Newer designs in Knee replacement
The good ,bad & ugly!

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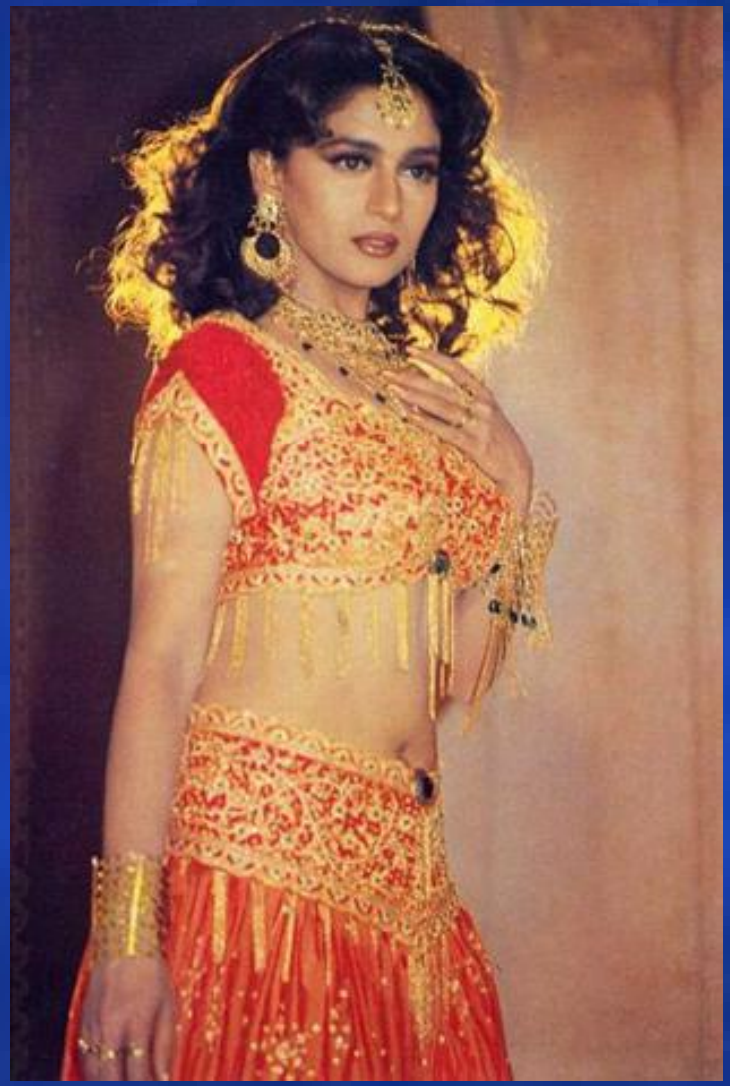
Joint replacement surgeon
COLUMBIA ASIA HOSPITAL, GZB.


COLUMBIA ASIA

Fresh face evokes excitement!



How do we pick our implants?

Training/fellowship experience

Wise colleagues influence

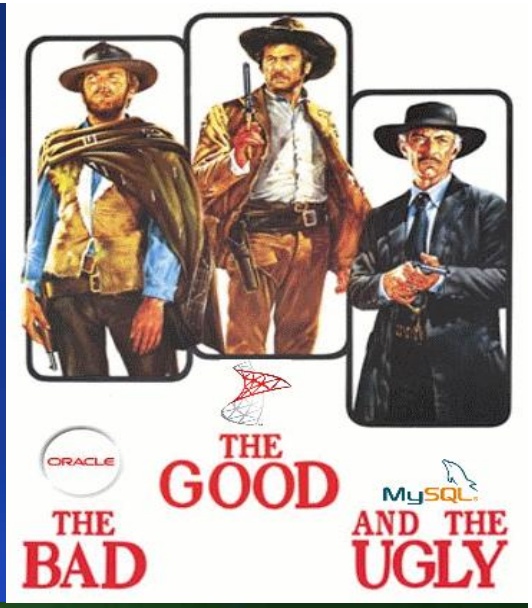
Literature review

Trade influences

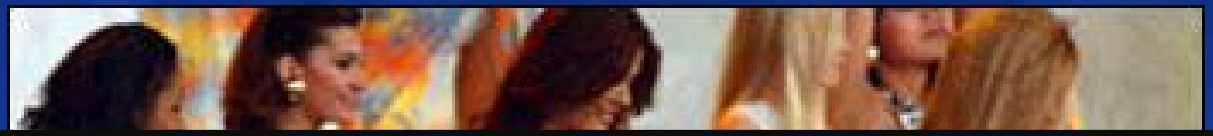
By our hospital

CME

Yet ..Good, Bad, Ugly!



Technological advances are trying to meet demands of today's genre.



Good--technological innovation

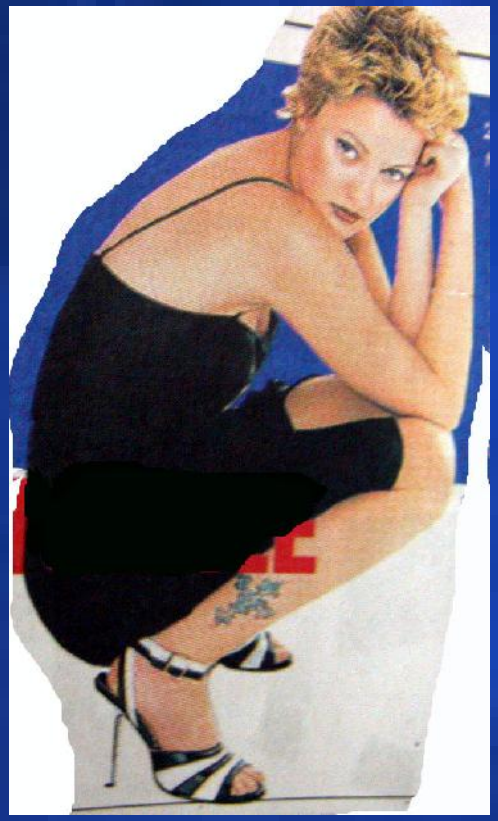
Bad--- conflicting report about its reflection in clinical practice

Ugly---Disastrous effects if any!

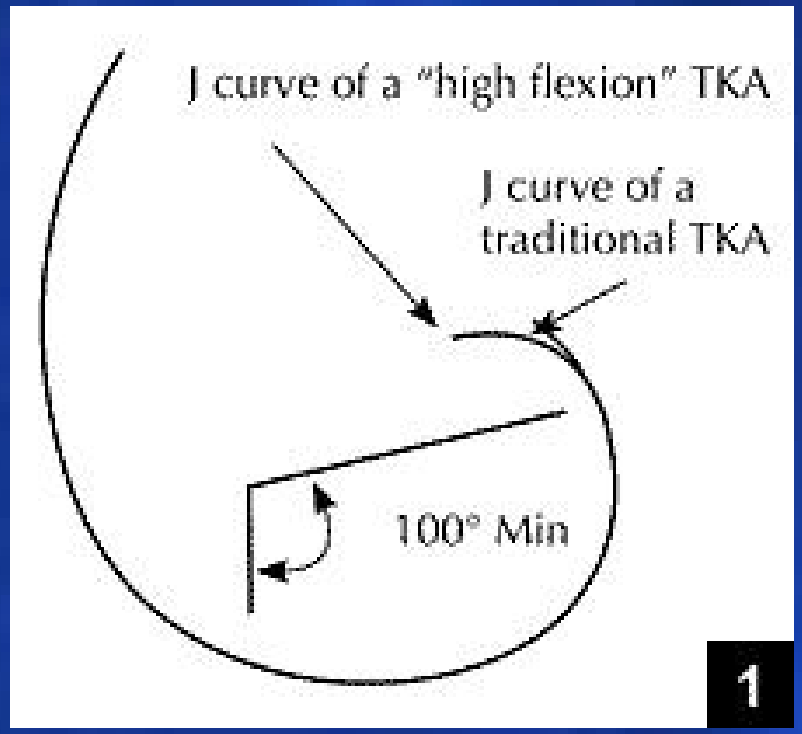
Points For Discussion

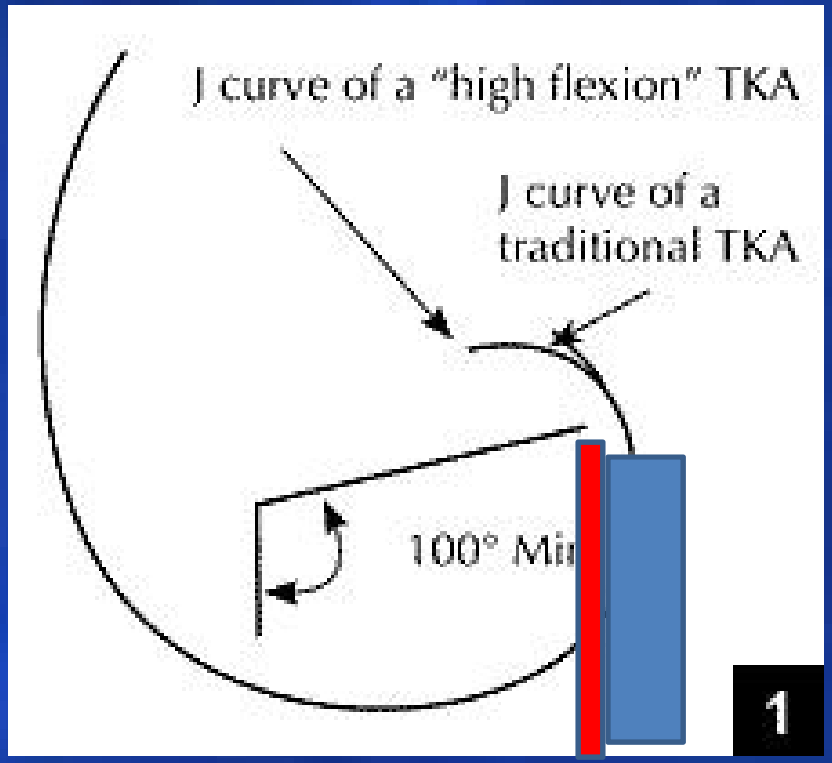
- Hi flex knee
- Single Radius Implants
- Gender specific implants
- Mobile bearing knee
- Oxinium Interface
- Uncemented Fixation
- Computer navigation
- Debutant – *'Fresh Off the Boat'*

Hi Flexion Designs

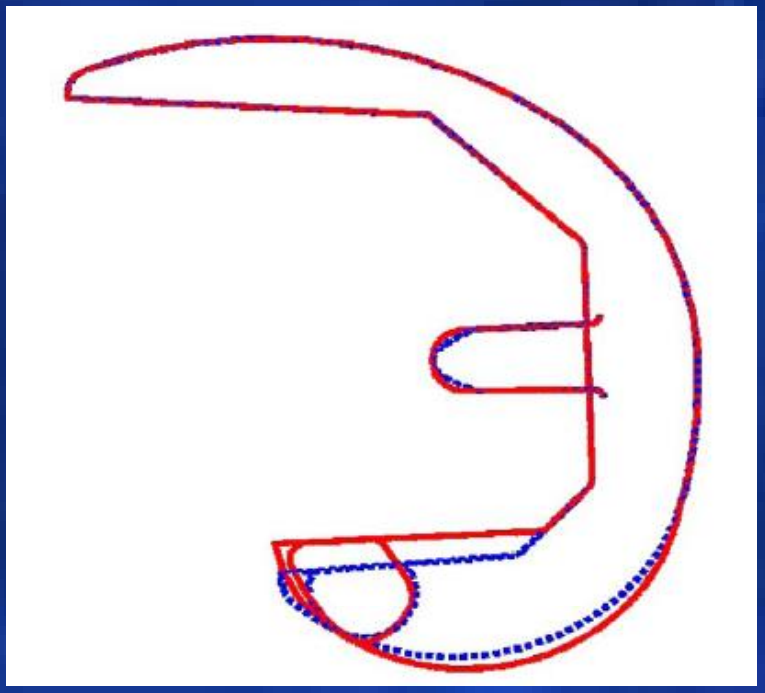


High flexion/high performance joints



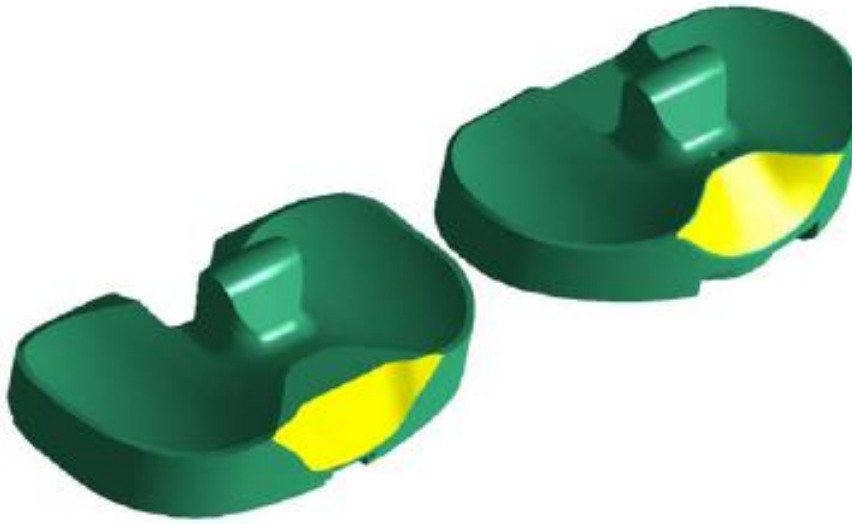


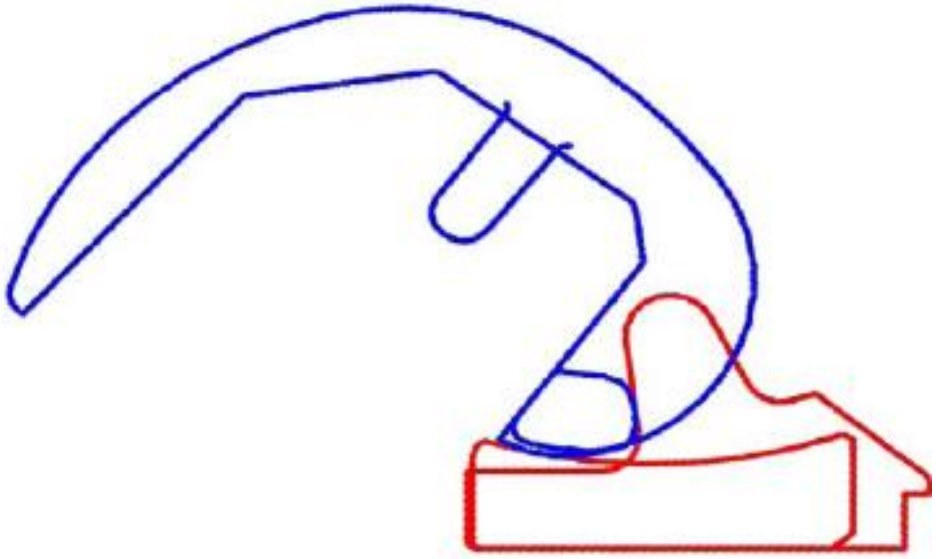
Extra bone cut reqd.



Design modifications:

P condyle offset, Poly shape, Tibial slope





Posterior stabilized

(non high flex)

High flexion design- Post. condylar offset

VERDICT

- Preoperative ROM remains the best guide
- Huang: Significantly better Flexion Esp – Preop < 90.
- Laskin, Bin et al: Better than Standard

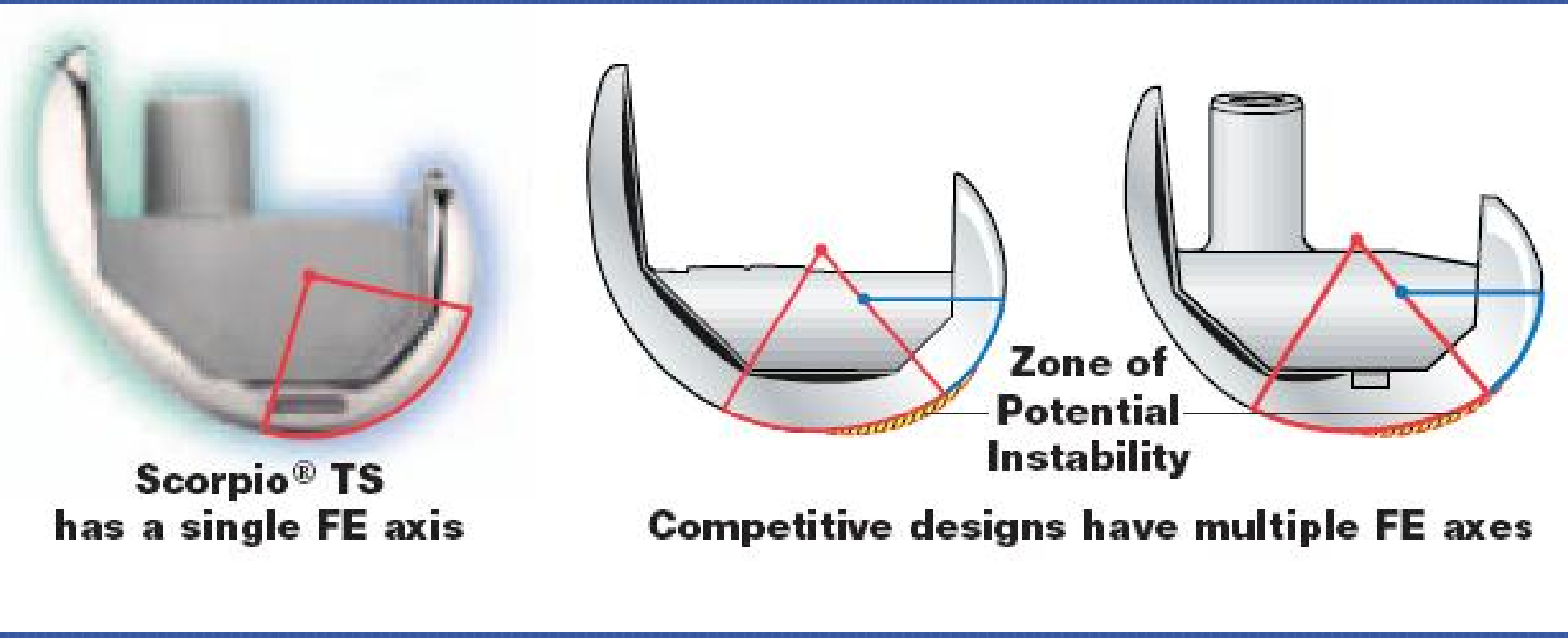
Good

Hi Flexion Knee

- Kim YH 2005; 2008: no benefit
- Meta Analysis: No benefit (Int Orth)
- Down side: Extra Bone Cut, ? Femoral loosening – earlier, Cost
- Long term results awaited

Bad

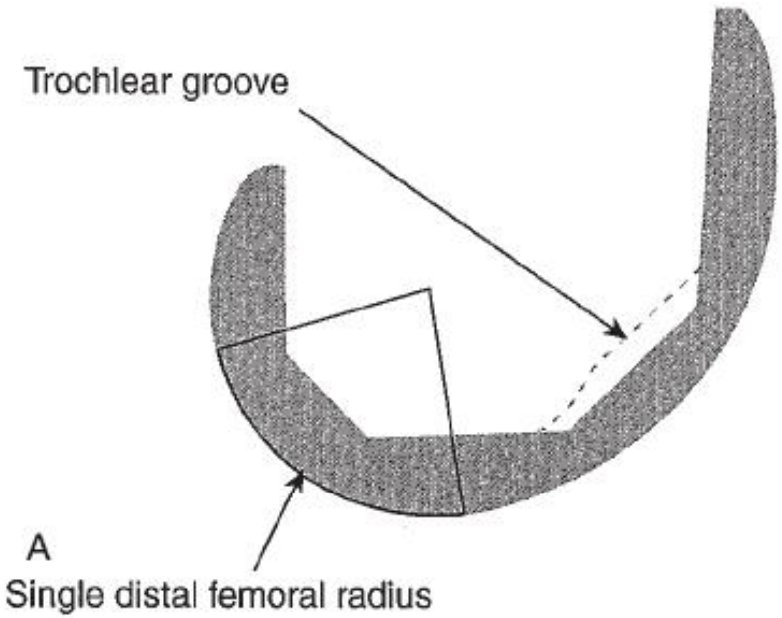
SINGLE RADIUS IMPLANTS



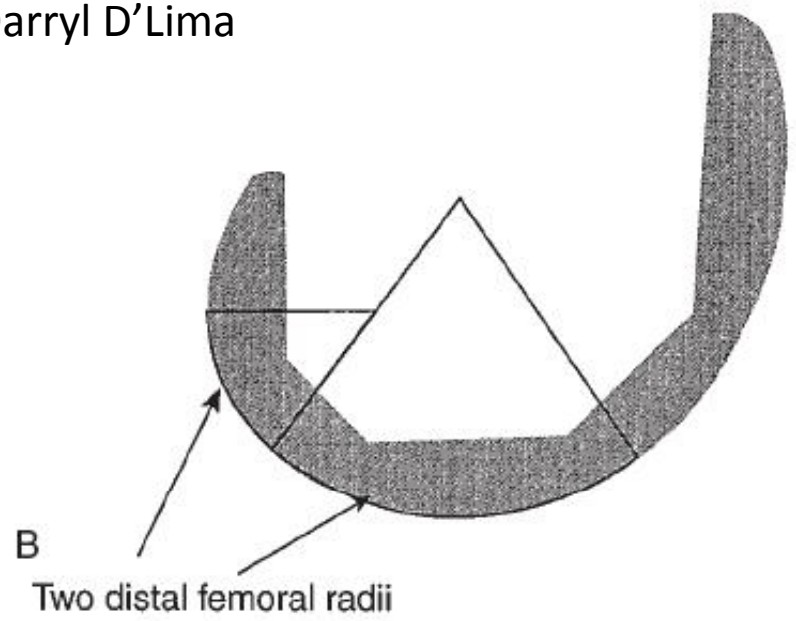
Scorpio® TS
has a single FE axis

Competitive designs have multiple FE axes

Single radius implants-in vitro studies



Darryl D'Lima



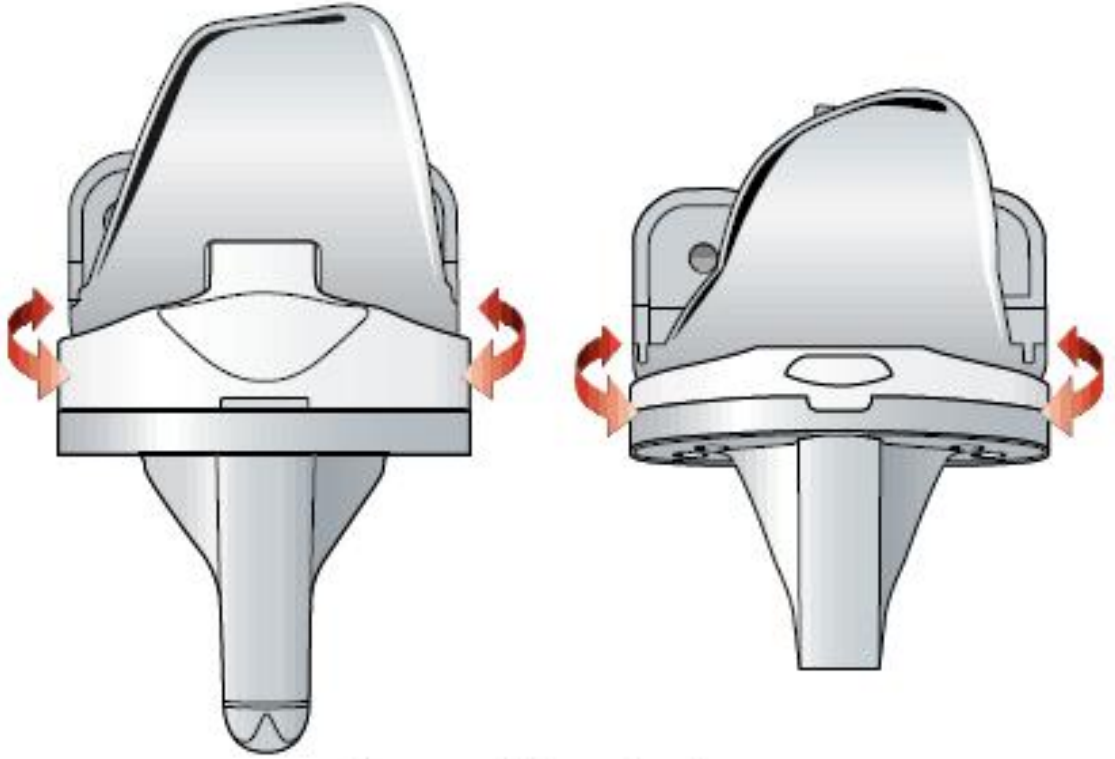
Reduced Q forces→

reduced P-F forces →

↓ed anterior knee pain

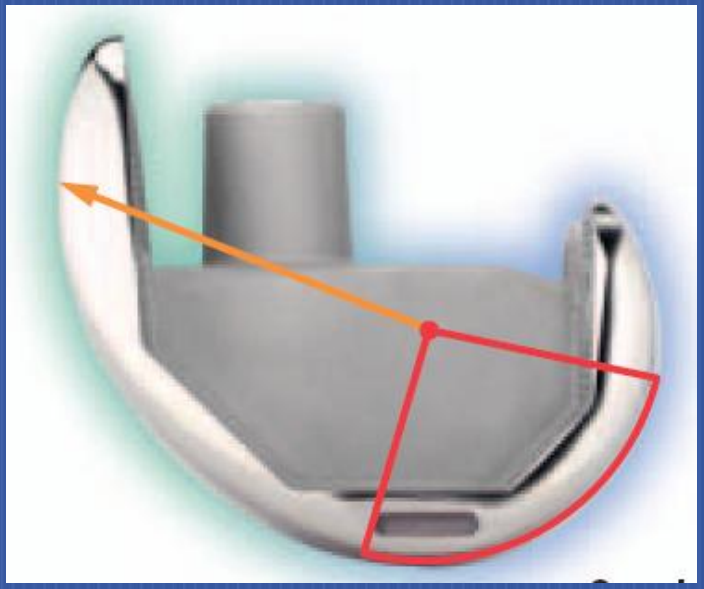
Good!

Scorpio® TS
allows up to ±10° of internal/external rotation



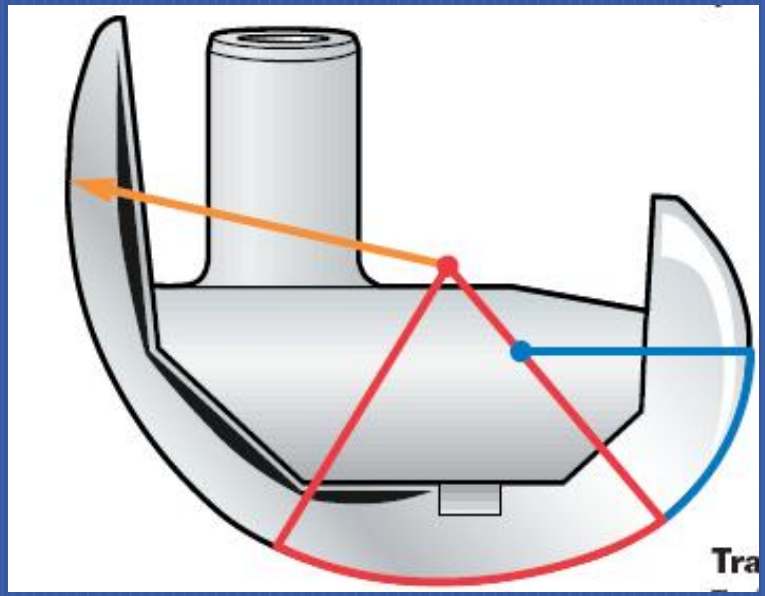
Competitive designs
allow only ±4° of internal/external rotation

Good!



Scorpio® Knee Design

Single axis patello-femoral moment arm is longer than that of traditional designs and Scorpio® has a single distal/posterior radius, providing smooth rotation.



Traditional Design

Traditional multiple axis patello-femoral moment arm and multiple radius distal/posterior condyles has transition points in rotation.

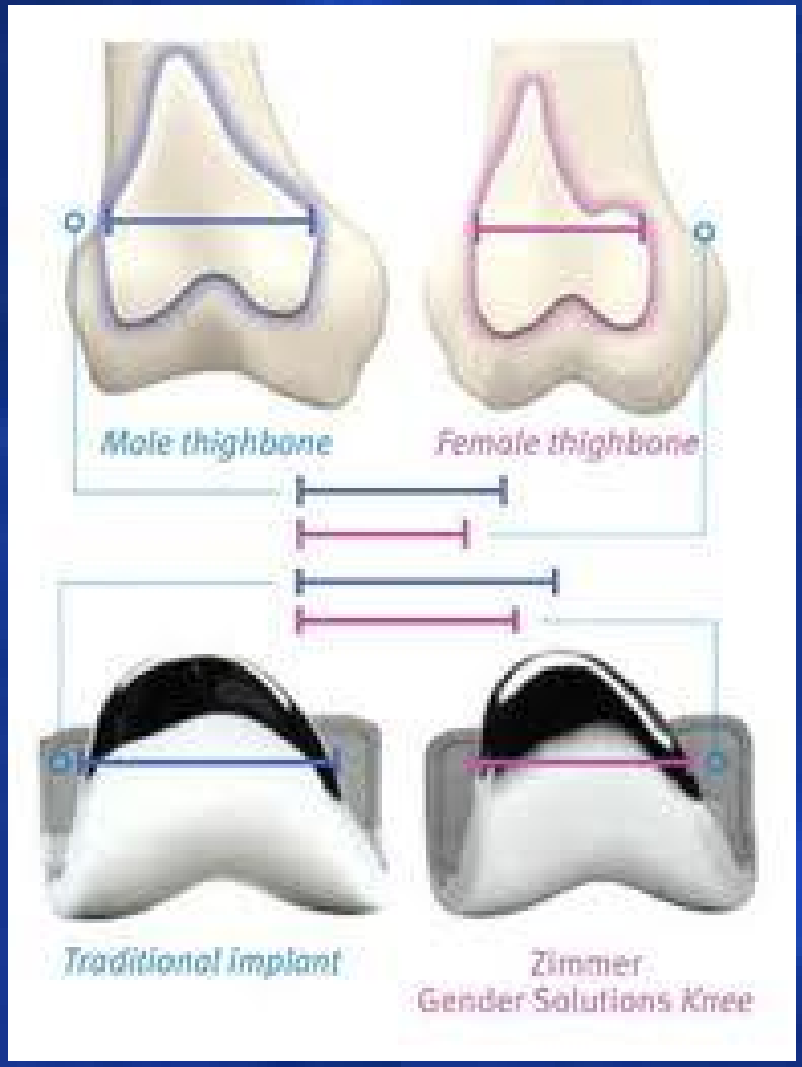
- Authors(Darryl D’Lima et al) found equal extensor mechanism function in subsequent publication between both knees in clinical study.
- Extensor mech. function in single radius Vs multiple radius ….JOA February 2008
- Compared Scorpio with PFC sigma CR knees.
- 50 knee in either group.

Bad!

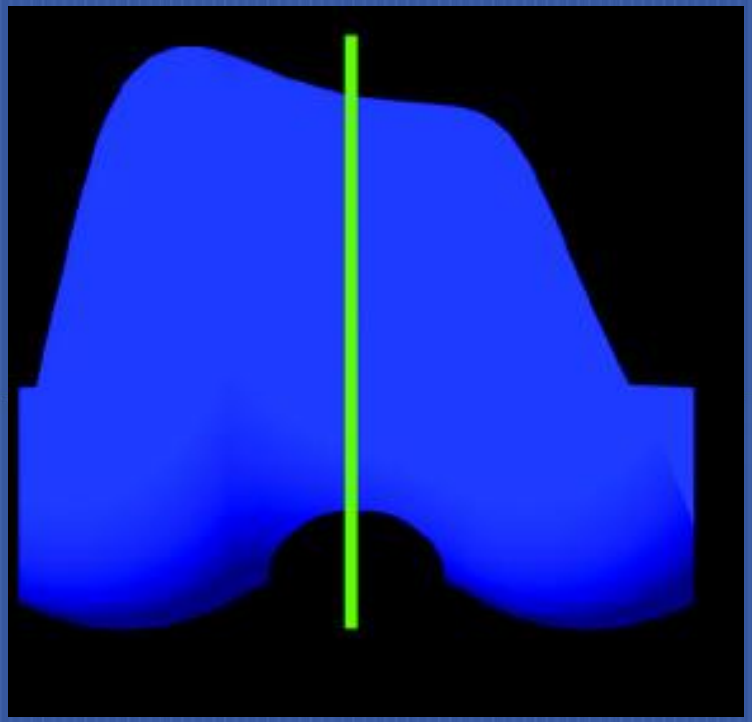
- Increasing the collateral ligament tension in flexion----due to posteriorly displaced axis of rotation---may decrease the actual flexion occurring in the knee.

----Chung

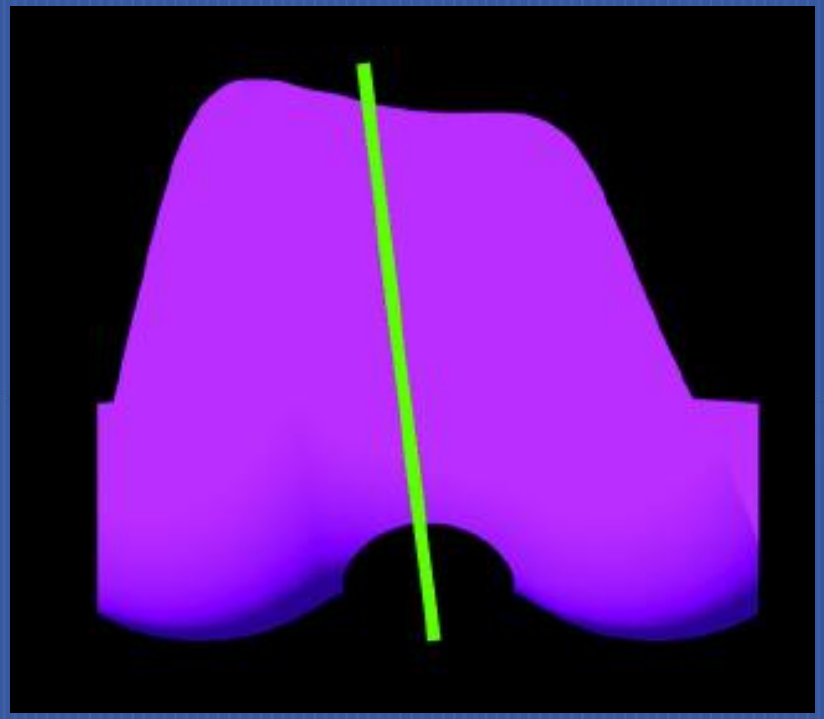
Gender Specific Implants



Do we really need the separate knees for males & females?

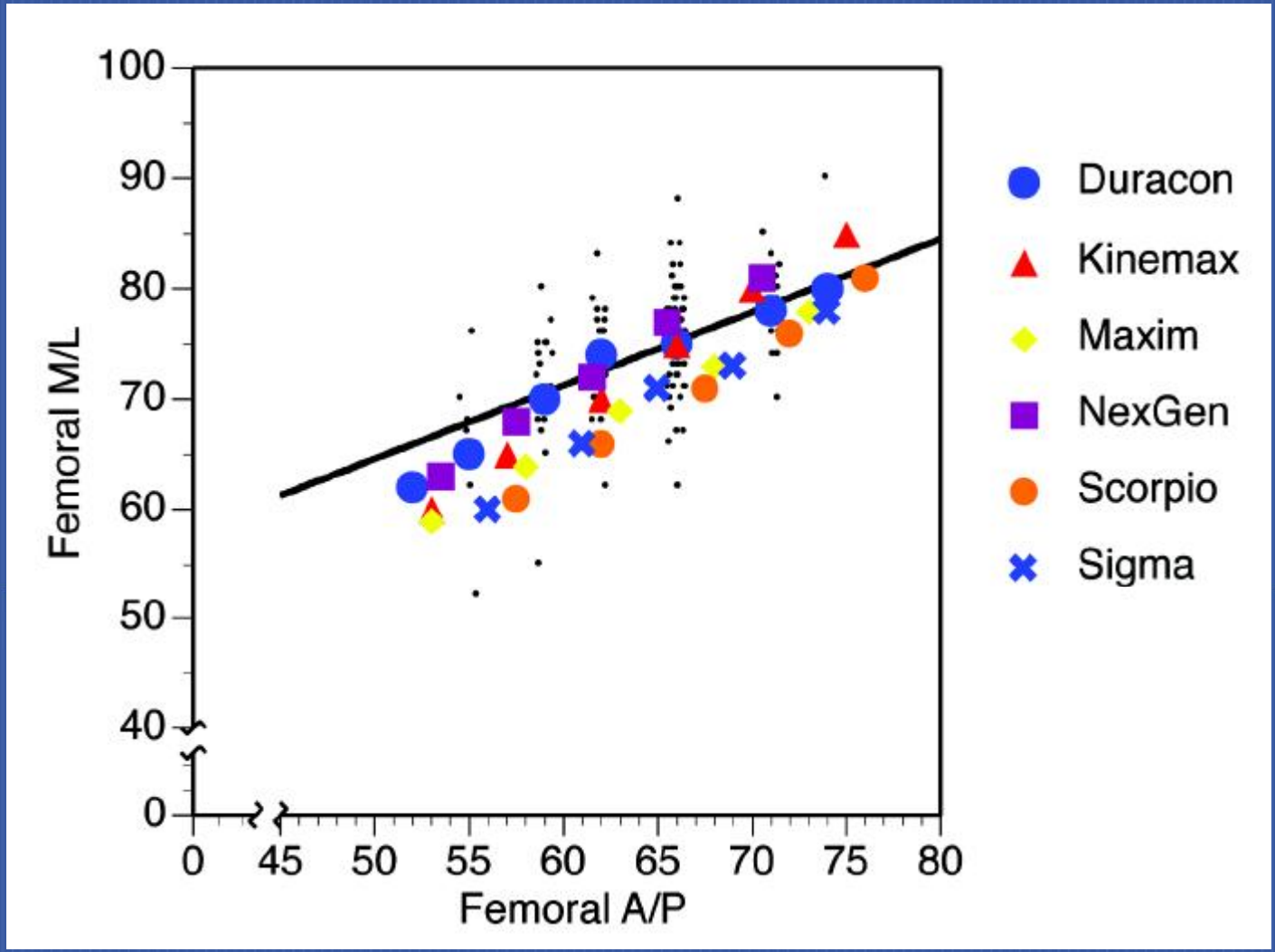


No Valgus Alignment



: 7 degrees Valgus Alignment

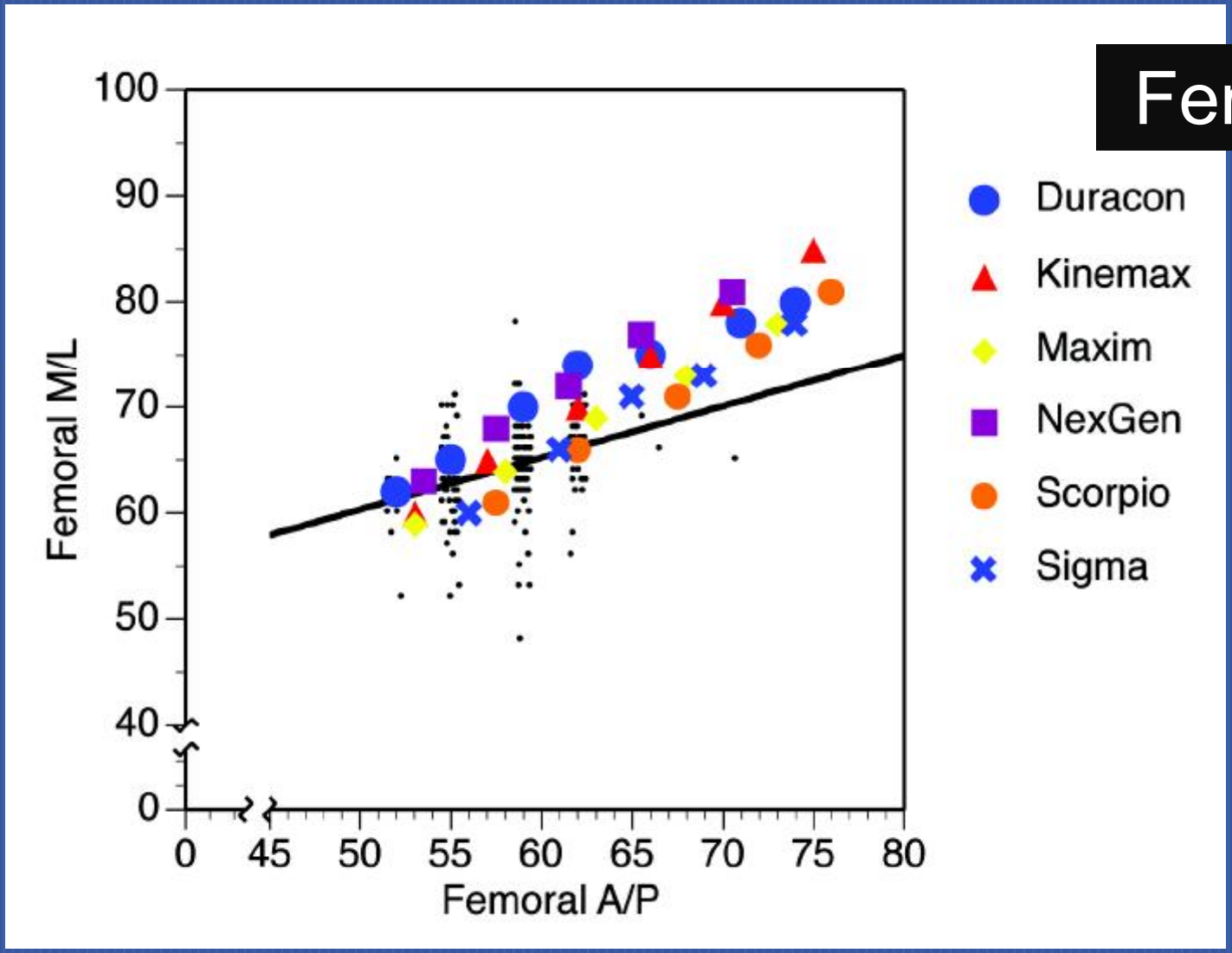
Males



Femoral Aspect ratio=
Femoral ML dimensions ÷ femoral AP dimensions x 100

Femoral Aspect ratio=

Femoral ML dimensions ÷ femoral AP dimensions x 100

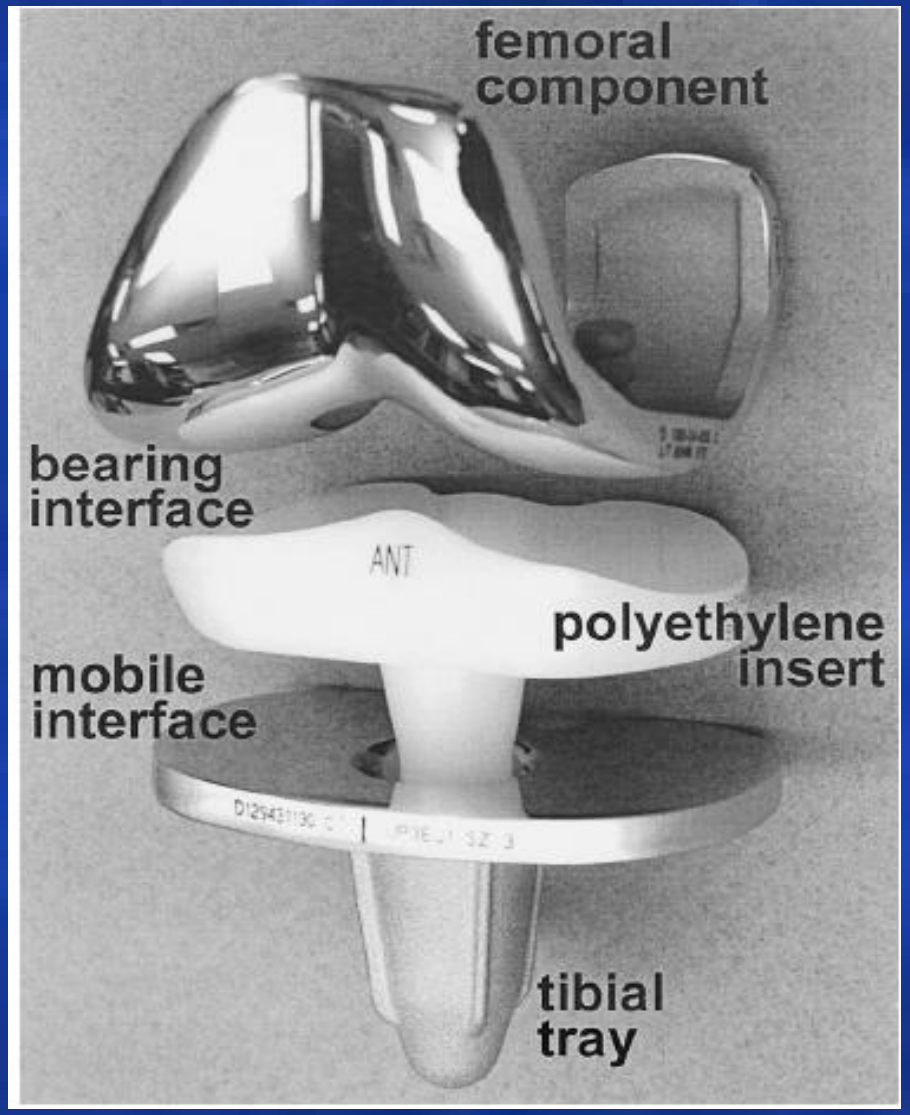


J Arthrolasty -2008-Merrill Ritter

- Improvement after TKA is similar for men and women, with few clinically significant differences.
- Sex-specific implants would appear to offer no clinical advantage
- 7326 AGC (Biomet)cruciate-retaining TKAs performed from 1987 to 2004

Bad!

Mobile bearings

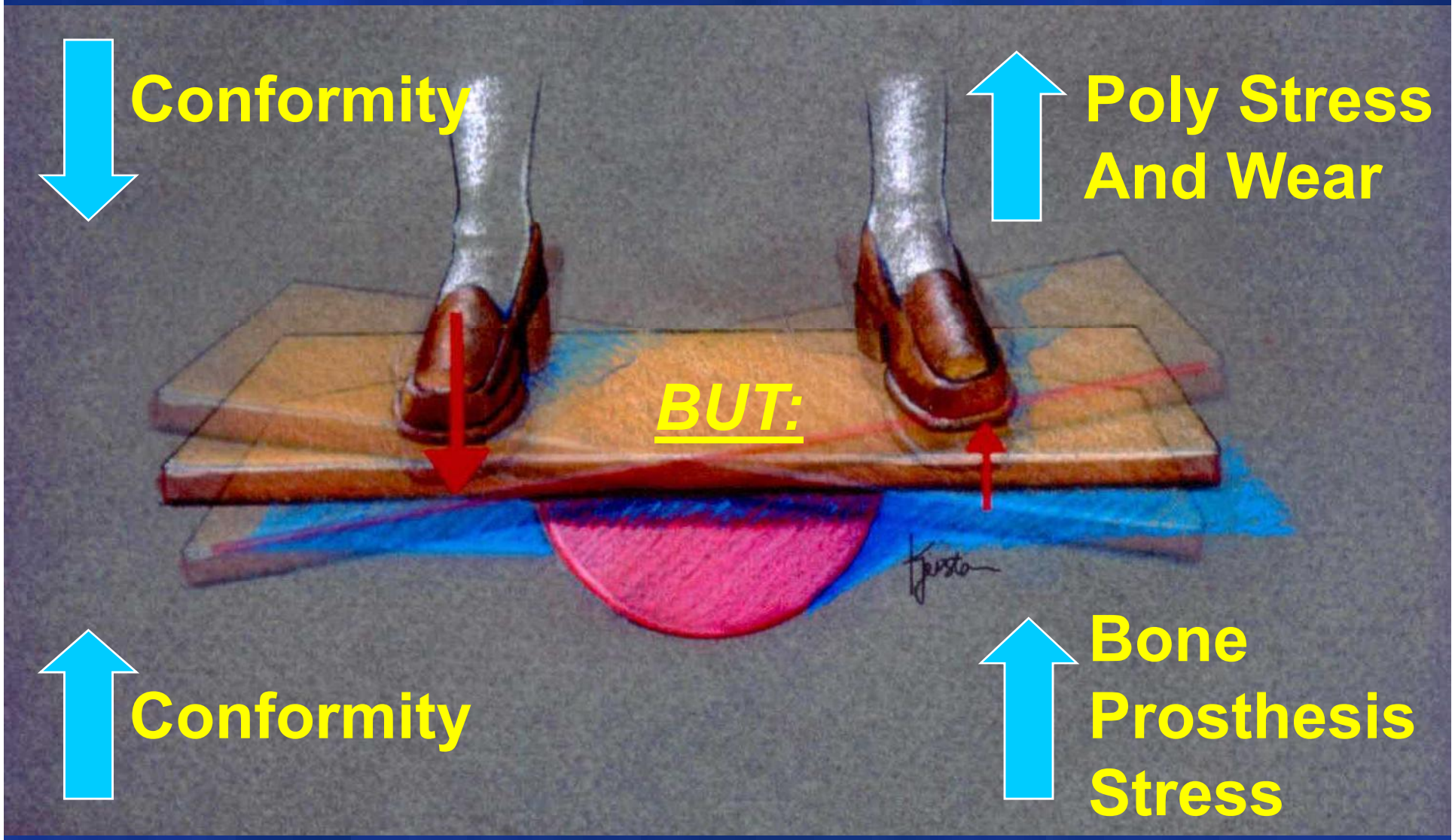


Normal knee kinematics

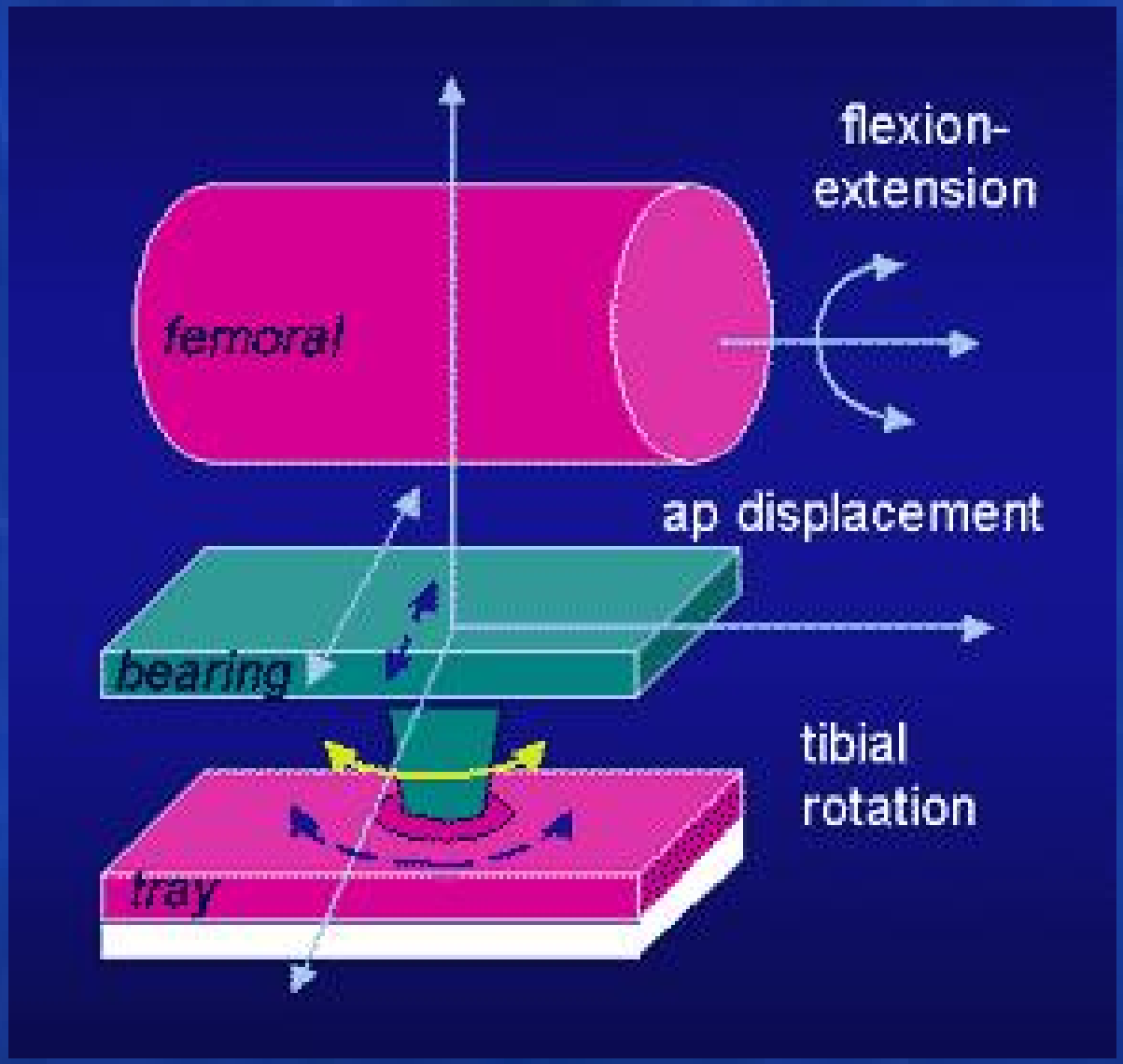
- Most knee (80%)-have medial pivot axial rotation pattern-i.e. lateral femoral condyle rotates around relatively stationary medial femoral condyle.
- Under wt. bearing conditions.16.5-16.8^{o} tibial rotation occurs.
- Screw home mechanism- IR of tibia in flex, ER of tibia in ex

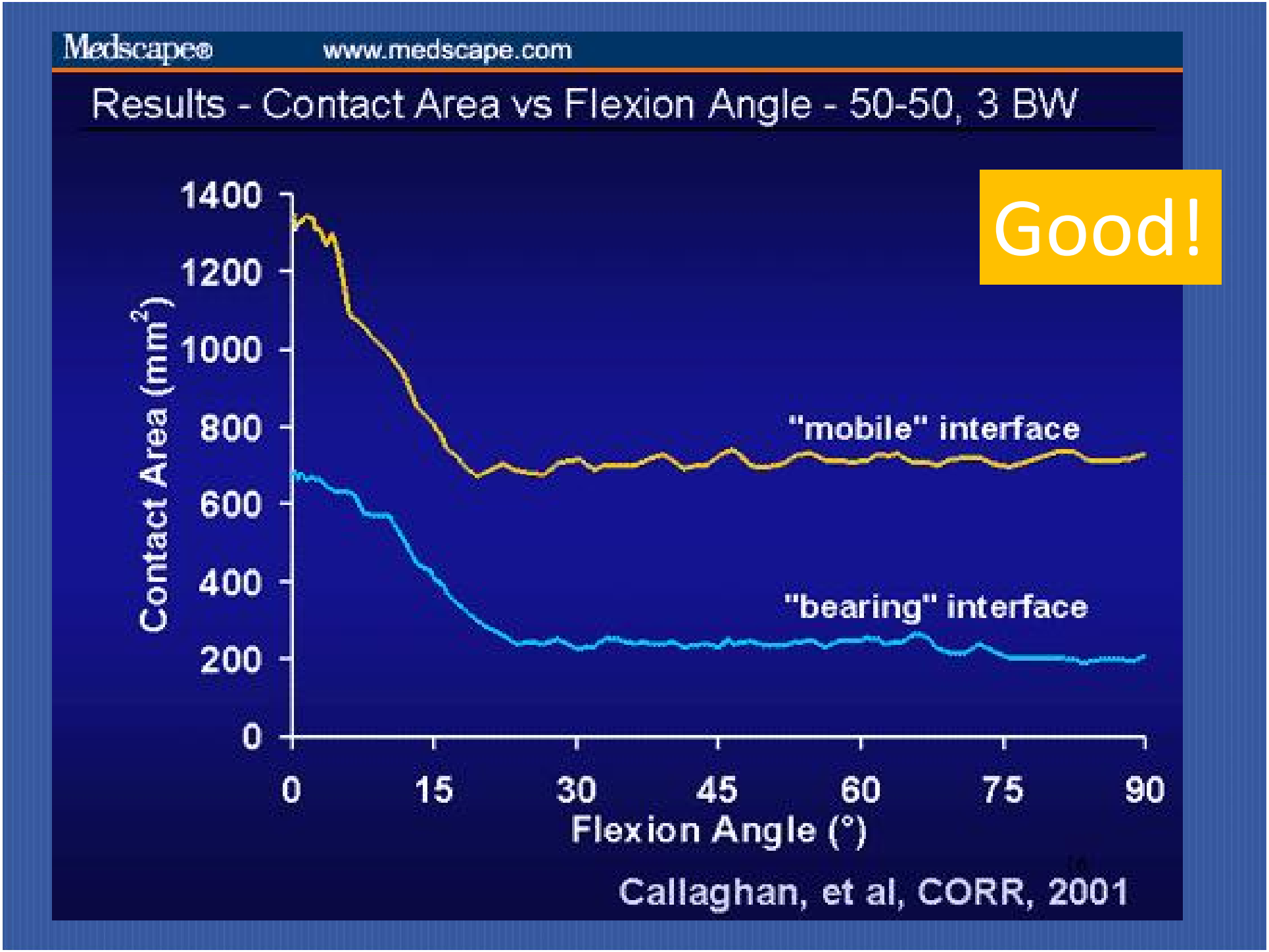
BALANCE

J. Black; Am. Clinics, N.A., 1989



Mobile bearing




Medscape®
www.medscape.com
Results - Contact Area vs Flexion Angle - 50-50, 3 BW
Good!
Contact Area (mm²)
1400
1200
1000
800
600
400
200
0
"mobile" interface
"bearing" interface
0
15
30
45
60
75
90
Flexion Angle (°)
Callaghan, et al, CORR, 2001

Mobile bearing

Good!

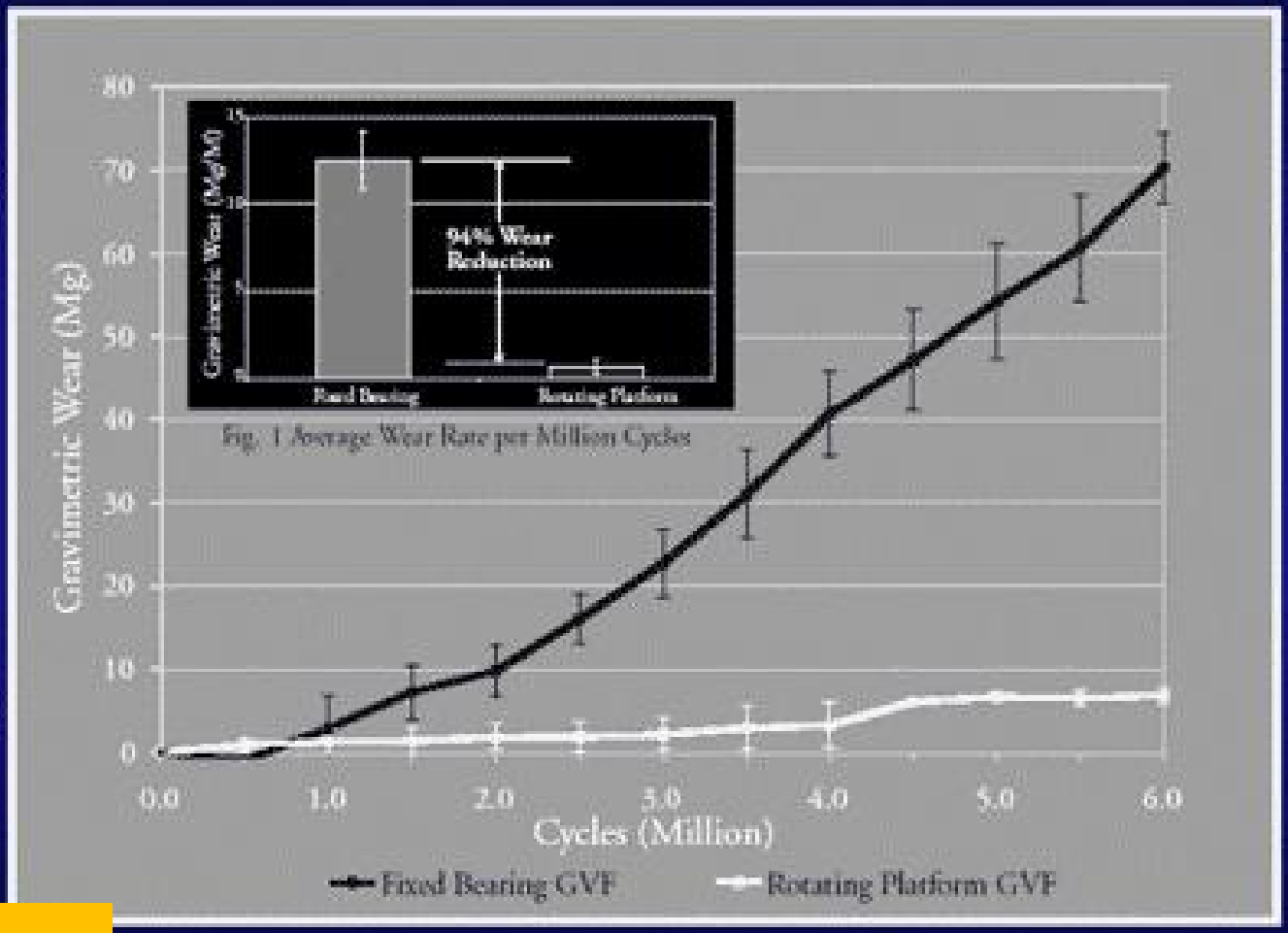
- In vitro- Improved kinematics-closely resembling that of natural knee.
- Reverse axial rotation, paradoxical anterior femoral translation & femoral condylar lift off is minimised

A.Seth Greenwald

Good!

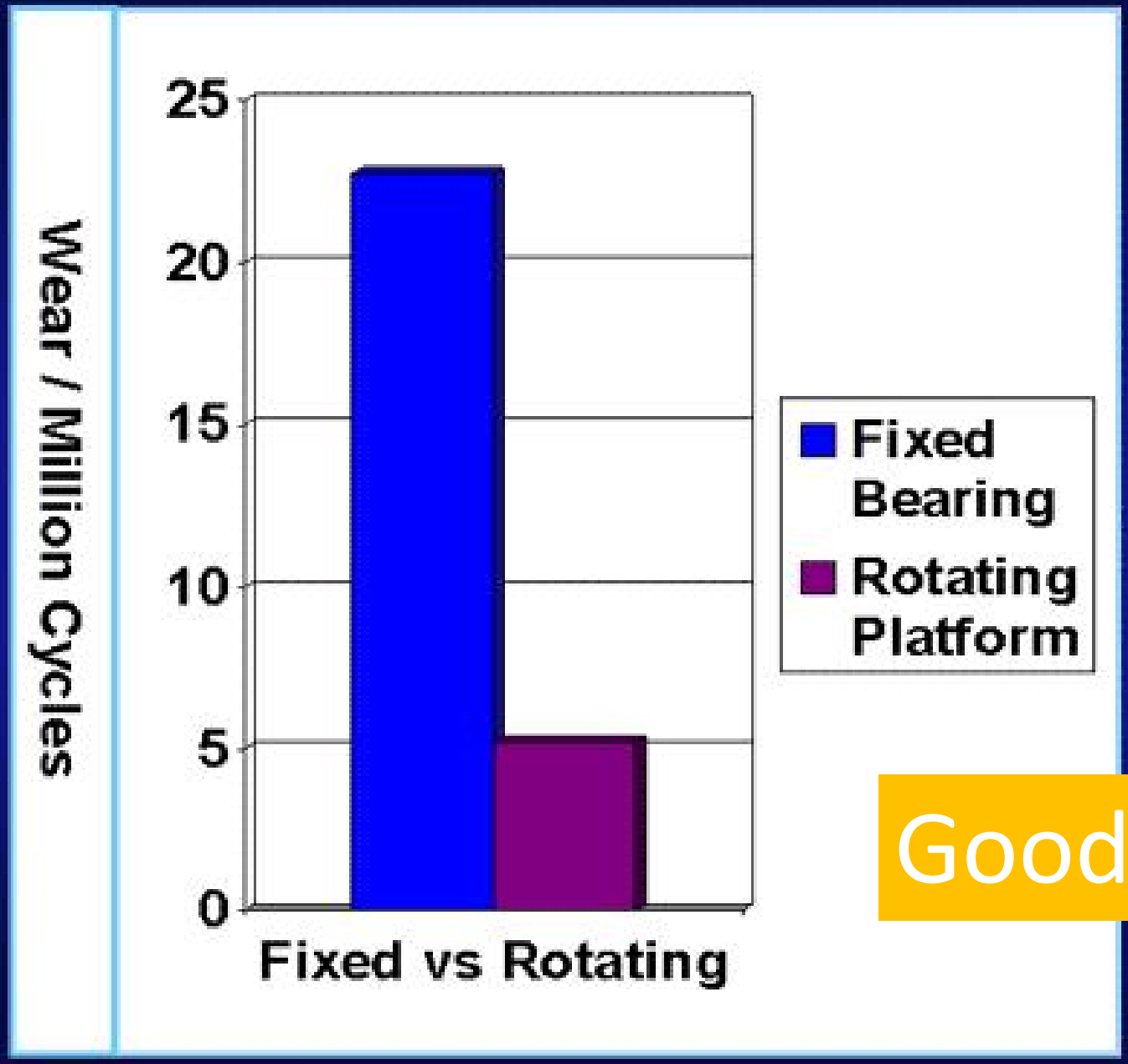
- Knee simulator-5 million cycles-meniscal bearing knee
- FEA(finite element analysis)
- Superior & inf. Surface of mobile bearing Stresses 6 mPa
- Fixed bearing-----14 mPa
- Yield strength of polyethylene---20-22 mPa

FIXED VS. MOBILE BEARING WEAR



Good!

McNulty, et al, ASTM, 2002


Wear / Million Cycles
25
20
15
10
5
0
Fixed vs Rotating
Fixed Bearing
Rotating Platform
Good!

Bad!

- Mobile bearing were introduced to improve wear & knee kinematics
- By uncoupling forces generated at articulation of implant bone interface it should improve fixation.
- However when MBK Zimmer was compared with Nextgen (CR-fixed bearing) MBK showed more subsidence whereas Nextgen had larger condylar lift off.

Bad!

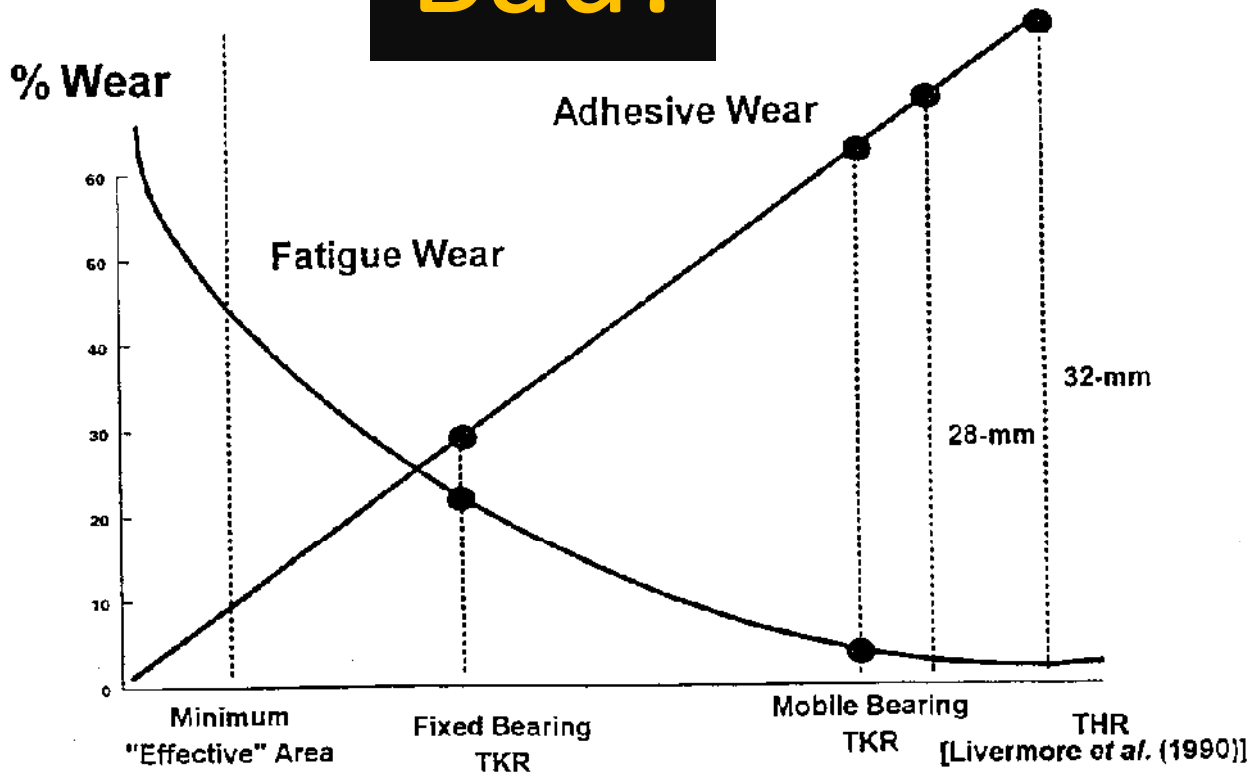
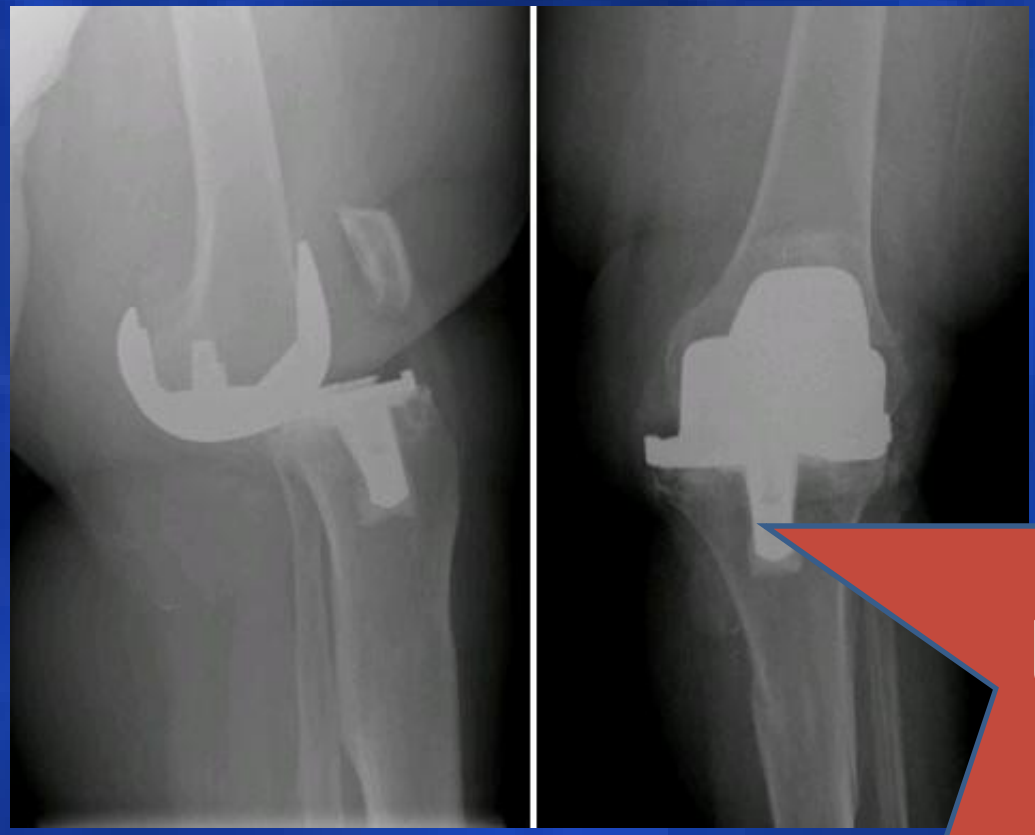


Figure 7.5 A conceptual model of the relationship between fatigue and adhesive wear mechanisms.

KINEMATIC CONDITIONS OF CONTACT AND WEAR OF ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE IN TOTAL JOINT REPLACEMENTS

Mobile Bearing



The Ugly !

Cochrane Review abstracts

- Conclusion: No superiority of any one prosthesis over other as regards ROM & functional performance.
- Up to 30 % of mobile bearing total knees have developed "radiolucent lines" around the total knee components. (Hartford 2001)

Bad!

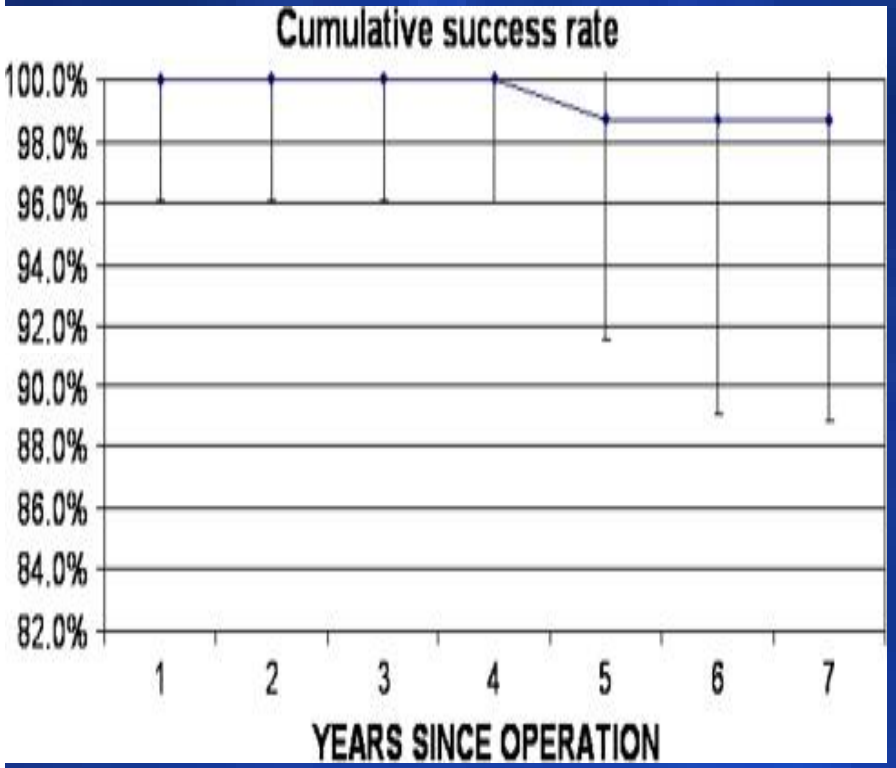
CERAMIC KNEES

Oxinium Knees

Compared to cobalt chrome, oxinium has

- Superior hardness
- Superior smoothness
- Increased resistance to scratching or abrasions
- No detectable nickel content (the leading cause of adverse reactions in patients with a metal allergy)
- Supposedly Less Wear

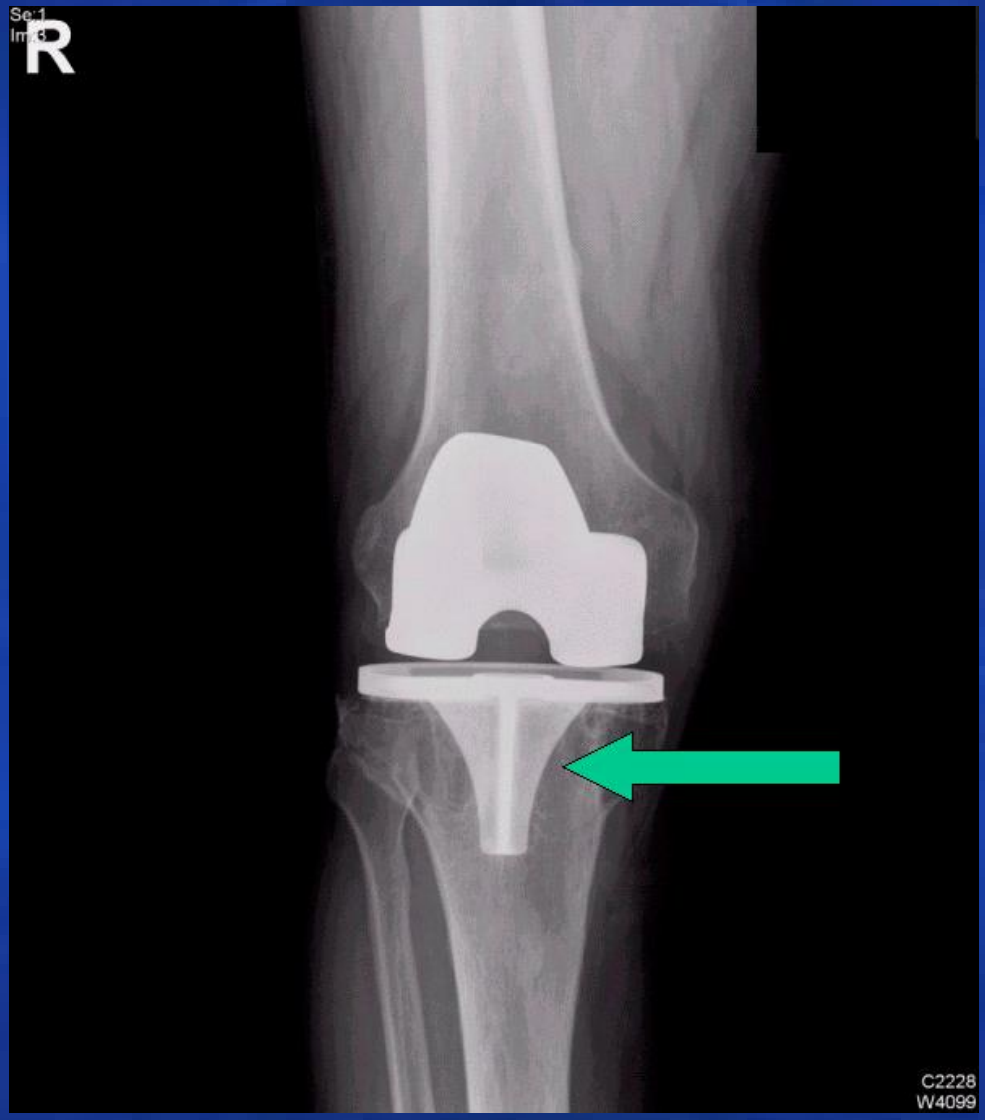
CERAMIC KNEE



Clin Orthop Relat Res. 2010 May; 468(5): 1258–1263.

Good!

UNCEMENTED KNEE



UNCEMENTED KNEE

- Introduced in 1980's, yet use not wide spread
- Concern over DVT with cemented use
- Improved survival of the cemented compared to uncemented implants – JBJS 2009 Gandhi et al.
- Trabecular metal (TM) and other augmentative agents used to improve the results.

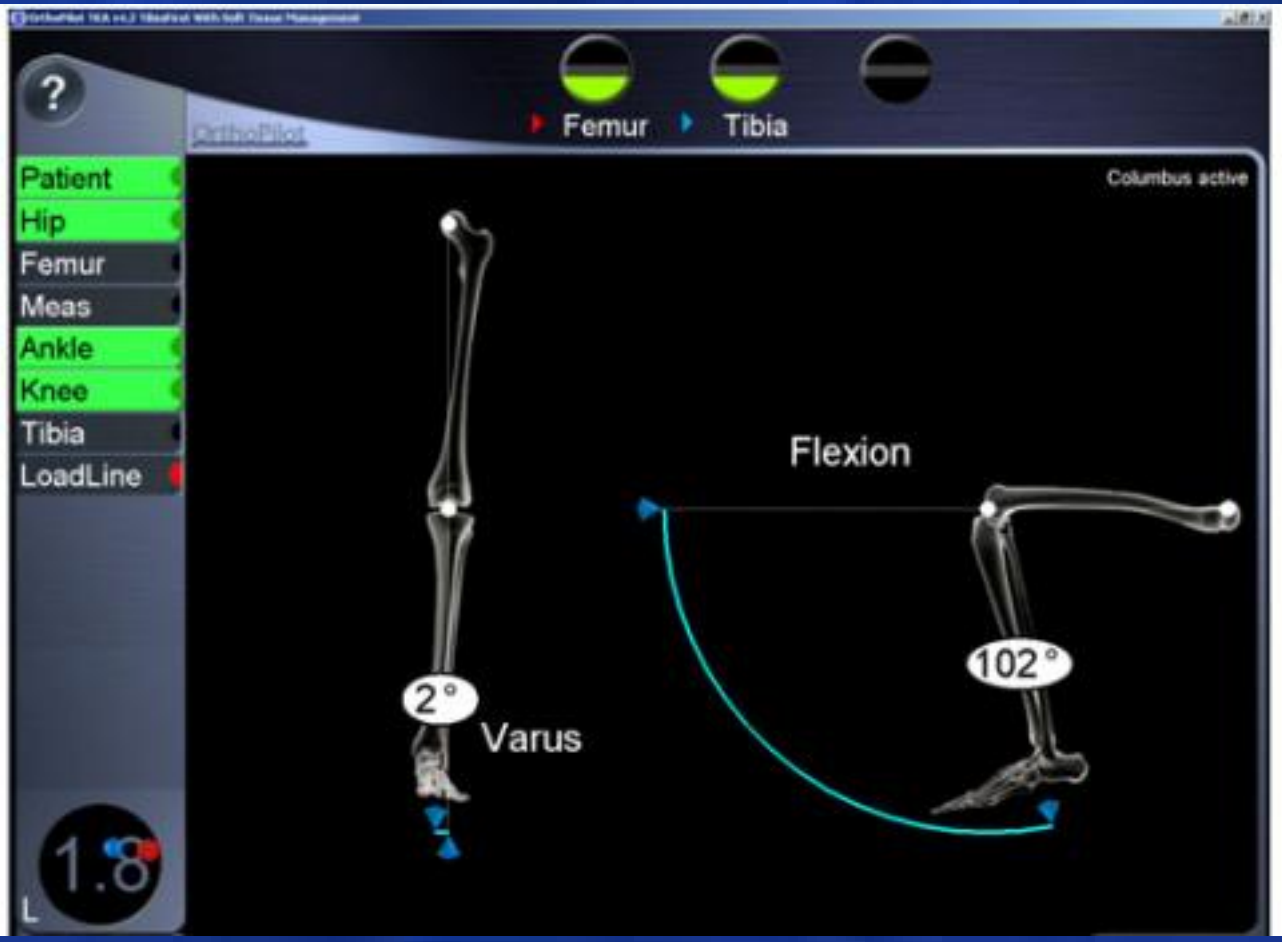
ZIMMER UNCEMETED RECALL

New York Times Advt…

The Ugly !

Zimmer knee failure in more than 8.3% percent of 108 recipients within 5 years of primary knee replacement surgery.

COMPUTER NAVIGATION



COMPUTER NAVIGATION

- Restored Alignment within +/- 3 degrees.
- Alignment would improve the results was the premise of its wide spread use world over.
- It also attracted patients as the its use would suggest technological innovation and superiority.

Good!

Computer Navigation

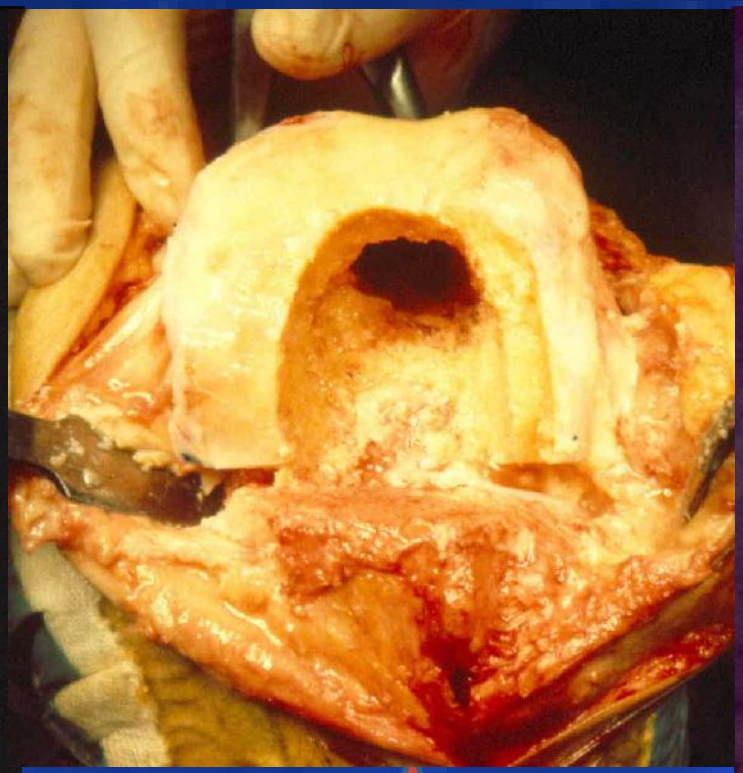
- “Navigation in 2008 remains a cumbersome, time-consuming, expensive tool with no proven clinical benefit.”- Pagano-
- Computer-assisted Surgery: A Wine Before Its Time”
- The mechanical axis may be the wrong target in computer assisted TKA

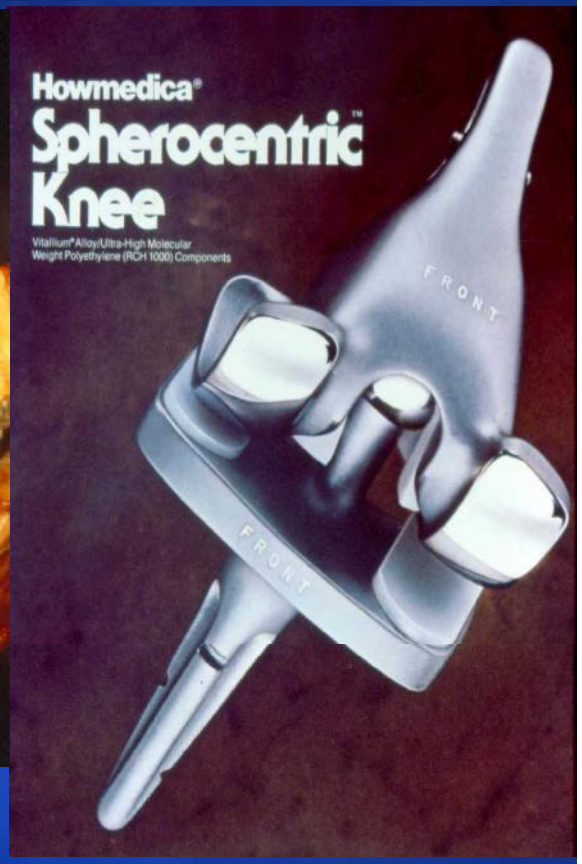
Computer Navigation

- factors other than alignment were more important than alignment along a neutral mechanical axis for 15-year survival.
- Parratte S, Pagnano MW, Trousdale RT, Berry
- Mean operative time 15 – 23 min more
- Cost is huge drawback
- No improvement in outcome.

Bad!

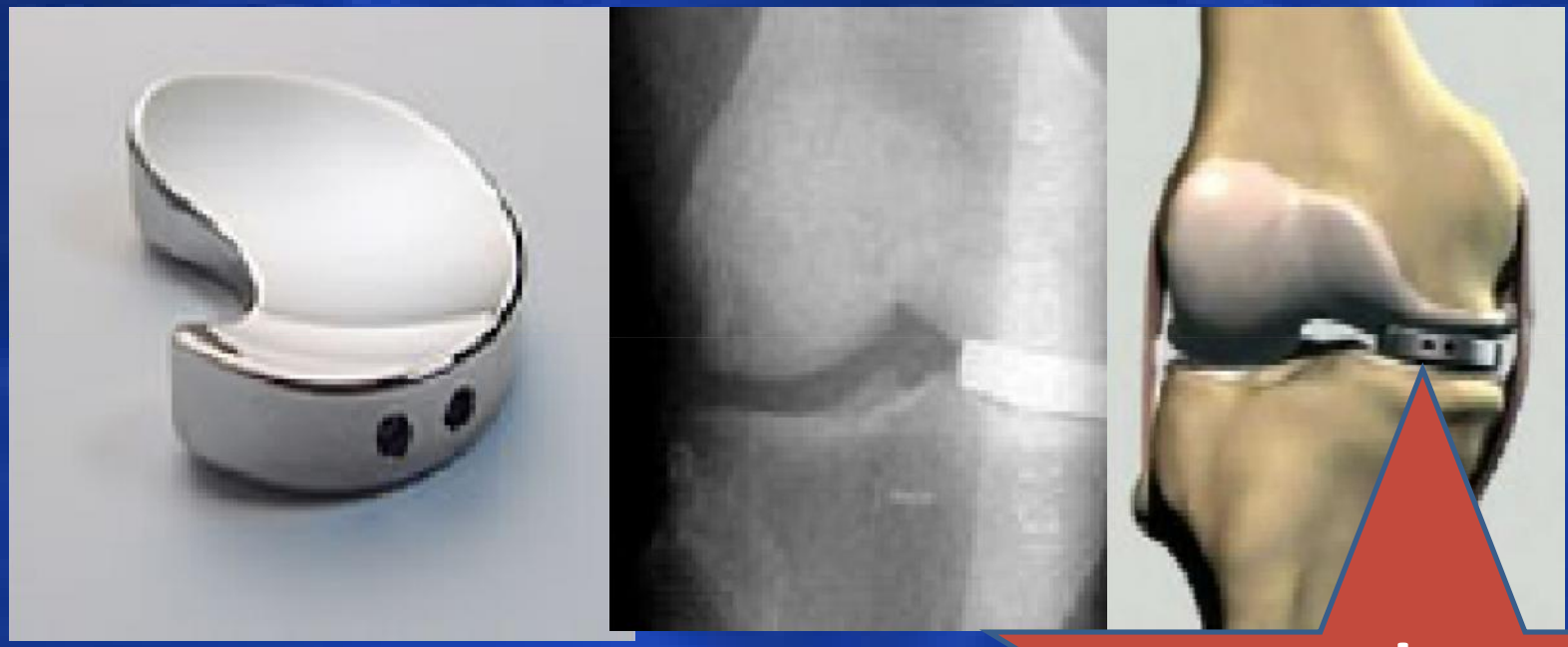

F.H.
5/85




Howmedica®
Spherocentric™
Knee
Vitallium® Alloy/Ultra-High Molecular
Weight Polyethylene (RCH 1000) Components
FRONT
FRONT

The Ugly !

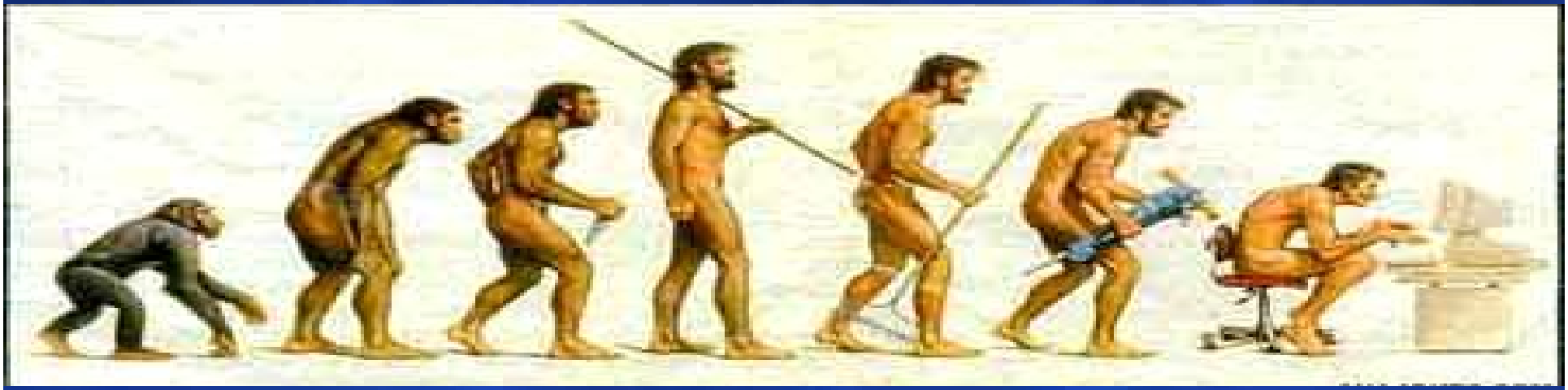
SPACERS



66% REVISIONS AT 3.5 YEARS

The Ugly!

Newer Developments



DASH SYSTEM

Report awaited

PATIENT SPECIFIC INSTRUMENTATION

Pin positioning guides - a conforming fit you can feel with intra-op flexibility

3-D Modeling from MRI captures true patient anatomy

Pre-op Planner - Simple. Efficient, Control.

Report awaited

GOOD KNEE

- Minimize Bone Resection
- Increase Surface Area for Support and Dissipation of Forces
- Protect Bone/Prosthesis Interfaces
  - Freedom
- Proper Conformity
- Optimal Surgical Technique
- (Revision Options)

Still Elusive

PASAND APNI APNI