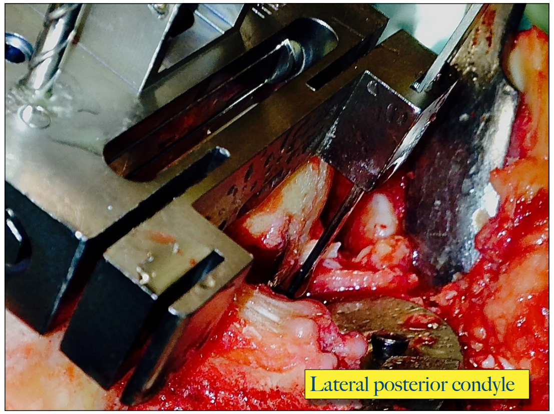


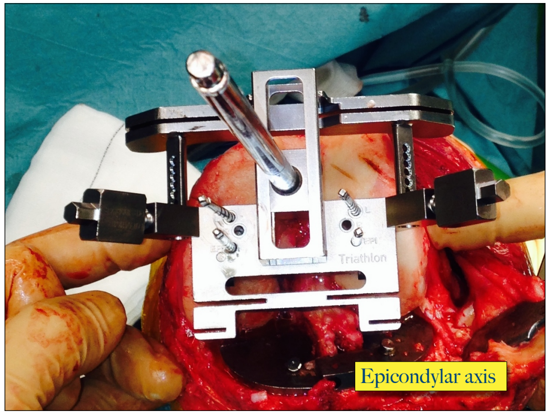
Read size of implant

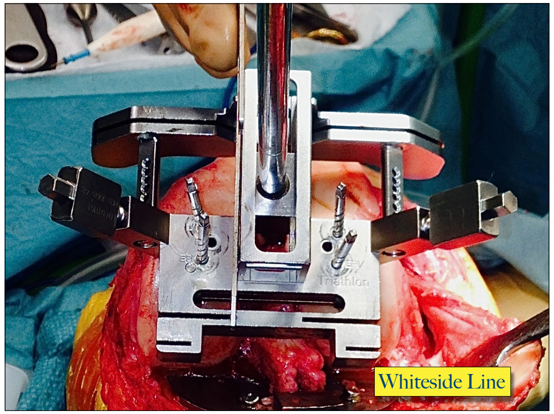


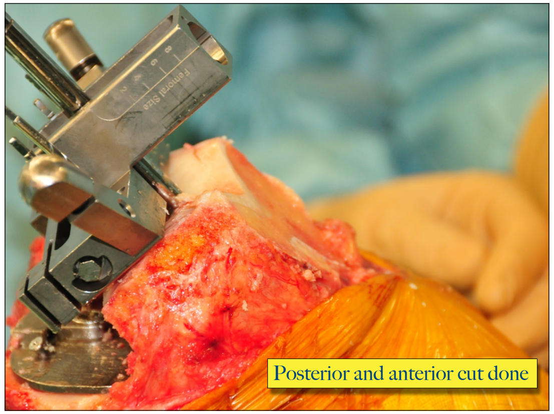

Two extra pins to secure FC block

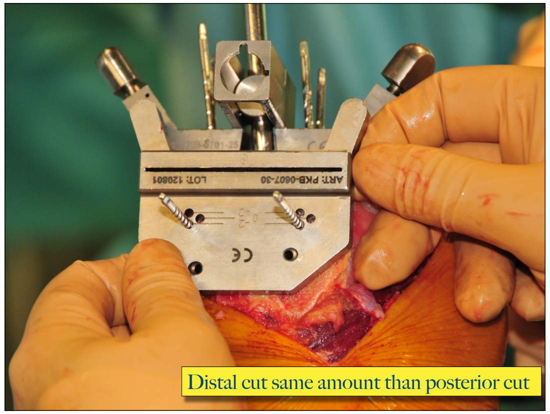

Control posterior offset medial condyle

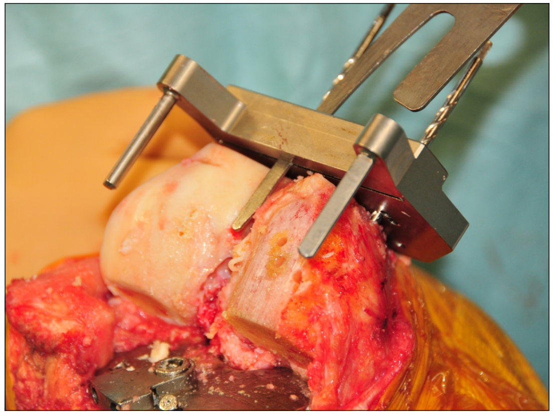

Lateral posterior condyle

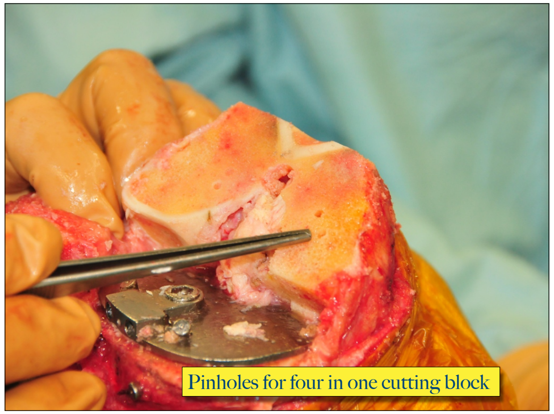

Epicondylar axis

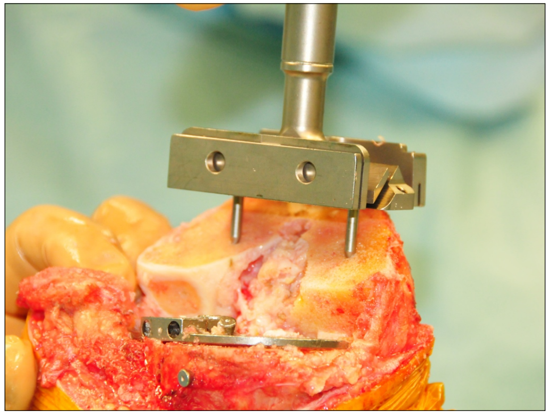

Whiteside Line

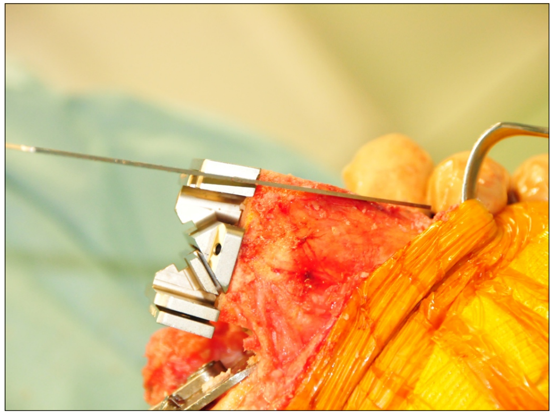

Posterior and anterior cut done

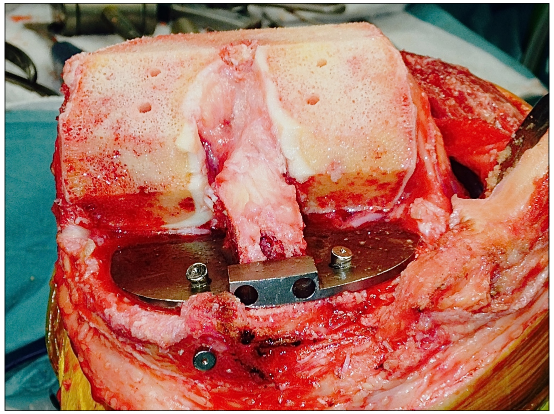

Distal cut same amount than posterior cut

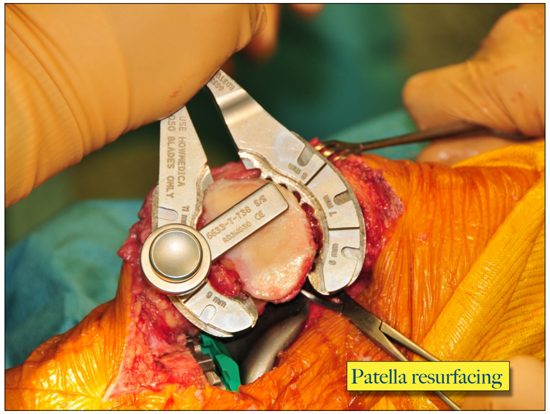


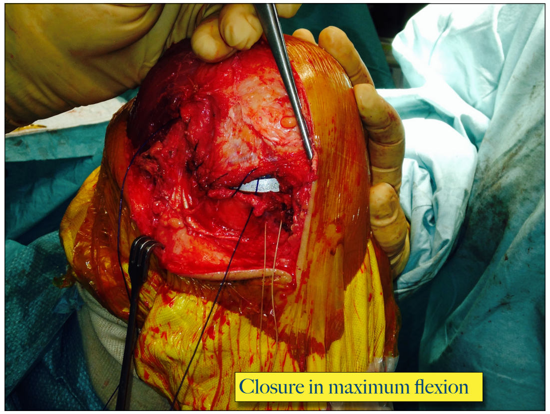

Pinholes for four in one cutting block

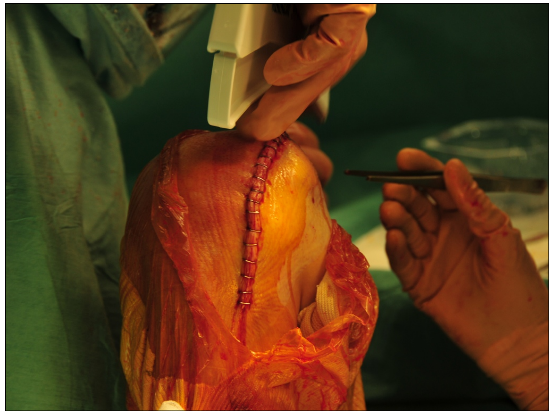







Patella resurfacing

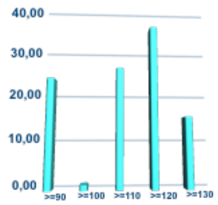

Closure in maximum flexion

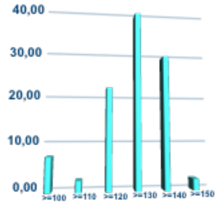


Results

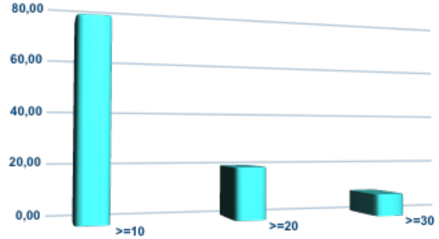
- 123 procedures, 98 patients
- NO patient selection
- Period from feb 2007 to feb 2008
- Age 50 tot 87, mean 69
- 71 ♀, 27 ♂
- BMI 29 (21 → 45)
- 97 % arthrosis

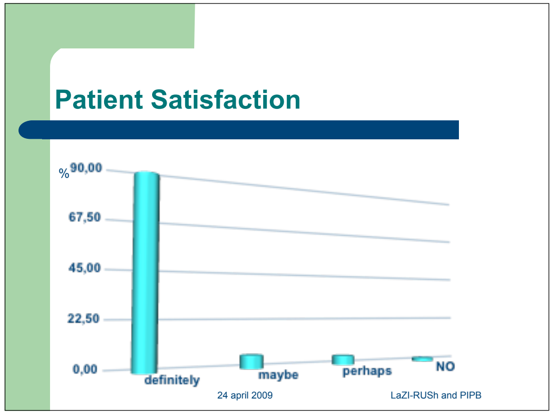
Active flexion : pre-op vs post-op 1 year

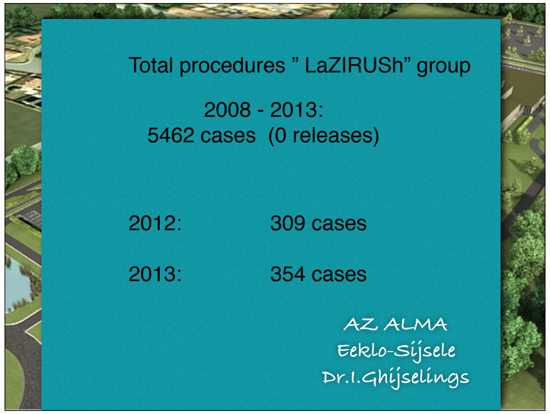


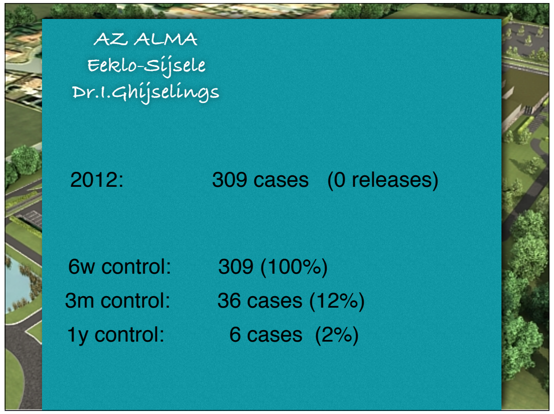


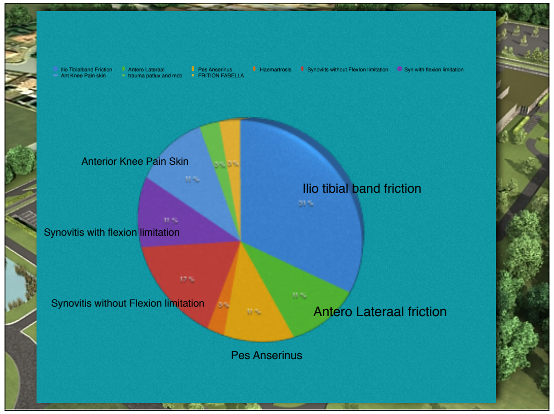
Oxford Knee Score : after 1 year

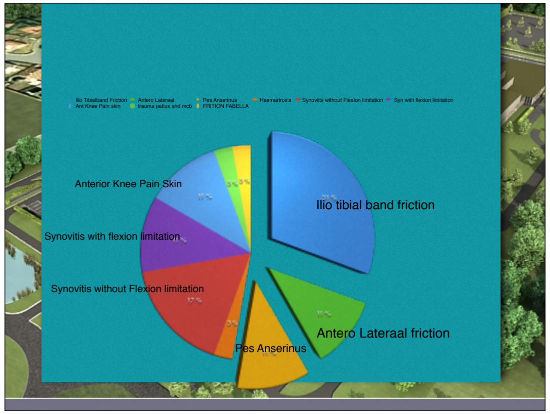



Patient Satisfaction
%
90,00
67,50
45,00
22,50
0,00
definitely
maybe
perhaps
NO
24 april 2009
LaZI-RUSh and PIPB

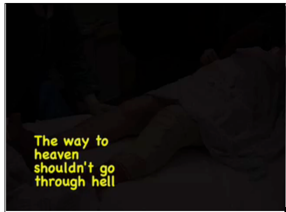

Total procedures " LaZIRUSh" group
2008 - 2013:
5462 cases (0 releases)
2012: 309 cases
2013: 354 cases
AZ ALMA
Eeklo-Sijsele
Dr.I.Ghijselings


AZ ALMA
Eeklo-Sijsele
Dr.I.Ghijselings
2012: 309 cases (0 releases)
6w control: 309 (100%)
3m control: 36 cases (12%)
1y control: 6 cases (2%)


Anterior Knee Pain Skin
Ilio tibial band friction
Synovitis with flexion limitation
Synovitis without Flexion limitation
Antero Lateraal friction
Pes Anserinus


Anterior Knee Pain Skin
Ilio tibial band friction
Synovitis with flexion limitation
Synovitis without Flexion limitation
Antero Lateraal friction
Pes Anserinus


Thank You
Conclusion
Playtime (release) is over !



The way to heaven shouldn't go through hell

Thank you