



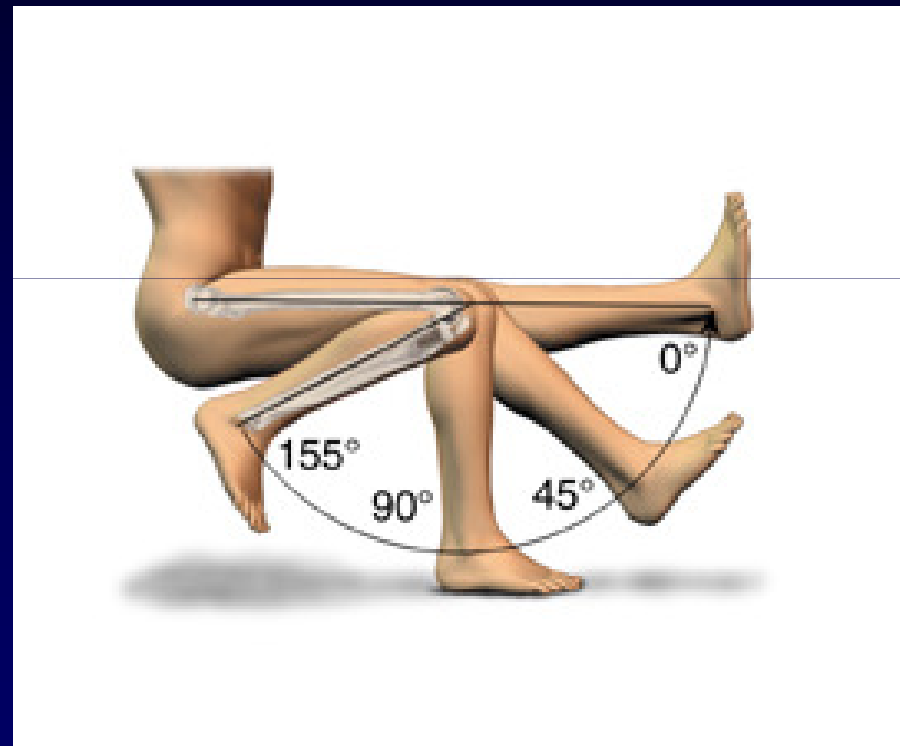
**Predicting Range of Movement after
Total Knee Replacement:
The Importance of Posterior Condylar
Offset and Tibial Slope**

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How much flexion do we need?





Patient Factors

- Pre-operative flexion
- Gender
- Body Mass Index (BMI)

Lizaur et al JBJS Br 1997
Harvey et al JBJS Br 1993
Schurman et al CORR 2005
Anouchy et al CORR 1996

Surgically Modifiable

- Tibial slope

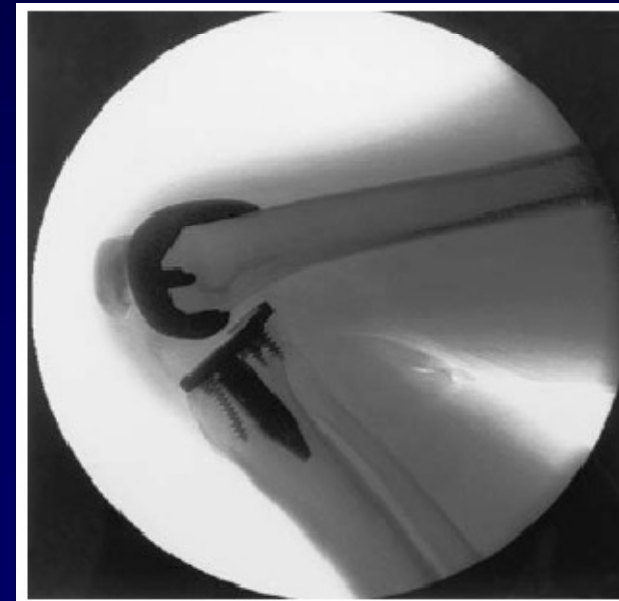
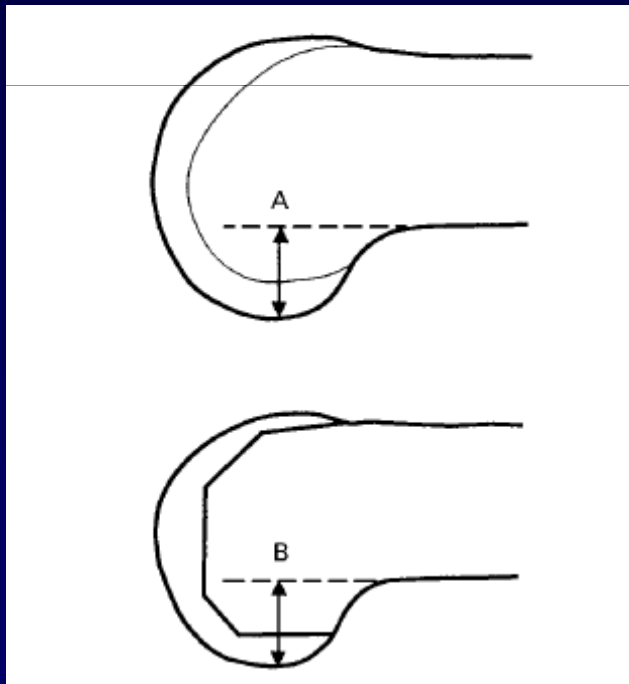
**Bellemans et al. KSSTA 2005; Catani et al. JOR 2006;
Massin et al. JA 2006**

- Posterior condylar offset

Bellemans et al. JBJS Br 2002; Massin et al. JA 2006

Posterior Condylar Offset

Bellemans et al. JBJS Br 2002





Surgically modifiable

- Level of the joint line
Hoffman et al. JA 2006
- Varus – valgus mal-alignment
Kawamura et al. JOS 2001; Matsuda et al JBJS Br 2005
- Design of the knee replacement
Bin et al. KSSTA 2007; Dennis et al. JA 1998
- Tibial insert
Coughlin et al. JA 2007
- Role of posterior cruciate ligament
Straw et al. JBJS Br 2003



Hypothesis

Surgically modifiable factors are significant predictors of range of movement 12 months after total knee replacement. These factors include:

- Insall index (Patella Baja)
- Tibial slope
- Posterior condylar offset



Study Design

- Secondary analysis of patients included in two randomised controlled trials (RCT)
 - Kinemax Plus RCT of fixed (Group A) vs. mobile bearing tibial (Group B) inserts [Stryker]
 - PFC Sigma (Group C) RCT of all polyethylene vs. metal backed tibial components [DePuy]



Patients and Methods

- All PCL sparing implants – J shaped design
- None had the patella resurfaced
- Post-operative rehabilitation followed standard protocol
- ROM assessment – Preop and 12 mth postop

Radiological Measurement

- Preoperative
 - Posterior condylar offset (PCO)
- Postoperative
 - Tibial slope
 - PCO
 - Varus-valgus alignment (VVA)
 - Insall ratio
- Only true lateral radiographs were used



Posterior condylar offset ratio (PCOR)

Ratio of the posterior offset to the diameter of the femur 2.5 cm above the termination of the supra-condylar flare on true lateral views

$$\text{PCOR} = a/b$$



Results – Demographics

Total Number	101
Mean Age (sd) in years	67.2 (8.1)
Gender – Female	54 (54%)
Diagnosis – Osteoarthritis	89 (88%)
Rheumatoid Arthritis	12 (12%)
Side – Right	50 (50.5%)
Left	51 (49.5%)



Results – Comparison of Groups

	Group A N=35	Group B N=28	Group C N=38	p-value
Age - mean	64	65	72	<0.0001
Gender – N (%) Female	21 (60)	17 (61)	16 (42)	0.21
Diagnosis – N (%) OA	30 (86)	24 (86)	35 (92)	0.63
Preop ROM – mean (SD)				
• Passive	94 (18)	100 (18)	104 (16)	0.046
• Active	91 (18)	96 (20)	102 (16)	0.058
12-mth ROM – mean (SD)				
• Passive	106 (14)	107 (12)	107 (10)	0.89
• Active	106 (13)	106 (10)	105 (10)	0.89



Results – Comparison of Groups

	Group A N=35	Group B N=28	Group C N=38	p-value
Tibial Slope	6.8 (1.7)	6.5 (1.7)	6.5 (1.6)	0.61
Valgus Varus Alignment	4.9 (2.5)	4.9 (2.0)	5.1 (2.0)	0.87
PCO Difference (postop–preop in mm)	2.3 (2.9)	1.8 (2.7)	1.6 (2.8)	0.60
PCOR Difference (postop–preop)	0.07 (0.09)	0.06 (0.09)	0.05 (0.08)	0.43
Insall Index	1.1 (0.18)	1.0 (0.20)	1.0 (0.17)	0.33



Results

Correlates of ROM at 12 Months

	Pearson Correlation Coefficient (R)	p-value
Preoperative ROM	0.20	0.046
Tibial Slope	0.58	<0.0001
PCO Diff	0.65	<0.0001
PCOR Diff	0.64	<0.0001
VVA	0.01	0.89
Insall Index	0.01	0.90



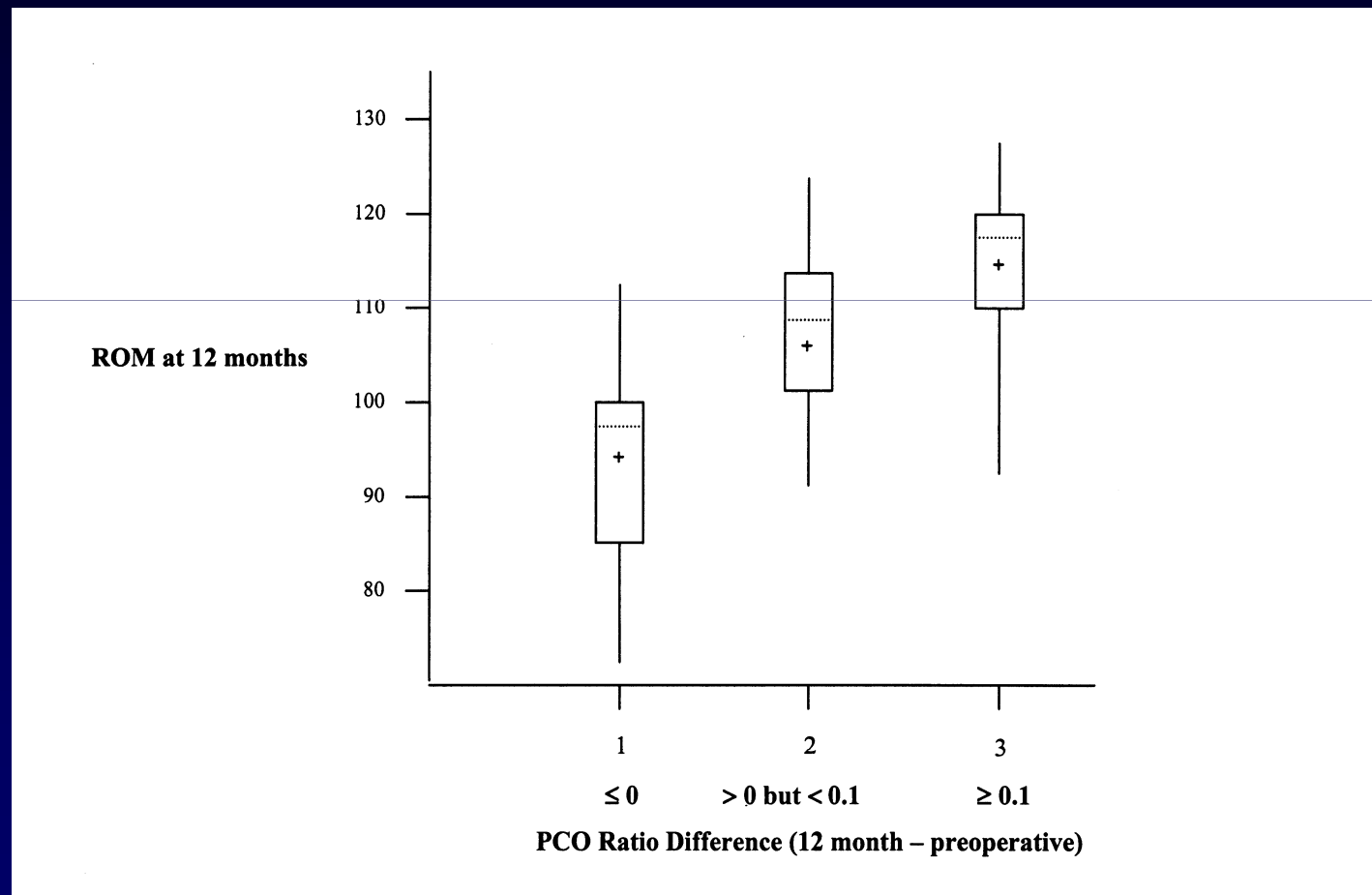
Results – Multivariate Analysis

Significant Predictors of ROM at 12-Months

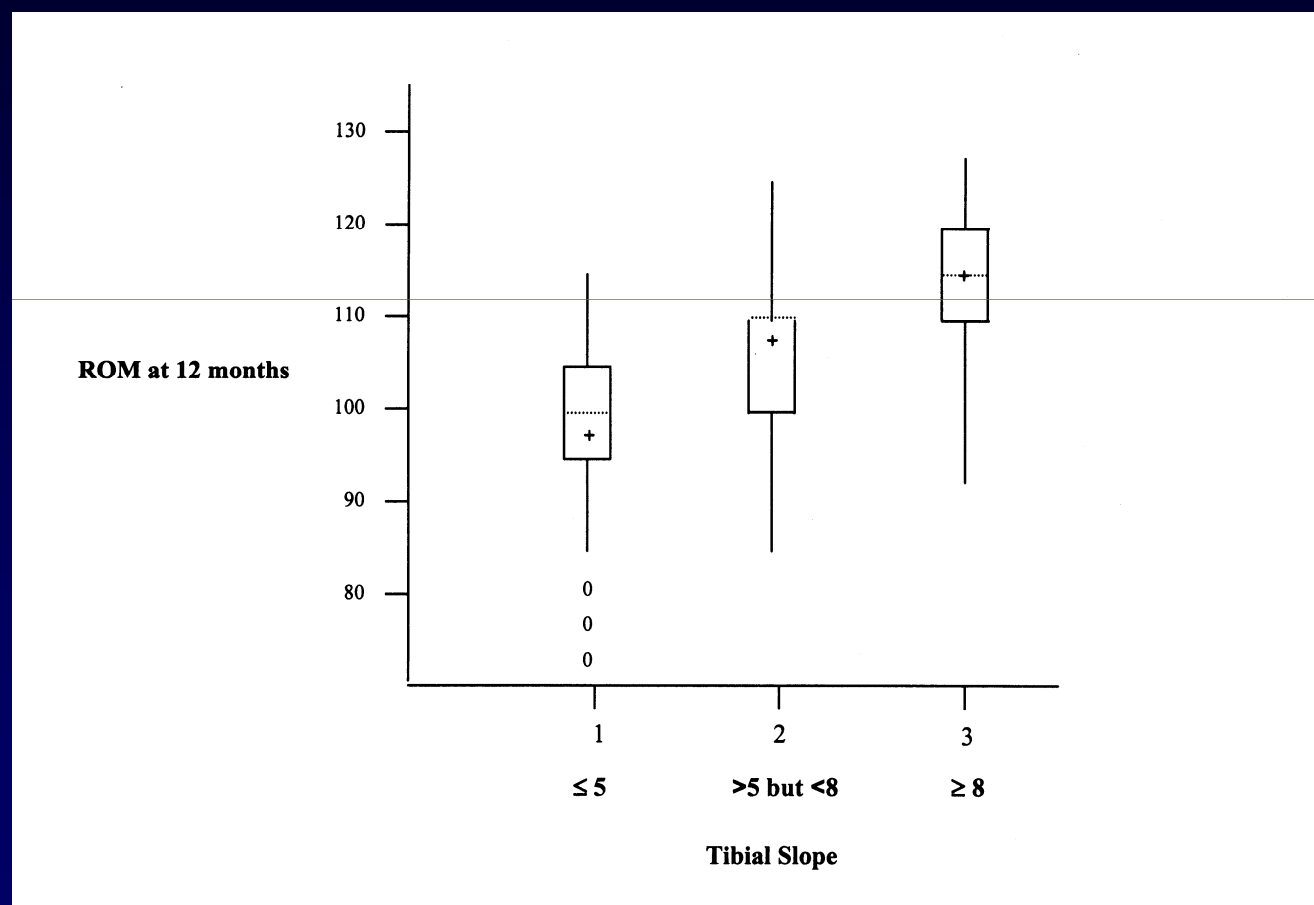
Predictor	All predictor model (p-value)	Significant predictors only model (p-value)
Age	0.058	
Gender	0.997	
Prosthesis	0.051	
Diagnosis	0.841	
Preoperative ROM	0.025	0.0076
Tibial Slope	<0.0001	<0.0001
PCOR Difference	<0.0001	<0.0001
Model R ²	0.59	0.57



ROM at 12-Months by difference in PCOR



ROM at 12-Months by Tibial Slope



Limitations & Strengths

- Limitations
 - ROM measured in non weight bearing
 - Secondary analysis
- Strengths
 - Detailed examination on complete data of 100 patients with prospective data
 - Analysis includes multiple factors

Conclusions

- Most significant predictors of ROM at 12-months included surgically modifiable variables
 - change in posterior condylar offset
 - tibial slope
- Pre-op flexion – limited predictive value
- Non-significant predictors - age, gender, BMI, type of prosthesis, type of tibial insert and varus-valgus alignment
- Future work should focus on
 - effect of surgically modifiable factors on stability and balancing
 - include other designs such as single radius

Thank you for your attention