

The learning curve in Knee Arthroplasty when changing prosthesis

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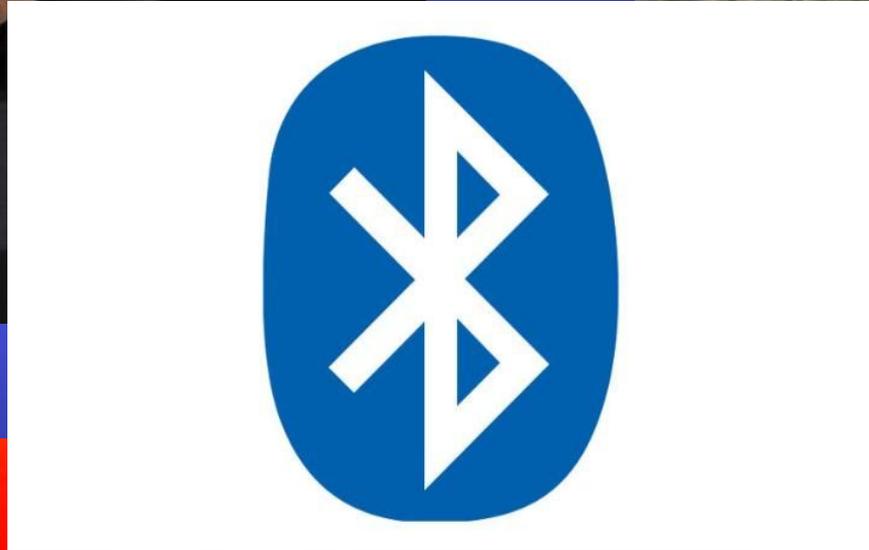
WHY CHANGING ?



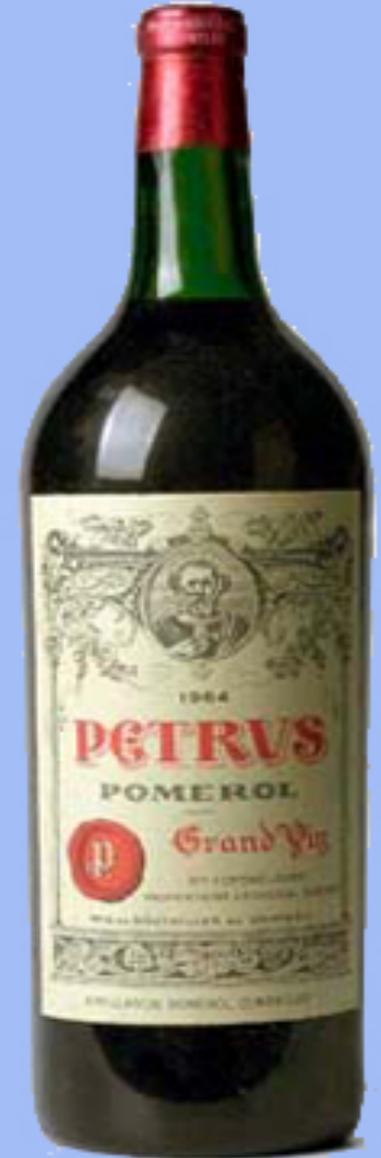
Changing for innovation



INNOVATIONS IN THE 21st CENURY



Long Term Results of Innovations



Innovations for the Orthopedic Surgeon !



New Patient Expectations

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PATIENTS' EXPECTATIONS OF KNEE SURGERY

BY CAROL A. MANGUSO, MD, THOMAS P. SCULCO, MD, THOMAS L. WICKIEWICZ, MD, EDWARD C. JONES, MD,
LAURA ROBBINS, DSW, RUSSELL E. WARREN, MD, AND PAMELA WILLIAMS-RUSSO, MD, MPH

Investigation performed at the Outcomes Unit, Department of Orthopaedic Surgery, Hospital for Special Surgery, New York, NY

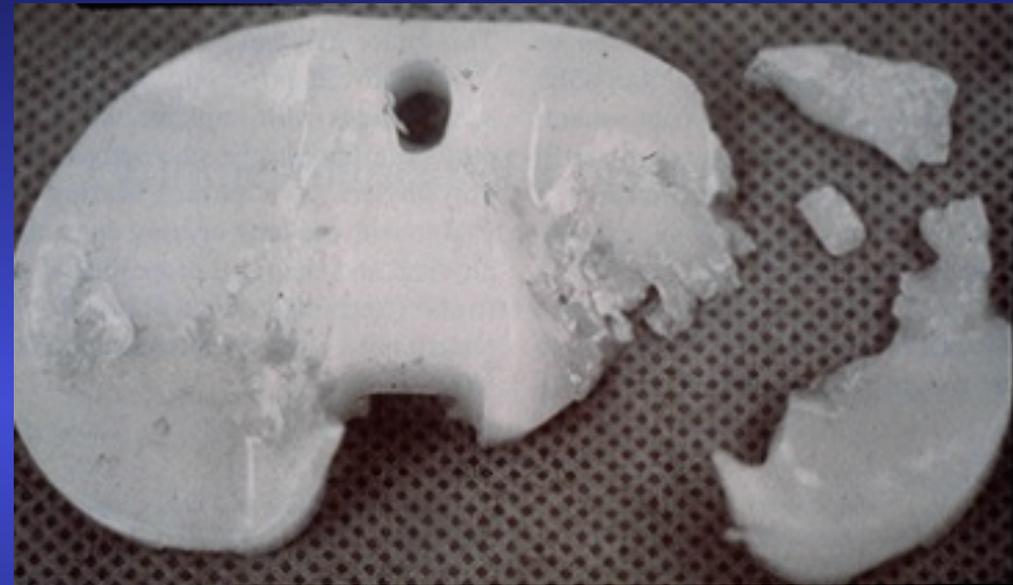
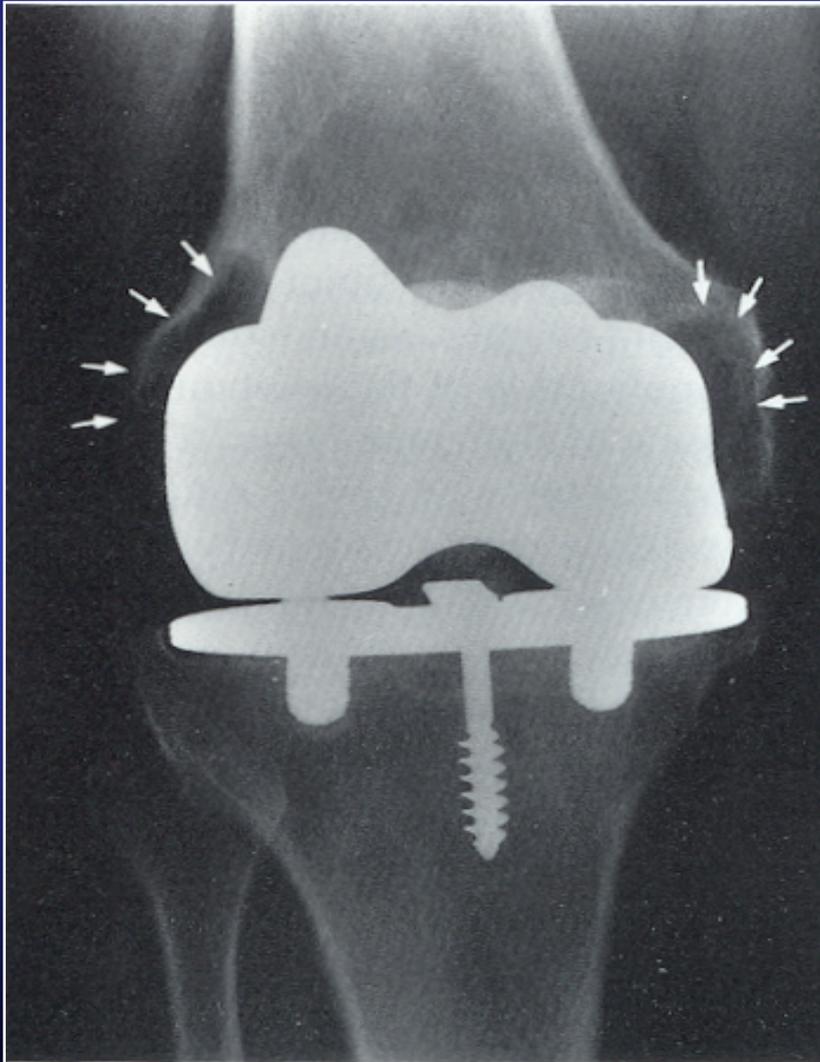
CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 404, pp. 172-188
© 2002 Lippincott Williams & Wilkins, Inc.

What Functional Activities Are Important to Patients With Knee Replacements?

*Jennifer M. Weiss, MD**; *Philip C. Noble, PhD**;
*Michael A. Conditt, PhD***; *Harold W. Kohl, PhD**; *Seth Roberts, BS**;
*Karon F. Cook, PhD**; *Michael J. Gordon, MD**;
and *Kenneth B. Mathis, MD**



Consequences for Arthroplasty?



Give The Correct Message

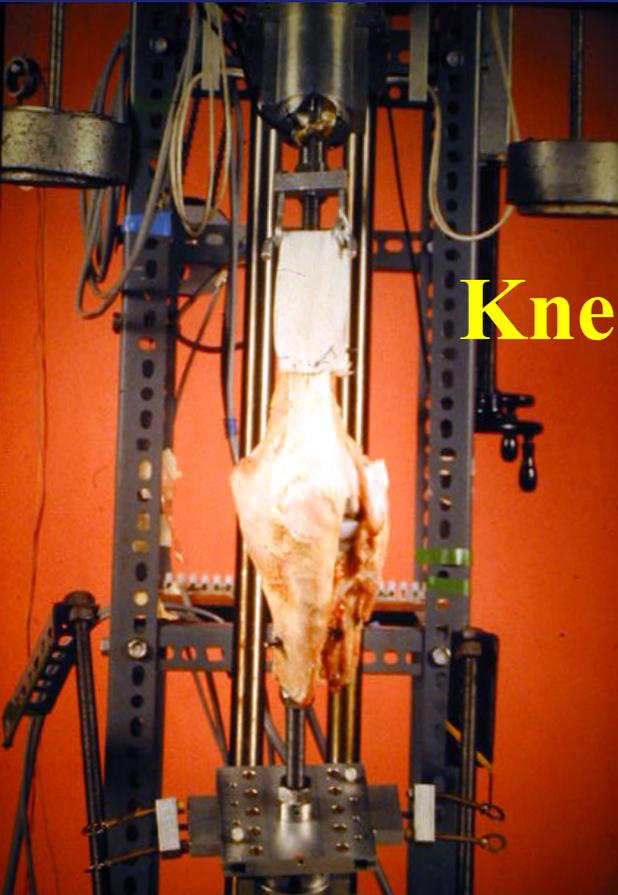


What else ?



Innovations in Research for design

A full load (2 X BW)
physiologic lunge activity
was simulated using a
KUKA KR500



Knee : Six degrees freedom rig



6 degrees of freedom

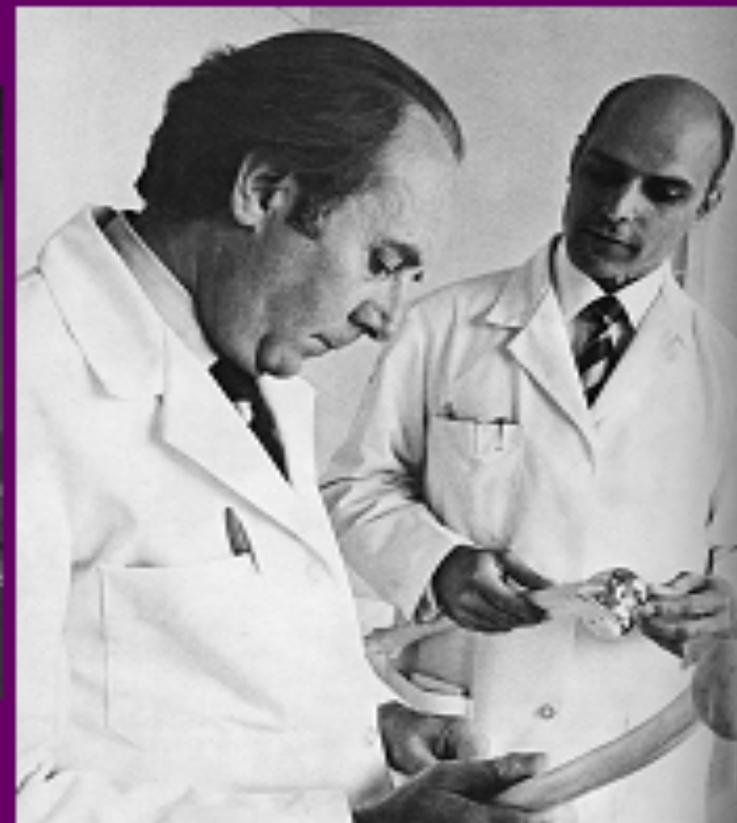
robotic arm: Force-
torque control were taken
from joint kinetics from live
patients during the lunge
activity

2010

*Argenson and
O'Connor, 1990*
6 degrees of freedom Oxford rig



CONCEPTS IN STABILITY & FIXATION WITH & WITHOUT CRUCIATES

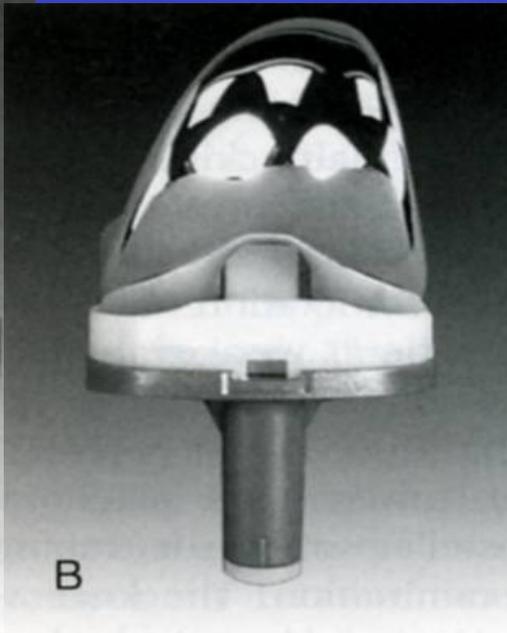


Peter Walker PhD, John Insall MD, Chit Ranawat MD
Hospital for Special Surgery 1970-1976

Transmission



Improving Design of TKA

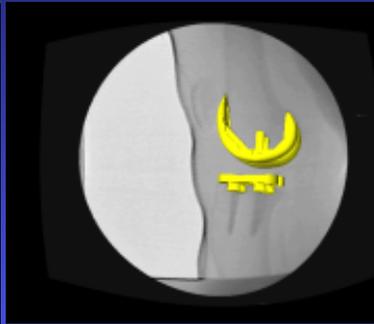


Design Considerations Related to Anatomy or Kinematics ?

ACL Retaining



PCL Retaining



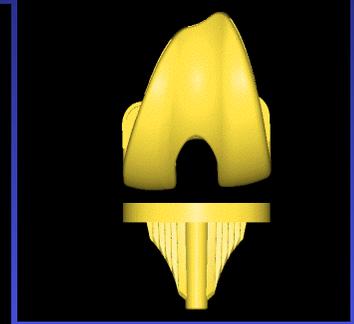
Posterior Stabilized



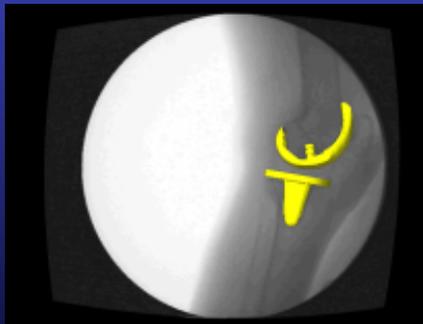
PS: Flat Insert



Single Radius



Rotating Platform



PS RP



PCR RP



PCR APG



PCR MBK

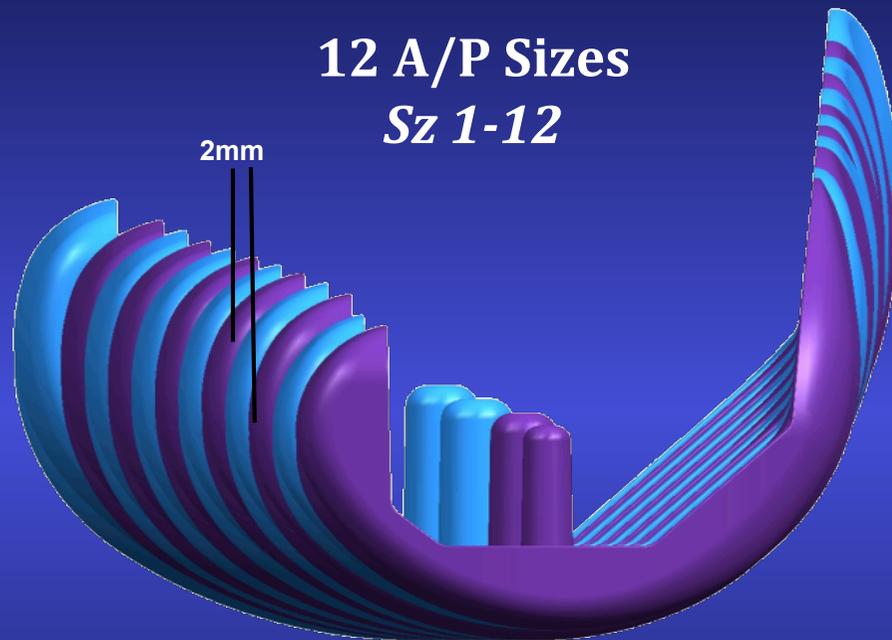


Richard D. Komistek, Ph.D.
University of Tennessee, Knoxville, TN

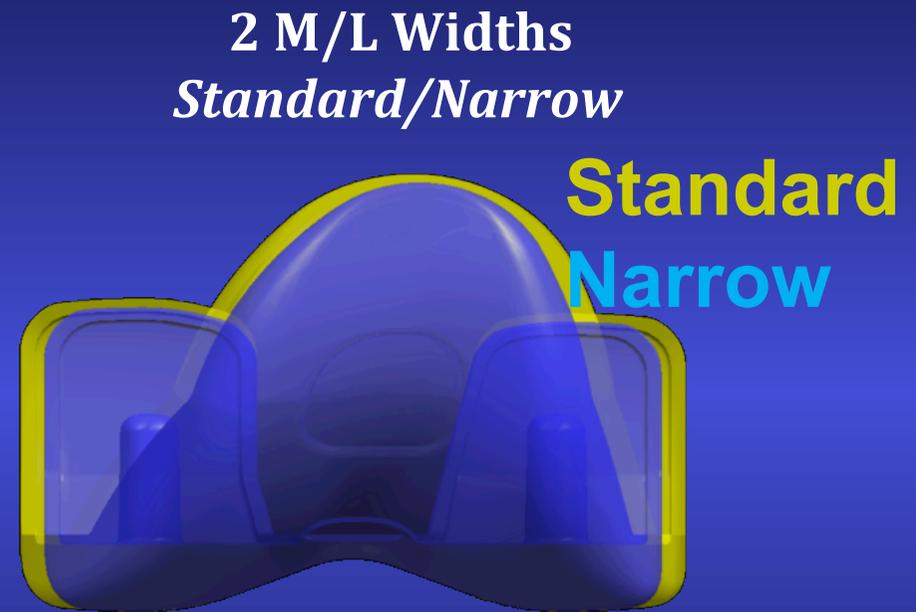
Personalized Fit

Sizing/Shape Refinements

High-Fidelity Femoral Sizing



+

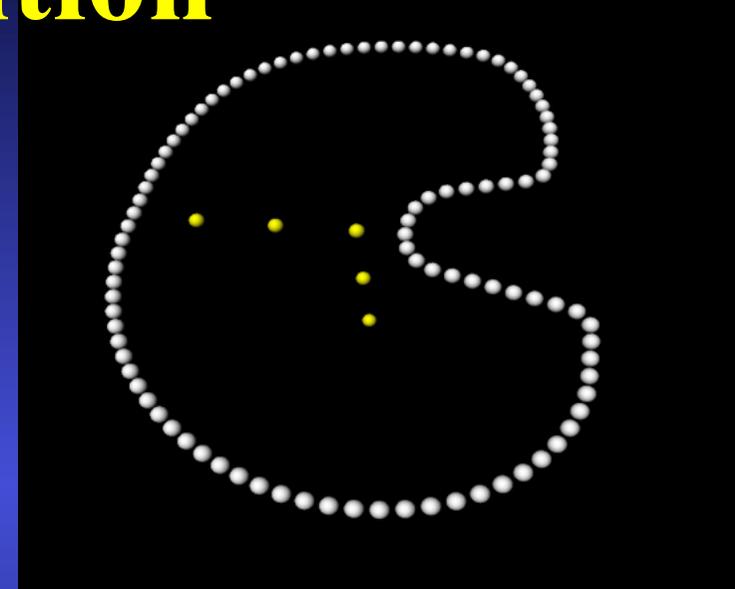
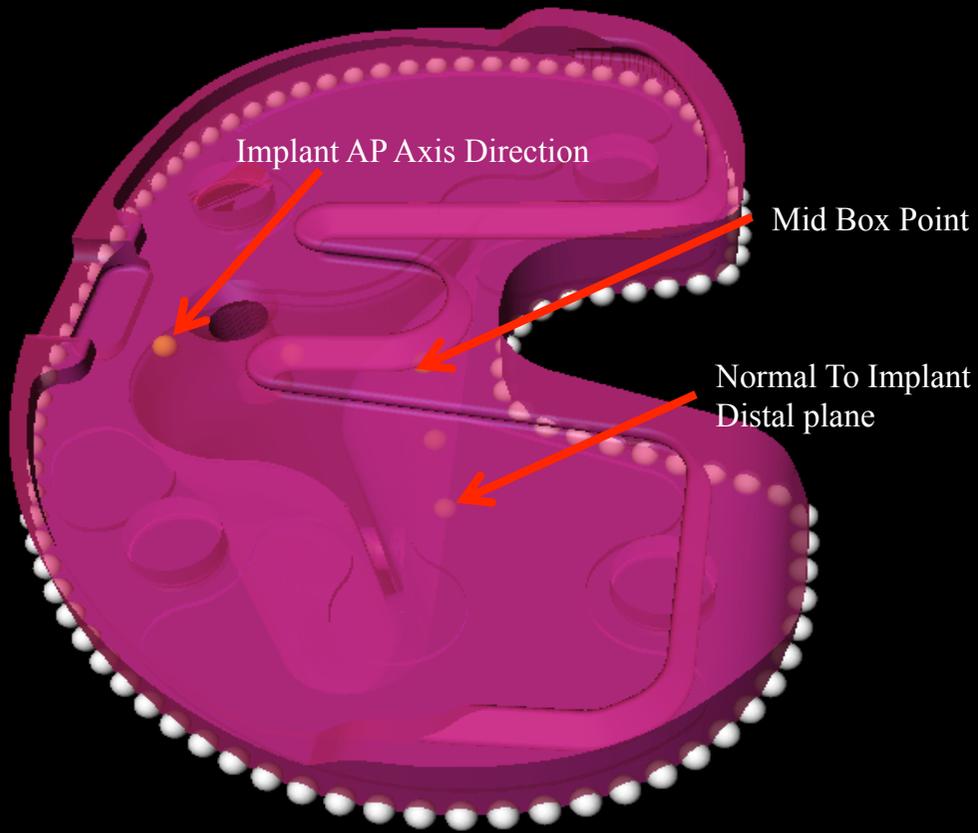


Persona Size	1	2	3	4	5	6	7	8	9	10	11	12
Corr. NexGen Size	B		C		D		E		F		G	H
Corr. N-K Flex Size	00		0		1		2		3		4	5

➤ 21 distincts femoral profiles



Optimizing standard design for a Personalized solution

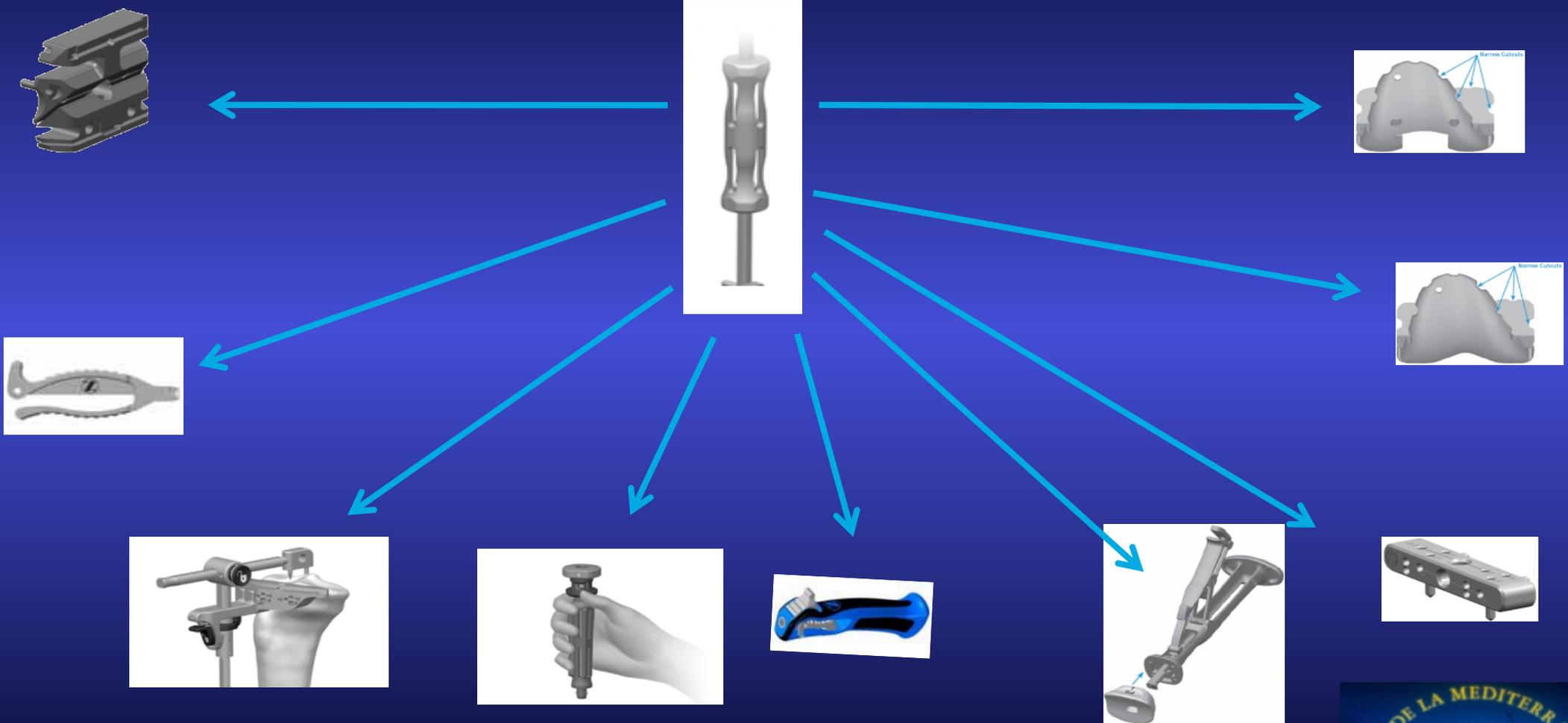


- Align Implant AP axis and Distal plane normal to bone projected AP axis and resection plane normal

Intra-operative Continuum of Stability

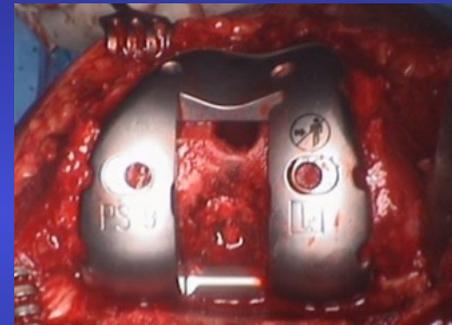
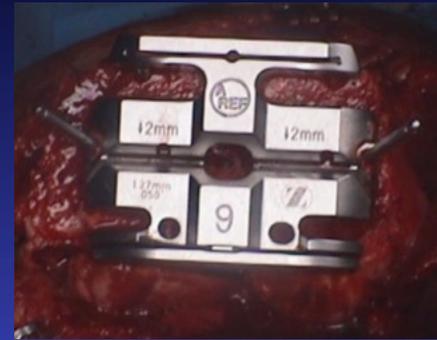
Cruciate Retaining	Ultracongruent	Posterior Stabilized	Constrained Posterior Stabilized (CPS)
<ul style="list-style-type: none"> Asymmetric femoral condyles mated with asymmetric art surfaces 1mm increments 	<ul style="list-style-type: none"> Maintain High flexion Kinematics Reduce sharp edge contact MCL/LCL 1mm increments 	<ul style="list-style-type: none"> Increased lateral mobility Enhanced post geometry 1mm increments 	<ul style="list-style-type: none"> Intermediate constraint b/t PS & CCK Moderate V/V & rotational constraint 2mm increments

Change for “Intelligent” Instrument



Changes for me

1. Do not change saw for chamfer cuts
2. No additional box cut guide
3. No compromise for tibia positioning
4. No manipulation for insert change



Lessons from the past



Evaluation is key

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The Outcome of Rotating-Platform Total Knee Arthroplasty with Cement at a Minimum of Ten Years of Follow-up

Jean-Noel A. Argenson, MD, Sebastien Parratte, MD, Abdullah Ashour, MD, Bertrand Saintmard, MD,
and Jean-Manuel Aubaniac, MD

Investigation performed at the Aix-Marseille University, Center for Arthritis Surgery, Marseille, France

639

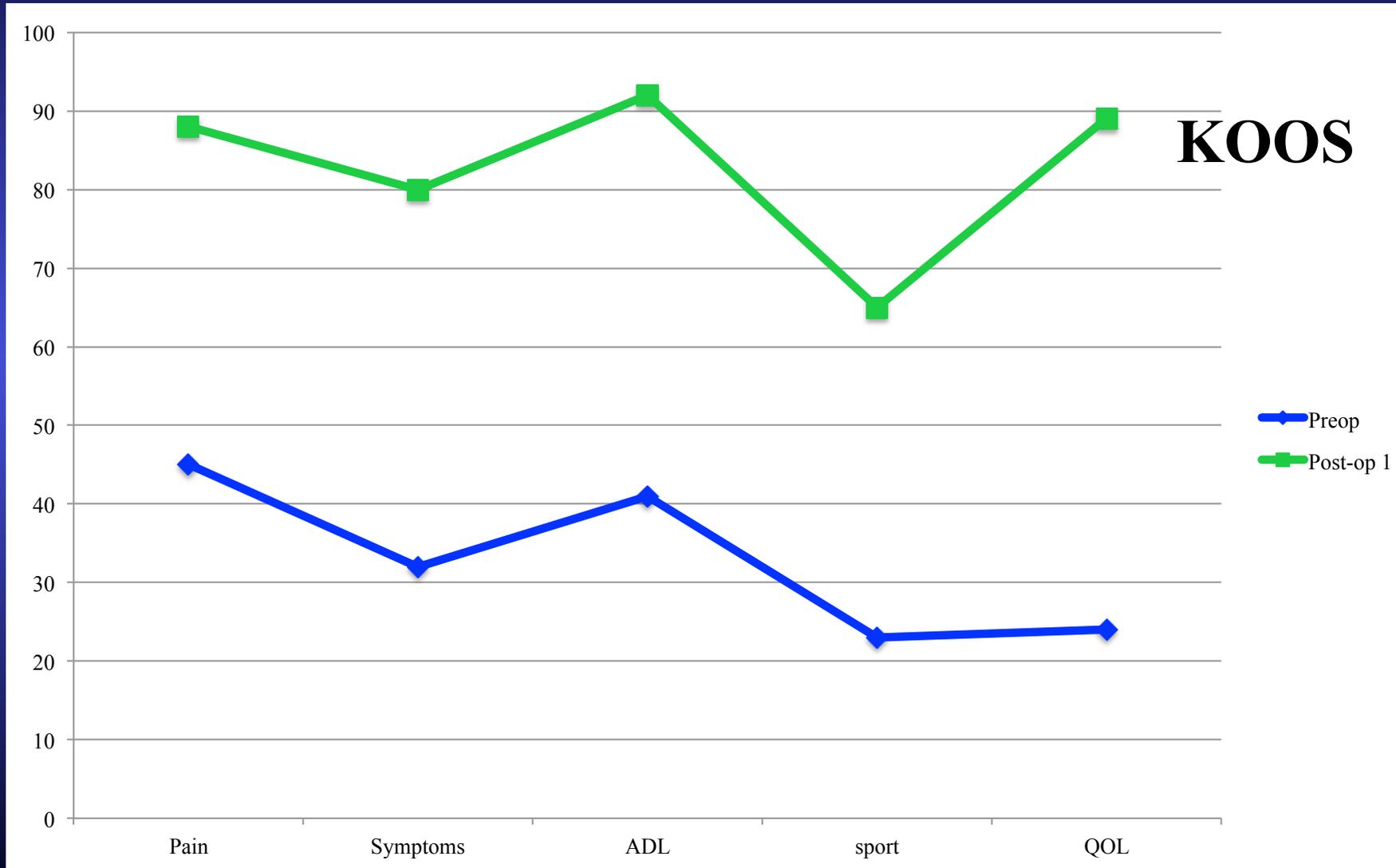
THE JOURNAL OF BONE & JOINT SURGERY · JBJS.ORG
VOLUME 94-A · NUMBER 7 · APRIL 4, 2012

ROTATING-PLATFORM TOTAL KNEE ARTHROPLASTY WITH CEMENT
AT MINIMUM OF TEN YEARS OF FOLLOW-UP

Long term studies



PROMS



Learning Curve for New Technology?

A Nationwide Register-Based Study of 46,363 Total Knee Arthroplasties

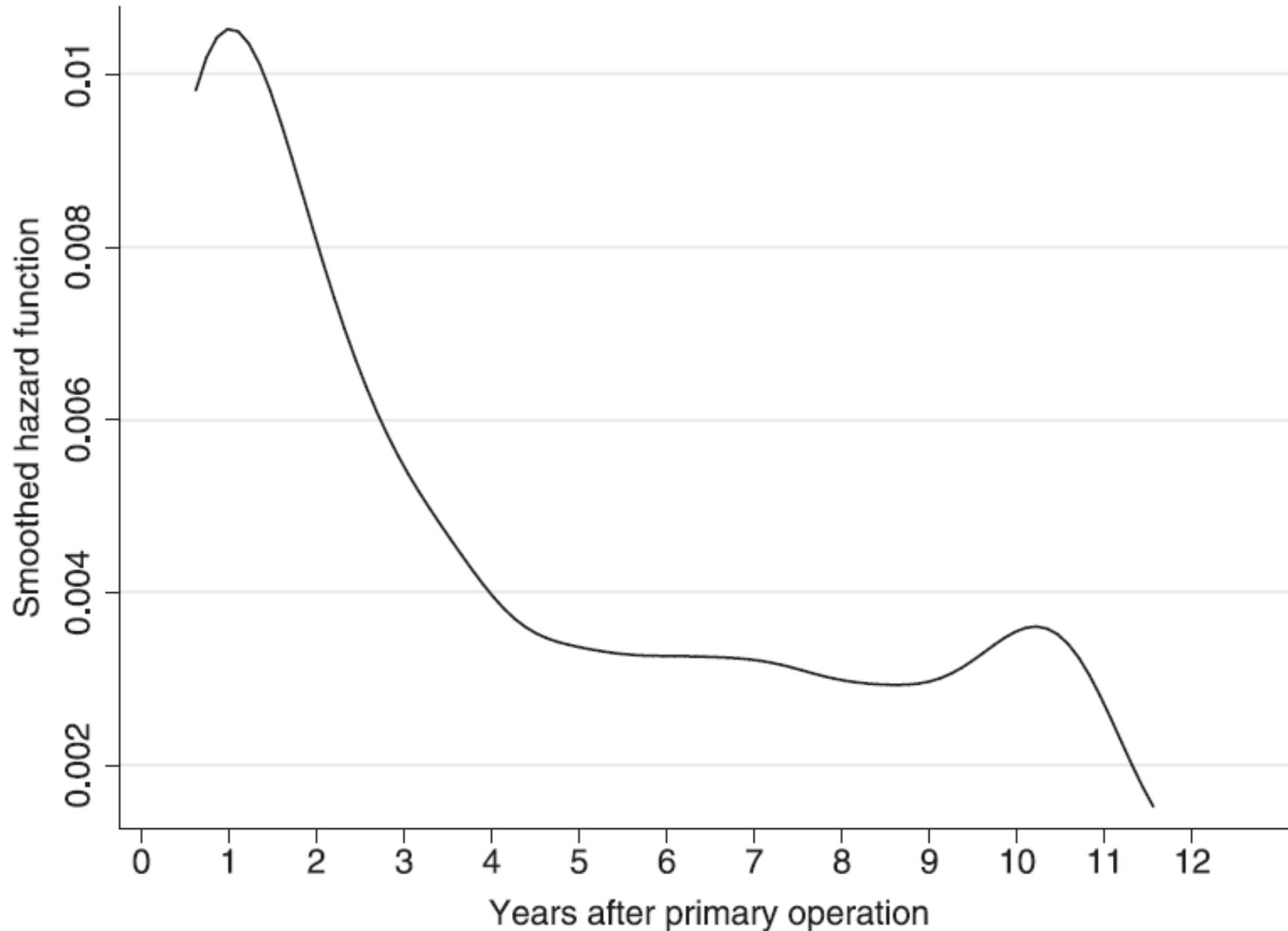
Mikko Peltola, MSc, Antti Malmivaara, MD, PhD, and Mika Paavola, MD, PhD

Investigation performed at the National Institute for Health and Welfare, Centre for Health and Social Economics, Helsinki, Finland

Methods: We studied register data from all seventy-five surgical units that performed knee arthroplasty in Finland from 1998 to 2007. Of 54,925 patients (66,098 knees), 39,528 patients (46,363 knees) underwent arthroplasty for osteoarthritis of the knee with the ten most common total knee implants and were followed with complete data until December 31, 2010, or the time of death. We used a Cox proportional-hazards regression model for calculating the hazard ratios for early revision for the first fifteen arthroplasties and subsequent increments of numbers of arthroplasties.



Risk of early revision when knee prosthesis introduced into practice



Differences in short term survival

	3-Year Survival	95% CI
All operations	97.1	96.9-97.2
Duracon	97.1	96.8-97.3
AGC V2	96.5	96.1-96.9
PFC Sigma	97.6	97.2-97.9
NexGen LPS	97.6	97.0-98.1
NexGen CR	98.0	97.4-98.4
PFC Sigma Stabilized	97.0	96.3-97.6
Triathlon CR	97.2	96.5-97.8
Arge	98.0	97.2-98.5
Maxim Primary	95.6	94.6-96.5
Vanguard CR	94.7	93.0-96.0



Differences in learning curve

(95% confidence interval [CI]: 3.07, 17.56), indicating the first fifteen patients treated with the [] implant in a hospital had a risk for revision surgery within the following three years that was over seven times higher than that of patients treated with the same implant after it has been used in the hospital in >100 knee arthroplasties. During the study period, the [] implant



Learning Curve for New Technology?

A Nationwide Register-Based Study of 46,363 Total Knee Arthroplasties

Mikko Peltola, MSc, Antti Malmivaara, MD, PhD, and Mika Paavola, MD, PhD

Investigation performed at the National Institute for Health and Welfare, Centre for Health and Social Economics, Helsinki, Finland

- Higher risk of revision for the first 30 implants with one prosthesis
- Surgical techniques for new implants should be practiced with models or cadavers before onto patients



The IDEAL Recommendations

- Innovation
- Development
- Exploration
- Assessment
- Long-term study

*No surgical innovation without evaluation:
The IDEAL recommendations. Lancet 2009;
374(9695):1105-12*



The CUSUM evaluation technique

- Quantitative assessment of individual performance with methods such the Cumulative Sums

Quantitative and individualized assessment of the learning curve using the LC-CUSUM. Biau DJ, Williams SM, Schlup MM, Nizard RS, Porcher R. Br J Surg. 2008; (95):925-29



Validation of the CUSUM test for the assessment of a learning curve: application to introduction of PSI for TKA in an academic department

- CUSUM test showed that positioning of the PS templates significantly differed from the target
- Study interrupted after 20 cases

De Gori M, Adamczweski B, Jenny JY. Knee. 2017; 24(3):615-21



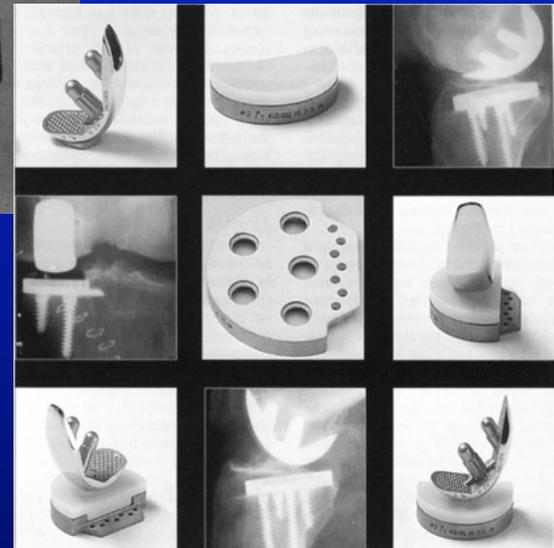
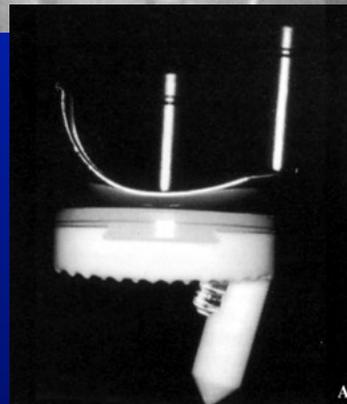
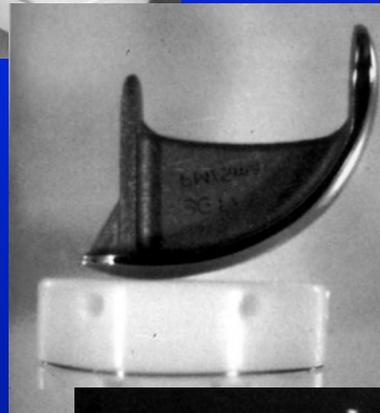
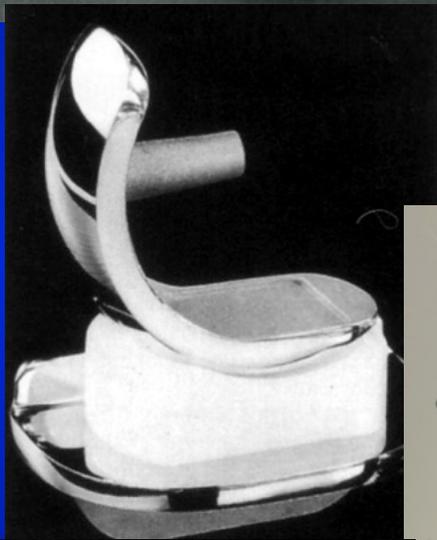
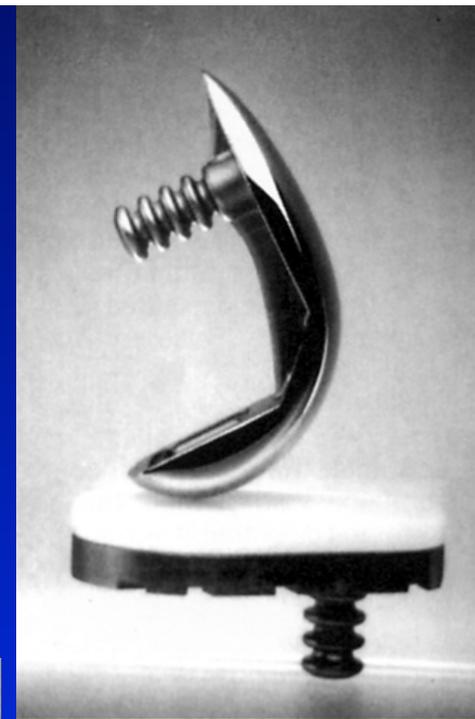
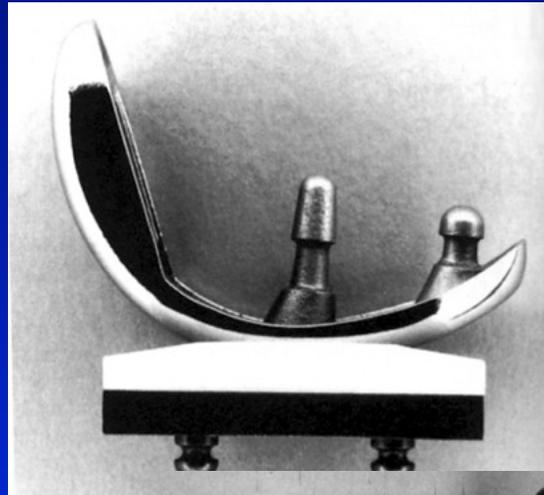
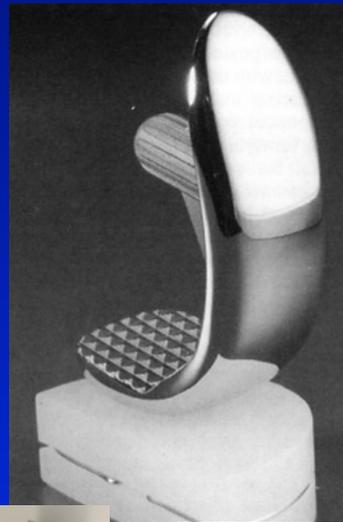
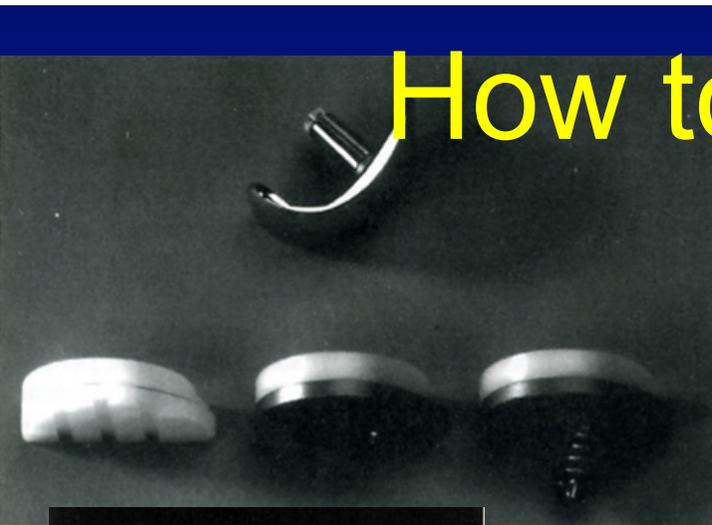
The learning curve for MIS Oxford phase 3 UKA: cumulative summation test for learning curve (LC-CUSUM)

- Group A (first 25 cases): 2 revisions, 2 dislocations, 1 lateral OA
- Group B (26 to 50 cases): 1 revision for fracture

*Zhang Q, Guo W, Liu Z et al. Arch Ger.2011
53(1):5-9*



How to chose for design?



Choices

- Use new TKA
- Defer pre-op plan
- Depend on rep.



Real Innovation ?



What is important for the surgeon ?

Reproducibility !

Right

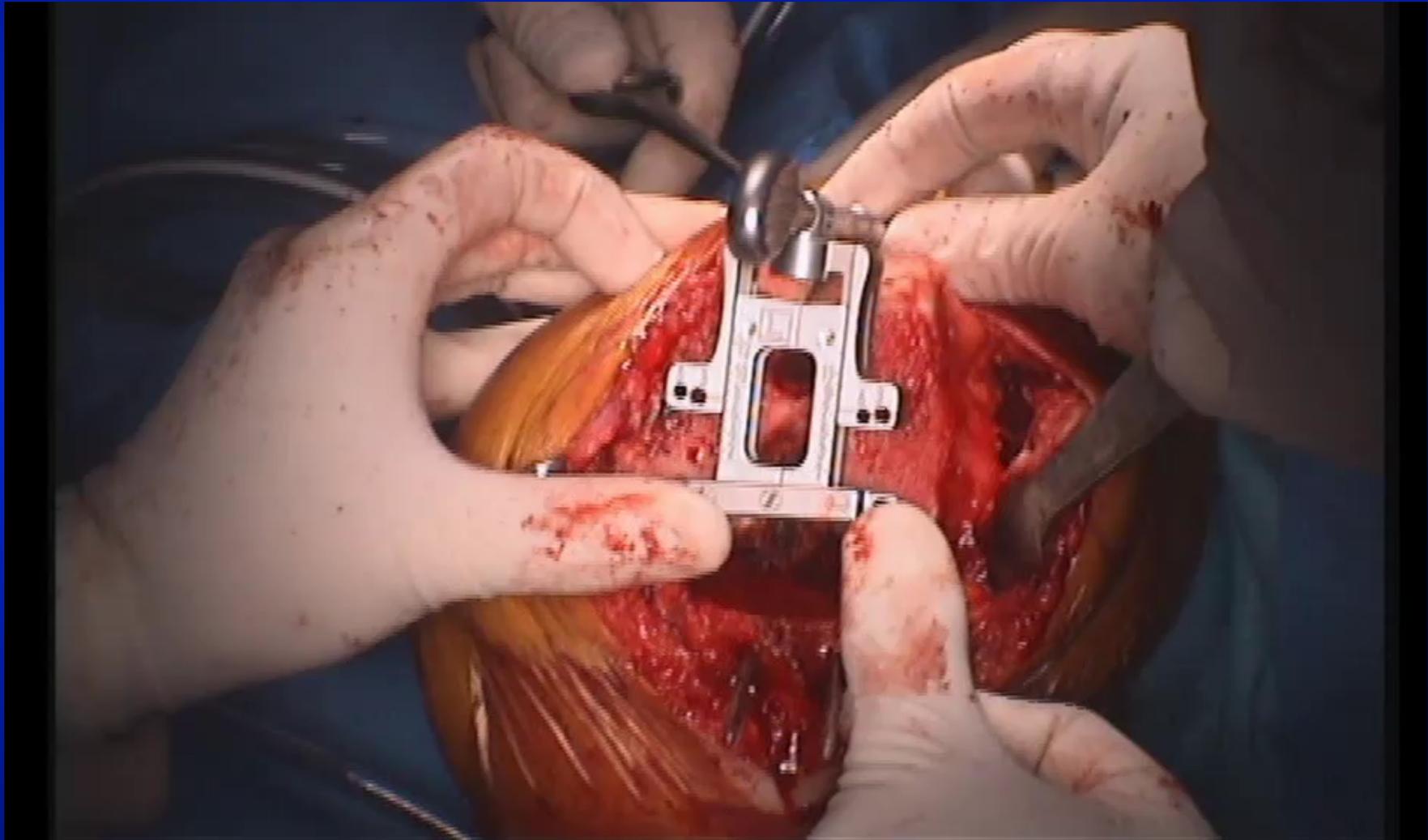
Left

Right

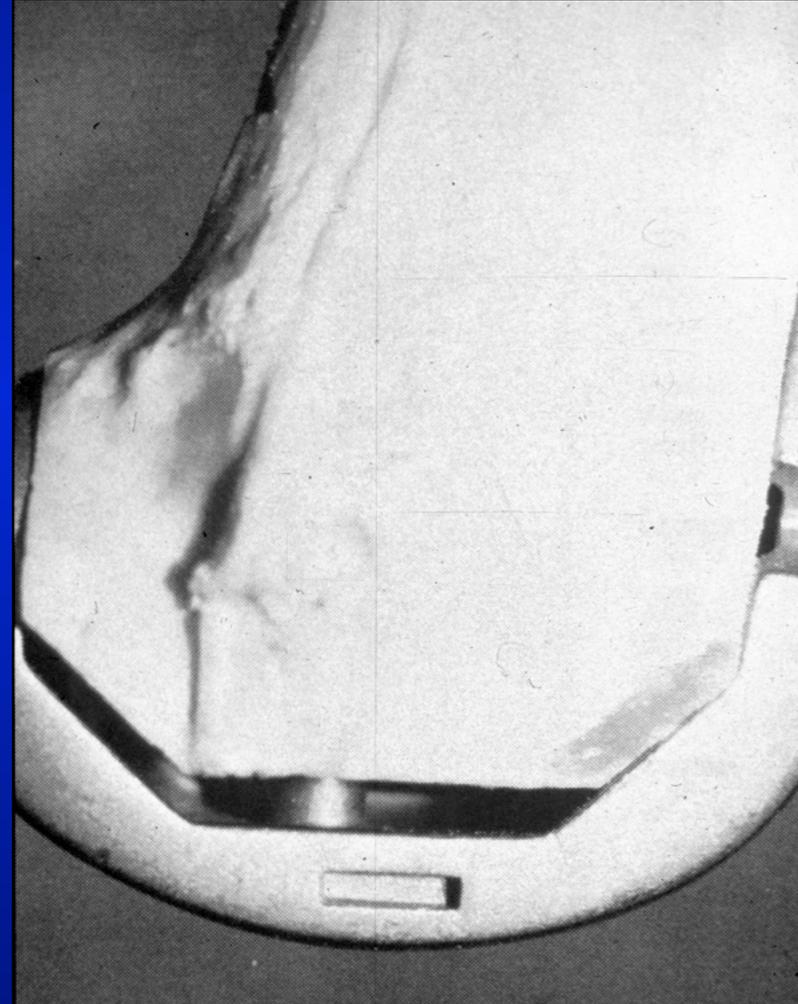
Left



« Automatic Surgery »



Evaluate consequences of your cuts

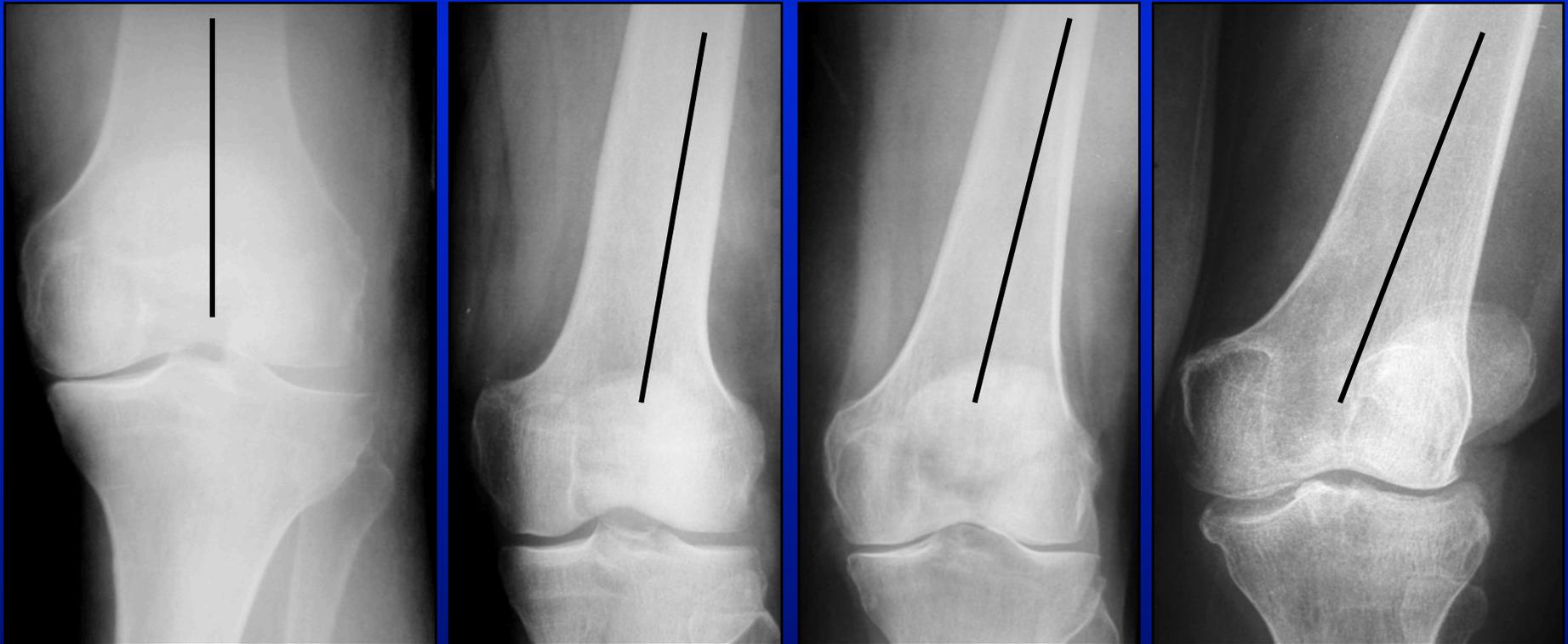


More difficult



Femur – “Average”

- 6° Valgus



Tibia – “Average”

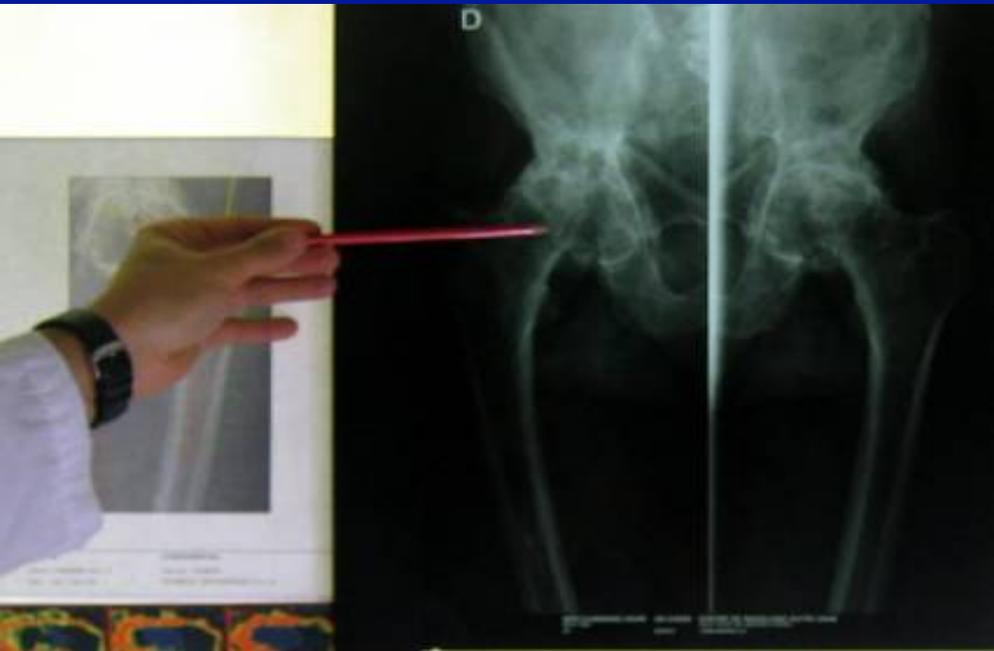
- 0° Coronal
- 7° Sagittal



Innovation from Industry .



Education from Institution



Education: fellows



ASSISTANCE PUBLIQUE
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INSTITUTE FOR LOCOMOTION

And

AIX-MARSEILLE
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WELCOME THE

2017 European Knee Society
TRAVELLING FELLOWS

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Dr Stefano Campi

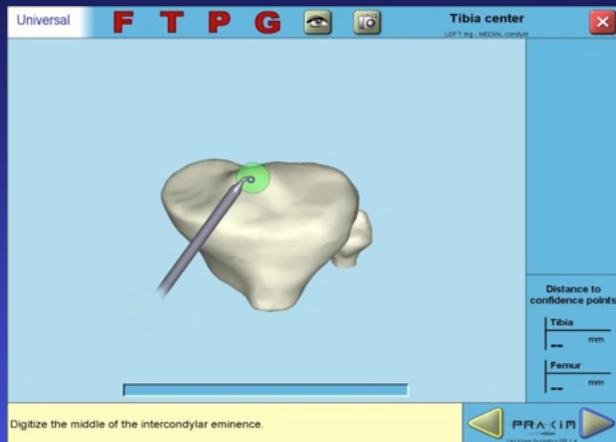
Dr Tom Piscaer

Dr Luc Vanlommel

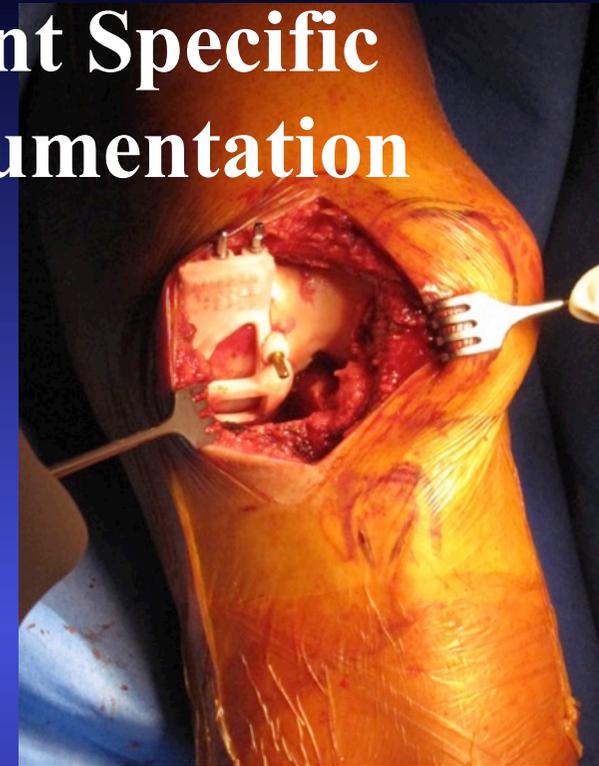


Solutions in 2020 ?

Navigation

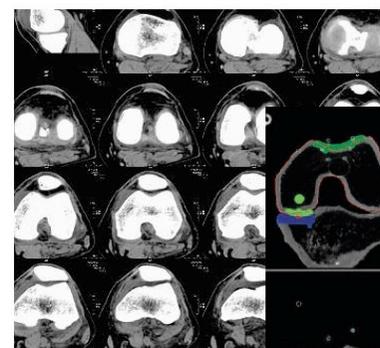


Patient Specific Instrumentation

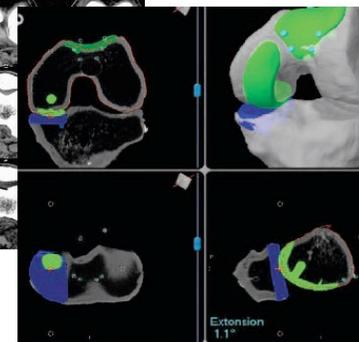


« Intelligent cutting guides »

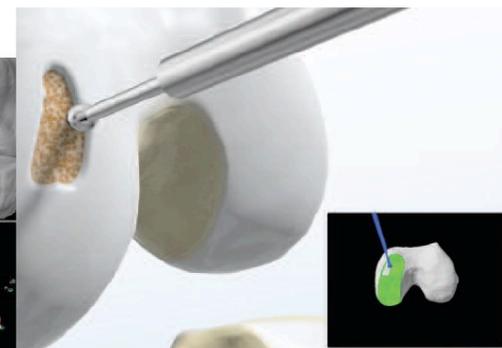
Robotics



CT Scan



Patient-specific Planning



Precision Sculpting



TOWARDS THE NEXT GENERATION OF ROBOTICS

	1st Generation	2 nd Generation	3rd Generation	NEXT Generation
Accuracy	++	~	~	++
Compact system	--	--	+	++
Seamless setup	--	-	+	++
Fast burring	+	-	-	++
Surgeon involved	-	++	++	++
Cost effective	-	--	+	++



THE CORRECT PRICE OF TECHNOLOGY



FINANCIAL PLANNING
LONG TERM: THE CAR IS CHEAPER

**No revolution,
just evolution...**



**Never be the
first, never be
the last...**



**Avoid changes during
the first five years of
your practice...**



2020 Knee Arthroplasty Surgeon

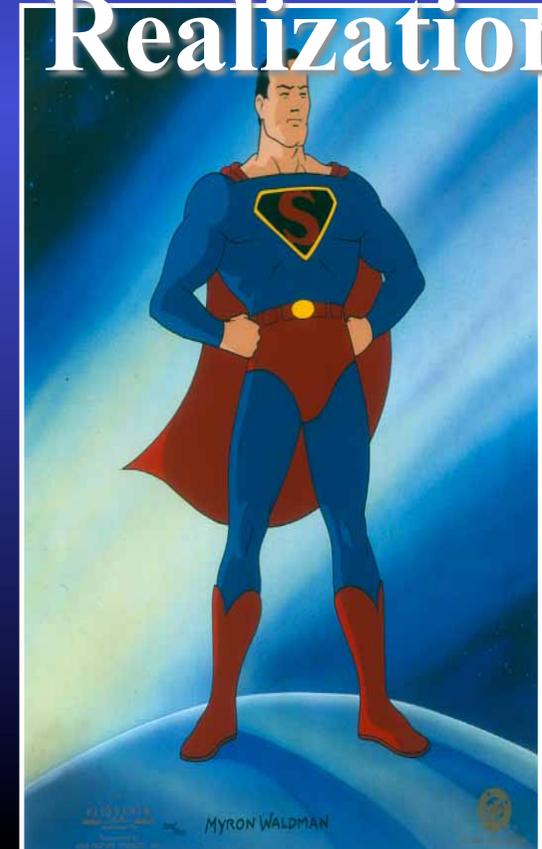
Patient Prediction



Procedure Indication



Procedure
Realization





ICJR

icjr.net

IN COLLABORATION WITH:



2ND WORLD ARTHROPLASTY CONGRESS

19 - 21 APRIL 2018 | ROME, ITALY

**ABSTRACT
SUBMISSION**

**Final program on
website today**

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