MID FLEXION INSTABILITY: ANALYSIS AND MANAGMENT

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11th Advanced Course on Knee Surgery, January 19-23, 2025

IML Institut du Mouvement et de l'appareil Locomoteur

European Knee Society

SOFCOT

Aix*Marseille université

Instability : Definition

" Impossiblity for a dynamic system to return to its establish regimen after moving away due to distorsion "

Frequency

Fehring **et al (AAOS 2001)**

→ **440 TKR revisions, 281 before 5 years**

- **infection 38 %**
- **instability 26 %**
- **fixation 16 %**
- **Patella 8 %**
- **PE wear or osteolysis 8 %**
- **others 4 %**

Registry	Period	Number TKA	Revision for instability %	Revision ranking
The Nederlands	2014-2021	22267	**26,3**	**2nd**
Canada	2020-2021	3424	**21,5**	**2nd**
UH	2003-2020	87535	**18**	**3rd**
Sweden	2009-2018	4875	**15**	**3rd**
USA	2012-2020	77520	**13,2**	**3rd**

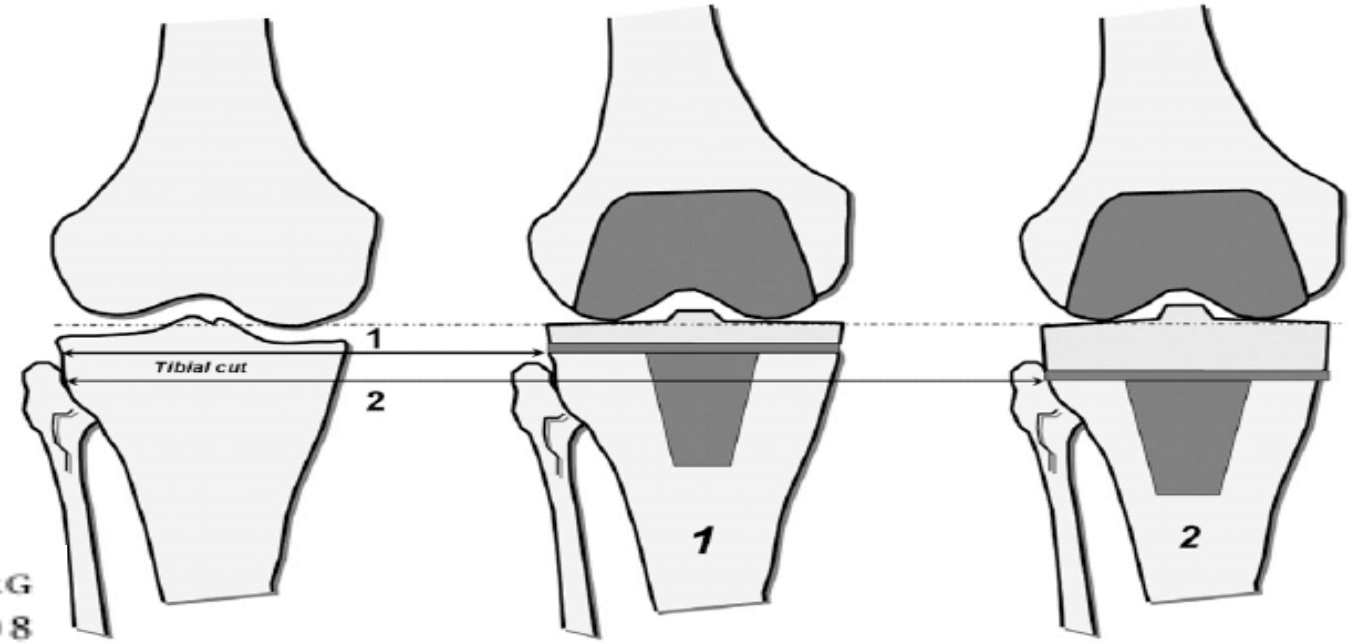
TKA ⇔Stable Knee

Instability after TKA 10 to 22%

Compromise

Motion stability

→ **Best option?**



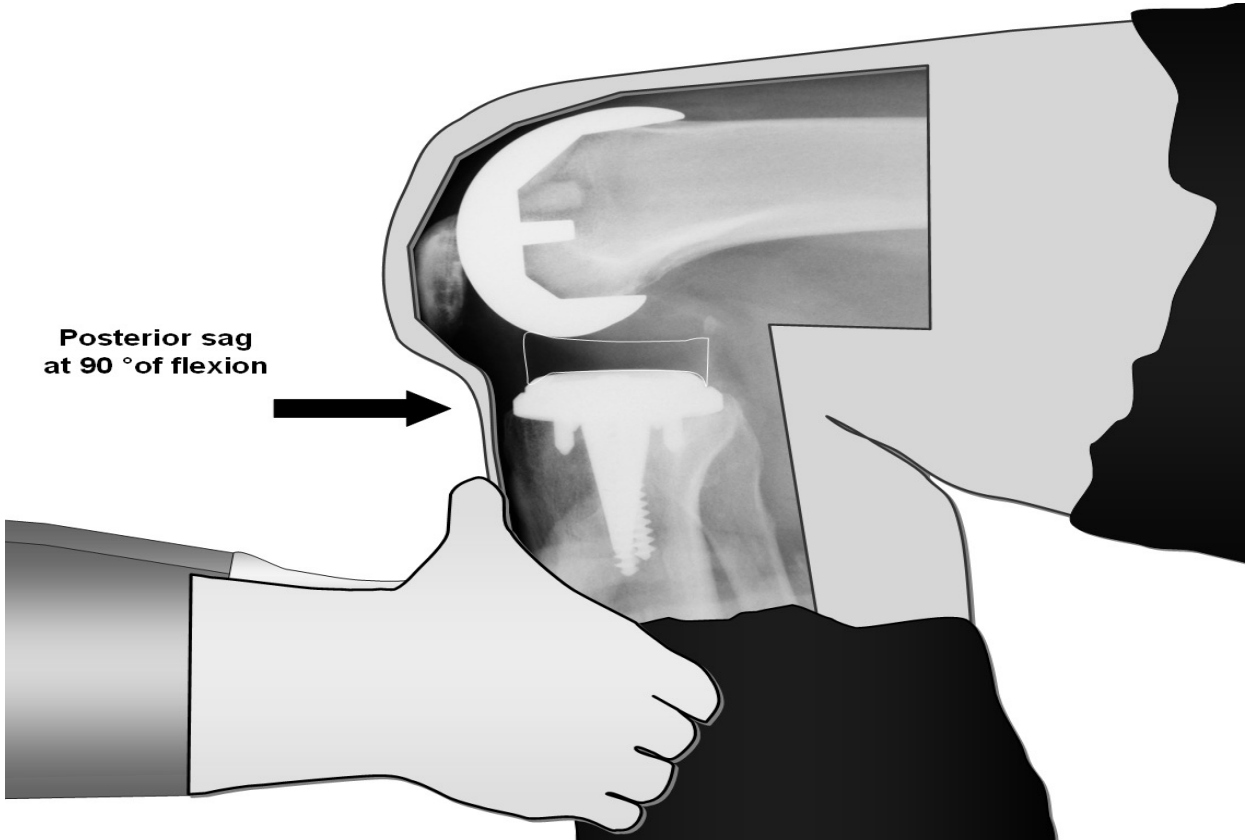
THE JOURNAL OF BONE & JOINT SURGERY · JBJS.ORG
VOLUME 90-A · NUMBER 1 · JANUARY 2008

Instability After Total Knee Arthroplasty

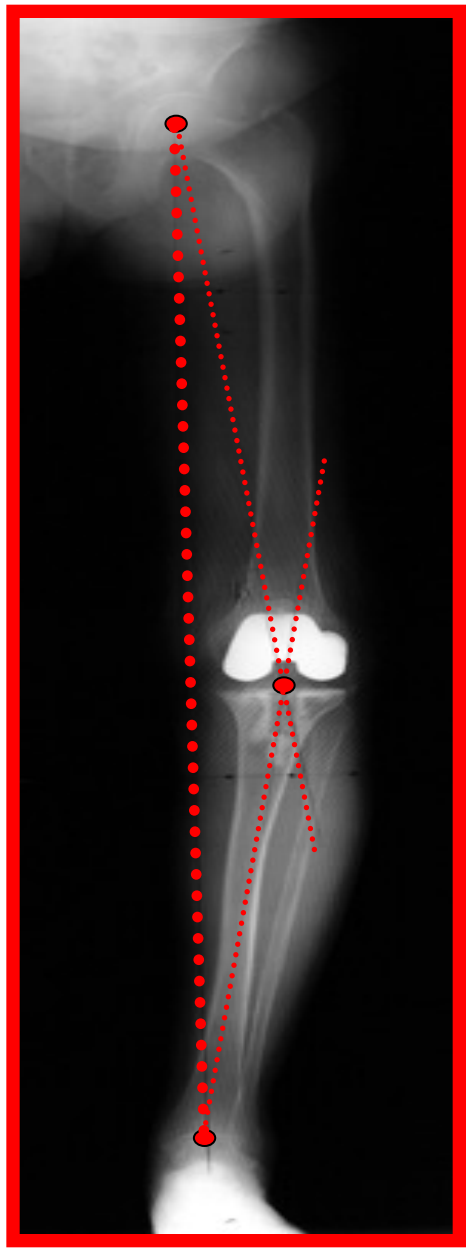
By Sebastien Parratte, MD, and Mark W. Pagnano, MD

An Instructional Course Lecture, American Academy of Orthopaedic Surgeons

Instability evaluation : clinical analysis



Instability evaluation : radiographic analysis



Instability evaluation : intra-operative prevention

Instability and Surgical Technique

1. Bone cuts
2. Soft-tissues
3. **Flexion/extension gaps, joint line**

Instability and surgical technique:
Flexion/Extension gaps

Flexion	Extension	Action
Tight	Tight	**Recut tibia**
Stable	Tight	**Recut distal femur**
Stable	Loose	**Augment distal femur**
Loose	Stable	**Augment femoral size**

Instability in TKA : Analysis

1. **Varus-Valgus or instability in the coronal plane**
2. **Buckling in the sagittal plane or 'plane of knee movement'**
3. **Flexion instability where the femur moves too freely on the tibial articular surface, with the knee flexed up to 90°**

Is there another type of flexion instability in which the knee is stable in extension and at 90° of flexion, but unstable somewhere mid-way between the two?

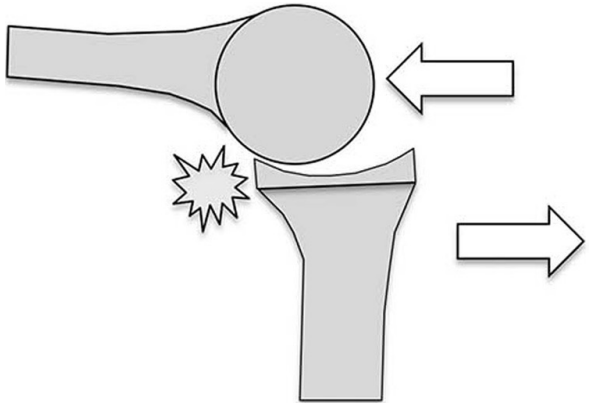
This can reasonably be called mid-flexion instability …if exists !

CONTROVERSIES IN KNEE ARTHROPLASTY
Mid-flexion instability after total knee arthroplasty
WOOLLY THINKING OR A REAL CONCERN?
K. Vince Bone Joint J 2016;98-B(1 Suppl A):84–8.

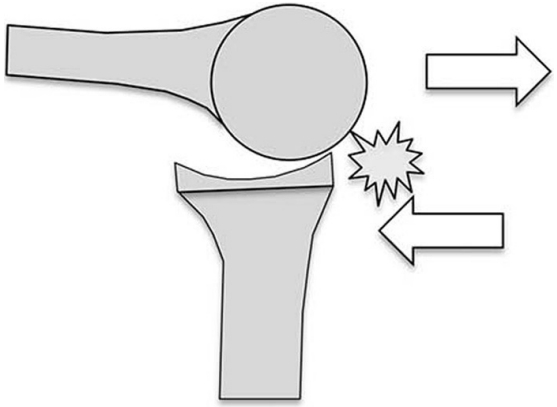
- **The term mid-flexion instability has entered the orthopaedic literature as a concept, but has not been confirmed as a distinct clinical entity**
- **The term is used freely, sometimes as a synonym for flexion instability**
- **The more common entity of an uncorrected flexion contracture after a measured resection arthroplasty technique is more likely to produce clinical findings that suggest instability in mid-flexion**

Chapitre 11, In Monographies Reprise PTG, Ed Huten & Pasquier, RCOT 2025
Technique en trois temps de reprise des PTG
K. Vince, J.-N. Argenson, M. Fabre-Aubrespy, W. Hoskins

Mid Flexion Instability or Flexion Instability ?



With flexion laxity, anterior displacement of the tibia under the femur is possible until the soft-tissue envelope is loaded abruptly



The opposite force drives the femur across the top of the tibia until excursion is arrested abruptly.

Problem: Gap Balancing

Clinical Setting

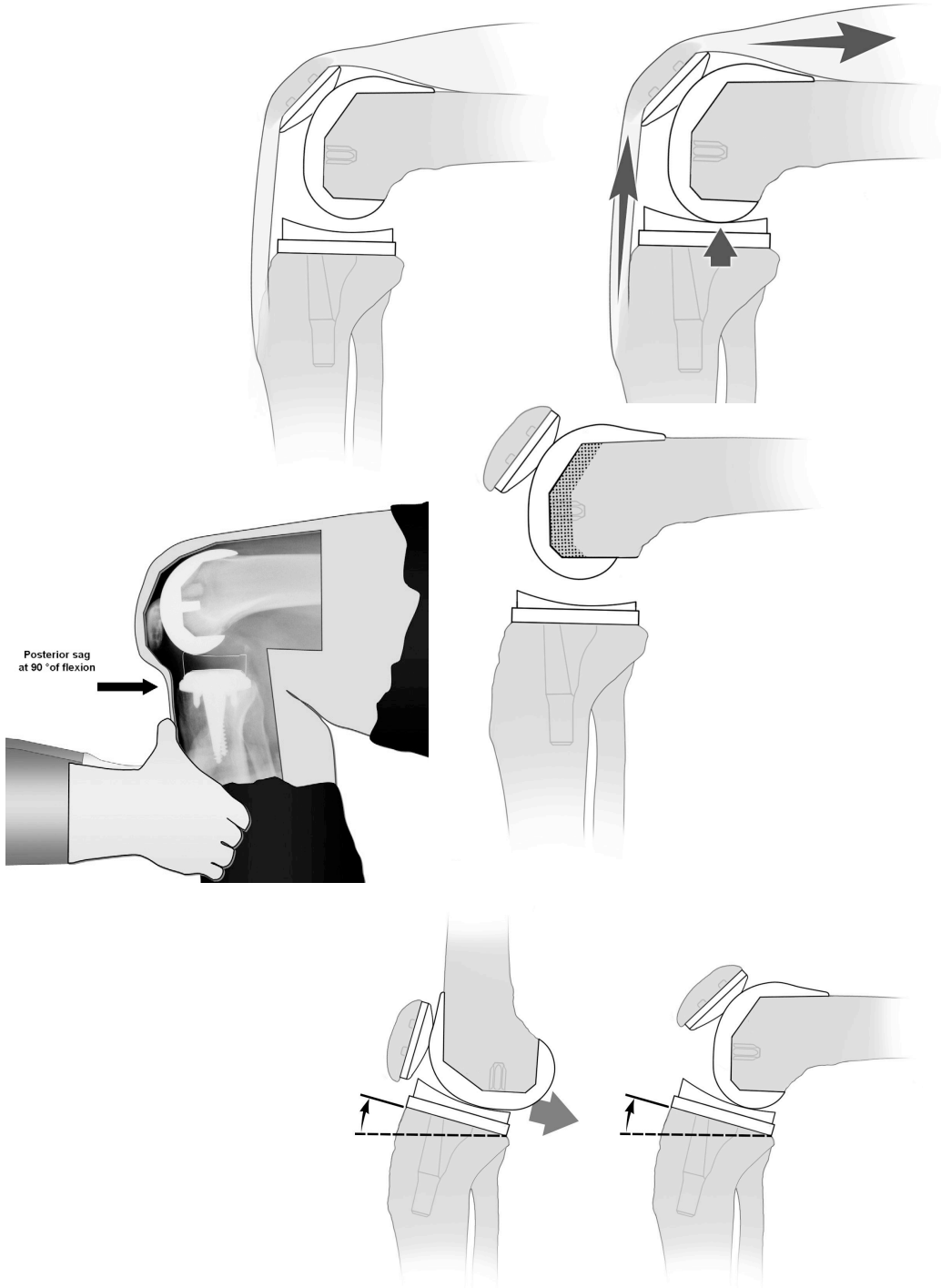
•Patients with flexion instability do not like to bear weight on a flexed knee

• They have difficulty rising from a chair and both ascending and descending stairs

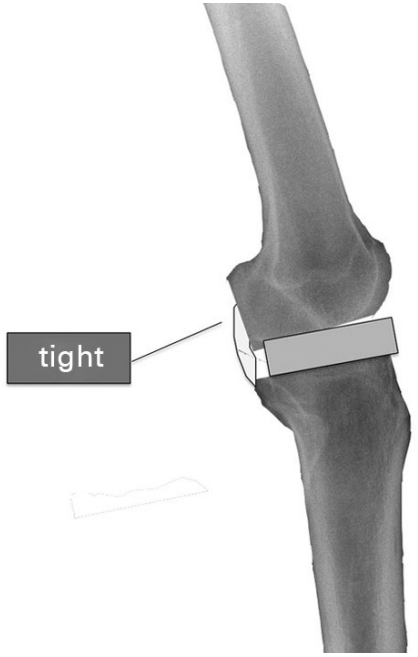
• Their knees flex freely, often achieving impressive amounts of flexion while still in hospital after surgery

Laxity on Flexion Instability

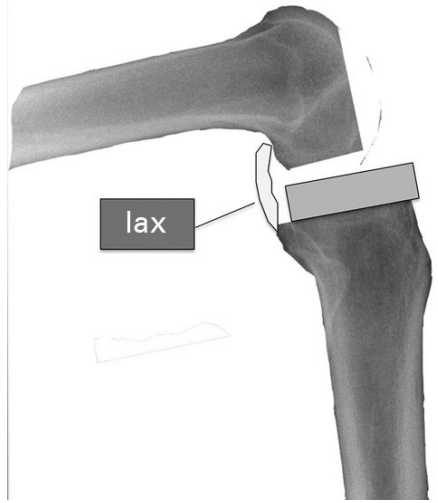
- Important signs / reassuring x-rays
  - Knee release
  - Stair instability
  - Pain on harmstrings
- At 90°
  - Significant anterior drawer or AP
- Imaging
  - Small femoral component
  - Increased posterior tibial slope



Mid Flexion Instability or Flexion Instability ?



The knee has been fully extended and stabilised in extension with a spacer of thickness less than the combined thickness of distal femoral and tibial resections



If the same spacer is inserted in flexion, the flexed knee will be lax.

When the knee is locked in full extension, the posterior structures may give a false sense of varus-valgus stability. As soon as the knee is flexed a few degrees, this effect is lost and instability is apparent in the mid ranges. Is it standard flexion instability or a new entity ?

Mid-flexion Instability

Same clinical picture as flexion instability

- **Pain and noisy functional signs**

- **Laxity**
  - between 30 and 60° flexion
  - Often a combination of frontal and sagittal laxity
  - Various values

The Journal of Arthroplasty 35 (2020) 3046–3054

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Systematic Review & Meta-Analysis

Risk Factors for Mid-Flexion Instability After Total Knee Arthroplasty: A Systematic Review

Sravya P. Vajapey, MD, MBA [a], Robert J. Pettit, MD [a], Mengnai Li, MD, PhD [a], Antonia F. Chen, MD, MBA [b], Andrew I. Spitzer, MD [c], Andrew H. Glassman, MD, MS [a, *]

Contributing Factors

Knee Surgery, Sports Traumatology, Arthroscopy (2021) 29:370–380
https://doi.org/10.1007/s00167-020-05909-6

KNEE

Midflexion instability in total knee arthroplasty: a systematic review

Umile Giuseppe Longo[1] · Vincenzo Candela[1] · Francesco Pirato[1] · Michael T. Hirschmann[2] · Roland Becker[3] · Vincenzo Denaro[1]

- **A/P translation** of ≥ 7 mm was an independent risk factor for midflexion instability at 30° knee flexion
- **Joint line position** can be altered by up to 5 mm without measurable changes in joint stability
- An increase and a **decrease in posterior condylar offset** led to 30° midflexion instability

Mid flexion laxity: InVitro

- PS and CR TKA can be well-balanced at 0° and 90° knee flexion and have instability in mid-flexion
- Elevating the joint line and shifting the femur anteriorly can cause the knee to be too loose in mid-flexion

The Journal of Arthroplasty 33 (2018) S265–S269

Contents lists available at ScienceDirect

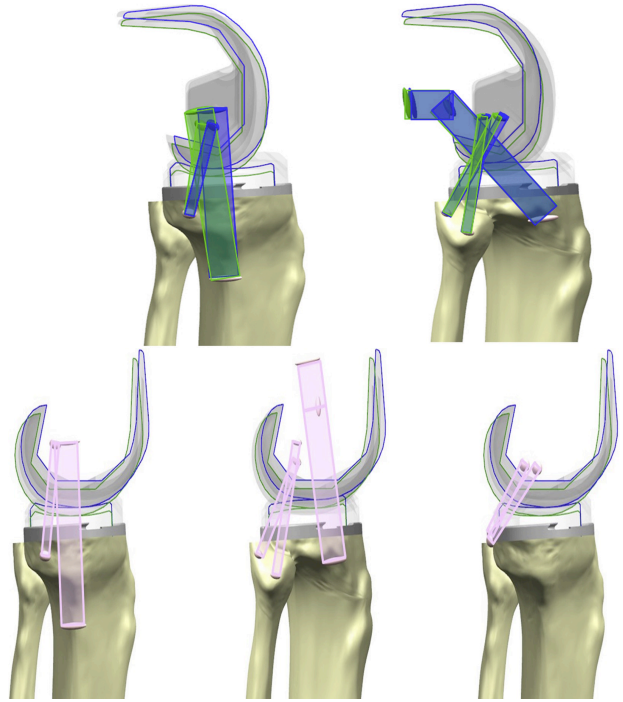
The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Basic Science

A Computer Model of Mid-Flexion Instability in a Balanced Total Knee Arthroplasty

Perry J. Evangelista, MD [a], Scott K. Laster, BA [b], Nathan M. Lenz, MS [b], Neil P. Sheth, MD
Ran Schwarzkopf, MD, MSc [a, *]



Mid flexion laxity: InVitro

Raising the Joint Line in TKA is Associated With Mid-flexion Laxity: A Study in Cadaver Knees.
Thomas Luyckx, Hilde Vandenneucker, Lennart Scheys Ing, Evie Vereecke, Arnout Victor Ing, Jan Victor
CORR 2018 Mar;476(3):601-611

- For a 10 degree flexion contracture, performing the first distal recut of +2mm increased overall coronal plane laxity by approximately 4.0° at 30° of flexion (p=0.002) and 1.9° at 60° of flexion
- Recutting the distal femur not only increases the maximum knee extension achieved but also **increases coronal plane laxity in midflexion**

Mid flexion laxity: InVitro

Joint line elevation is not associated with mid-flexion laxity in patients with varus osteoarthritis after total knee arthroplasty . Yukihide Minoda -, Ryo Sugama -, Yoichi Ohta , Hideki Ueyama , Susumu Takemura , Hiroaki Nakamura. KSSTA 2020 Oct;28(10):3226-3231

- Two femoral trial component models were prepared: normal model with a thickness of the distal and posterior femoral components of 9 mm, and 2-mm joint line elevation model with a thickness of the distal and posterior femoral components of 9 - 2 = 7 mm
- This study showed that a 2-mm **joint line elevation was not associated with mid-flexion laxity** in patients with varus osteoarthritis in the knee

In Which category is your patient for Managment ?

Category 1

Super Actif
Baby-boomer

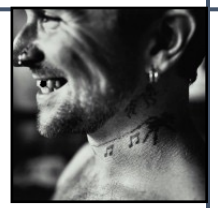
They want a forgotten knee

Category 2

The low demand patient

They want a Stable pain-free Knee

Category 4: « Bob Booth Criteria »



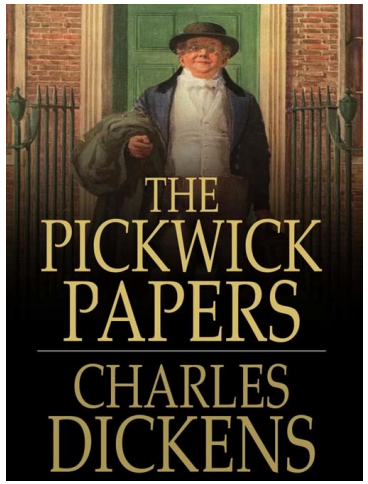
Women

- In between 2 husbands
- Fibromyalgia
- > 2 allergy
- >2 cats

Men

- Accompanied by mother
- Tattoo - to -Tooth Ratio
- Sunglasses indoor
- White shoes in Winter

They do not know what they want !

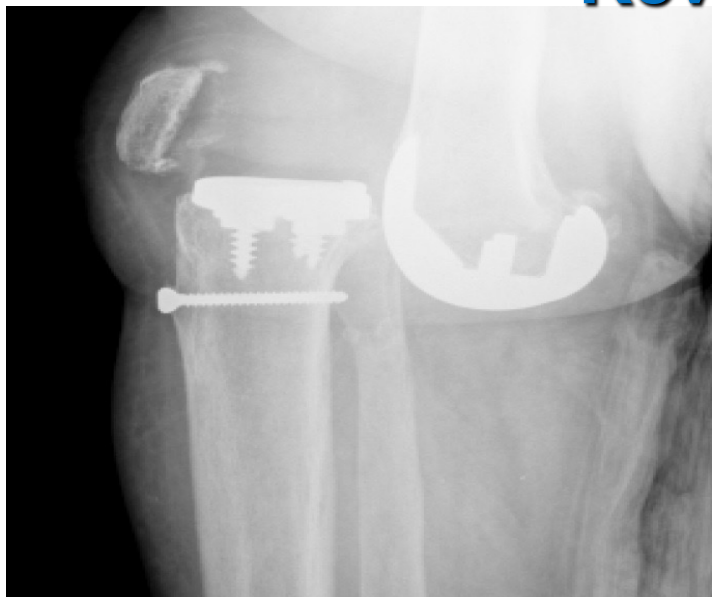


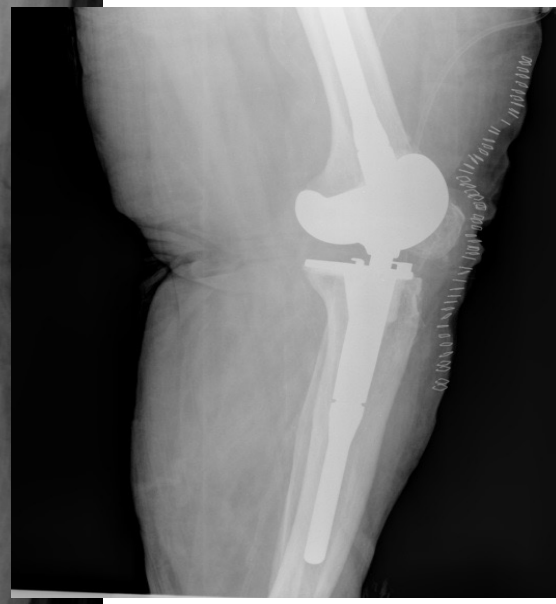
Category 3

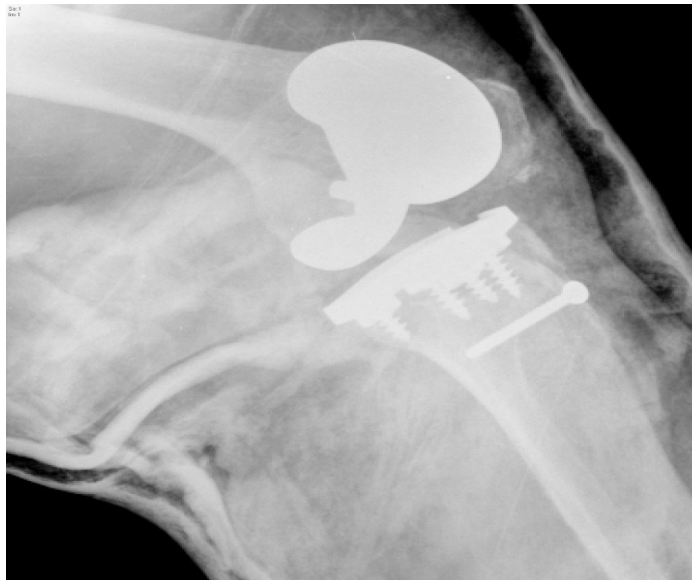
« The pink and puffy »

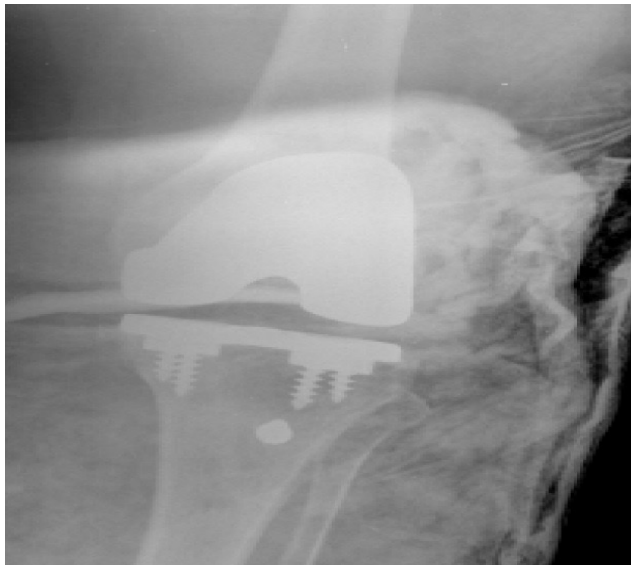
They want to survive after the surgery

Late rupture of the cruciate concept : Revision by constraint TKR

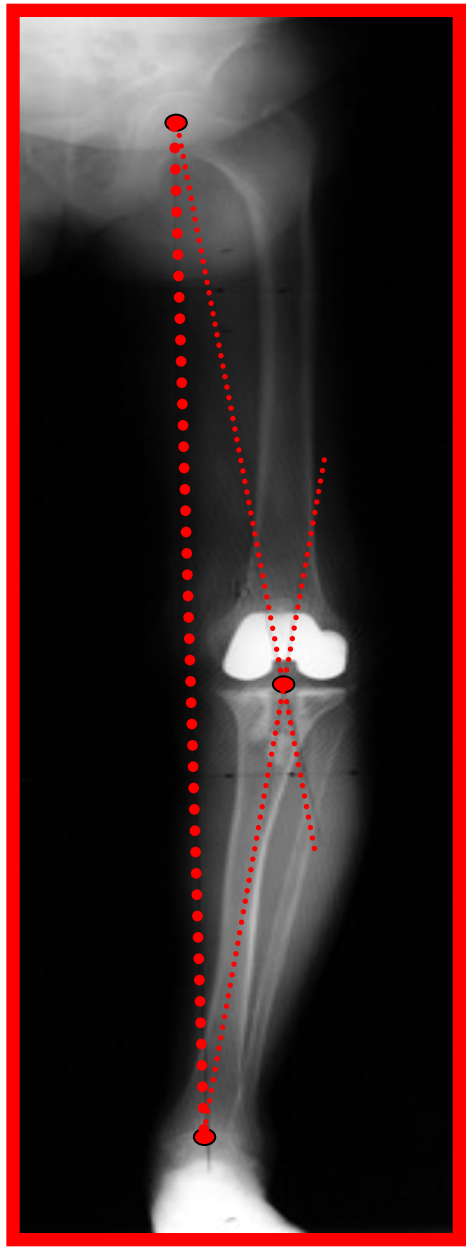








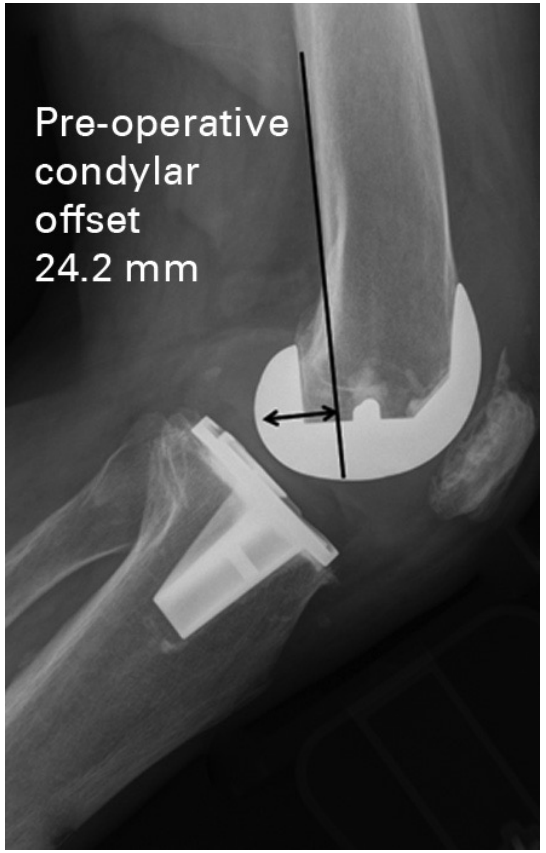
Instability in PS design: Treatment

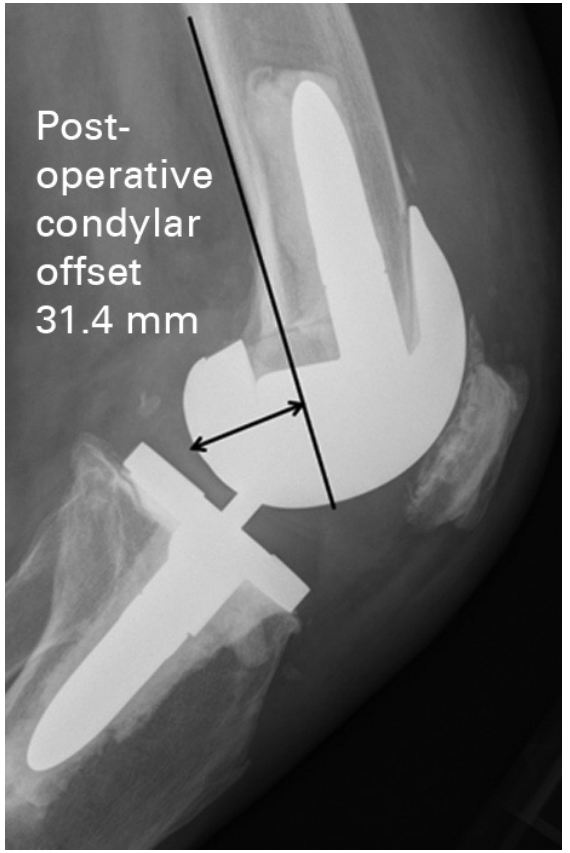


Instability in TKA : Managment

Stepwise surgical correction of instability in flexion after total knee replacement
M. P. Abdel, L. Pulido, E. P. Severson, A. D. Hanssen *From Mayo Clinic, Minnesota, United States*
Bone Joint J 2014;96-B:1644–8.

- **Increase condylar offset**
- **Correct distalisation of the joint line**
- **Reduce posterior tibial slope**



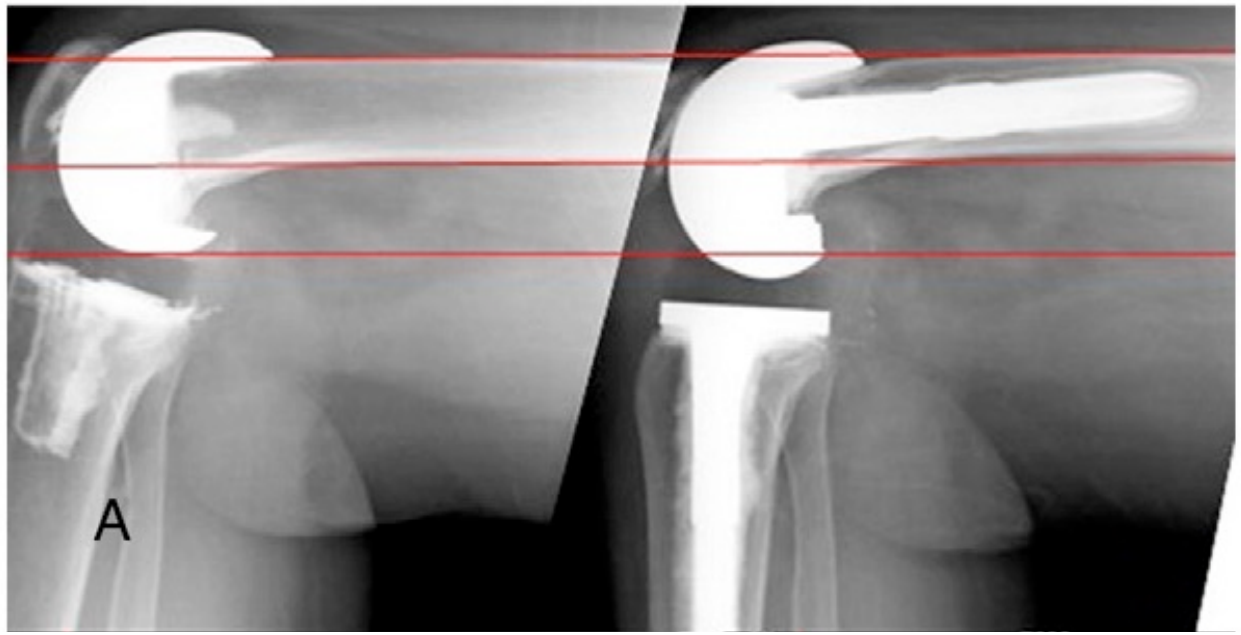


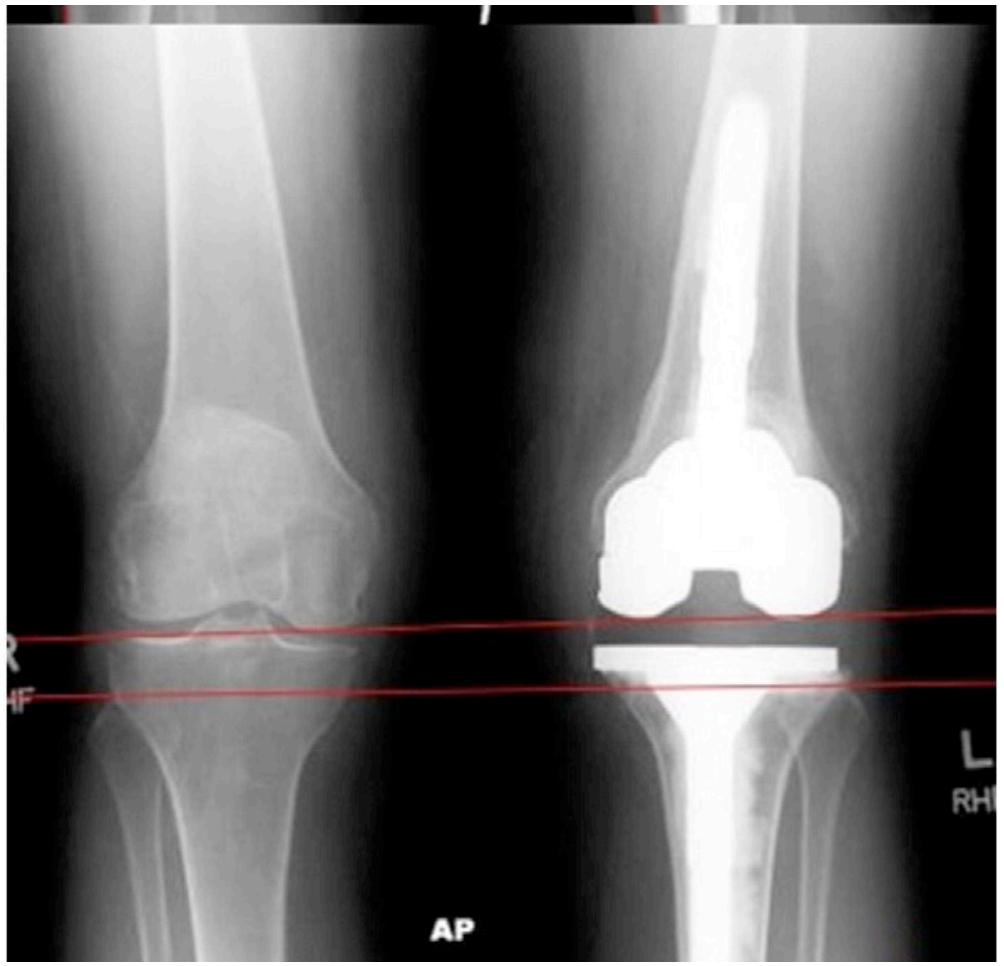
Courtesy S.Lustig

Revision TKA for Flexion Instability Improves Patient Reported Outcomes

J Arthroplasty 2015

Arun Kannan, MBBS, MS [a], Robert S. O'Connell, MD [b], Niraj Kalore, MD [c], Brian M. Curtin, MD [a], Jason R. Hull, MD [d], William A. Jiranek, MD [a]

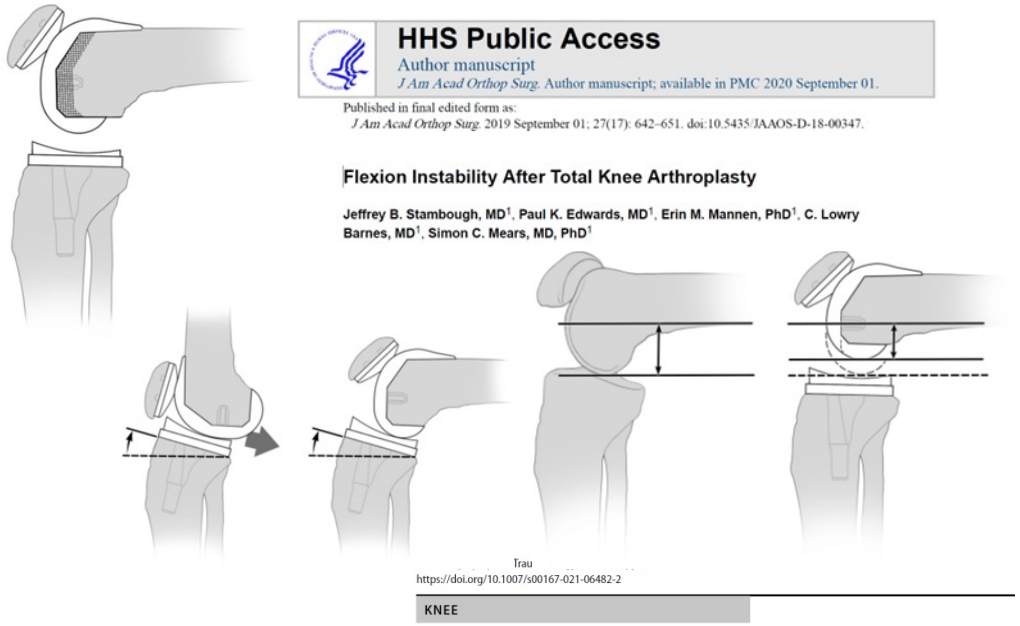




Must Restore Joint Line And PCO

Correct flexion and mid-flexion laxity

- **All parameters**
  - Joint line
    - Obliquity, height,
  - Size of femoral component
    - Condylar radii of curvature
- **Achieving appropriate ligament tension**
  - From extension to full flexion
- **Otherwise constrained TKA**

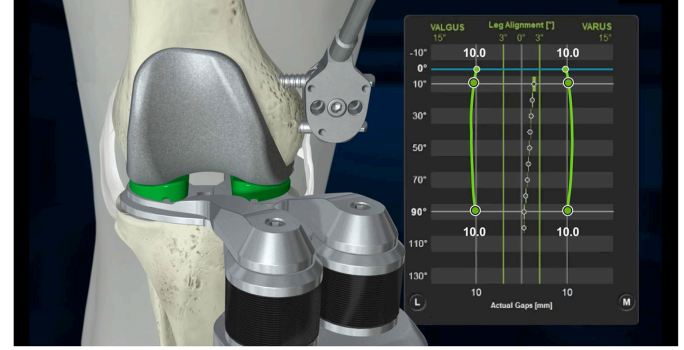


HHS Public Access
Author manuscript
J Am Acad Orthop Surg. Author manuscript; available in PMC 2020 September 01.

Published in final edited form as:
J Am Acad Orthop Surg. 2019 September 01; 27(17): 642–651. doi:10.5435/JAAOS-D-18-00347.

Flexion Instability After Total Knee Arthroplasty

Jeffrey B. Stambough, MD[1], Paul K. Edwards, MD[1], Erin M. Mannen, PhD[1], C. Lowry Barnes, MD[1], Simon C. Mears, MD, PhD[1]



Trau
https://doi.org/10.1007/s00167-021-06482-2

KNEE

Improved total knee arthroplasty pain outcome when joint gap targets are achieved throughout flexion

Edgar A. Wakelin[1] · Sami Shalhoub[1] · Jeffrey M. Lawrence[2] · John M. Keggi[3] · Jeffrey H. DeClaire[4] · Amber L. Randall[5] · Corey E. Ponder[6] · Jan A. Koenig[7] · Stephen Lyman[8,9] · Christopher Plaskos[1]

Is P.E. exchange an option for mid flexion instability?

- **Increase the thickness of the bearing to stabilize extension gap**, retension collateral ligts in extension and mid flexion, reduce instability
  - ➢Side effect: tighten the flexion gap, loose some flexion
  - ➢Partially address any flexion laxity

- **Increase tibial bearing thickness to stabilize flexion gap**
  - ➢Side effect: tighten extension gap Loose some extension Less desirable

Results of Treatment

Revision total knee arthroplasty for flexion instability. A concise follow-up of a previous report.
C. P. Hannon, B. M. Kruckeberg, M. W. Pagnano, D. J. Berry, A. D. Hanssen, M. P. Abdel.*From Mayo Clinic, Minnesota, USA*
Bone Joint J 2022;104-B(10):1126–1131.

- **The original publication included 60 revision TKAs in 60 patients**
- **The mean age of the patients at the time of revision TKA was 65 years**
- **The ten-year cumulative incidence of any re-revision for instability was 7%**
- **We found fair functional outcomes and implant survivorship at a mean of ten years after revision TKA for flexion instability with a PS implant.**

➢ **Components with increased constraint, such as a Var-Valg Constraint or Hinged, should be used in these patients in order to reduce the risk of recurrent instability.**

CONCLUSION
MID-FLEXION INSTABILITY TREATMENT

- **Treatment is difficult as the etiological diagnosis is difficult**

- **Factors identified in the diagnosis to be corrected** :
  - -anteroposterior translation greater than 7 mm
  - -joint line elevation of 5 mm
  - -reduction in posterior condylar offset

- **Use of a CCK or RHK rotational hinge prosthesis**

F.Remy G.Pasquier ELSEVIER 2023

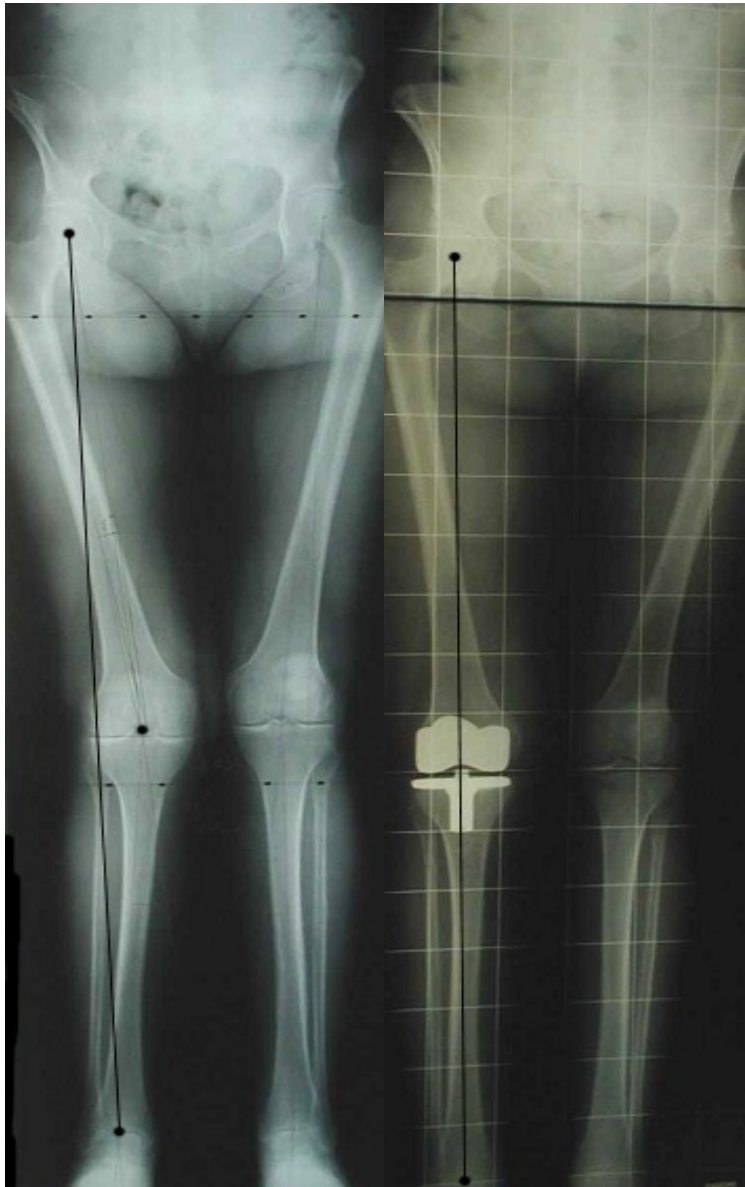
CONCLUSION : Prevention ++

Before TKR:

- Ligaments
- Extensor mechanism

During TKR :

- Alignement lower limb
- Equality and symetry Fl./Ex. gaps
- Position implants
- Tension soft-tissue



CONCLUSION

After TKR :

- **PE thickness and wideness**
- **Wedges and augments +**
- **LCCK & RHK type knees ++**