

Patellofemoral Instability After Total Knee Arthroplasty

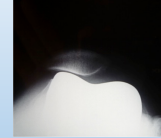
Orthopaedica Belgica 2019 Congress
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"Complications in Orthopaedics and Traumatology"

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CHU Charleroi - Hopital Civil Marie Curie



EPIDEMIOLOGY

INSTABILITY



- 1st non infectious source of **TKA revision**.
- But also main source of **pain** after TKA.

EPIDEMIOLOGY

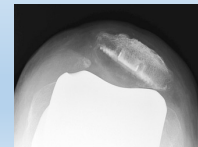
"Most frequent complication after TKA" but **few literature**, and very few new:

- Malo M., Vince K.G. The unstable patella after total knee arthroplasty : etiology, prevention, and management. *J Am Acad Orthop Surg.* 2003; 11(5) : 364-7.
- Eisenhuth S.A., Saleh K.J., Cui Q., Clark C.R., Brown T.E. Patellofemoral instability after total knee arthroplasty. *Clin Orthop Relat Res.* 2006; 446 : 149-160.
- Moutsis E.K., Paschos N., Pakos E.E., Georgoulis A.D. Review article : Patellar instability after total knee arthroplasty. *Journal of Orthopaedic Surgery* 2009; 17(3) : 351-7.
- Heller K.D. Ursachen und management der patellainstabilitäten nach künstlichem gelenkersatz (Causes and management of patellar instability after total knee replacement). *Der Orthopäde* 2016; 45(5) : 399-406.
- Demey G. Quel bilan en cas d'instabilité fémoro-patellaire après prothèse totale de genou ? *Maltrise orthopédique* 2018; 276.

- Today's prosthesis designs: **1-12%**
- Cause of revision in 0.1-0.5% TKA
- Patellar **subluxation** > luxation (malpositioning!!)

CLINICS

- Anterior knee pain
- Particularly when climbing or descending stairs, squatting, standing up
- **Different** pain as in pre-op
- Giving way feeling, weakness, stiffness



CLINICS

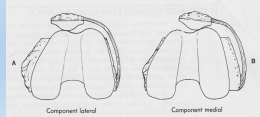
- Time from TKA:
 - **Continuous** pain from the surgery: surgical technique.
 - Sudden pain after a **pain-free period**: soft tissue lesion, patellar component failure.

ETIOLOGY

- **Malpositioning:**
 - > Femur/Tibia
 - > Patella
- **Soft tissues over-tension**
 - > Prosthesis design
 - > Surgical Approach

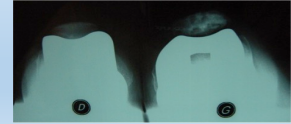
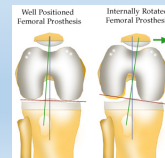
MALPOSITIONING

- **Excessive HKA valgus:** increased Q angle -> increased lateral force vector on the patella
- **Excessive medial placement of the femoral component:** trochlear groove medialization -> pressure overload btw patella lateral facet and trochlea lateral facet + lateral retinaculum over-tension



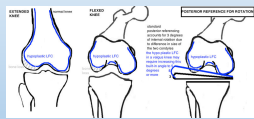
MALPOSITIONING

- **Internal rotation of the femoral component = main source of instability**
- > lateral retinaculum over-tension
- > pressure overload btw patella lateral facet and trochlea lateral facet



MALPOSITIONING

- Frequent mistake when referring to **posterior condylar axis** for the anteroposterior femoral cutting-especially when **posterior bone defects** or **lateral condyle hypoplasia** (genu valgum).

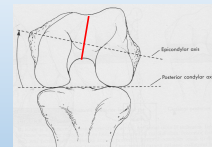


- Resection of the distal femur using a fixed posterior condylar reference guide results in rotational malalignments of at least **3 degrees in 45% of knees**.

Fehring TK. Rotational malalignment of the femoral component in TKA. Clin Orthop Relat Res 2000; 380:72-9.

MALPOSITIONING

- Best option: anterior and posterior cutting parallel to the **epicondylar axis**.



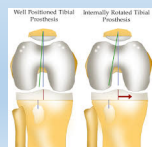
- OR: perpendicular to the **Whiteside's line**.

NB: systematic 3° of external rotation IS NOT the best way: flexion cut space too tight on the lateral side.

MALPOSITIONING

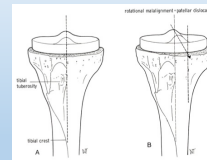
- **Excessive internal rotation of the tibial component:**
- > tibia is going to move in external rotation
- > increased Q angle
- > increased TT-TG
- > lateral traction on the patellar tendon and on the patella

- **Causes:**
- > Poor exposition of posterolateral corner
- > Implant aligned on the posterior cortex



MALPOSITIONING

- **Best alignment of the tibial plateau** = middle of the component in front of medial third of TT.

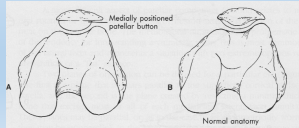


But potential posterolateral overflow with irritation of the popliteus tendon -> asymmetric plateau?

MALPOSITIONING

Patellar component positioning:

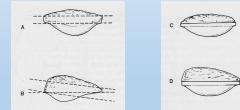
- Lateralization: medial shift of the patella + overtension of the lateral retinaculum
- Medialization: decreased Q angle



MALPOSITIONING

Coronal plane: asymmetrical shape of the native patella

- > Cut parallel to the anterior cortex: skew and toggling
- > Ideal cut: plane of the medial and lateral edges of the patella + thicker cut at the medial side



Alternative: no resurfacing

SOFT TISSUES OVER-TENSION

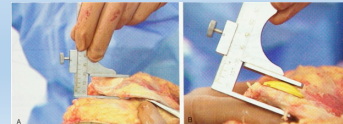
Patello-femoral component too thick in the antero-posterior plane:

- Femoral component too big/too anterior > default cut of the posterior condyles
- > Choose the implant's size based on the antero-posterior dimension - no transversal!
- > Smallest possible
- > No notch on the anterior cortex
- > No excessive cut on the posterior condyles (*flexion instability*)

SOFT TISSUES OVER-TENSION

Lack of patellar cut or patellar component too thick:

- > Ideal cut = thickness of the component BUT 12 mm minimal remaining thickness
- > No resurfacing...



SOFT TISSUES OVER-TENSION

Prosthesis design: compromise...no quick fix!

- **Flat trochlea, few strains:**
Less guided and less stable patella
- **Deep trochlear groove + elevated lateral slope (asymmetrical and lateralized femoral component)**
Overstress and loosening
- **No evidence about patellar component design**

SOFT TISSUES OVER-TENSION

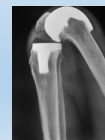
Prosthesis design: compromise...no quick fix!

Do mobile tibial bearing enhance the patello-femoral stability?

- > Theoretically, this would correct small implants rotation errors, but no evidence about patellofemoral issues

- > Same for "High-Flex"

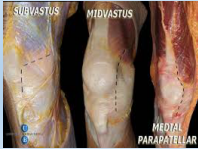
- > Same about computer-assisted TKR.



SOFT TISSUES OVER-TENSION

- Surgical approach:

Subvastus and midvastus approaches have the theoretical benefit to limit the extensor apparatus dissection - but **no evidence** about any femoropatellar impact.



OTHERS

Per- and post-operative events:

- Arthrotomy suture rupture
- Significant postoperative hematoma
- Aggressive rehabilitation

PEROPERATIVE EVALUATION

- Check stability with **both** trial and definitive implants
- **Deflated tourniquet!**
- Bias: open arthrotomy
- No-thumb test, one suture test

MANAGEMENT

First of all: Meticulous clinical and radiologic evaluation.

Read and write the surgical procedure!

-> Peroperative unpredictable patellar stability, lateral release: Isolated soft tissue approach is unlikely to succeed.

CLINICAL EVALUATION

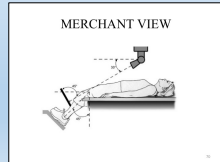
- **Lower limb axis**
- **Passive and active range of motion**
- **Patella and extensor apparatus palpation during full range of motion:**
 - > Lateral retinaculum tension
 - > Patellar tracking during motion
 - > Tibial and femoral gross appreciation

CLINICAL EVALUATION

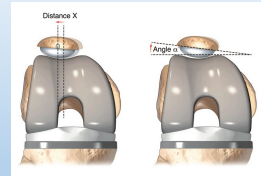
- **Femoral rotation:**
 - > Supine position, 90° hip and knee flexion, hip internally rotated: slowly increase the internal rotation -> passive TKA rotation: femur internally rotated.
- **Tibial rotation:**
 - > Sitting position, joined knees, foot externally rotated -> tibia internally rotated.

RADIOLOGIC EVALUATION

- Goniometry, HKA angle
- Skyline patella projection: appropriate alignment
-> 30° flexion!
- Profile: components size



RADIOLOGIC EVALUATION

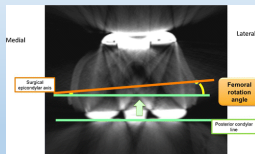


Translation: X < 5 mm Tilt: α angle < 5°

Gomes LS, Bechtold JE, Gustilo RB. Patellar prosthesis positioning in total knee arthroplasty. A roentographic study. Clin Orthop Relat Res. 1988; 236 : 72-81.

RADIOLOGIC EVALUATION

Implants rotation: **CT scan**: Femoral component:

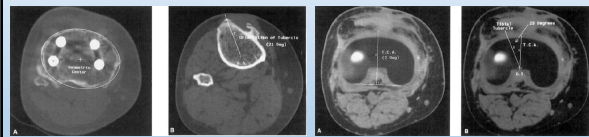


- Female: $0.3^\circ \pm 1.2^\circ$
- Male: $3.5^\circ \pm 1.2^\circ$

Berger RA, Crosse LS, Jacobs JJ, Rubash HE. Malrotation causing patellofemoral complications after total knee arthroplasty. Clin Orthop Relat Res. 1998 : 356 - 144-153.

RADIOLOGIC EVALUATION

Tibial component rotation:



Berger : N = IR $18^\circ \pm 2,6^\circ$

TREATMENT

- **NO PLACE for conservative treatment** (physiotherapy, kneepad)
- **SURGERY:**
 - > Lateral retinaculum release
 - > Medial retinaculum tightening
 - > Medial patellofemoral ligament reconstruction
 - > Anterior tibial tubercle transfert (Emslie-Trillat): if NO component malpositioning!
 - > Components replacement

TREATMENT

Femoral component replacement:

- IR > 5°
- 10° difference % other side
- Technically easy, few osseous damages
- Transepicondylar axis tracking, posterior cut of medial condyle, posterior wedge on the lateral condyle (equipment!)

TREATMENT

Tibial component replacement:

- Tibial plateau replacement: significant osseous damages - complicated without femoral component replacement.
- MAINLY for **associated femoral malrotation** or need of more constrained implant.
- Isolated tibial malrotation: tibial tubercle medialization.

TREATMENT

Patellar component malposition:

- Lack of cut/oblique: additional cut + component medialization
-> Centering of the patella and decrease of lateral retinaculum tension

TREATMENT

No component malpositioning: **SOFT TISSUES:**

- Lateral retinaculum release - to be associated with other procedures
- Medial tension increase: **medial patellofemoral ligament reconstruction:**
 - > Increased interest since 90-00's
 - > 1st case report on TKA: 2008 (Asada and al. *Medial Patellofemoral ligament reconstruction for recurrent patellar dislocation after total knee arthroplasty. J Orthop Sci. 2008; 13 : 255-258*)

TREATMENT

Medial patellofemoral ligament reconstruction:

- 9 patients, quadriceps strip/allograft, 2 associated TT transfers, satisfying results.

Van Gennip S, Schimmel J P, van Hellemond G G, Defoort K C, Wymenga A B. Medial patellofemoral ligament reconstruction for patellar maltracking following total knee arthroplasty is effective. Knee Surg Sports Traumatol Arthrosc. 2014; 22 : 2569-73.

- 6 patients, gracilis, 1 associated TKA revision, 5 satisfying results, 1 failure.

Lamotte A, Neri T, Kawaya A, Boyer B, Farizon F, Philippot R. Medial patellofemoral ligament reconstruction for patellar instability following total knee arthroplasty : A review of 6 cases. Orthopaedics & Traumatology : Surgery & Research 2016 ; 102 : 607-610.

TREATMENT

Medial patellofemoral ligament reconstruction:

- Seems better to use a pedicled quadriceps strip on the patella or an allograft.
- Particularly interesting if secondary rupture of the medial plane (hematoma, wound dehiscence).

TREATMENT

- 1459 TKA
- 6 revisions > patellar instability:
 - > 1 medial patellofemoral ligament reconstruction
 - > 3 TT osteotomies
 - > 1 vastus medialis plasty
 - > 1 femoral component replacement + TT osteotomy

Poor results: 1 persistant patellar subluxation, 1 persistant patellar luxation, 1 sepsis

Bonin M, Demey G, Trichine F, Badet R, Chambat P, Neyret Ph, Dejour D. Analyse globale des complications rotuliennes sur la prothèse totale de genou HLS Noetos à 3 ans de recul minimum. 14èmes Journées Lyonnaises de Chirurgie du Genou, Sauramps Medical 2010; 109-115.

PATELLOFEMORAL INSTABILITY-CONCLUSION

- 1st Cause of TKA revision
- Components malpositioning / soft tissues overtension
- Patella resurfacing?
- Peroperative evaluation
- Clinics and XR tools
- Revision: unpredictable results

Thank you for listening

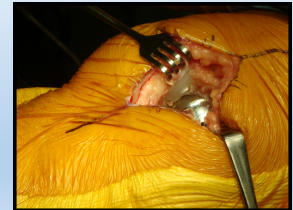
PATELLOFEMORAL INSTABILITY-Clunk Syndrome

- Painful, palpable "clunk" at the patellofemoral articulation during knee extension.
- > anterior fibrosis catching on the box of the femoral component.
- Highest complication: 3.5%.
- First described in 1982 by Insall et al.
- The term was later coined in 1989 by Hozack & al.

Beight JL, Yao B, Hozack WJ, Hearn SL, Booth RE Jr. The patellar « clunk » syndrome after posterior stabilized total knee arthroplasty. Clin Orthop Relat Res. 1994; 299 : 139-42

PATELLOFEMORAL INSTABILITY-Clunk Syndrome

- Superior pole > inferior
- Women
- First 6 post-operative months



PATELLOFEMORAL INSTABILITY-Clunk Syndrome

- Takahashi Classification:
 - TYPE 1:** isolated fibrous nodule located in the suprapatellar region
 - TYPE 2:** impinging hypertrophic synovitis
 - TYPE 3:** Types 1+2: suprapatellar fibrous nodule with generalized hypertrophic synovitis

Takahashi M, Miyamoto S, Nagano A. Arthroscopic treatment of soft-tissue impingement under the patella after total knee arthroplasty. Arthroscopy. 2002; 18(4) : E20

PATELLOFEMORAL INSTABILITY-Clunk Syndrome

Etiology:

- Femoral component design
- Patellar component too proximal
- Patellar depth too high

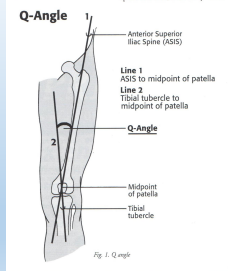
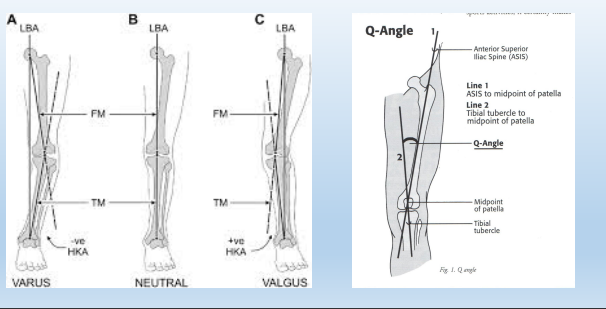
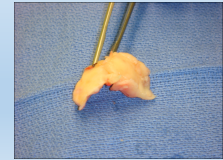
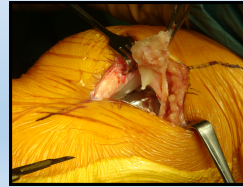
PATELLOFEMORAL INSTABILITY-Clunk Syndrome

Femoral component design: decreased incidence if narrow and flat trochlea, narrow and smooth intercondylar box.

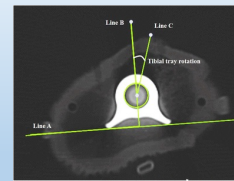
(Martin J.R., Jennings J.M., Waters T.S., Levy D.L., McNabb D.C., Dennis D.A. Femoral implant design modification decreases the incidence of patellar crepitus in total knee arthroplasty. J Arthroplasty. 2017; 32(4) : 1310-13.)

PATELLOFEMORAL INSTABILITY-Clunk Syndrome

Arthrotomy, fibrous nodule debridement.



RADIOLOGIC EVALUATION



Figuerosa J, Guarachi JP, Matas J, Arnander M, Orrego M. Is computed tomography an accurate and reliable method for measuring total knee arthroplasty component rotation? International Orthopaedics 2016 : 40(4) : 709-714.