



### 1- How much flexion do we need??

Rowe et al. Gait Posture 2000, 12(2):143-55

Activities	Flexion required	
	Minimal	Mean
Walking	59°	67°
Climbing stairs (step=16.5cm)	81°	98°
Descending stairs	76°	97°
Rising from a chair	74°	99°
Rising from a low armchair	83°	105°
Entering in a bathtub	103°	131
Going out from bathtub	106°	138

### 1- How much flexion do we need??

- ✓ Activity itself
- ✓ Size of patients
- ✓ How activity is done

### How much flexion do we need??

- ✓ Activity itself
- ✓ Size of patients
- ✓ How activity is done

### How much flexion do we need??

- ✓ Activity itself
- ✓ Size of patients
- ✓ How activity is done

### 2- Does high flexion improves satisfaction after TKA?

- ✓ Devers. JoA 2011
- ✓ 122 PFC (standard)
- ✓ Questionnaire at 1 year FU
- ✓ Function & satisfaction
- ✓ 3 groups depending on Post op Flexion

1. High flexion (n=20): **F>130°**
2. Mid flexion (n=81): **F >110° <130°**
3. Low flexion (n=21): **F<110°**

**Results in « high flexion » group**

	>130°	110°-130°	<110°	P-value
KSS	93	91	87	<b>0.54</b>

**Results in « high flexion » group**

	>130°	110°-130°	<110°	P-value
KSS	93	91	87	<b>0.54</b>
Positive satisfaction	93%	73%	74%	<b>0.24</b>

**Results in « high flexion » group**


	>130°	110°-130°	<110°	P-value
KSS	93	91	87	<b>0.54</b>
Positive satisfaction	93%	73%	74%	<b>0.24</b>
Expectations achieved	94%	68%	53%	<b>0.009</b>

**Results in « high flexion » group**

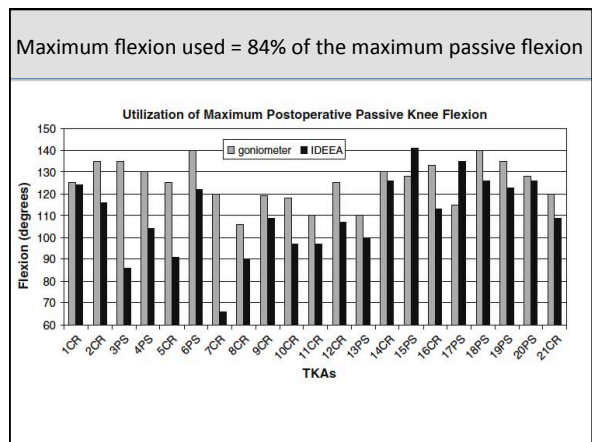
	>130°	110°-130°	<110°	P-value
KSS	93	91	87	<b>0.54</b>
Positive satisfaction	93%	73%	74%	<b>0.24</b>
Expectations achieved	94%	68%	53%	<b>0.009</b>
Knee feels « normal »	87%	70%	43%	<b>0.01</b>

**3-** How much patients use the flexion after TKA?

- ✓ 20 patients with high-flex TKA
- ✓ Western population
- ✓ Age: 66±10 years
- ✓ Flexion: 125°± 12
- ✓ Analysis at 27 months post-op
- ✓ Monitoring of ROM : 35 hours



Huddleston CORR 2009



### Patients do not use often the flexion

During the 35 hours of monitoring:


flexion	Nb of patients	Duration of flexion	% of the time
F>90°	20	10±4mn	0.5%
F>120°	2	2.2mn	0.1%

### 4- Does ROM reflect function?

Function (KSS, WOMAC, HSS) correlated

- ✓ With Quad strength
- ✓ With flexion in charge
- ✓ Not with passive flexion

- Devers 2010
- Miner 2003
- Kurayanagi 2009
- Mizner 2009
- Silva 2003
- Yoshida 2008



### Function is multifactorial - Flexion in only one aspect

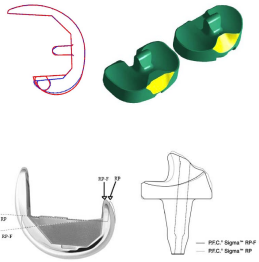
- ✓ Residual pain
- ✓ Quad. strength
- ✓ Stability
- ✓ Stiffness
- ✓ Global health
- ✓ Mental status



### 5- Can we improve flexion with the design?

- ✓ Radii of curvature
- ✓ Thickness post<sup>re</sup> condyles
- ✓ PS Box
- ✓ PE

Increase bone resection



### Series from litterature

author	country	study	n	FU	ref
▪ Bin	S Korea	CGS	90	12	<i>KSSA 2007</i>
▪ Cho	S Korea		218	51	<i>KSSA 2011</i>
▪ Gupta	USA		50	12	<i>Orthopedics 2006</i>
▪ Han	S Korea	CGS	72	32	<i>JBIS Br 2007</i>
▪ Huang	Taiwan		25	28	<i>JoA 2005</i>
▪ Kim	S Korea		50	25	<i>JBIS Am 2009</i>
▪ Malik	USA	CGS	50	12	<i>Int Orthop 2010</i>
▪ Weeden	UK	PRS	25/25	12	<i>JoA 2008</i>
▪ Nutton	Scotland	PRS	28/28	12	<i>JBIS Br 2008</i>
▪ Seon	S Korea		50	26	<i>JBIS Am 2009</i>
▪ Bauman	USA		154	46	<i>CORR 2012</i>
▪ Hamilton	USA	PRS	71/71	12	<i>JoA 2011</i>
▪ McCalden	Canada	CGS	197	12	<i>CORR 2010</i>

### Series from litterature

author	Post op flexion	Flexion gain	KSS	Failures (%)	
▪ Bin	★	129	6	-	0
▪ Cho		131	14	169	4%
▪ Gupta		125	17	190	0
▪ Han	★	132	11	-	38%
▪ Hung		138	28	184	0
▪ Kim		139	12	-	0
▪ Malik	★	120	5	-	?
▪ Weeden	★	133	11	-	0
▪ Nutton	★	110	2	-	?
▪ Seon		131	3	-	?
▪ Bauman		129	6	185	0
▪ Hamilton	★	124	5.2	-	7%
▪ McCalden	★	119	9.7	-	-

**P R Study** Weeden: J of A 2008: [Nexgen std vs High flex](#)


**Failure to return to prep ROM**

Group A (Standard): 50% P<0.05  
 Group B (High-flex): 8%

**Table 2. Comparison of ROM Before and After TKA**

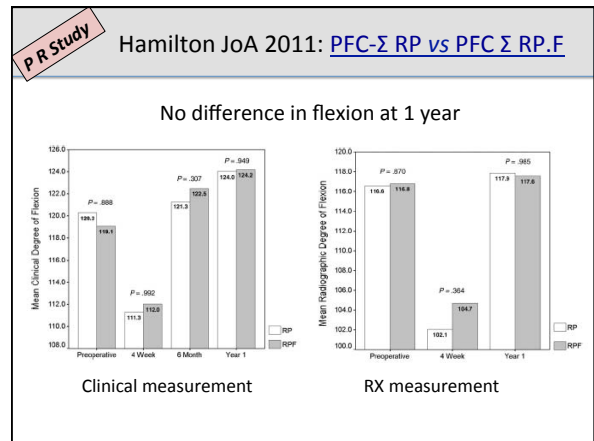
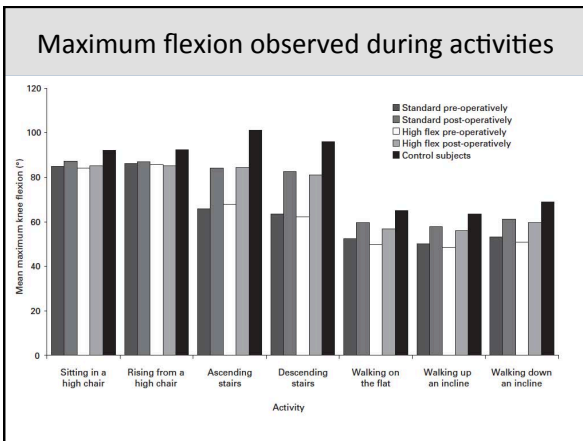
	Preoperative Average ROM (°)	6 mo Average ROM (°)	1 y Average ROM (°)	
Group A	2-121	0.8-120	0.6-120	P<0.05
Group B	1.8-122	0.6-130	0.6-133	

**P R Study** Nutton. JBJS Br 2008. [Nexgen std vs High flex](#)



Maximum flexion  
 Flexion during activities  
 Flexion during Squatting

No difference



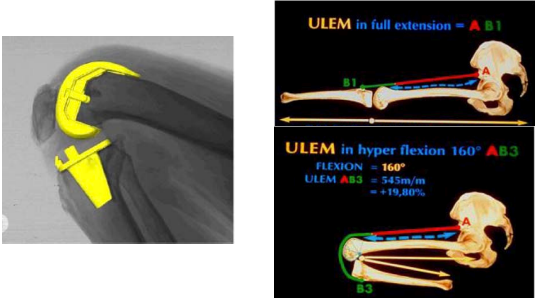
**Results from comparative studies**

Study	Improve Flexion?
Bin ★	YES
Han ★	YES
Malik ★	NO
Weeden ★	YES
Nutton ★	NO
Hamilton ★	NO
McCalden ★	YES

**Results from comparative studies**

Study	Improve Flexion?	Improve Function?
Bin ★	YES	NO
Han ★	YES	YES
Malik ★	NO	NO
Weeden ★	YES	YES
Nutton ★	NO	NO
Hamilton ★	NO	NO
McCalden ★	YES	Not reported

**6-** Is it dangerous to modify the design??



Argenson J Biomech


Results from comparative studies

		Increase Complications?
▪ Bin	★	NO
▪ Han	★	YES
▪ Malik	★	NO
▪ Weeden	★	NO
▪ Nutton	★	NO
▪ Hamilton	★	YES
▪ McCalden	★	Not reported

Han: 21% revision for femoral loosening at 23 months

Bauman CORR 2012: 154 PFC Σ RP.F (24-70 months FU)

- ✓ No revision
- ✓ 43% of lucencies on Post<sup>®</sup> condyles
- ✓ 24% with PFC. Σ RP




**P R Study** Hamilton JoA 2011: PFC-Σ RP vs PFC Σ RP.F

Higher rate of complication in High-flex group (71 patients / gp)

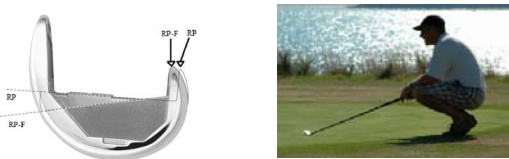
- ✓ 1 fracture of the patella
- ✓ 1 rupture of Quadriceps tendon
- ✓ 11 patella crepitus (16.7%) 3 revised

3.2% in the standard group (p=0.07)



**7-** What is dangerous?

Design modifications?      Increase of activities in flexion?



- Does higher flexion improves satisfaction after TKA? **YES**
- Do patients use the flexion after TKA? **NO**
- Does ROM reflect function after TKA? **NO**
- Do we improve flexion design modifications? **?**
- Is it dangerous to modify the design? **?**
- Is it dangerous to authorize full flexion if patient is able to? **YES**

## Conclusion

- ✓ I prefer having good flexion in my patients
- ✓ I do not authorize squatting
- ✓ The alchemy of the success of a design is subtle
- ✓ Be cautious with any modification in the design...

