Antwerp Orthopaedic Center

knee department

Coronal Instability and TKA

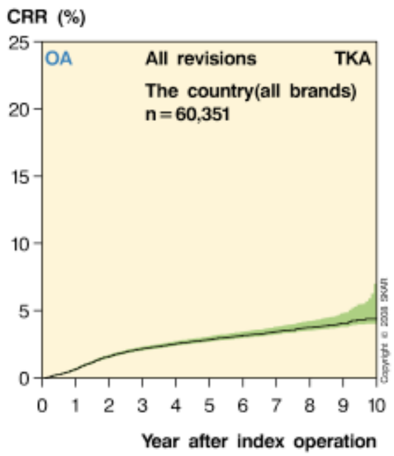
When do you switch to a constrained design in primary TKA?

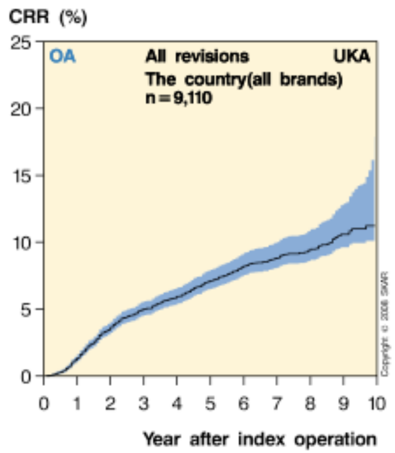
Peter Verdonk MD, PhD

LAGAE VERDONK

www.knee.be

from the Swedish Joint Registry

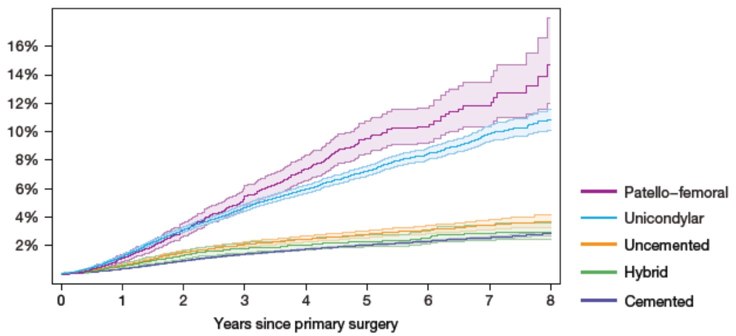




from the UK Joint registry

Figure 3.6

Risk of revision following primary knee replacement (cumulative hazard with 95% confidence intervals), by prosthesis type.

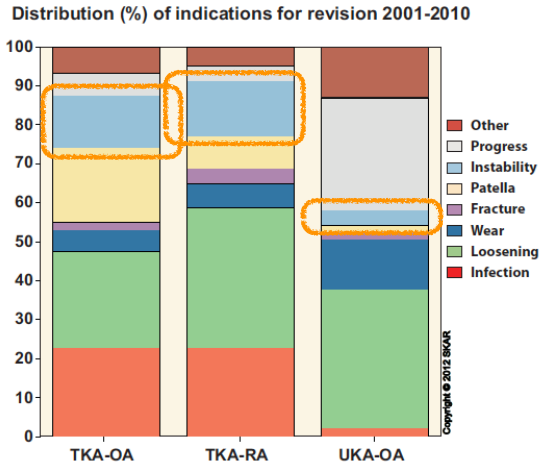


from the UK Joint registry

Table 3.18 Reasons for revision after primary knee replacement: patient time incidence rates per 1,000 years (95% confidence intervals).

Fixation/bearings	Pain	Dislocation/ subluxation	Infection	Aseptic loosening	Lysis	Periprosthetic fracture	Implant fracture	Implan[illegible]	Instability	Mala[illegible]nment	Stiffness	Other
All cemented	0.75 (0.70-0.80)	0.1[illegible] (0.12-0.16)	1.13 (1.08-1.19)	0.98 (0.93-1.03)	0.22 (0.20-0.25)	0.11 (0.09-0.13)	0.02 (0.01-0.03)	[illegible]16 ([illegible]18)	0.62 (0.58-0.66)	0.34 ([illegible].38)	0.34 (0.31-0.37)	0.44 (0.41-0.48)
Cemented, unconstrained, fixed	[illegible].73 (0.67-0.78)	0.12 (0.10-0.15)	[illegible]02 (0.96-1.09)	[illegible] (0.78-0.90)	0.20 (0.17-0.23)	0.07 (0.06-0.09)	0.02 (0.01-0.03)	[illegible]	0.57 [illegible]	0.35 ([illegible]32-0.40)	0.33 (0.30-0.37)	0.44 (0.40-0.48)
Cemented, unconstrained, mobile	0.94 (0.76-1.17)	0.22 (0.14-0.34)	1.28 (1.06-1.54)	1.24 (1.03-1.50)	0.31 (0.21-0.45)	0.17 (0.10-0.29)	0.01 (0.00-0.08)	[illegible] (0.15-0.[illegible])	[illegible]	0.40 (0.29-0.56)	0.46 (0.34-0.63)	0.41 (0.30-0.57)
Cemented, posterior-stabilised, fixed	0.66 (0.58-0.76)	0.13 (0.10-0.18)	1.33 (1.22-1.46)	1.20 (1.09-1.32)	0.25 (0.20-0.31)	0.16 (0.12-0.21)	0.01 (0.00-0.03)	0.20 (0.16-0.25)	0.60 (0.52-0.69)	0.31 (0.26-0.38)	0.29 (0.24-0.35)	0.38 (0.32-0.45)
Cemented, posterior-stabilised, mobile	1.36 (0.97-1.91)	0.28 (0.13-0.59)	0.92 (0.61-1.39)	1.00 (0.68-1.48)	0.24 (0.11-0.54)	0.28 (0.13-0.59)	0.08 (0.02-0.32)	0.16 (0.10-0.43)	1.04 (0.71-1.53)	0.24 (0.11-0.54)	1.00 (0.68-1.48)	1.20 (0.84-1.72)
All uncemented	1.31 (1.10-1.55)	0.31 (0.22-0.44)	0.90 (0.73-1.10)	1.99 (1.74-2.28)	0.27 (0.19-0.40)	0.14 (0.08-0.23)	0.07 (0.03-0.14)	0.18 (0.11-0.28)	0.91 (0.74-1.11)	0.59 (0.45-0.75)	0.55 (0.42-0.71)	0.52 (0.40-0.68)
All hybrid	1.04 (0.73-1.48)	0.20 (0.09-0.45)	1.27 (0.93-1.75)	1.31 (0.96-1.80)	0.30 (0.16-0.58)	0.10 (0.03-0.31)	0.07 (0.02-0.27)	0.34 (0.18-0.62)	0.80 (0.54-1.20)	0.44 (0.25-0.75)	0.34 (0.18-0.62)	0.17 (0.07-0.40)
Uncemented/hybrid, unconstrained, fixed	1.04 (0.83-1.32)	0.15 (0.08-0.28)	1.02 (0.80-1.29)	1.69 (1.40-2.03)	0.18 (0.10-0.32)	0.07 (0.03-0.18)	0.06 (0.02-0.16)	0.19 (0.11-0.3[illegible])	0.84 [illegible]	0.45 (0.31-0.64)	0.46 (0.33-0.66)	0.40 (0.28-0.59)
Uncemented/hybrid, unconstrained mobile	1.34 (1.06-1.69)	0.42 (0.28-0.64)	0.94 (0.71-1.24)	1.91 (1.57-2.33)	0.40 (0.26-0.62)	0.19 (0.10-0.36)	0.08 (0.03-0.20)	[illegible]	0.90 (0.68-1.20)	0.59 ([illegible]-0.84)	0.42 (0.28-0.64)	0.32 (0.20-0.52)
All unicondylar	3.94 (3.63-4.27)	0.87 (0.73-1.03)	0.76 (0.63-0.91)	4.01 (3.70-4.35)	0.44 (0.35-0.57)	0.33 (0.25-0.43)	0.05 (0.03-0.11)	[illegible]90 ([illegible]07)	1.03 (0.88-1.21)	[illegible].78 ([illegible].94)	0.26 (0.19-0.36)	3.26 (2.98-3.57)
Unicondylar, fixed	4.68 ([illegible]5.46)	0.17 ([illegible].39)	0.78 (0.54-1.14)	4.51 ([illegible]5.28)	0.43 (0.26-0.72)	0.32 (0.18-0.57)	0.09 (0.03-0.27)	[illegible]	0.84 [illegible]	[illegible].69 ([illegible].47-1.04)	0.35 (0.20-0.61)	3.06 (2.53-3.71)
Unicondylar, mobile	3.72 (3.37-4.10)	1.10 (0.92-1.31)	0.76 (0.61-0.94)	3.90 (3.55-4.29)	0.46 (0.35-0.60)	0.34 (0.24-0.47)	0.04 (0.01-0.10)	[illegible] (0.83-1.2[illegible])	[illegible]	0.81 (0.66-1.00)	0.24 (0.16-0.35)	3.35 (3.03-3.71)
All patello-femoral	5.21 (4.31-6.29)	1.01 (0.66-1.55)	0.34 (0.16-0.71)	1.88 (1.37-2.58)	0.10 (0.02-0.39)	0.24 (0.10-0.58)	0.10 (0.02-0.39)	1.45 (1.01-2.07)	0.92 (0.58-1.44)	1.59 (1.13-2.24)	0.53 (0.29-0.96)	6.56 (5.55-7.76)
Other/unknown	2.13 ([illegible]2.96)	0.65 (0.36-1.18)	1.84 (1.30-2.61)	1.96 ([illegible])	0.18 (0.06-0.55)	0.30 (0.12-0.71)	0	0.29 ([illegible])	1.07 (0.61-1.69)	0.71 ([illegible])	0.71 (0.40-1.25)	0.83 (0.49-1.40)

from the Swedish Knee registry

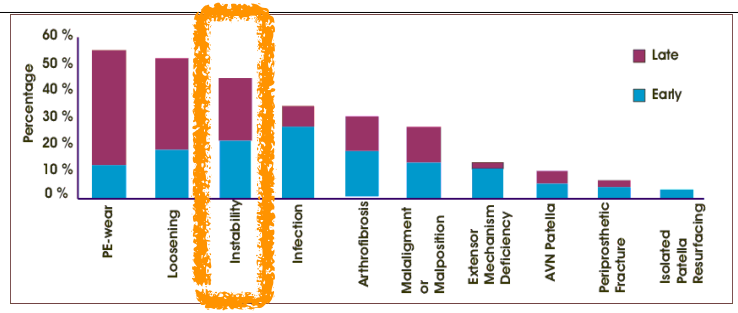


5

"Why are total knee arthroplasties failing today?"

Peter F. Sharkey, MD; William J. Hozack, MD; Richard H. Rothman, MD, PhD; Shani Shastri, MD; Sidney M. Jacoby, BA

Clinical Orthopaedics and Related Research, november 2002 pag 7-14



6

Fehring 2001

- 120 TKA revised within 5 years after index TKA
  - **33% instability**
  - 30% infection
  - 23% non ingrowth porous implant
  - 6% patellar problems
  - 5% osteoysis
  - 3% miscellanrous

7

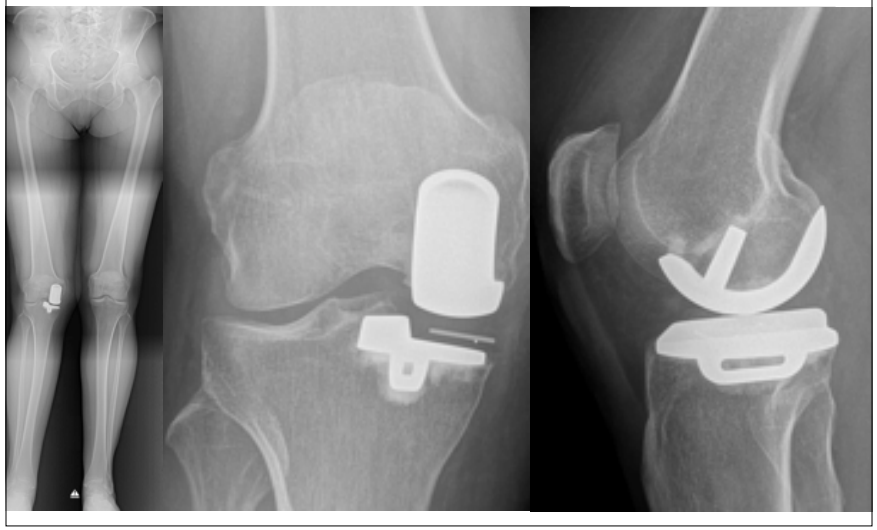
Definition of Knee Prothesis Instability (KPI)

- **early** KPI
  - malalignment of the components
  - failure of restoration of the mechanical axis of the limb
  - [illegible]
  - secondary rupture of the posterior cruciate ligament (PCL)
  - iatrogenic rupture of medial collateral ligament (MCL)
  - patellar tendon rupture or patella fracture.

surgical error

often a combination of multiple factors…Murphy's law

MCL injury, malalignment, balancing, overcorrection…
(52 year old lady, oxford <1y postop)



9

Definition of Knee Prothesis Instability (KPI)

- **late** KPI
  - polyethylene (PE) wear
  - either alone or in combination with ligamentous instability
  - PE wear is often a function of malalignment,

10

Clinical Findings of KPI

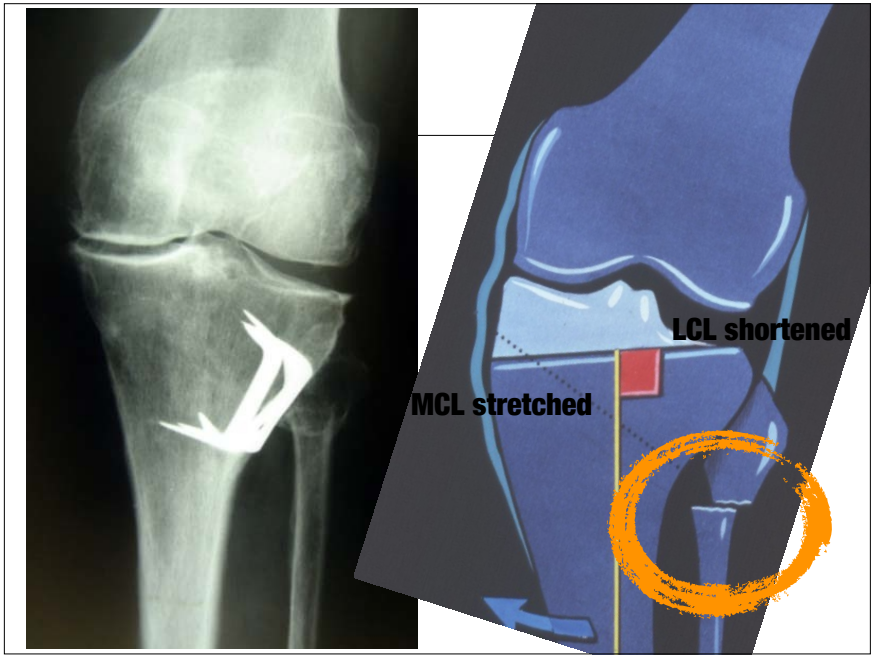
- **Obvious**
  - alignment
  - dislocation
- **often Subtle…**
  - pain…lateral instability
  - effusion…increased flexion gap mismatch in PS design
  - restricted motion
  - locking

11

Preoperative Risk Factors

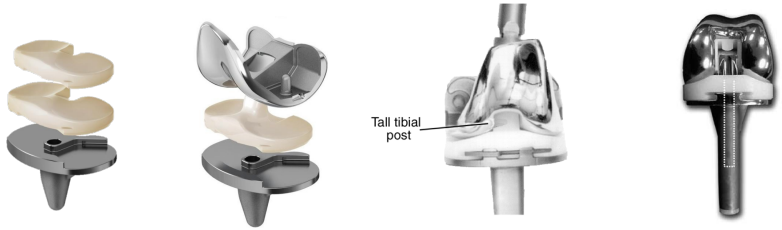
- **Patient-related** risk factors
  - deformity requiring a large surgical correction and aggressive ligament release
  - general or regional neuromuscular pathology (polio)
  - hip or foot deformities
  - obesity
- **Surgeon-related** risk factors:
  - in-appropriate selection of implants
  - bad surgical technique.

13



14

TKA design aspects: Levels of constraints



cruciate retaining

varus valgus constrained VVC
constrained condylar knee CCK

posterior substitution

linked hinge

- As a general rule, it is recommended that, the minimum amount of constraint necessary to achieve stability should be used

15

TKA design aspects: CR

- needs functional soft tissue enveloppe. some laxity on lateral side is accepted
- needs functional PCL
  - beware of secondary insufficiency of PCL with sagital instability

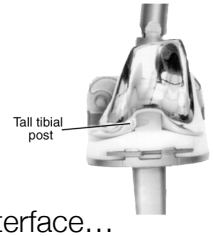
16

TKA design aspects: PS design

- offers no additional benefit over CR design stability
- no worries about PCL balancing
- sacrificing PCL will result in increased flexion gap especially in bigger males…
  - loose flexion gap can result in effusion and pain or frank dislocation
  - increase PE and proximalise joint line **or** posteriorize/ upsize femoral component

17

TKA design aspects: VVC/CCK



- increase constraint to varus and valgus
- but increased stress at prosthesis-bone interface…
- indicated in isolated lateral (or medial) instability in coronal plane…(accept the stretched ligament)
- indicated if aggressive medial collateral overrelease happened?
- prefer a mobile bearing VVC to allow greater flexion

18

TKA design aspects: Levels of constraints

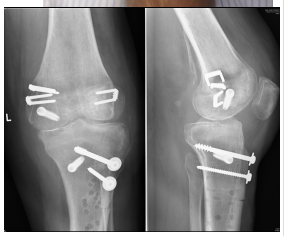
- indicated in gross soft tissue insufficiency both in flexion and extension in elderly
  - infinite flexion gap!

- increased loosening rates and infection rates
- newer designs perform better
- gets the joint line right!

19

Constrained designs in Primary TKA

- VVC design for **isolated lateral** collateral insufficiency
  - varus thrust (muslim population)
  - status post ligament injury…
  - often under recognised until per-operative
  - often in flexion…cave rotation!
  - preferably mobile bearing VVC design to achieve high flexion



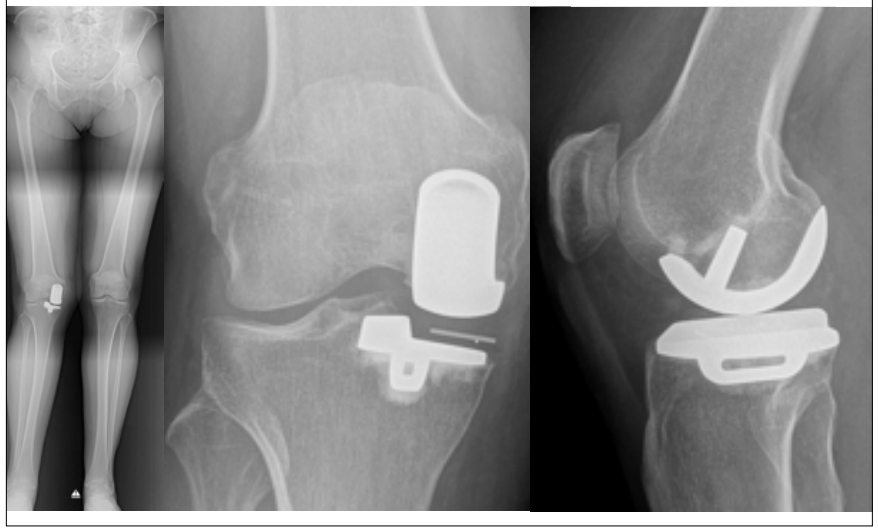
20

Constrained designs in Primary TKA

- VVC design for **isolated medial** collateral insufficiency??
  - post-traumatic
  - iatrogenic
  - not very predictable
  - laxity in flexion and extension
  - fixed bearing VVC or CCK design but **personal preference for hinge**

21

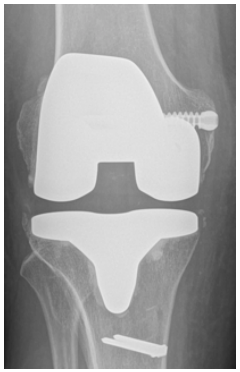
MCL injury, malalignment, balancing, overcorrection… (52 year old lady, oxford <1y postop)



22

Alternatives in the young population

- primary MCL repair or reconstruction

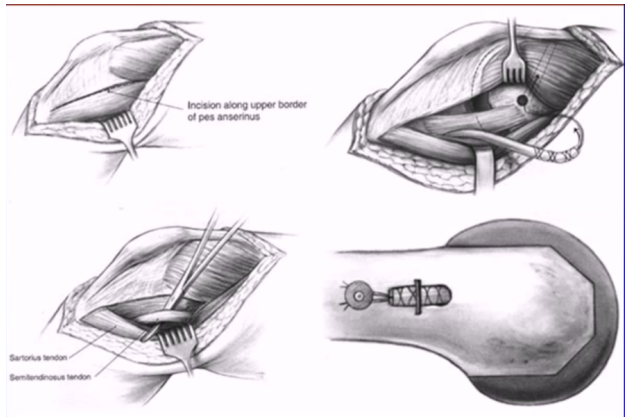


23

What to Do When You Cut The MCL in TKA

By Kenneth A Krackow

5 Videos



24

Constrained designs in Primary TKA

- hinge design for **medial** collateral insufficiency in type 3 valgus
  - stretched MCL
  - very unpredictable release algorithm
  - especially in the elder
  - great outcome with hinge
  - beware of rotation for patellar tracking

25

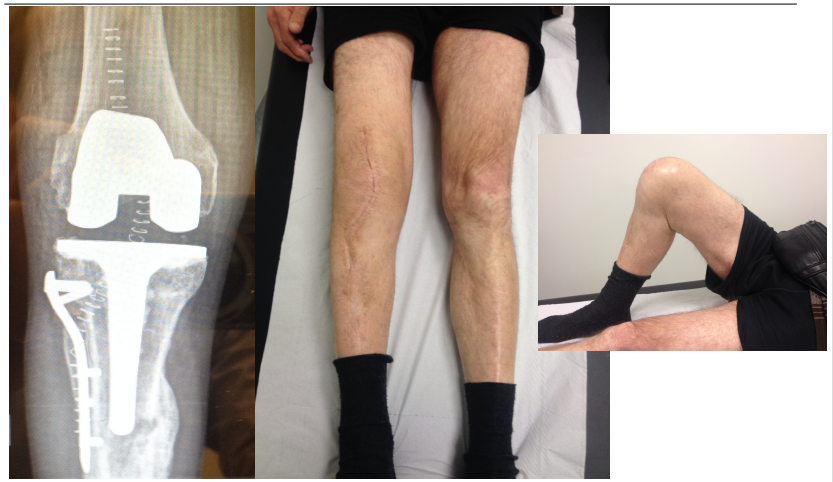
conclusions

- KPI is third most common reason for failure of primary TKA
- better prevent and anticipate than treat after index TKA!
- KPI needs surgical treatment with revision
- increased constraint always necessary
- however, the minimum amount of constraint necessary to achieve stability should be used

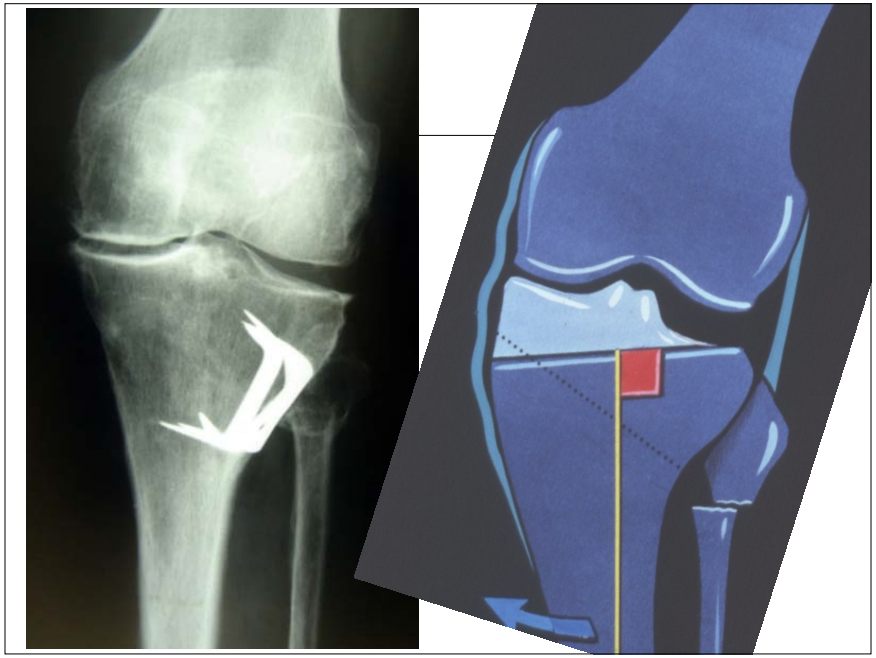
26

27

closing wedge osteotomy + PS design TKA



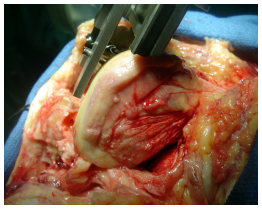
28

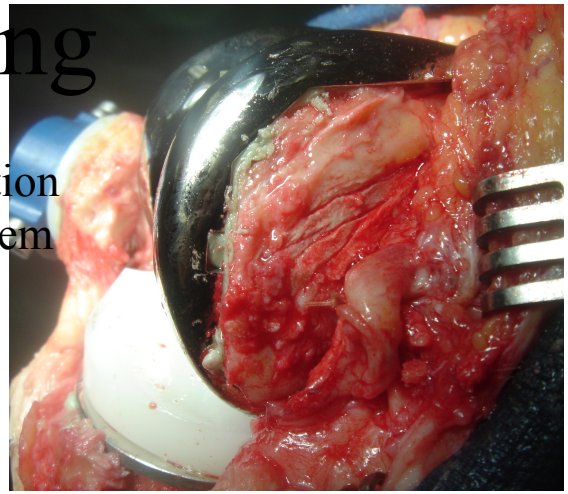


29

- Soft tissue balancing

•LCL desinsertion
•Popliteus T idem





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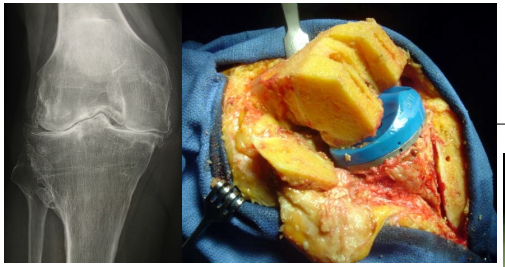
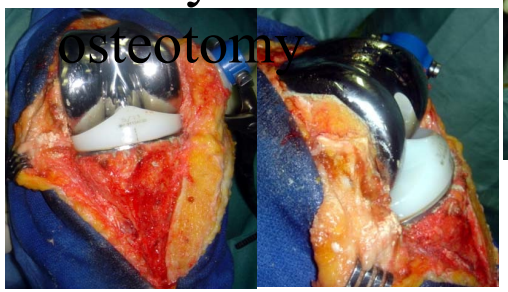
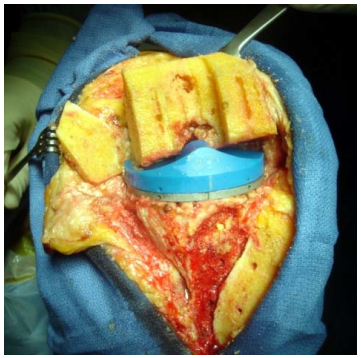
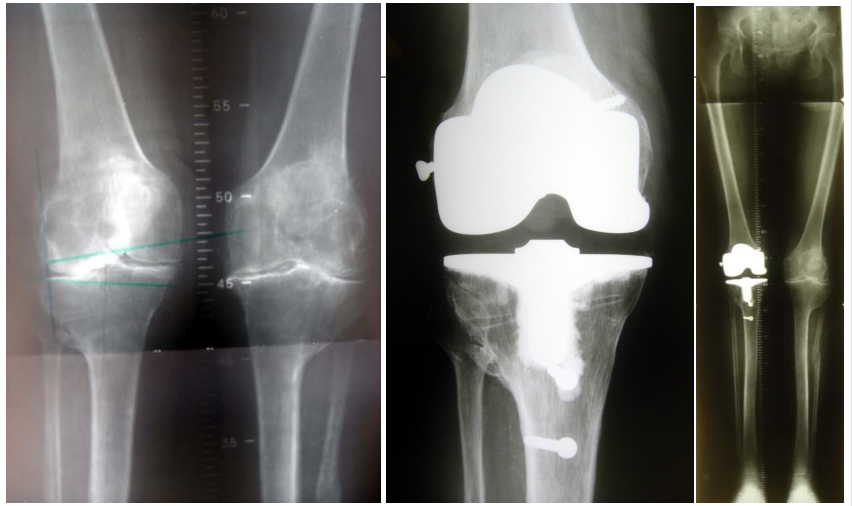


Condylar osteotomy





31



Antwerp Orthopaedic Center
knee department

Thank you for your attention

When do you switch to a constrained design in primary TKA?

Peter Verdonk MD, PhD

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Instability

Diagnosis ≠

Laxity

	Bone cuts	Soft tissues
Collateral Ligaments ?	COMPETENT	INCOMPETENT
R TKA?	NON CONSTRAINED	CONSTRAINED

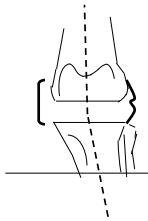
Instability

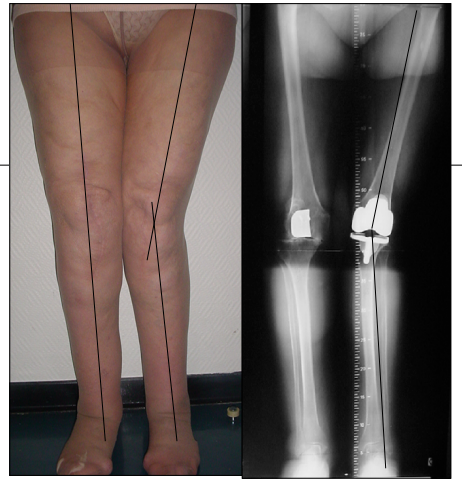
Diagnosis ≠

Laxity

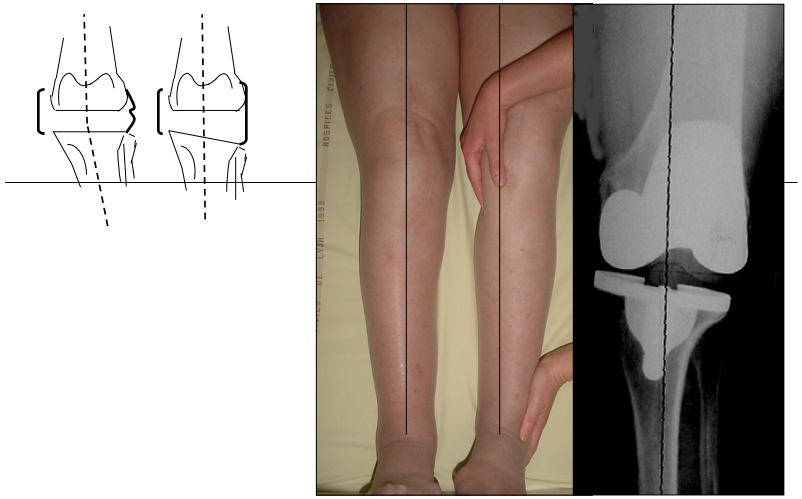
	Bone cuts	Soft tissues
Collateral Ligaments ?	COMPETENT	INCOMPETENT
R TKA?	NON CONSTRAINED	CONSTRAINED

proper bone cuts





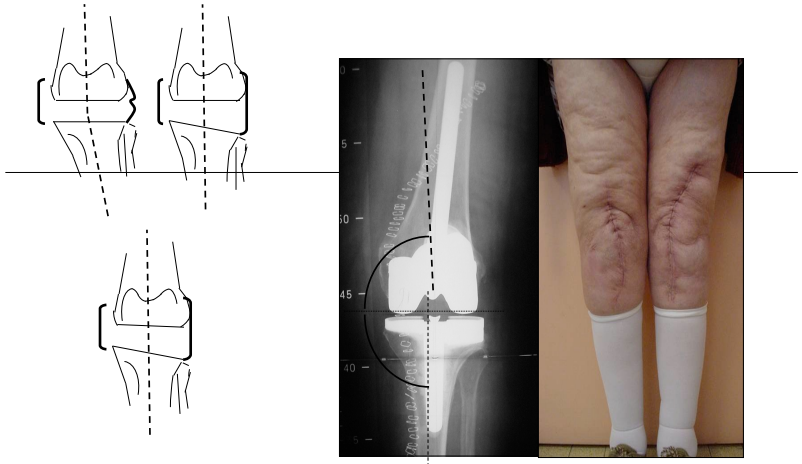
Concavity Laxity



37

reconstruction

Bone balancing



38

Instability

Diagnosis ≠

Laxity

Bone cuts

COMPETENT

NON CONSTRAINED

Soft tissues

INCOMPETENT

CONSTRAINED

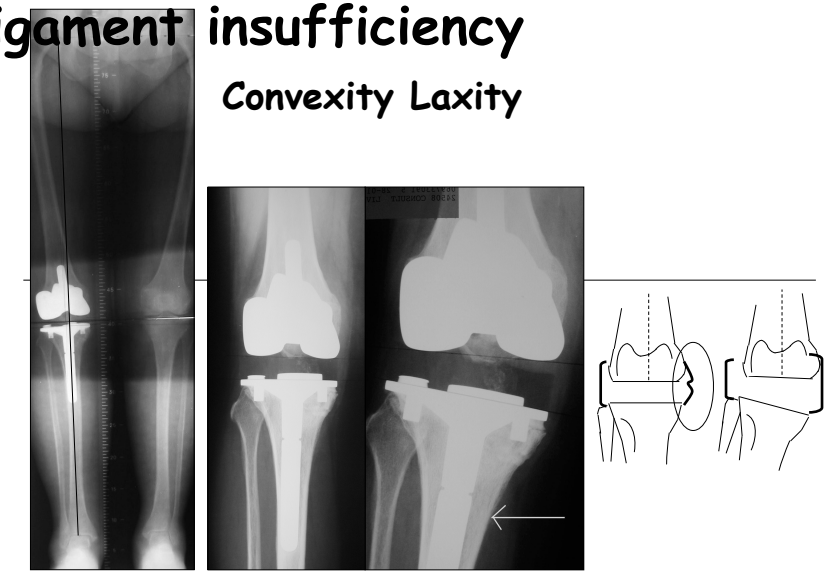
Collateral Ligaments ?

R TKA?

39

ligament insufficiency

Convexity Laxity



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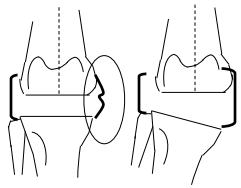
Convexity Laxity



Concavity release

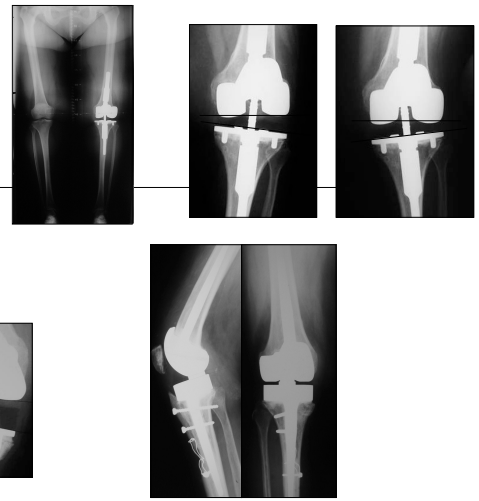
Lgts retensioning

CONSTRAINED
PROSTHESIS

distal femoral augment

PE augmentation

Which constraint?



Non linked constrained TKA

Hinge prosthesis

Conclusion

FT Instability

Laxity? Concavity Convexity

Problem?

Bone cuts COMPETENT

Soft tissues INCOMPETENT

Collateral Ligaments ?

Conclusion

FT Instability

Laxity? Concavity Convexity

Problem?

Bone cuts COMPETENT

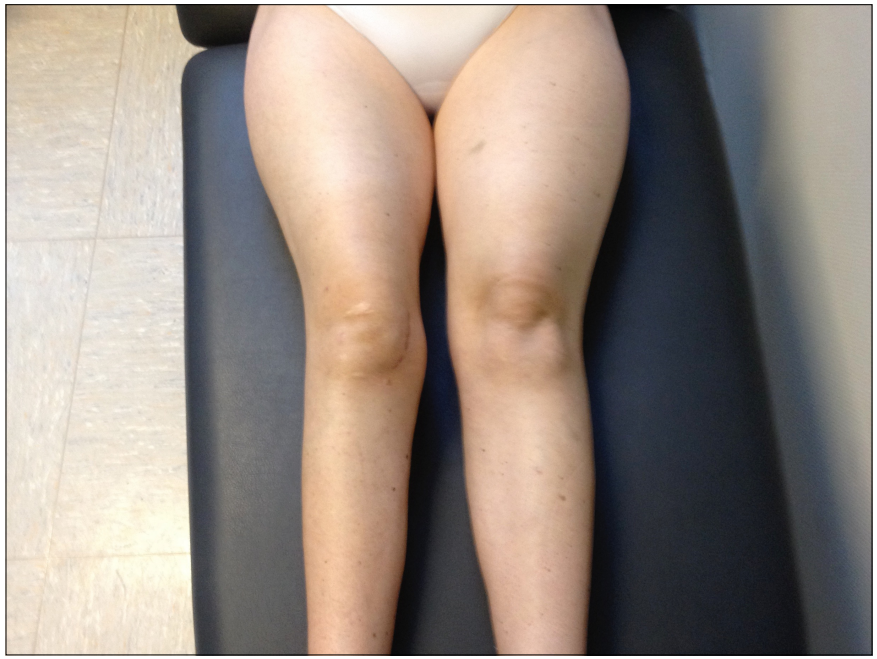
Soft tissues INCOMPETENT

Collateral Ligaments ?

R TKA?

NON CONSTRAINED + bone balancing

CONSTRAINED



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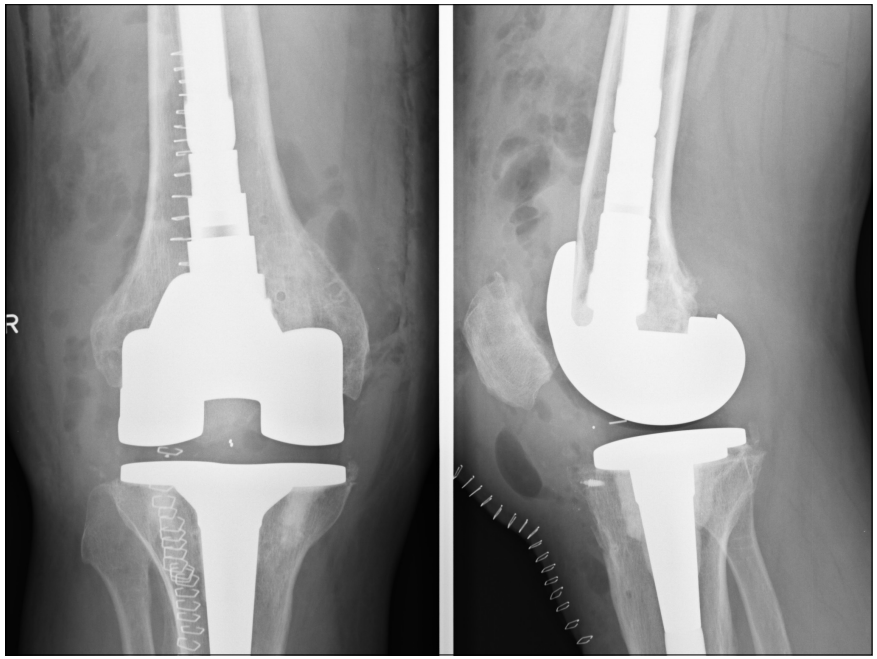

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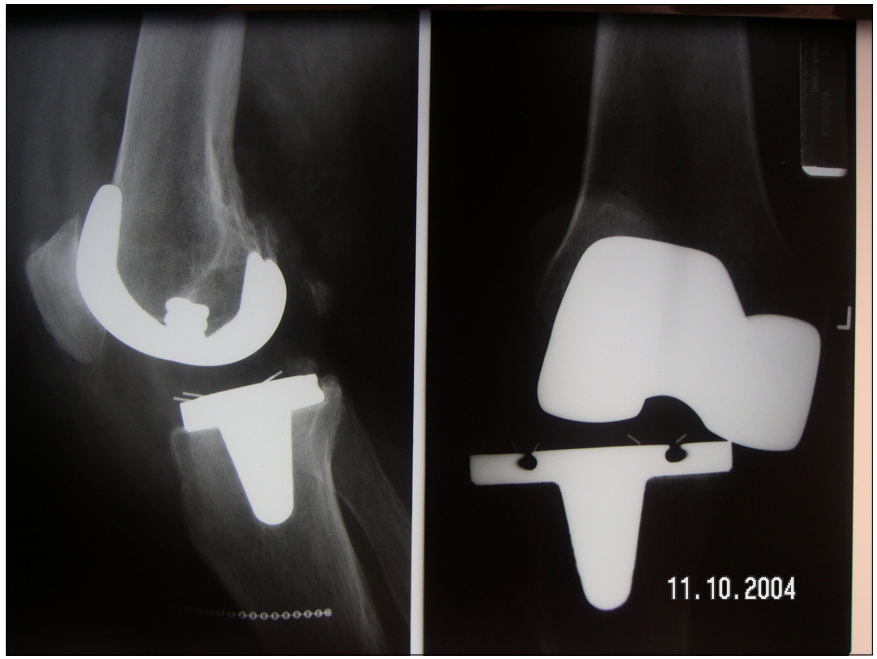

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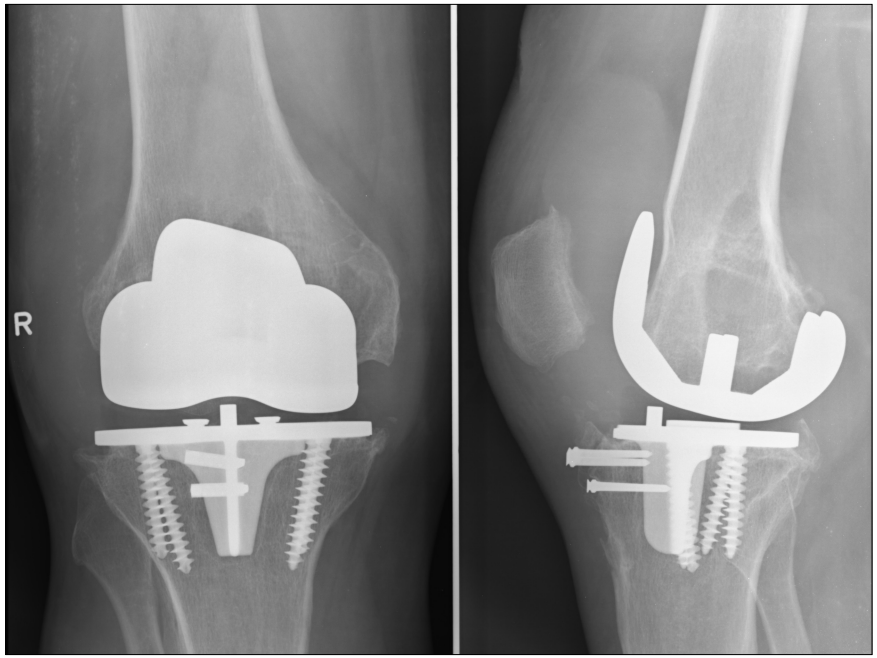

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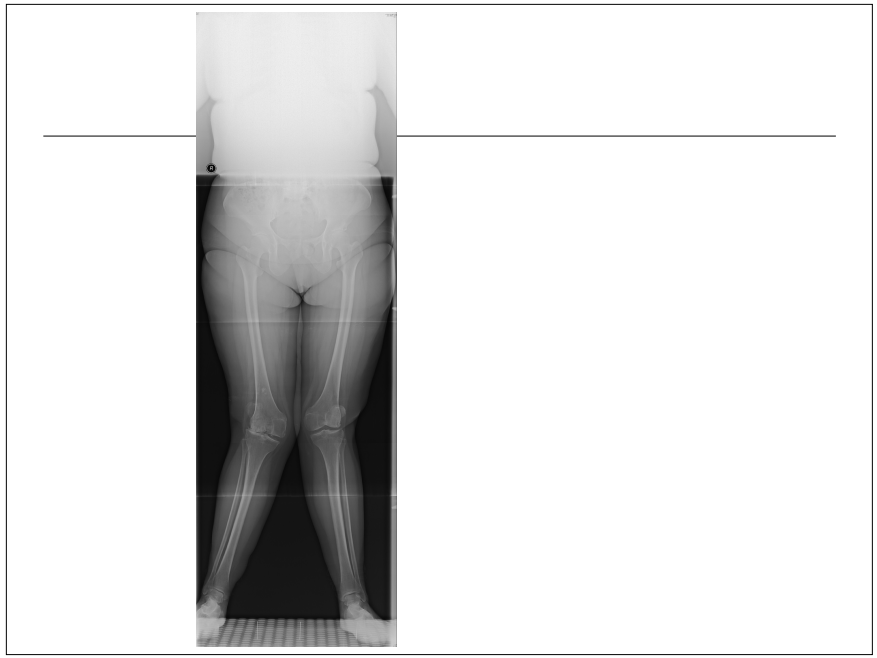

56


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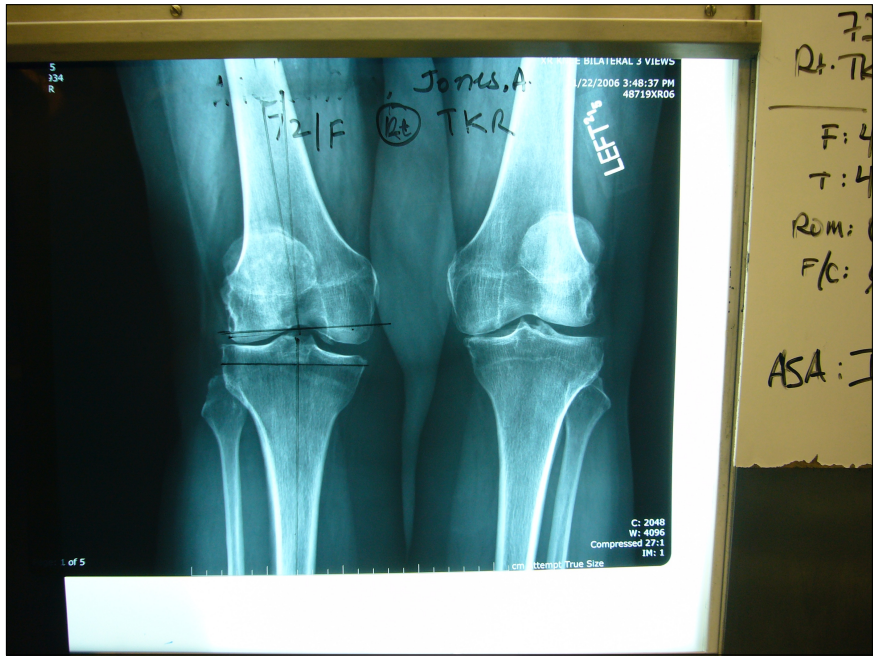
Page: 1 of 6

57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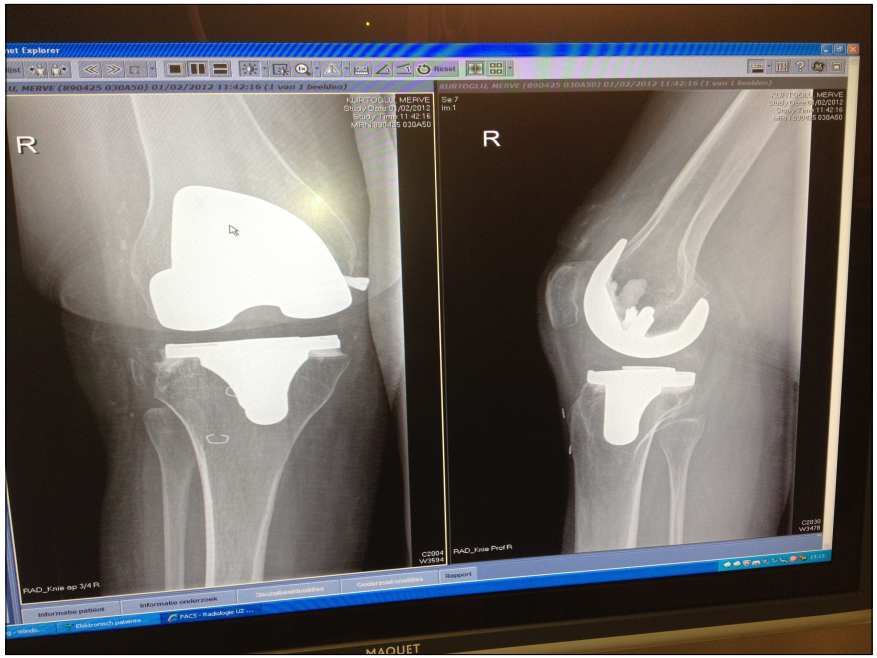
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