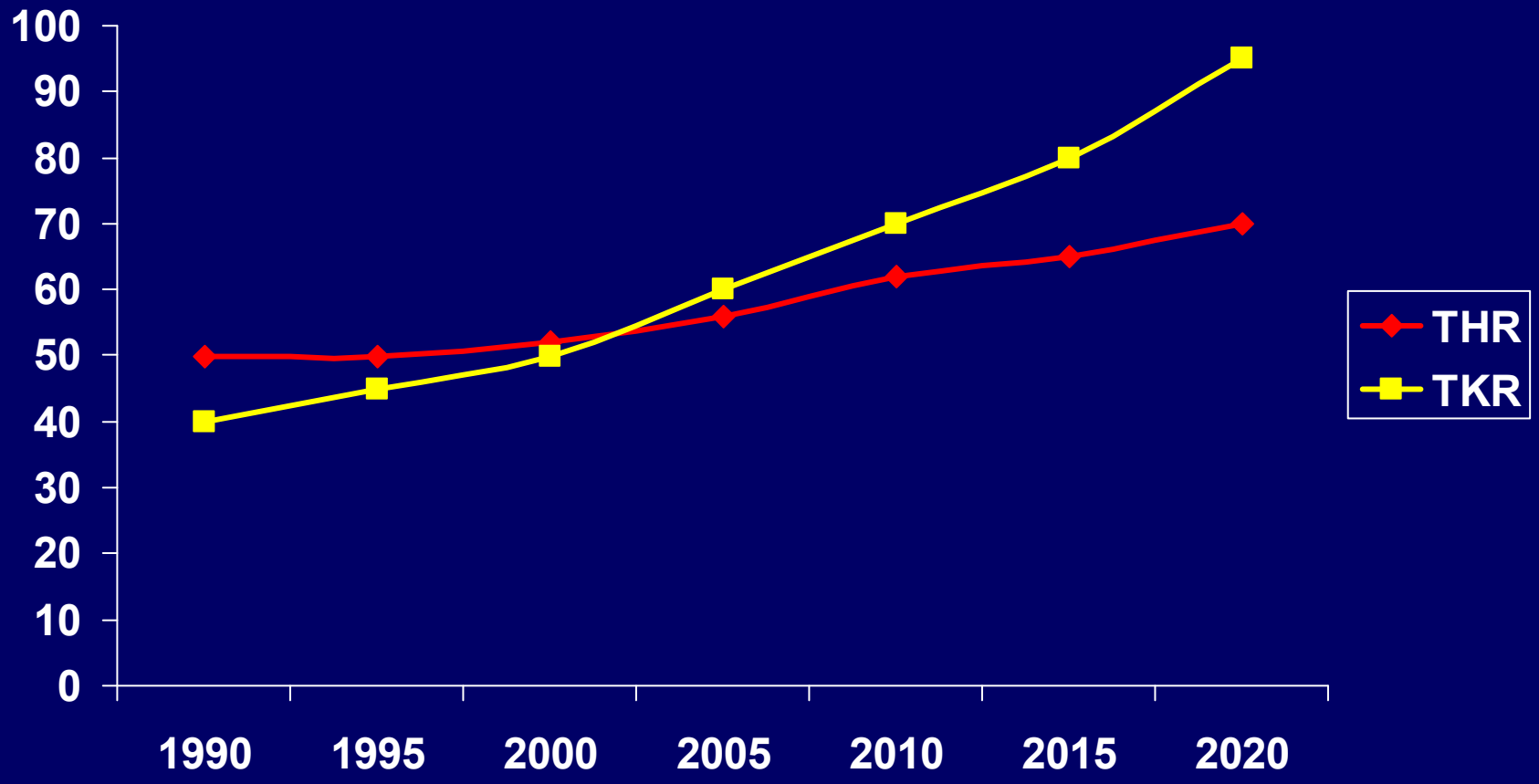
Failure of TKR

Mr A Port – November 2009

Patient


100
90
80
70
60
50
40
30
20
10
0
1990
1995
2000
2005
2010
2015
2020
THR
TKR

Causes of failure of TKR

- Poly wear
- Aseptic loosening
- Instability
- Infection
- Arthrofibrosis
- Malalignment

Sharkey Corr 2002

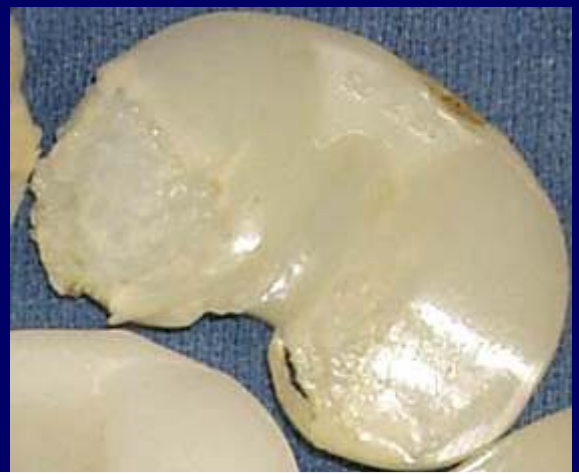
Causes of failure of TKR
NJR

Aseptic loosening	24%
Pain	17%
Instability	10%
Infection	30%
Malalignment	6%
Periprosthetic #	3%
Stiffness	6%

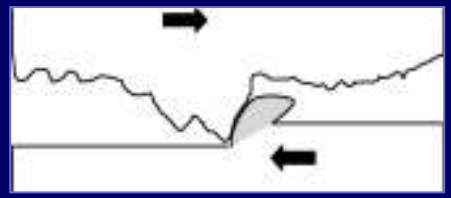
Wear mechanisms

Delamination wear

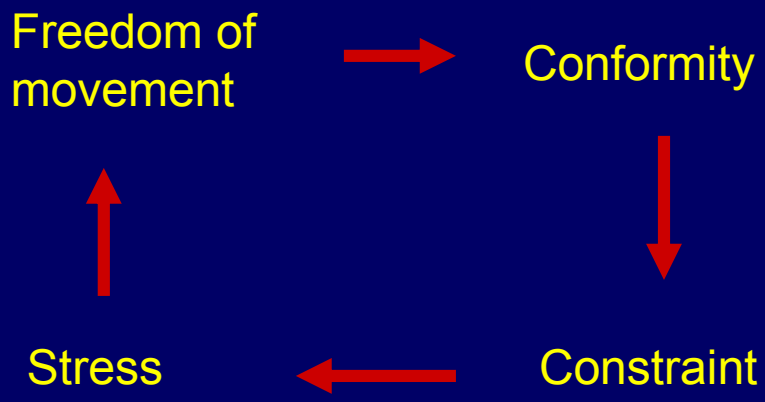
- Sliding creates high tensile and shear stresses in the subsurface of the polyethylene leading to cracks which coalesce into large delamination fragments

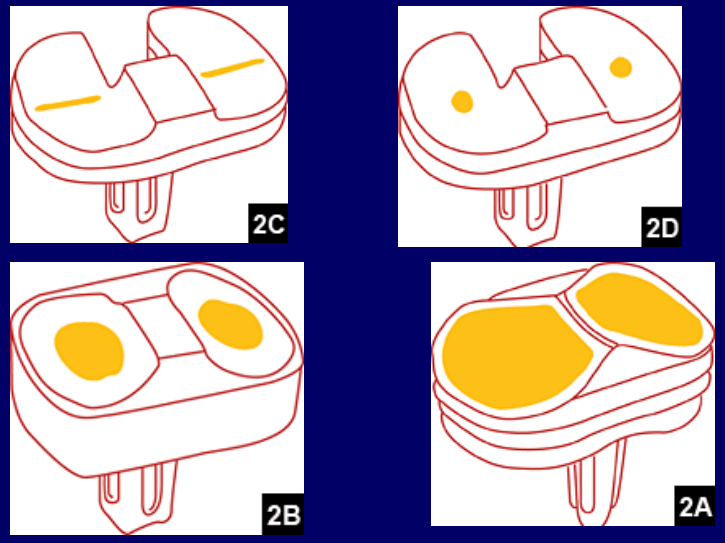


- Abrasive wear – asperity contact – wear particles
- Adhesive wear - localised bonding of the two surfaces and material is removed from one surface



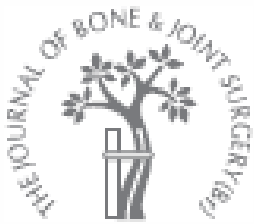
Design of TKR





- Mobile bearing ?
- Backside wear
- UHMPE (Reay 09)

Satisfaction



The role of pain and function in determining patient satisfaction after total knee replacement

DATA FROM THE NATIONAL JOINT REGISTRY FOR ENGLAND AND WALES

P. N. Baker,
J. H. van der Meulen,
J. Lewsey,
P. J. Gregg

From James Cook University Hospital, Middlesborough, England

A postal questionnaire was sent to 10 000 patients more than one year after their total knee replacement (TKR). They were assessed using the Oxford knee score and were asked whether they were satisfied, unsure or unsatisfied with their TKR. The response rate was 87.4% (8231 of 9417 eligible questionnaires) and a total of 81.8% (6625 of 8095) of patients were satisfied. Multivariable regression modelling showed that patients with higher scores relating to the pain and function elements of the Oxford knee score had a lower level of satisfaction ($p < 0.001$), and that ongoing pain was a stronger predictor of this. Female gender and a primary diagnosis of osteoarthritis were found to be predictors of lower levels of patient satisfaction. Differences in the rate of satisfaction were also observed in relation to age, the American Society of Anesthesiologists grade and the type of prosthesis.

This study has provided data on the Oxford knee score and the expected levels of satisfaction at one year after TKR. The results should act as a benchmark of practice in the United Kingdom and provide a baseline for peer comparison between institutions.

Early revision

- Instability
- Malalignment
- Malposition
- Fixation failure
- Patella
- Infection

75% <2yr

technique

Sharkey Corr 2002

Accurate assessment

- Diagnosis

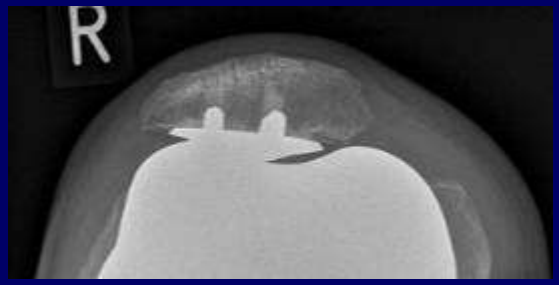
- Patient

Approach

- Skin incision
  - Most recent
  - Most lateral

Patella

- Metal backing



- Resurfacing

Infection

- Technique
- Discipline
- Lavage

Infection

Glove perforation and contamination in primary total hip arthroplasty

M. Al-Maiyah,
A. Bajwa,
P. Finn,
P. Mackenney,
D. Hill,
A. Port,
P. J. Gregg

From James Cook University Hospital and University of Teesside, Middlesbrough, England

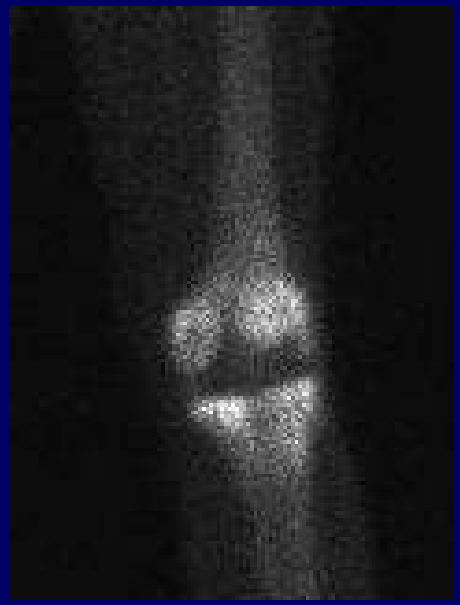
We conducted a randomised, controlled trial to determine whether changing gloves at specified intervals can reduce the incidence of glove perforation and contamination in total hip arthroplasty. A total of 50 patients were included in the study. In the study group (25 patients), gloves were changed at 20-minute intervals or prior to cementation. In the control group (25 patients), gloves were changed prior to cementation. In addition, gloves were changed in both groups whenever there was a visible puncture. Only outer gloves were investigated.

Contamination was tested by impression of gloved fingers on blood agar and culture plates were subsequently incubated at 37°C for 48 hours. The number of colonies and types of organisms were recorded. Glove perforation was assessed using the water test. The incidence of perforation and contamination was significantly lower in the study group compared with the control group. Changing gloves at regular intervals is an effective way to decrease the incidence of glove perforation and bacterial contamination during total hip arthroplasty.

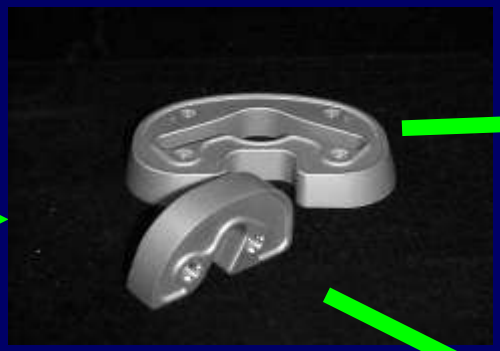
Objectives of TKR

- Stable fixation of implants (in face of bone loss)
- Restoration anatomical alignment
  - Mechanical axis
  - Translation
  - Rotation
- Restoration of normal joint line
- Restore functional stability throughout ROM

Bony fixation



Bony defects

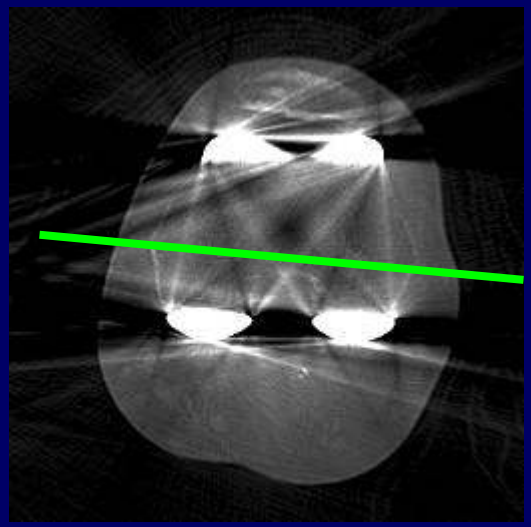


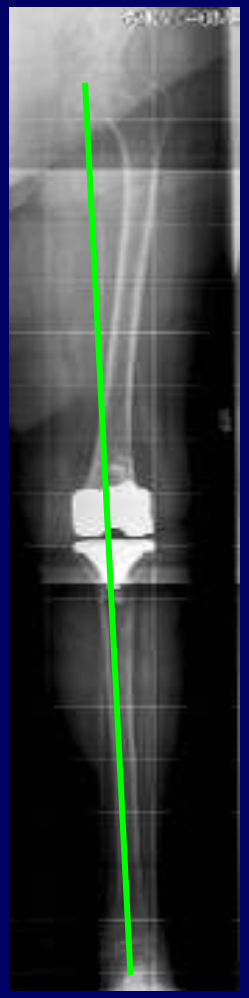
Bone fixation

Osteoporotic supracondylar

Aims

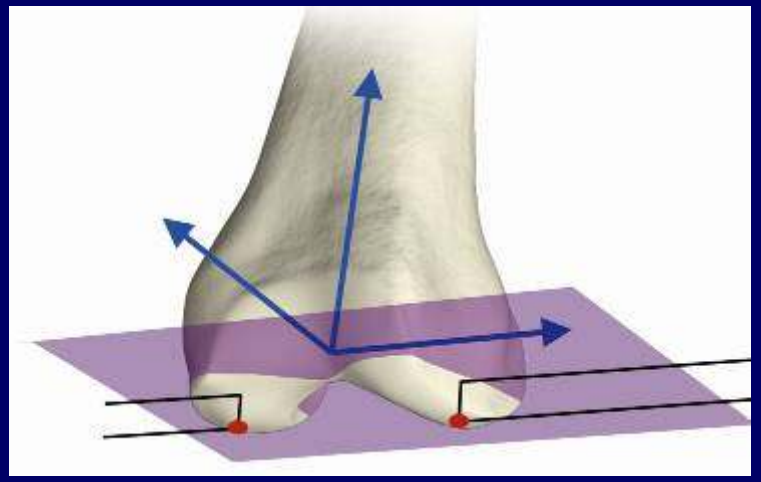
- Correct mechanical alignment
  - coronal
  - sagittal
  - rotation

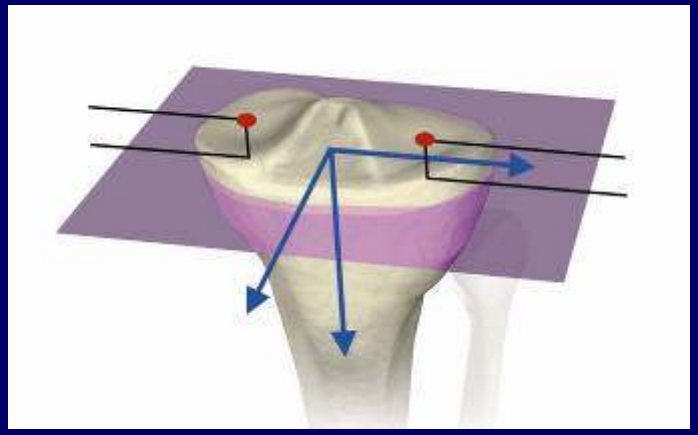




Accuracy

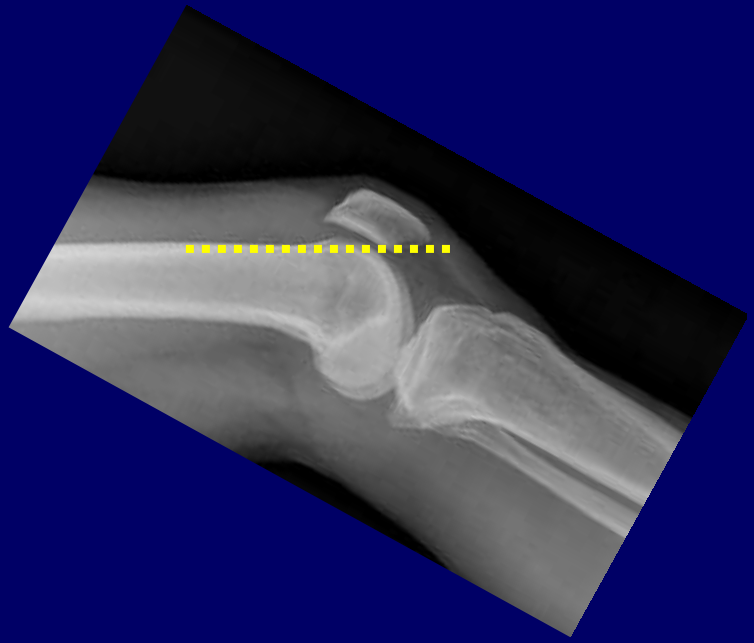
- Each component has 3 degrees of rotational freedom
- 3 degrees of translational freedom

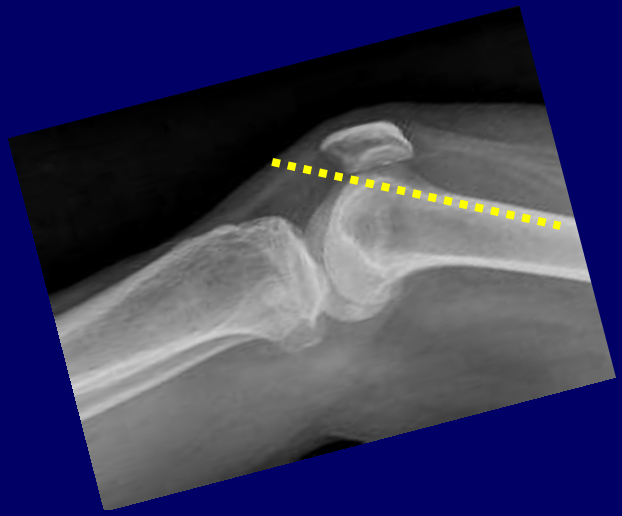




Individuality

Patella offset

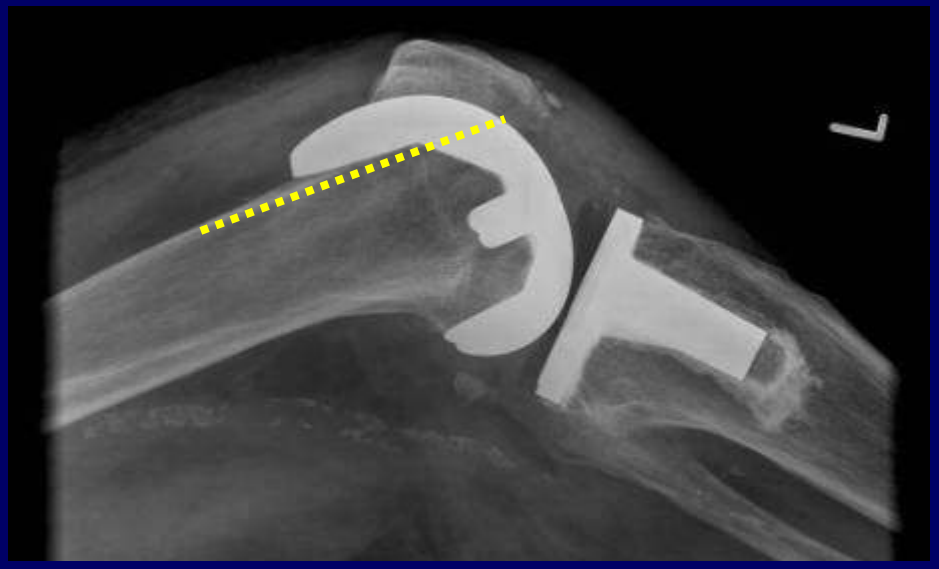


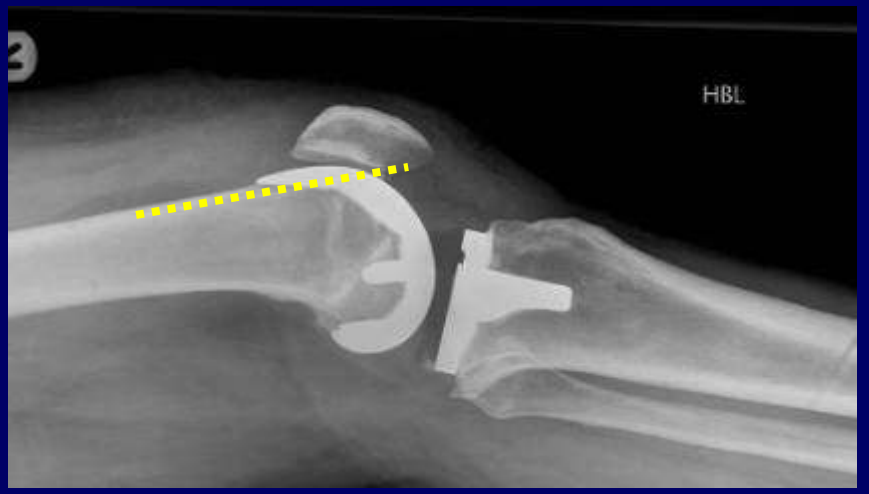


Translation

Overhang

Translation
Patella overstuff

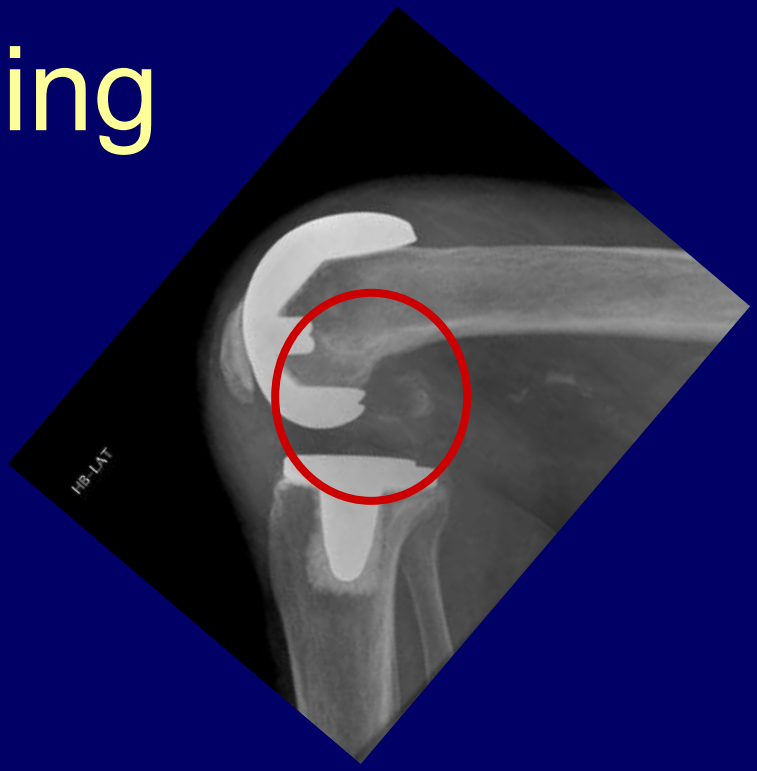


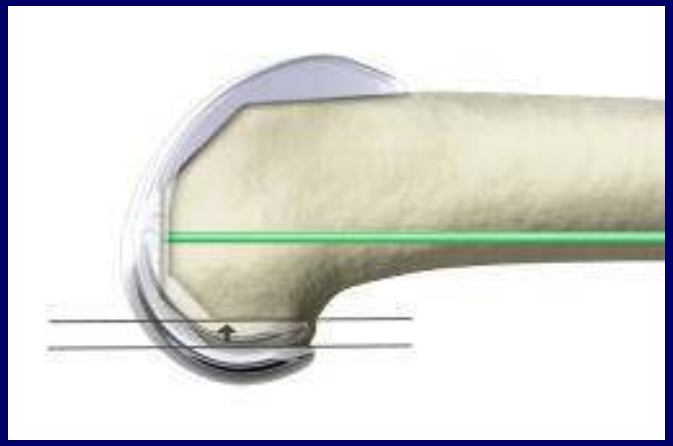


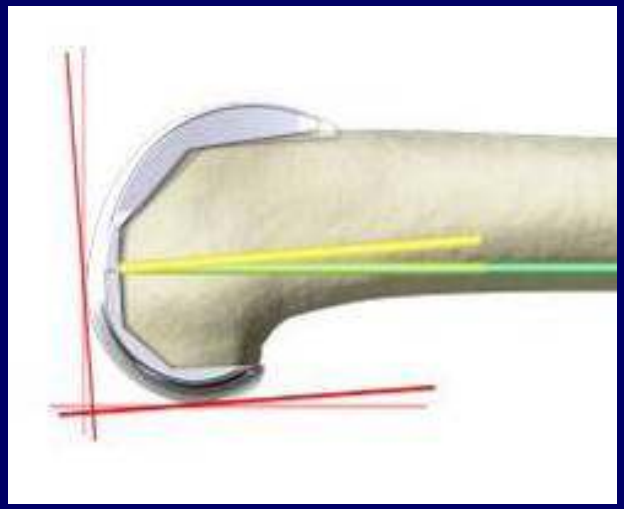
Posterior condylar offset

Deehan/Ghosh

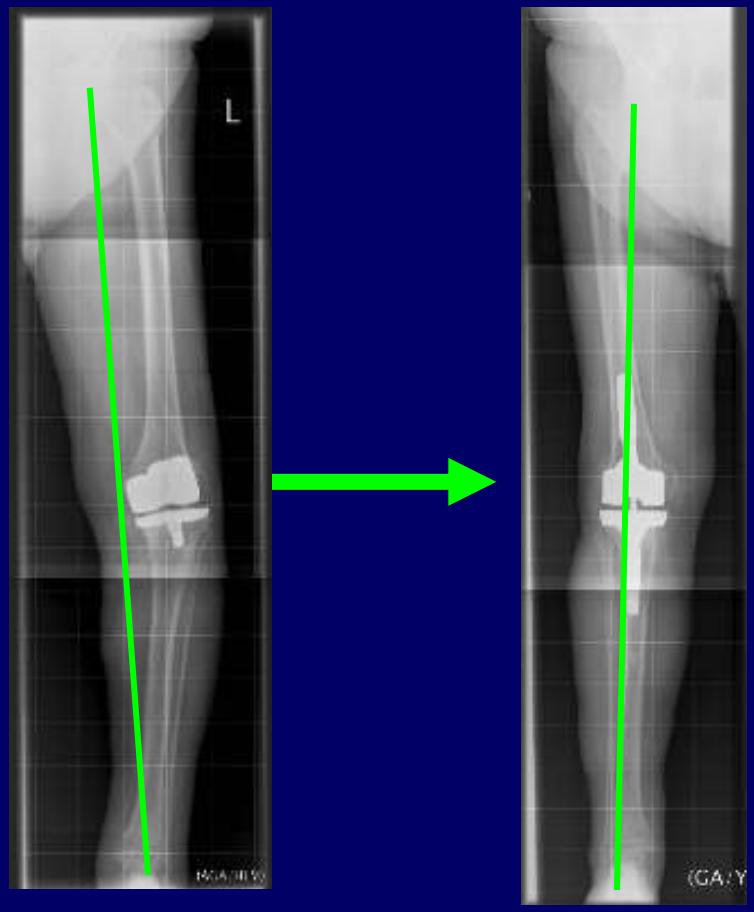
Downsizing







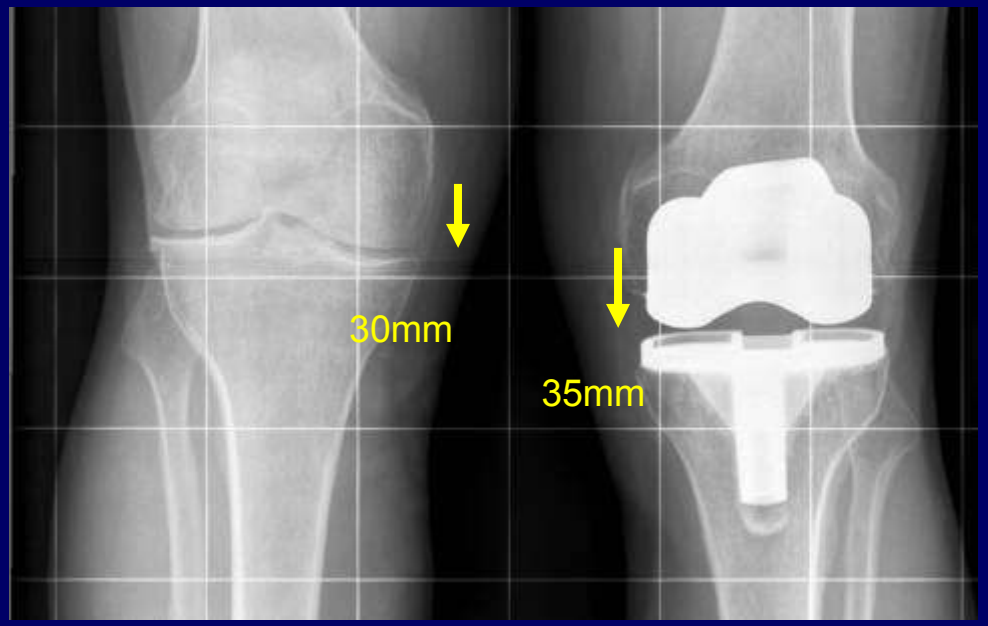
Improved alignment leads to greater longevity



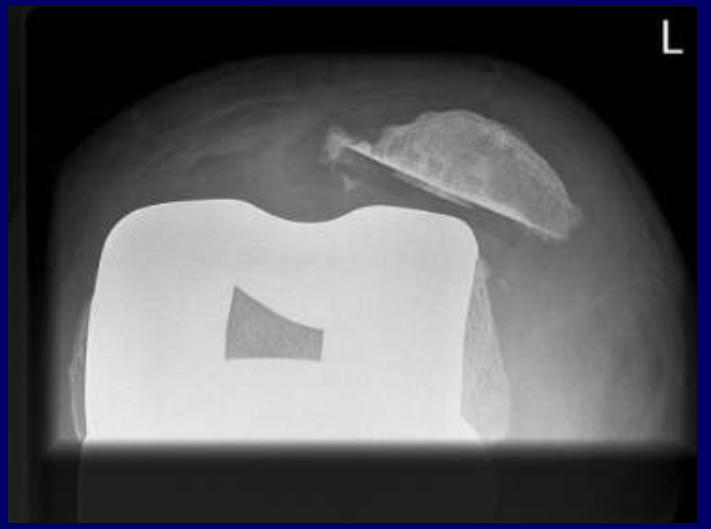
- Lotke JBJS 77
- Laskin CORR 01
- Ritter CORR 94
- Bonner/Gregg 08

Alignment

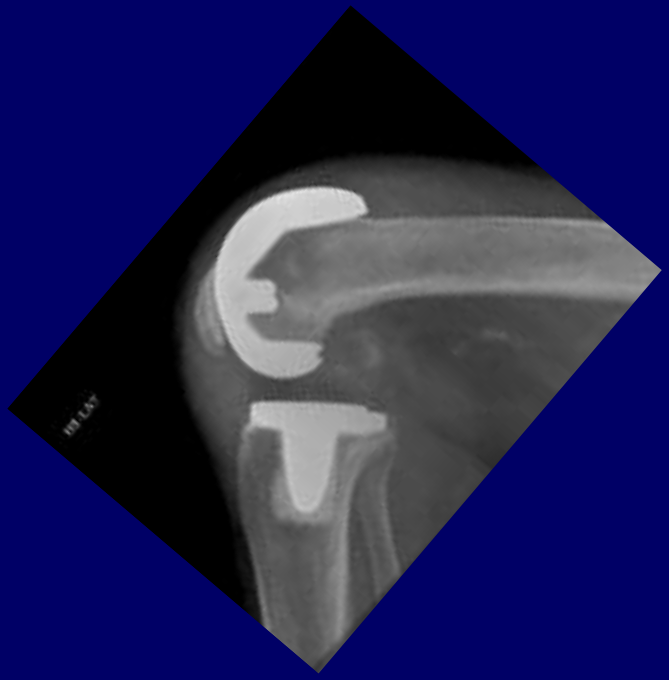
Alignment



Alignment rotation



Rotation errors

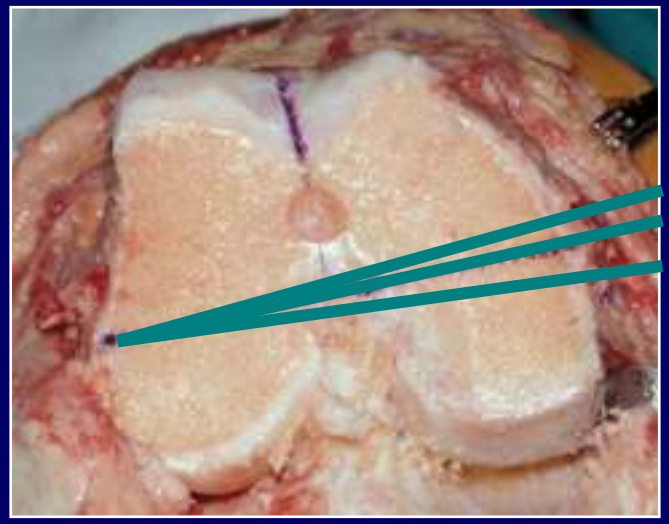


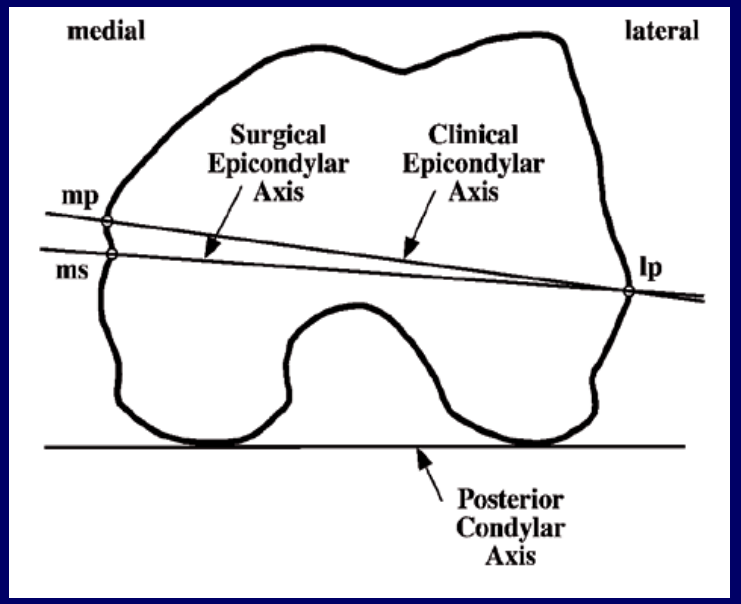
Femoral rotation

- Transepicondylar axis
- Whitesides line
- Posterior condyles
- Balanced gaps

Femoral rotation

Flexion-extension axis

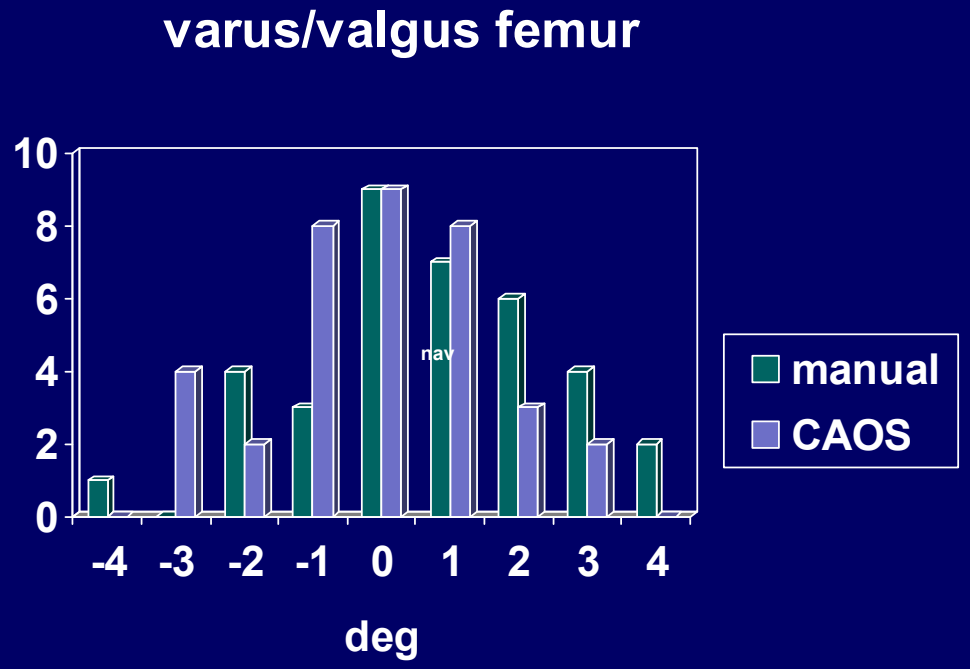




Asano *et al* **J Arthroplasty**, Vol 20(8), (2005)

Can navigation improve accuracy?

- Longstaff /Beaver 2007
  - No clinical difference



Does mechanical axis predict longevity?

		survivorship
• Mayo 14yr Pagnano	$<3^0$	84%
	$>3^0$	87%

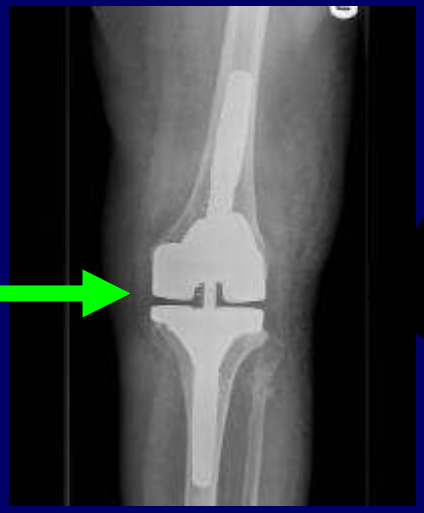
"Mechanical axis may be wrong target" Pagnano AAOS 2008

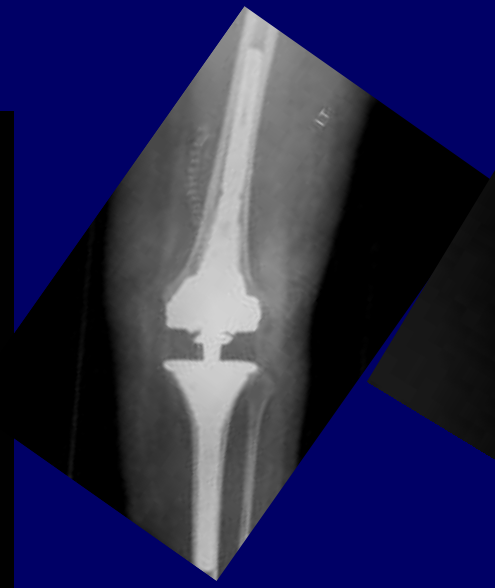
Instability

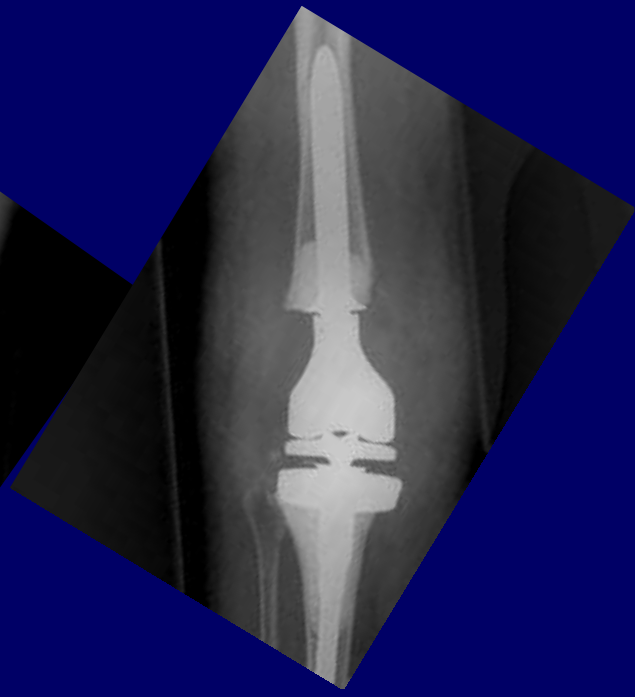
Aims

- Correct mechanical alignment
- Balanced soft tissues throughout ROM
  - NB MCL

Difficulties








STANDING
SLM,JR


STANDING

Ligamentous

- Range
  - Deficient → Absent

MCL

MCL

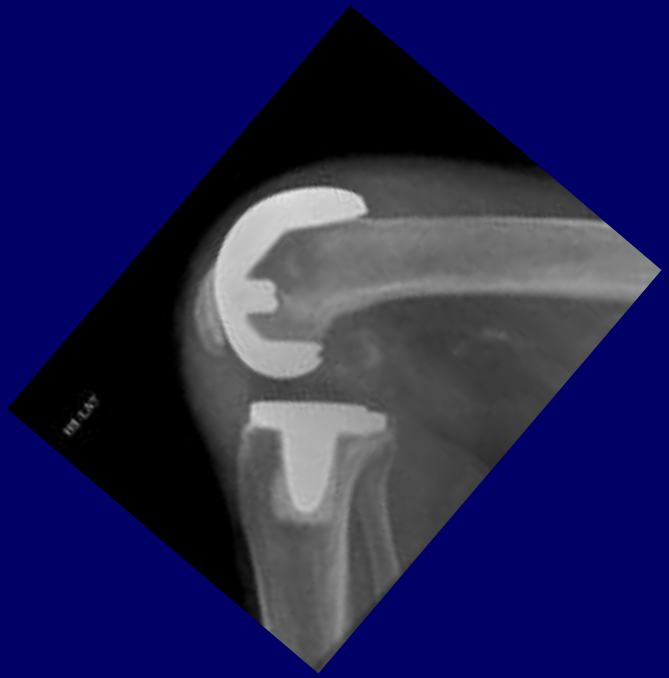
NB Approach

Posterior capsule

Instability

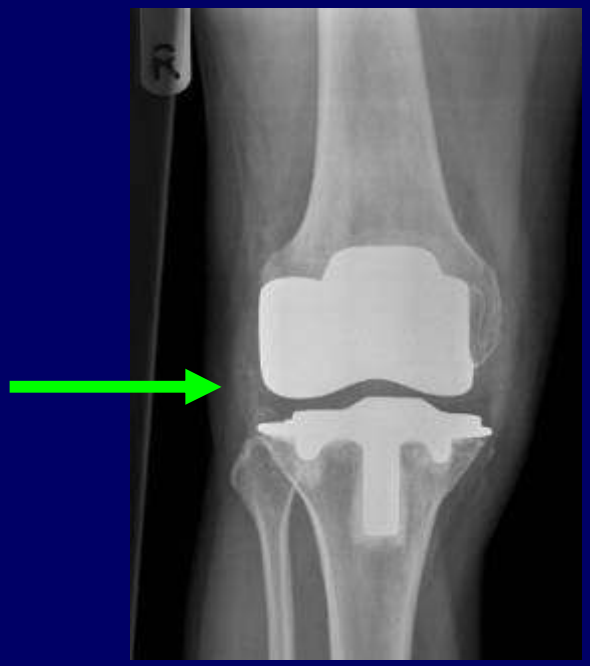
- Flexion
- Global
- Mid flexion

Flexion instability



Global instability

Global instability


R


R

Mid-range instability

mid-range instability

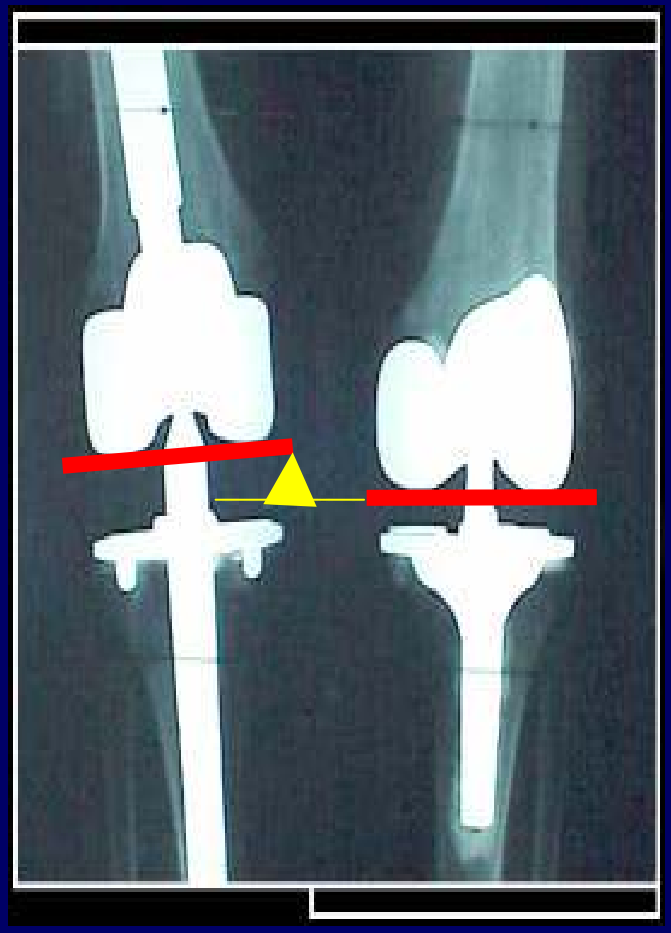
- Pain of unknown origin
- Medial pain
- AP translation
- M/L stress discomfort
- ‘not right’
- Lack confidence

- Incorrect femoral size/rotation
- xs tibial slope
- Incorrect joint height

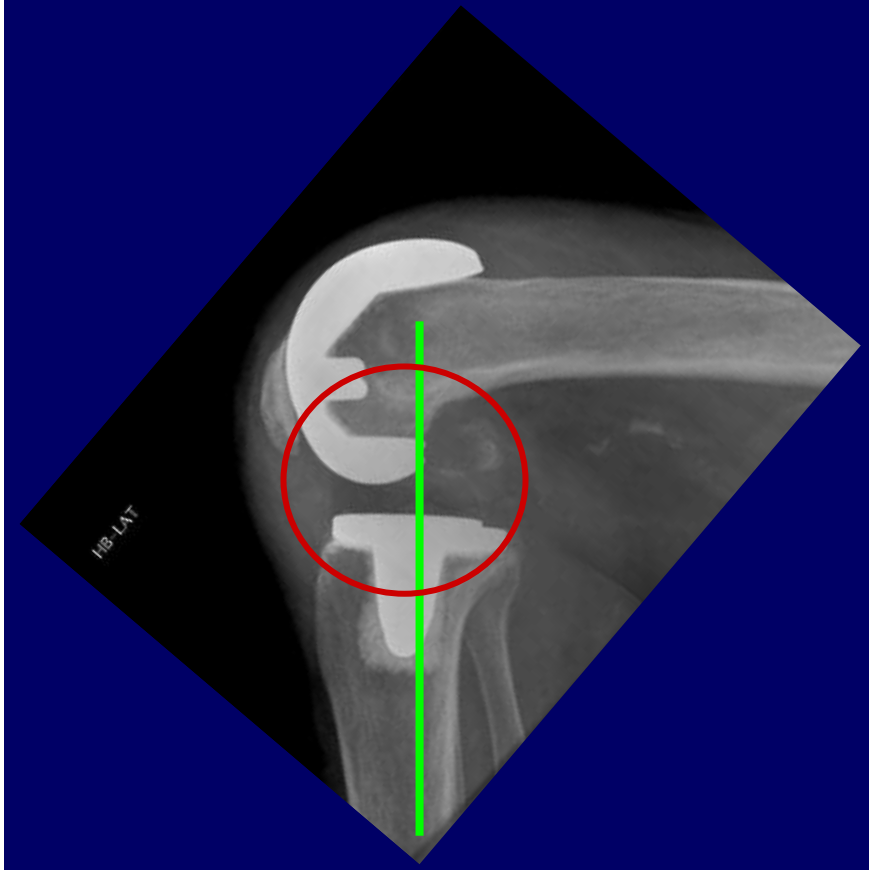
Mid range instability

Importance of Joint-Line Restoration

- Partington Corr 1999
  - elevated > 5 mm (79%)
- Whistler 2002
  - Knee soc. score
  - JL >8mm 125
    JL <8mm 141
- Whiteside Corr 1990
  - JL elevated 5mm
  - mid-flexion instability
  - ↑ manipulation
  - ↑ re-revision
  - ↑ pain



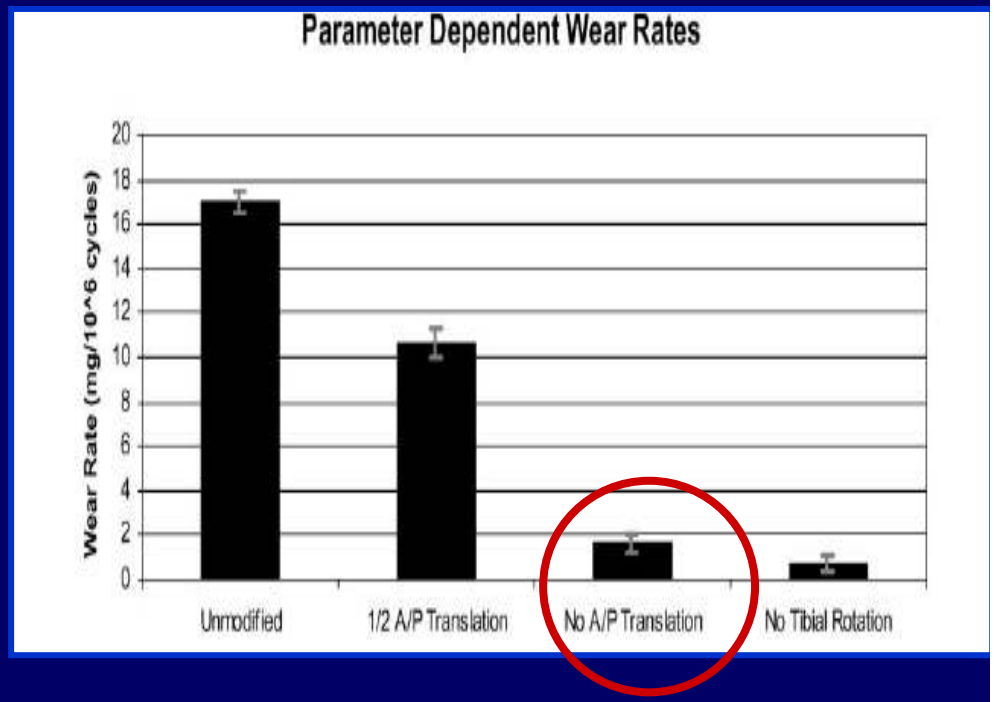
Paradoxical motion



Instability - wear

AP TRANSLATION AND TIBIAL ROTATION

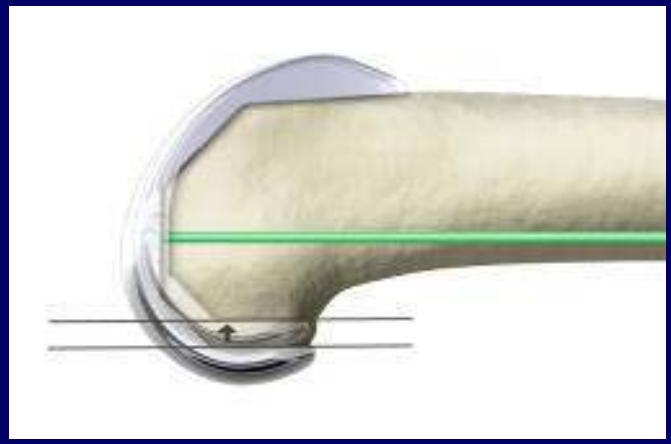
- Wear rates in knee simulator demonstrate significant reductions with reduced AP translation



Johnson *et al,* **Wear**, 250, (2001)

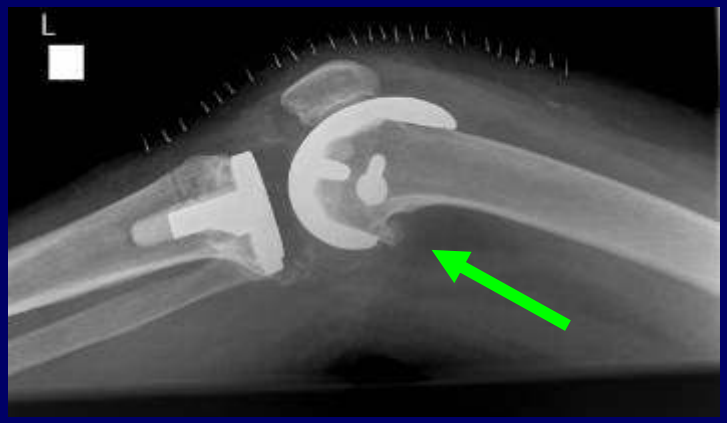
Downsizing

LCS



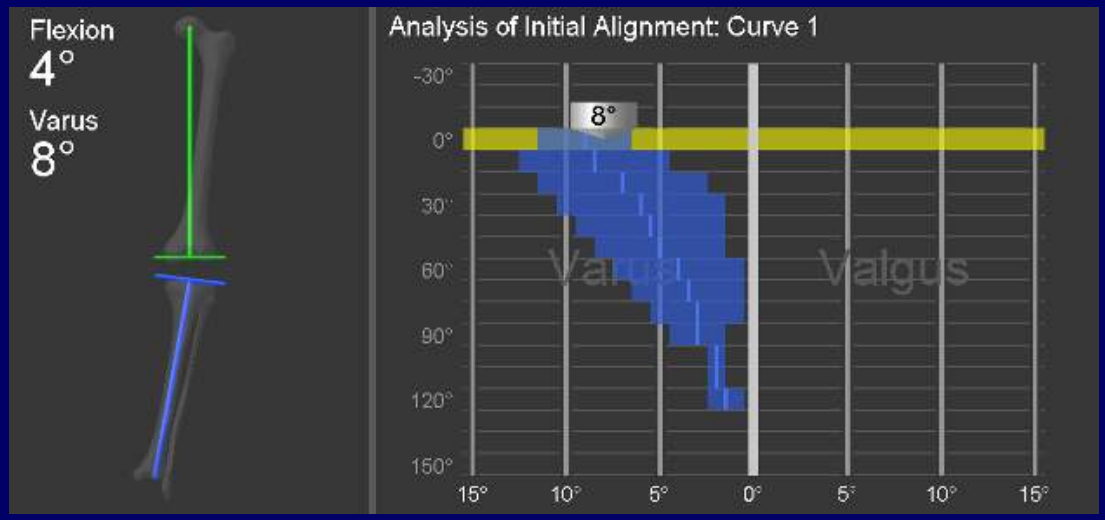
Extension

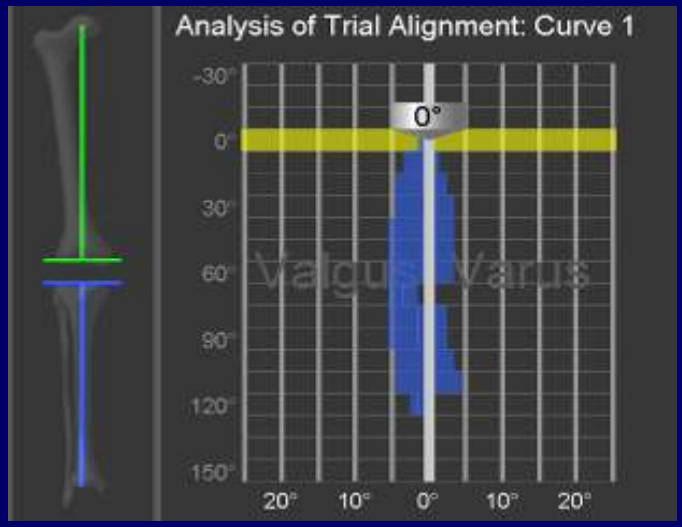
- ~~Xs femoral resection~~



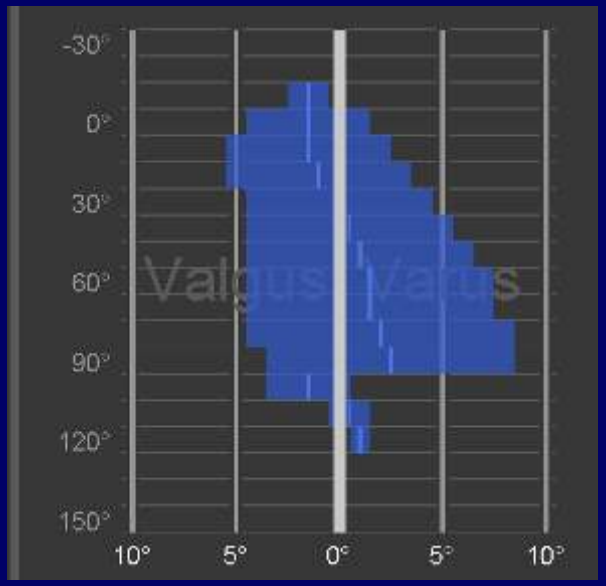
Muller/Reed

Soft tissue envelopes

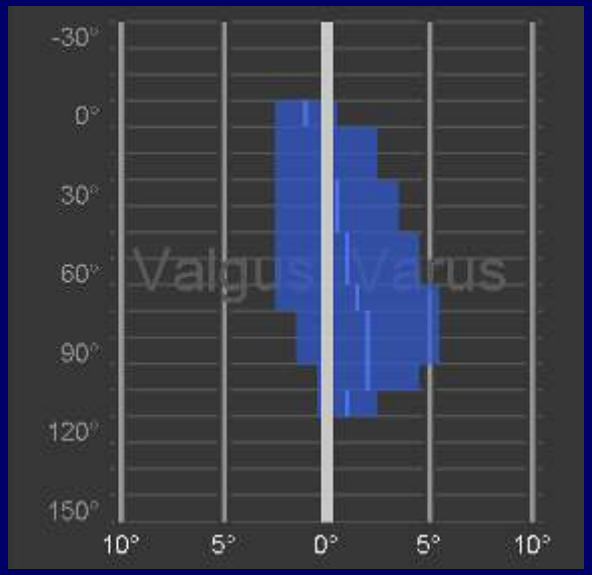




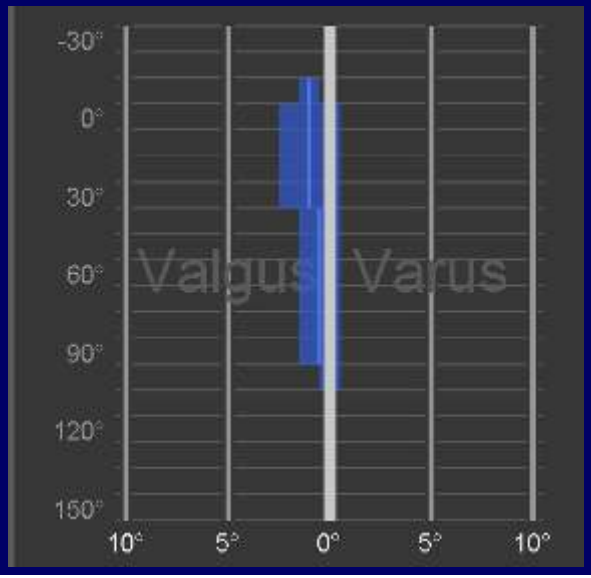
9mm



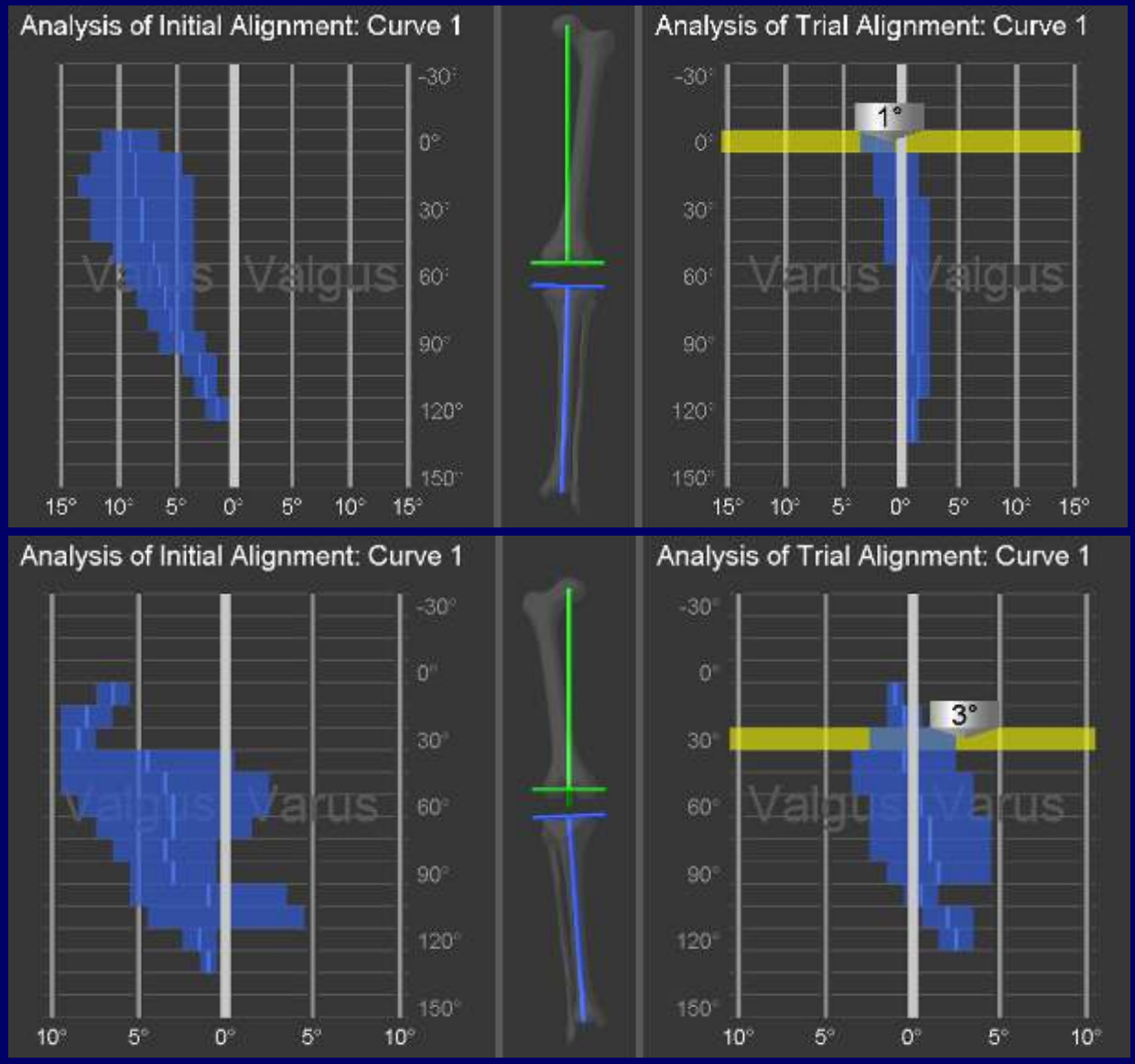
11mm



13mm

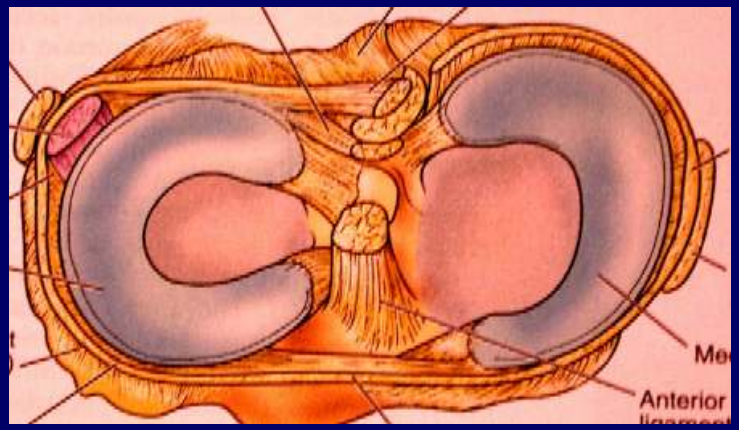


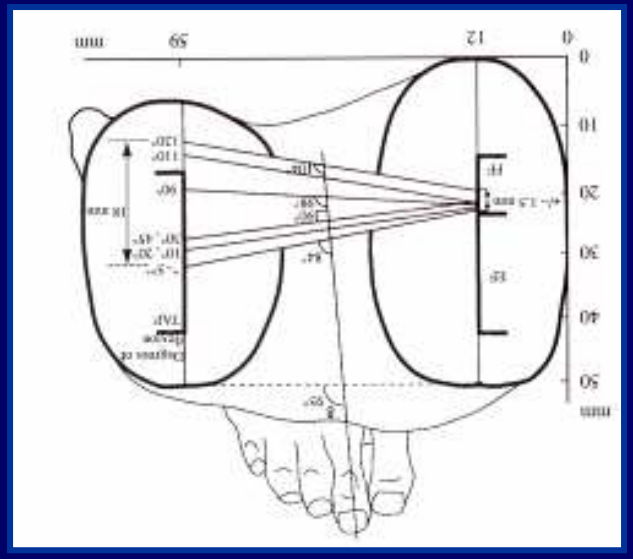
Rotation kinematics



Kinematics

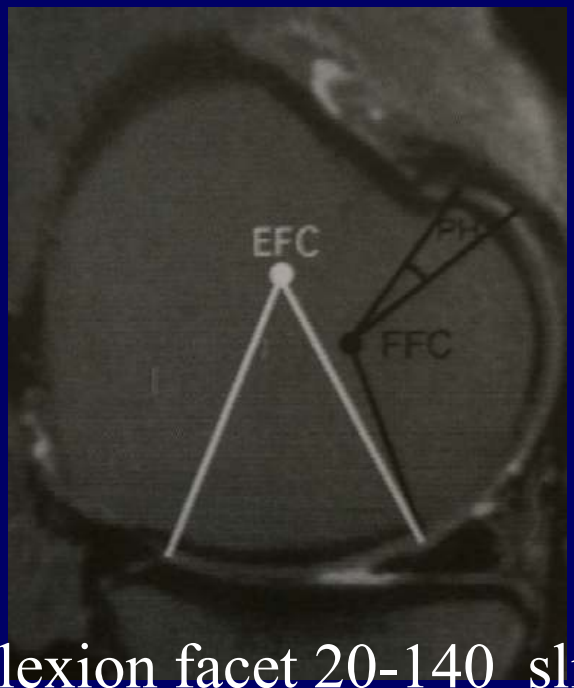
Form follows function





Freeman

Medial femoral condyle

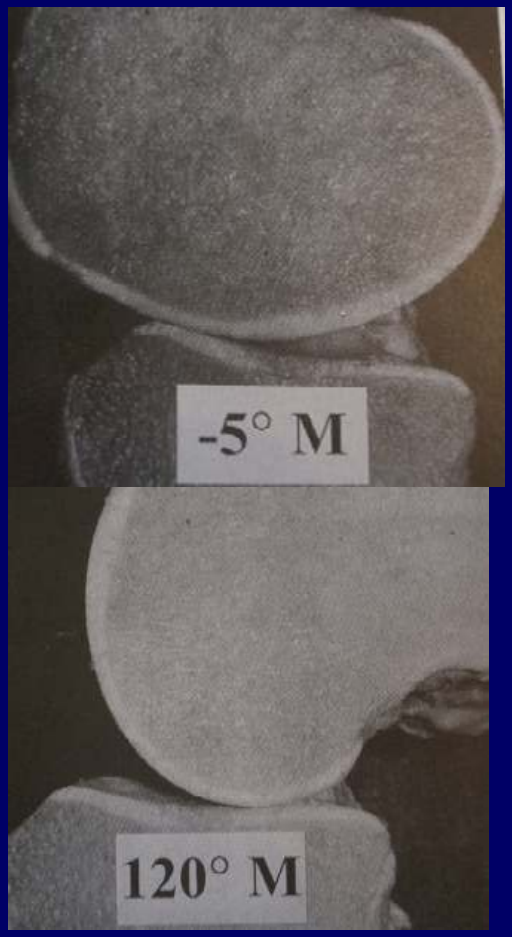


Flexion facet 20-140 slide

Extension facet –5-20 roll

Humans only

Knee lock out - erect stance



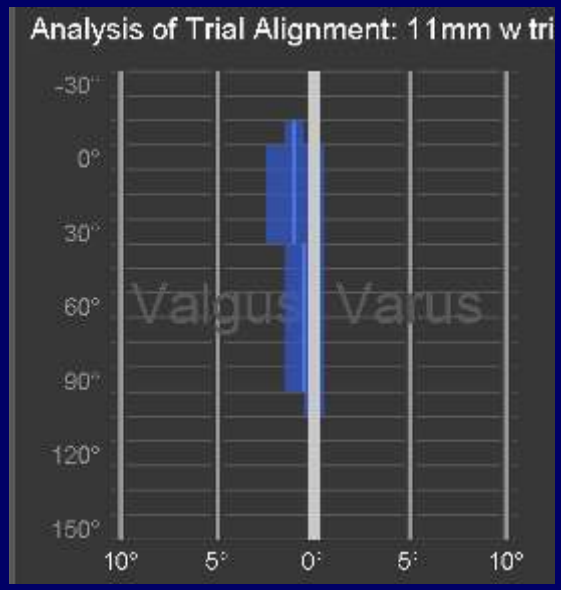
No rollback

Rotation kinematics

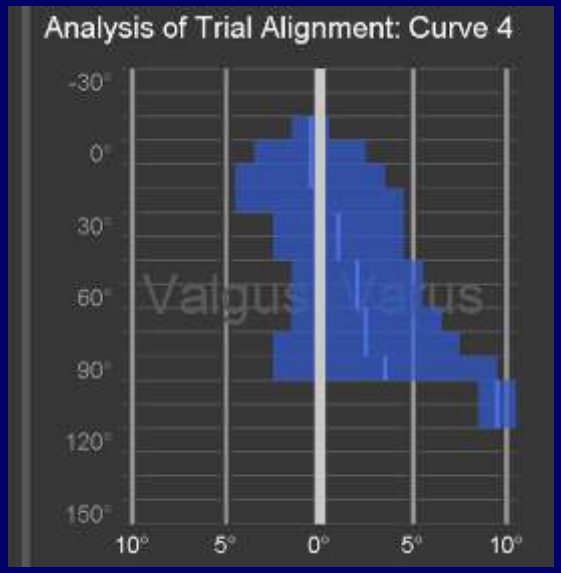
kinemax

triathlon

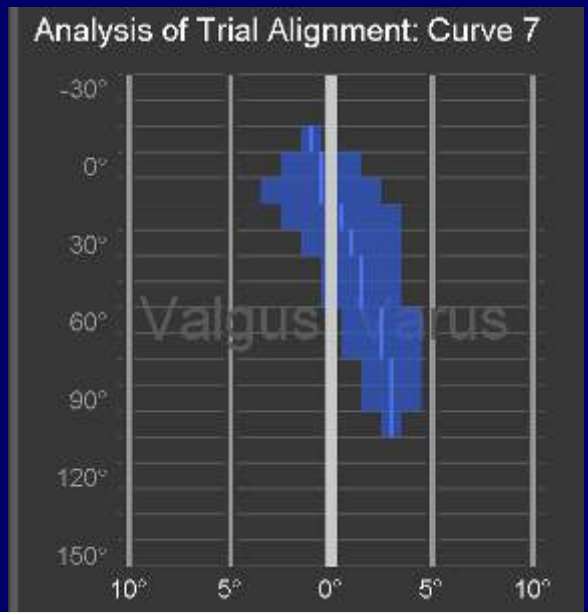
11mm triathlon



8mm kinemax

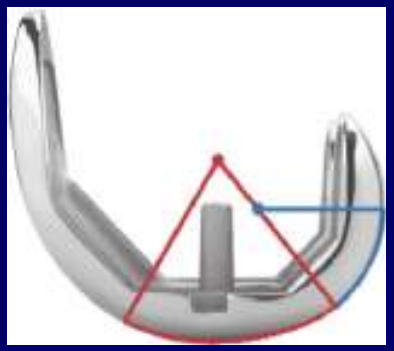


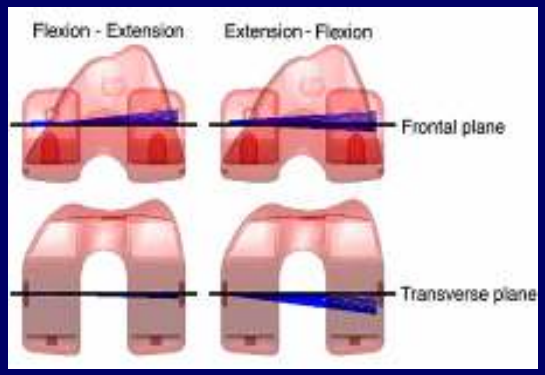
12mm kinemax

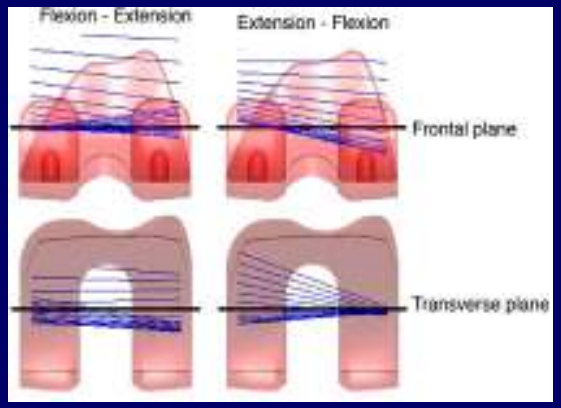


A- P translation

- As AP glide is associated with increased abrasive wear of the tibial component a reduction should lead to improved wear properties in single radius knees







Kessler *et al* **Clinical Biomechanics**, 22, (2007)

Extra-articular

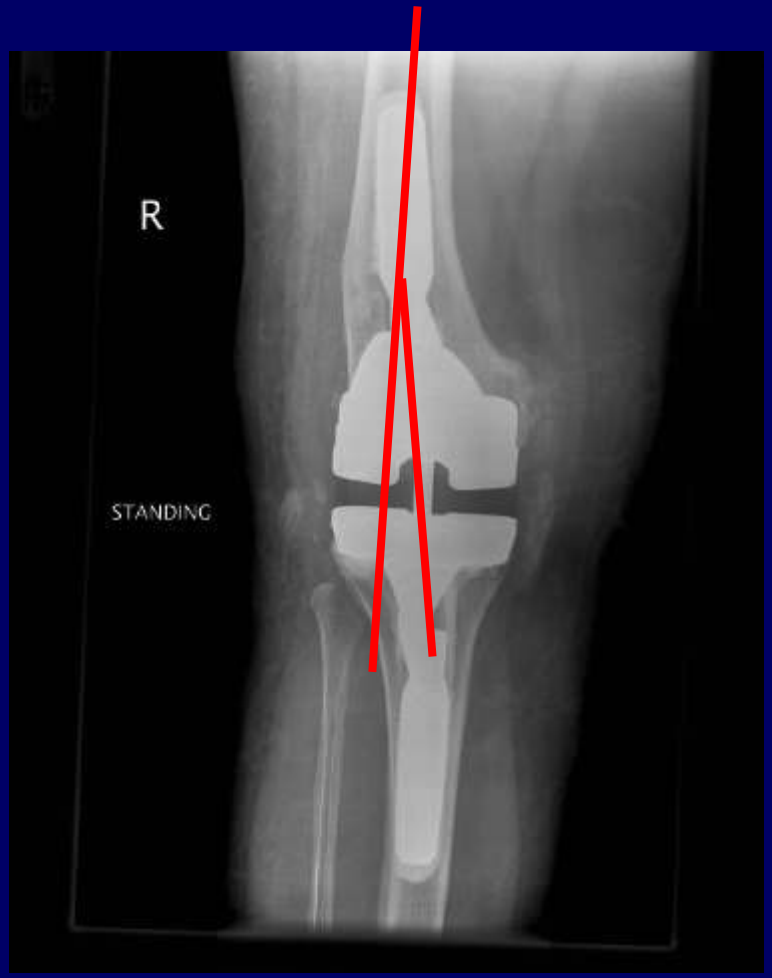
- Long leg alignment
- Joint perpendicular to long axis
- Distance from joint
- Maintain stability THROUGHOUT ROM
- ~~Intra-articular correction of extra-articular deformity~~

Flexion / Extension

Extra-articular

- Simple

Osteotomy with deformity



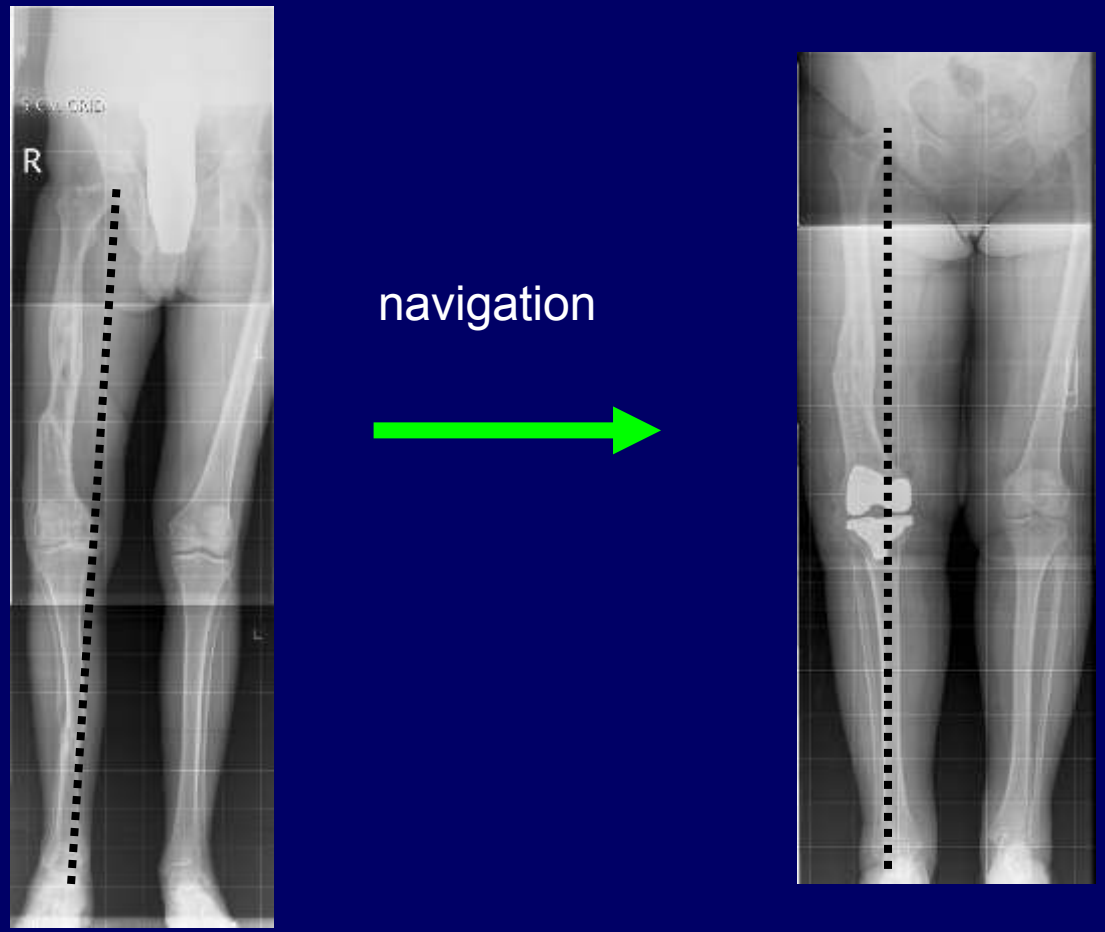
- Wang et al 2002 intra-articular bone resection

  15 pts
- Lonner et al 2000 simultaneous osteotomy

  10% non-union

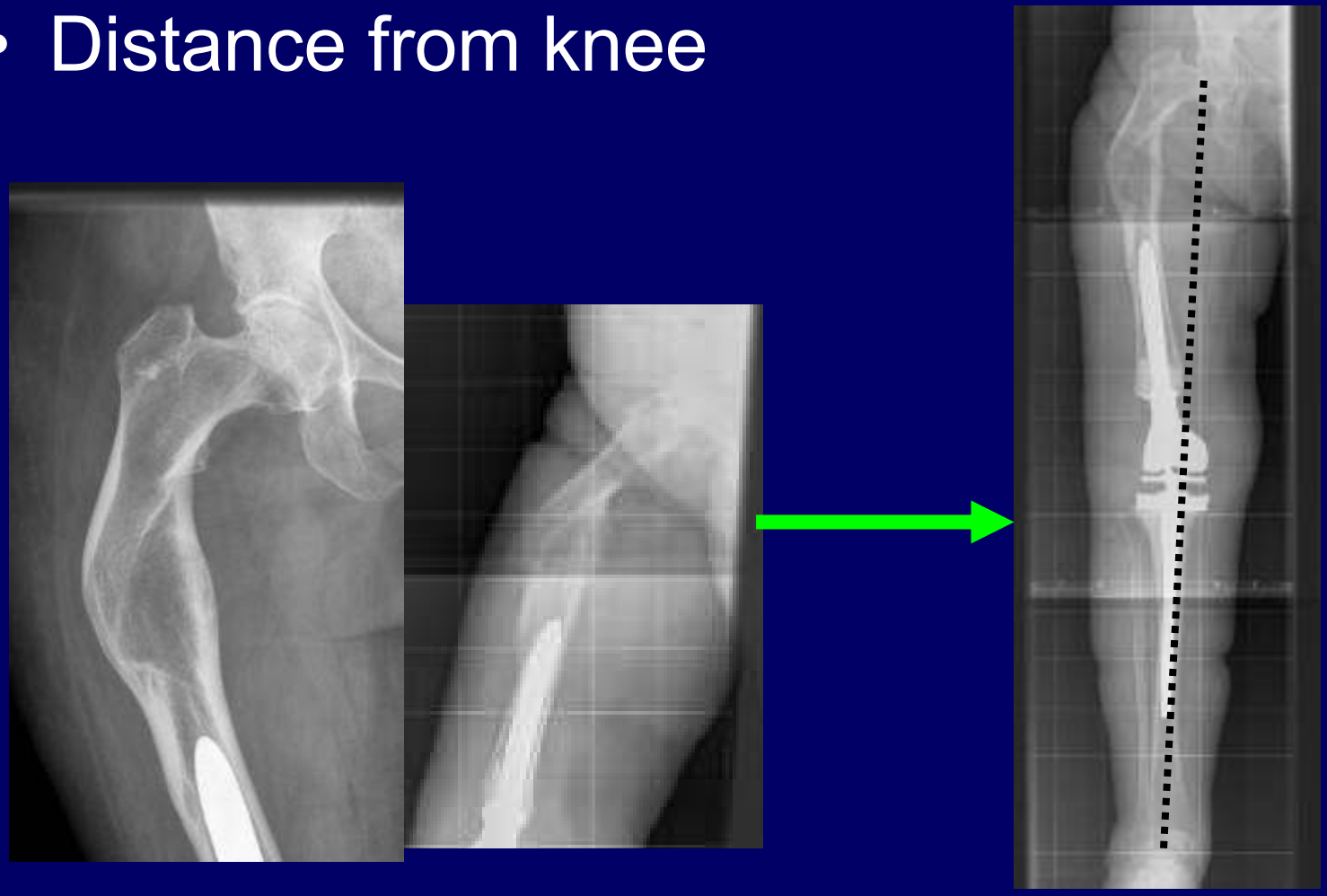
Extra-articular

- Translation / angulation



Extra-articular

- Distance from knee



Stiffness

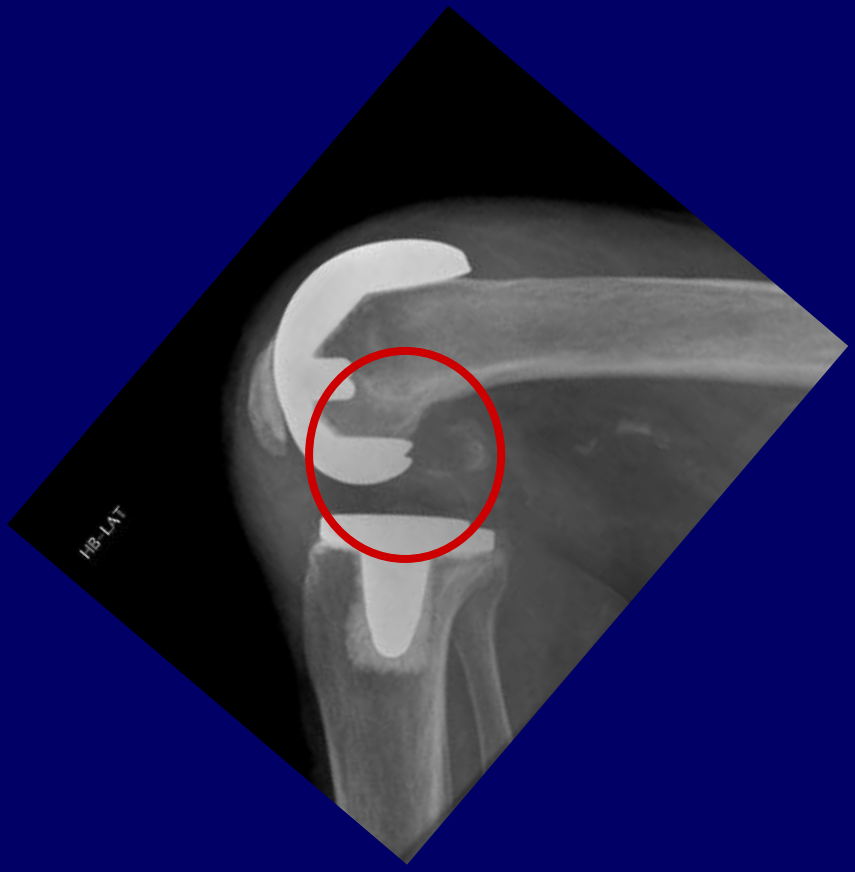
- Arthrofibrosis
- Surgical technique
  - Maru, Port Eur J Surg Trauma 2009
  - Mid vastus/in situ vs conventional
- Mal-position

Baha

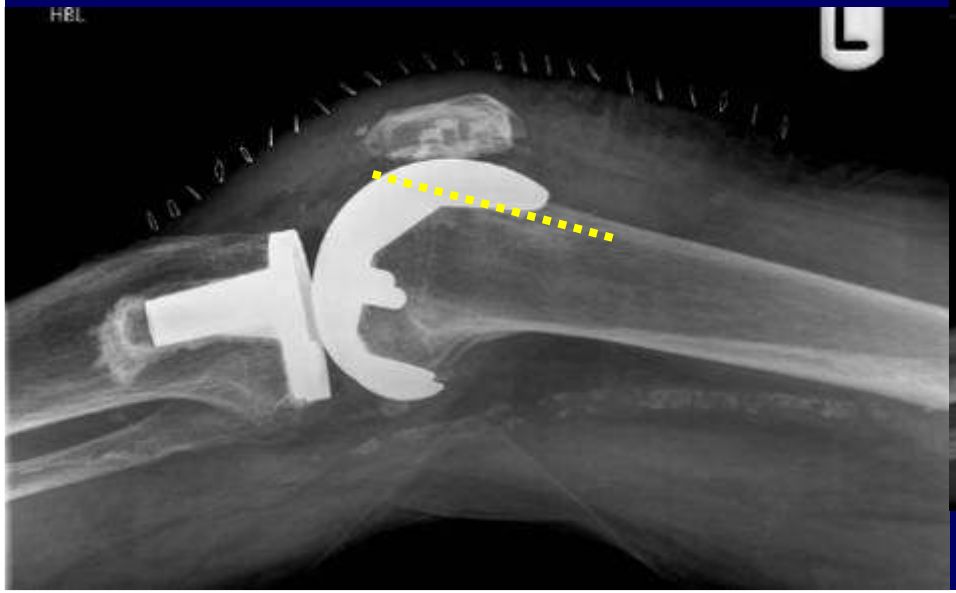
Bony ankylosis

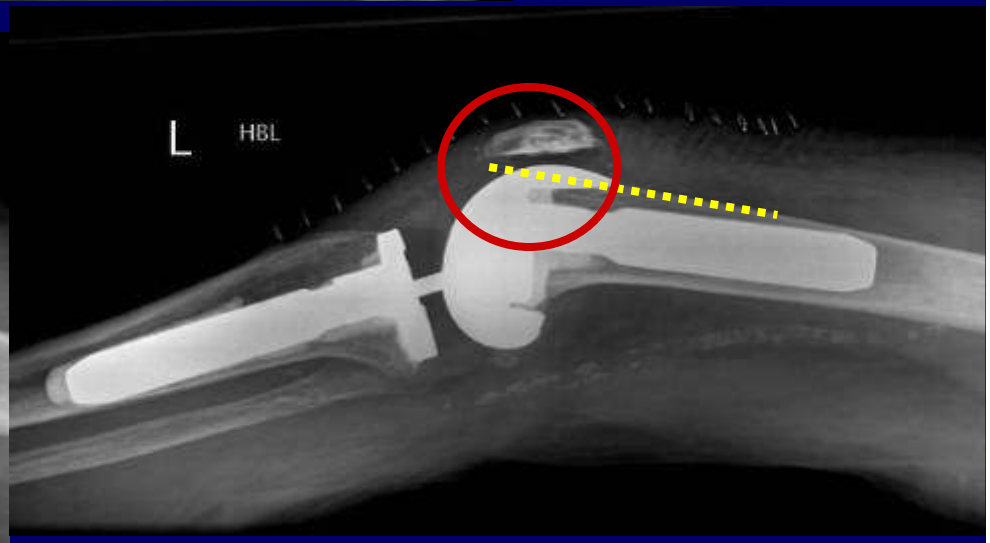
Posterior condylar offset

Deehan/Ghosh



Patella offset





Summary

- Prosthetic design may be important
- Accurate placement
- Important to individualised TKR
- Instability produces
  - Symptoms
  - Wear
- Axial alignment not whole story
- Global stability may be important
  - Not just F/E gaps

Summary

- Future
  - Effect of surgical accuracy on outcome

Extra-articular

- Complex
- Multiple CORA