Accuracy of PSI: control with navigation

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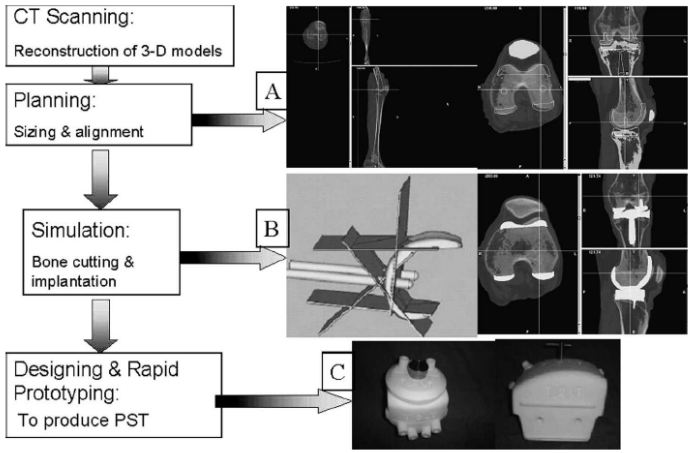
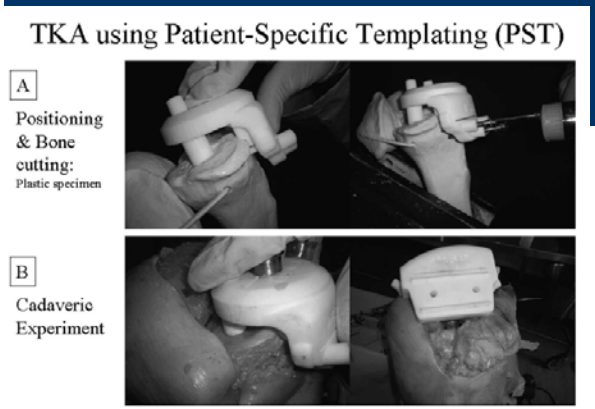
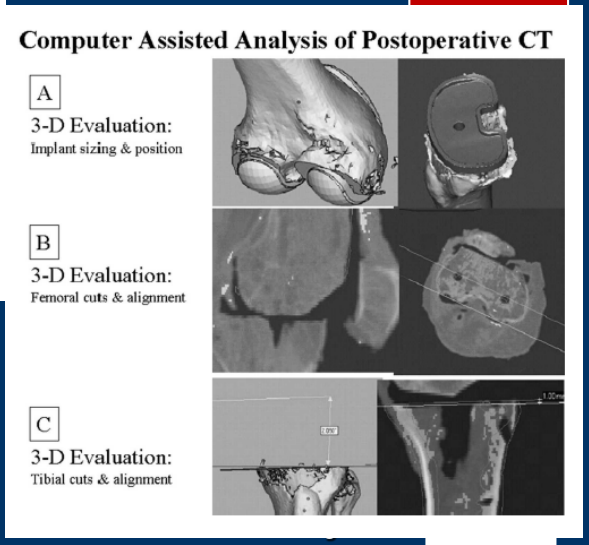
CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 444, pp. 184–192

Computer-assisted Total Knee Arthroplasty Using Patient-specific Templating

M. A. Hafez, FRCS(Ed)†; K. L. Chelule, PhD†; B. B. Seedhom, PhD†; and K. P. Sherman, FRCS, PhD‡*







Knee Surg Sports Traumatol Arthrosc (2013) 21:2227–2233
DOI 10.1007/s00167-013-2626-5

KNEE

Patient-specific instruments: industry's innovation with a surgeon's interest

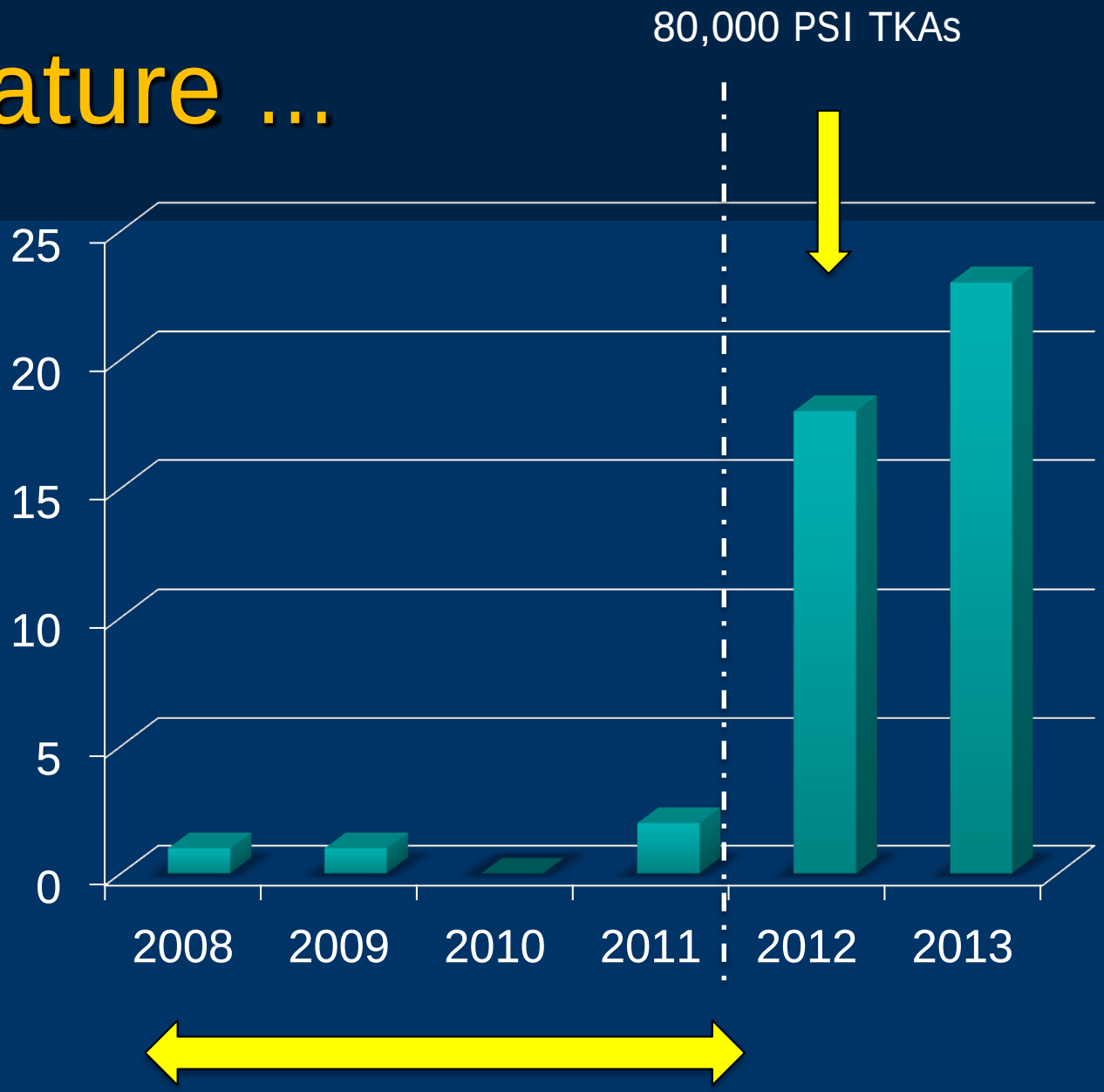
Emmanuel Thienpont · Johan Bellemans · Hendrik Delport · Philippe Van Overschelde · Bart Stuyts · Karl Brabants · Jan Victor

80,000 TKA with PSI in 2012

Table 1 Numbers in volume PSI TKA cases 2011 and 2012

Company name by alphabetical order	PSI TKA Global 2011	PSI TKA Europe 2011	PSI TKA Global 2012	PSI TKA Europe 2012
Biomet	11,192	3,169	22,506	6,501
DuPuy-Synthes	6,000	700	16,000	1,100
Medacta	4,600	3,400	6,200	4,600
Smith & Nephew	19,500	1,825	22,000	2,614
Wright Medical	1,600	400	2,000	550
Zimmer	9,800	1,250	13,850	2,150

Literature ...

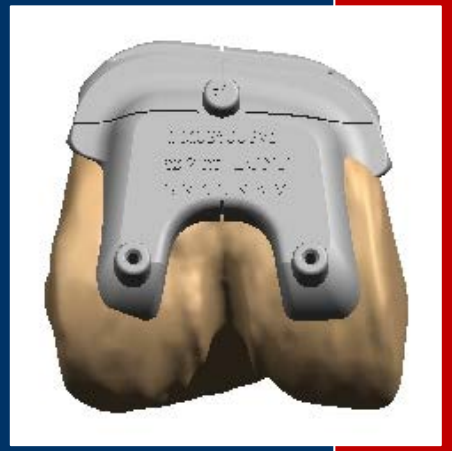


A. J. Costa,
S. Lustig,
C. J. Scholes,
J-C. Balestro,
M. Fatima,
D. A. Parker

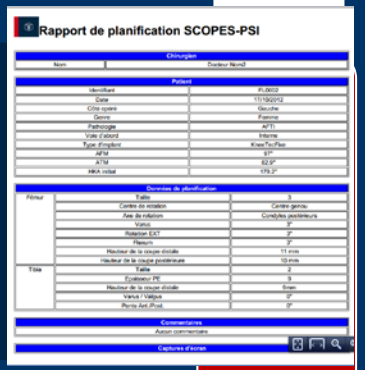
BJR

KNEE

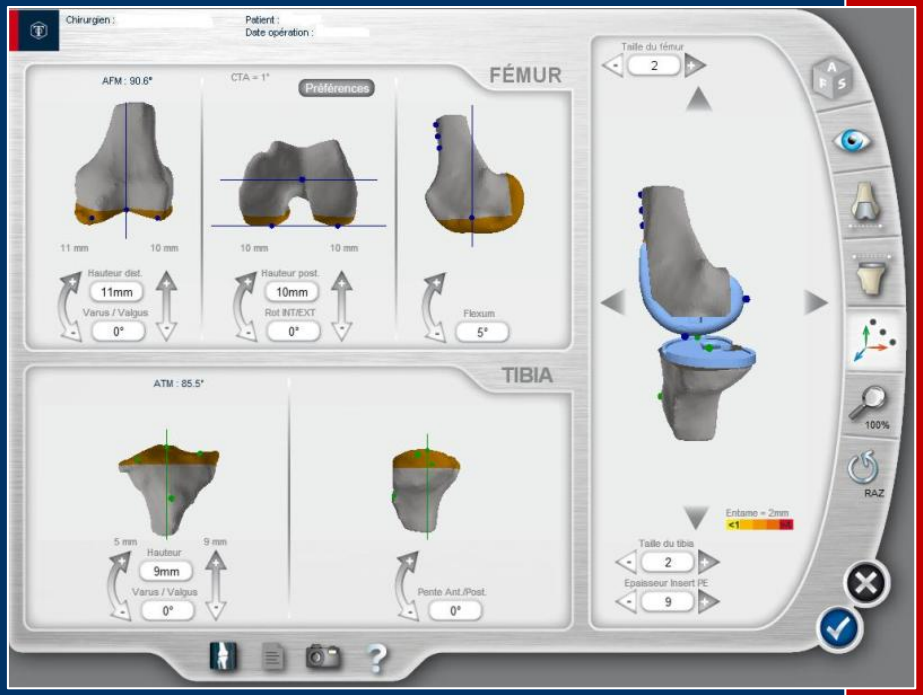
Can tibial coverage in total knee replacement be reliably evaluated with three-dimensional image-based digital templating?



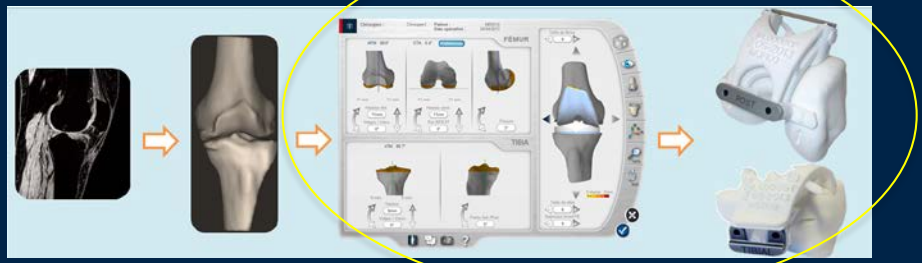
Problem ?



Someone at computer making all the decision for you …



Problem ?



How can we control the accuracy of the process…

Aim

Assess intraoperatively the accuracy

Of a Patient Specific Instrumentation

for TKA

Using a navigation system

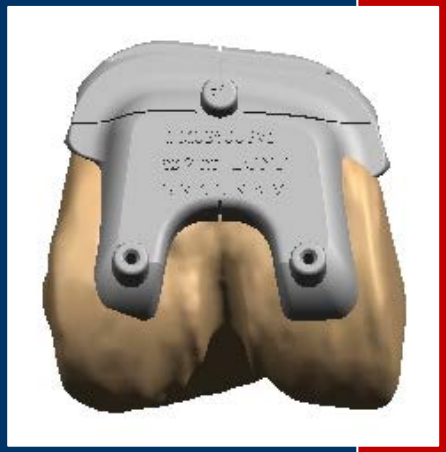
PSI

vs

Navigation

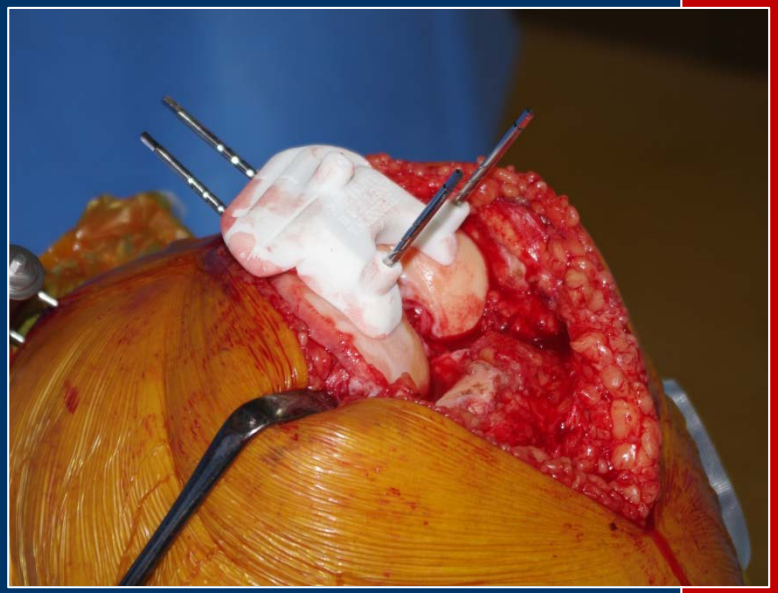
Method

Visionaire® Smith and Nephew



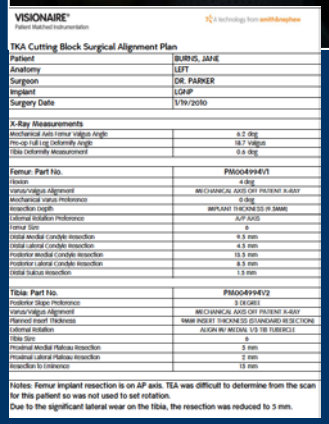
Method

- 60 consecutiv primary TKAs
  - Genesis II PS cemented
  - Navigation system Stryker Precision®
- Patient specific instrumentation
  - Visionaire® (SN)
- Positioning checked with CAS



(PSI used only if positioning was ideal – error less than 1° or 1mm)

Method



VISIONAIRE

TKA Cutting Block Surgical Alignment Plan

Patient	BURNS, JANE
Anatomy	LEFT
Surgeon	DR. PARKER
Implant	LGNP
Surgery Date	1/19/2010

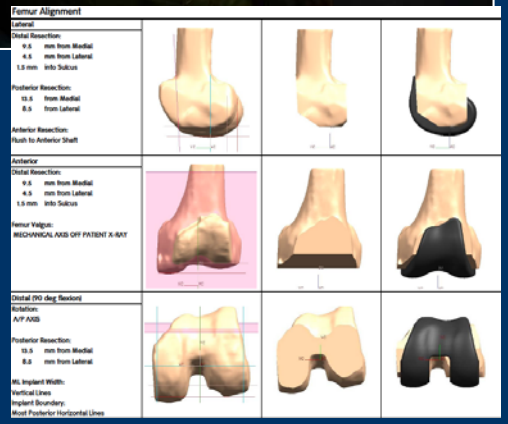
X-Ray Measurements

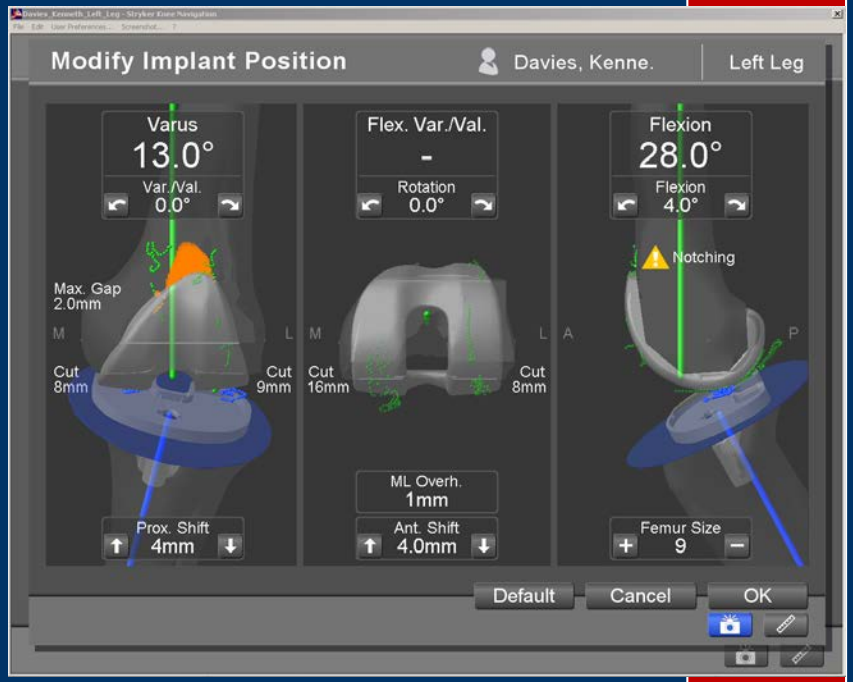
Mechanical Axis Femur Valgus Angle	6.2 deg
Pre-op Full Leg Deformity Angle	18.7 Valgus
Tibia Deformity Measurement	0.6 deg

Femur: Part No.	PM004994V1
Flexion	4 deg
Varus/Valgus Alignment	MECHANICAL AXIS OFF PATIENT X-RAY
Mechanical Varus Preference	0 deg
Resection Depth	IMPLANT THICKNESS (9.5MM)
External Rotation Preference	A/P AXIS
Femur Size	8
Distal Medial Condyle Resection	9.5 mm
Distal Lateral Condyle Resection	4.5 mm
Posterior Medial Condyle Resection	10.5 mm
Posterior Lateral Condyle Resection	8.5 mm
Distal Sulcus Resection	1.5 mm

Tibia: Part No.	PM004994V2
Posterior Slope Preference	3 DEGREE
Varus/Valgus Alignment	MECHANICAL AXIS OFF PATIENT X-RAY
Planned Insert Thickness	10MM INSERT THICKNESS (STANDARD RESECTION)
External Rotation	ALIGN W/ MEDIAL 1/3 TIB TUBERCLE
Tibia Size	6
Proximal Medial Plateau Resection	3 mm
Proximal Lateral Plateau Resection	2 mm
Resection to Eminence	15 mm

Notes: Femur implant resection is on AP axis. TEA was difficult to determine from the scan for this patient so was not used to set rotation.
Due to the significant lateral wear on the tibia, the resection was reduced to 5 mm.



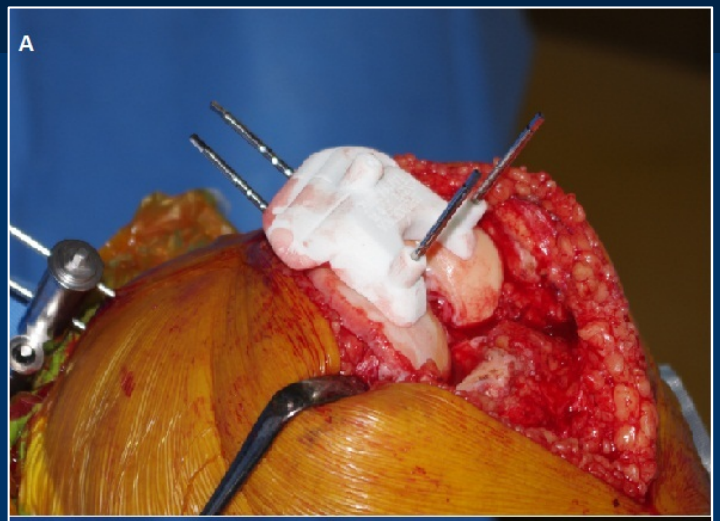


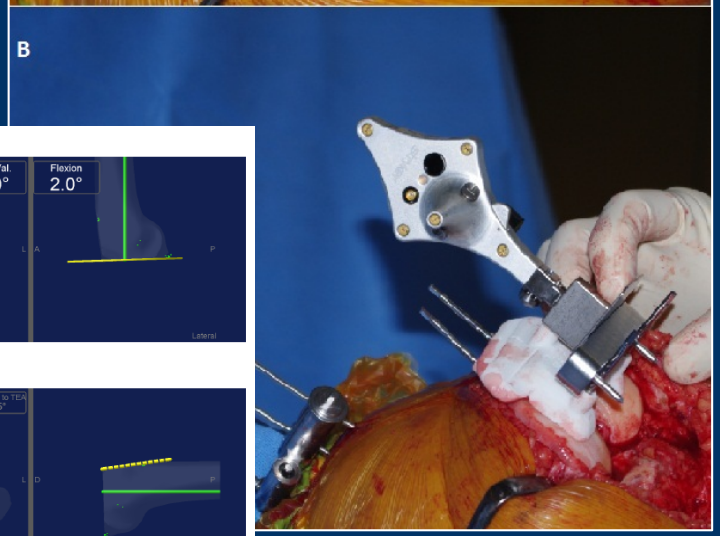
Method : Parameters assessed

Femur

Bone cuts :

- Frontal plane
- Sagittal plane
- Rotation
- Thickness
- Implant Size



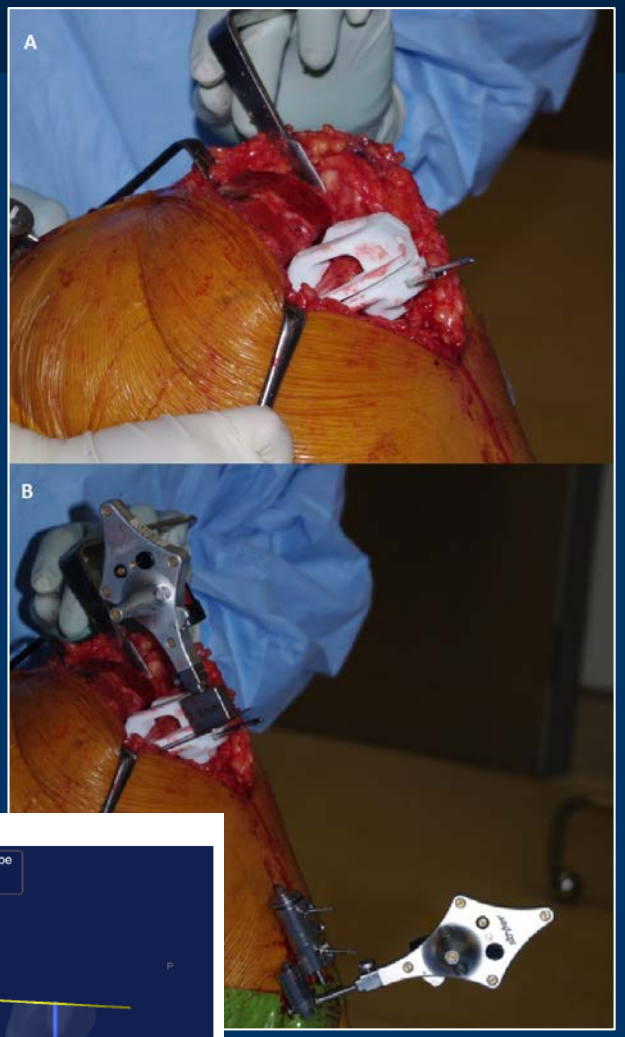


Method : Parameters assessed

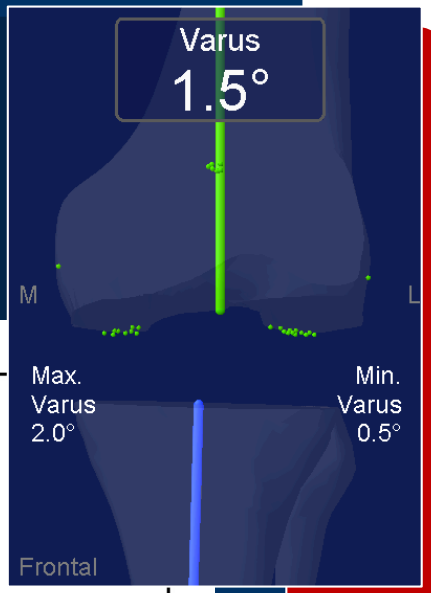
Tibia

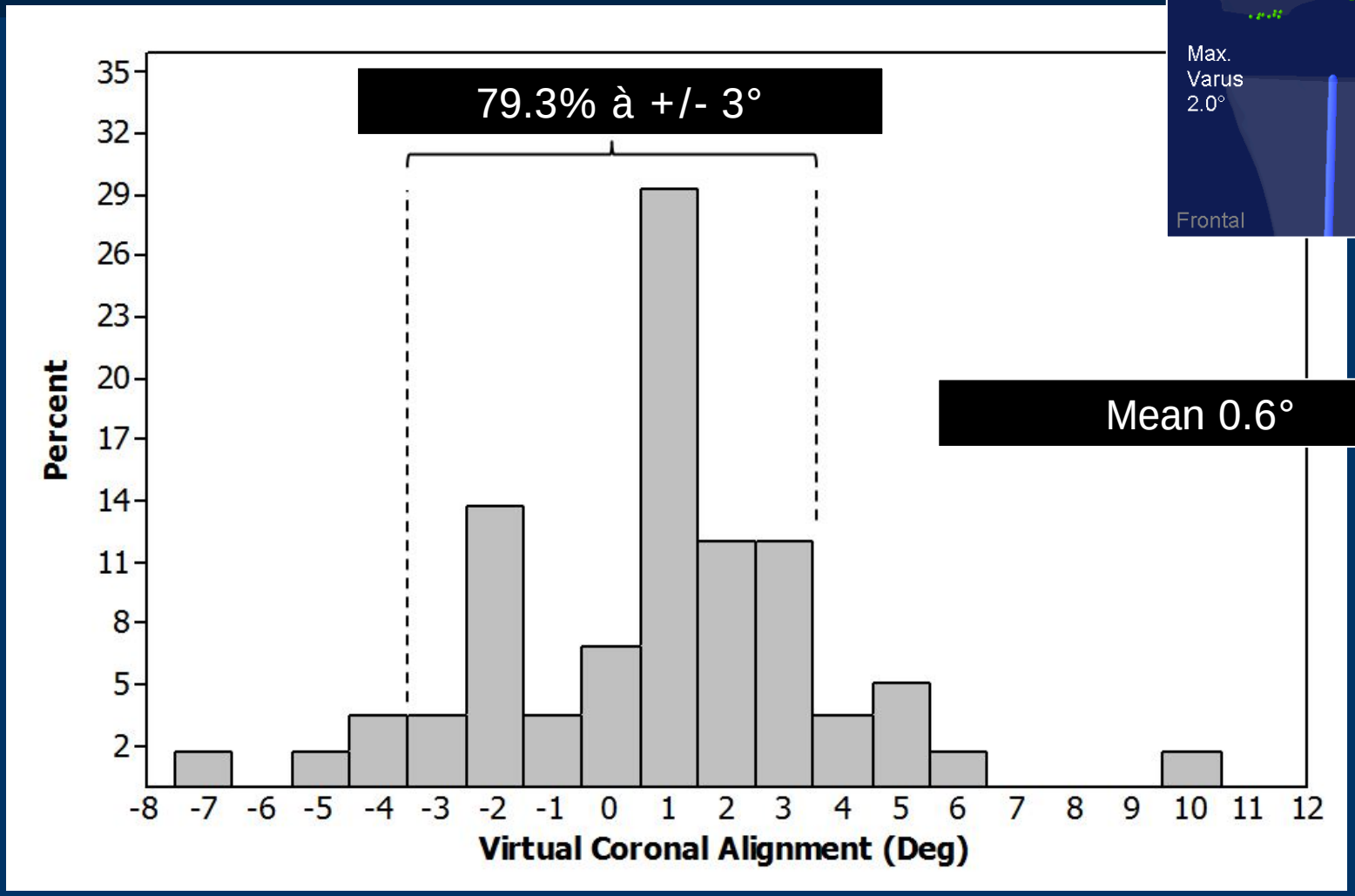
Bone cuts :

- Frontal plane
- Tibial Slope
- Thickness
- Implant Size

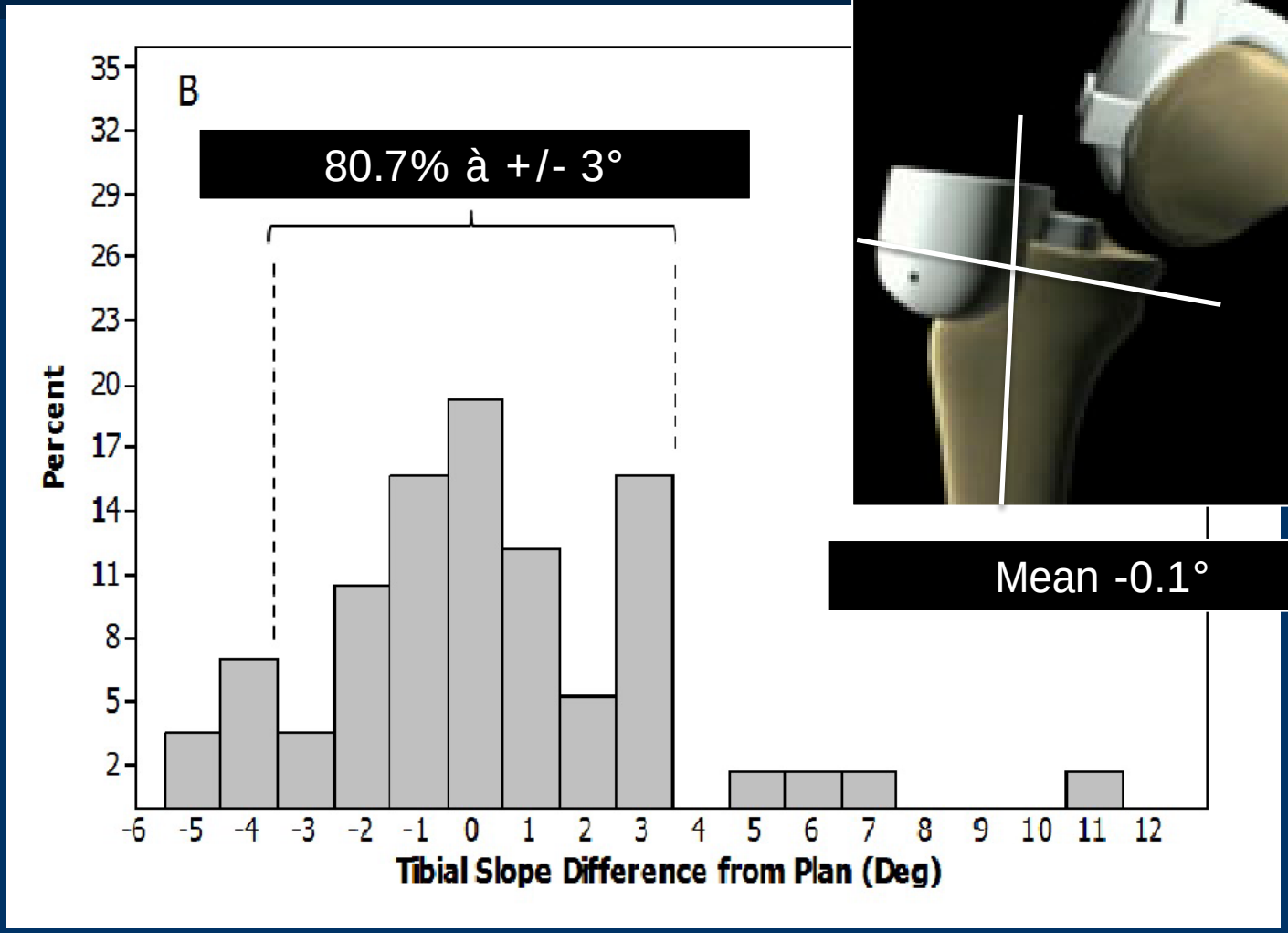


Results – Alignement



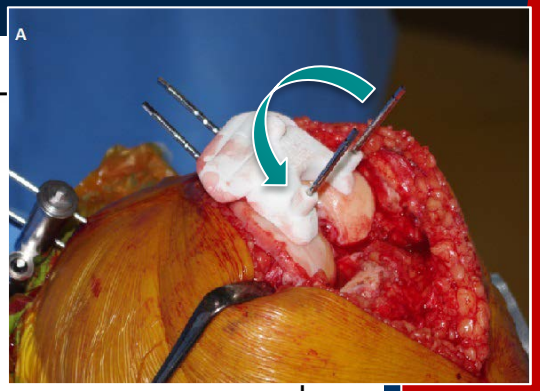


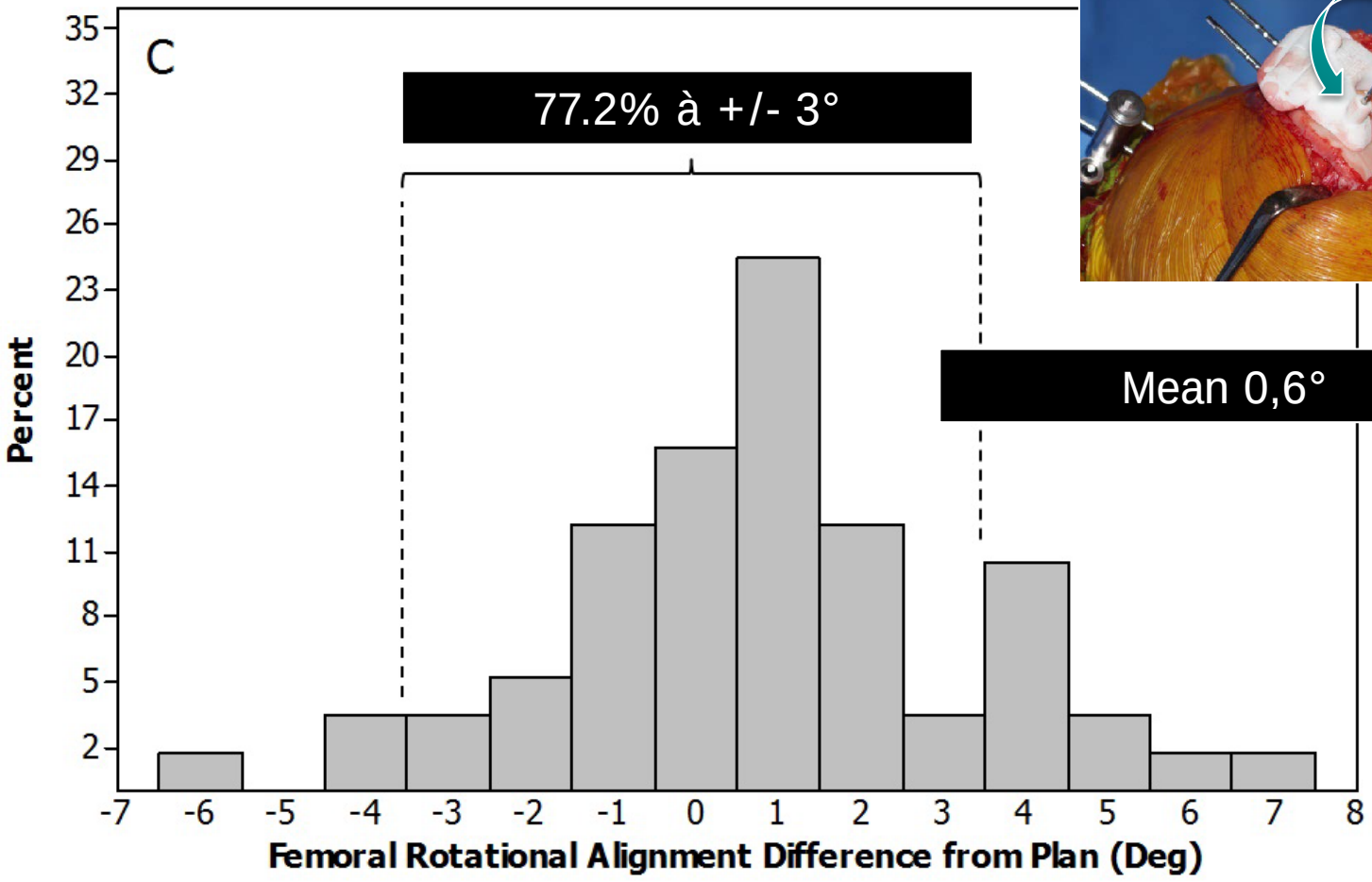
Tibial Slope



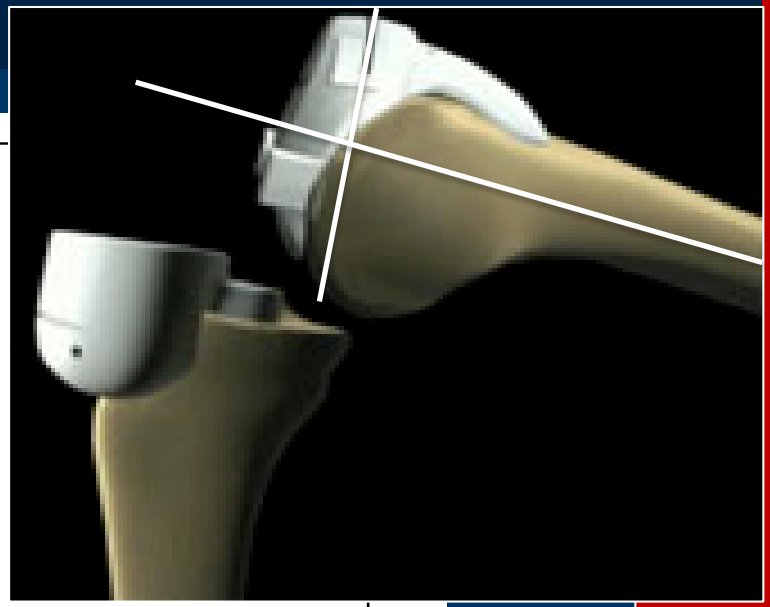
Mean -0.1°

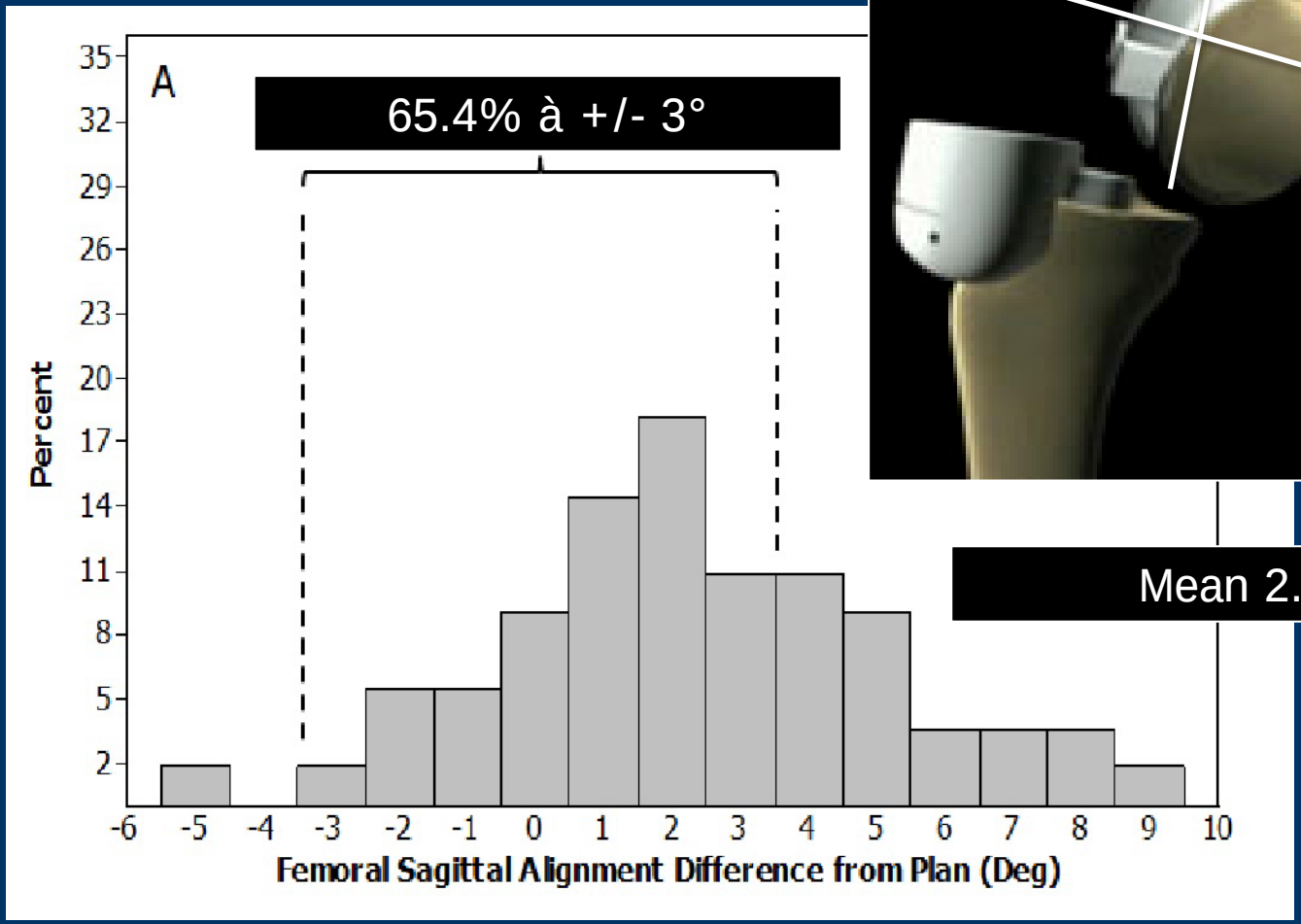
Femoral rotation





Femur : sagittal alignment





Results

- Compared to preop plan :
  - → Implants size : Femur 52% Tibia 50%
  - → Bone cuts thickness:

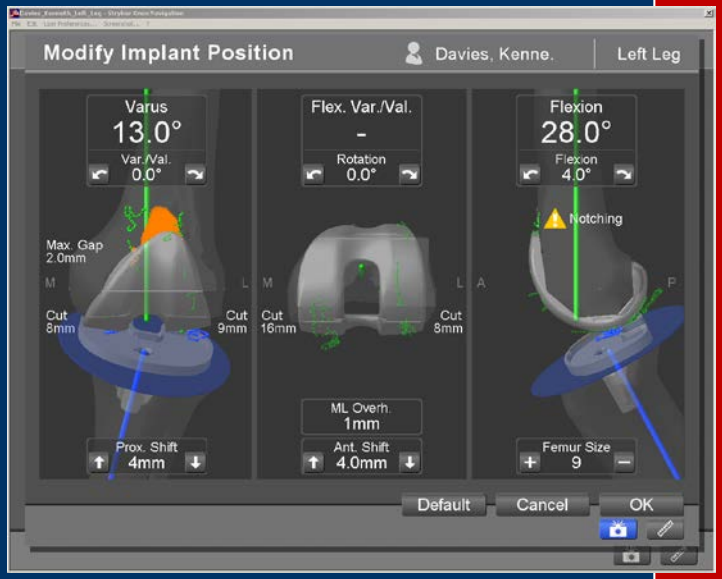
	Difference (mm)	Max (mm)	% +/- 2mm
Femur			
Medial	0.0 ± 1.2	-3.5 to 6.5	87.7
Lateral	0.25 ± 1.1	-6.5 to 6.5	87.7
Tibia			
Medial	0.1 ± 1.2	-6.0 to 3.0	78.9
Lateral	0.1 ± 1.1	-7.0 to 3.0	78.9

Discussion

20% mismatch > 3° for all parameters

35% mismatch > 3° for sagital positionning of the femur

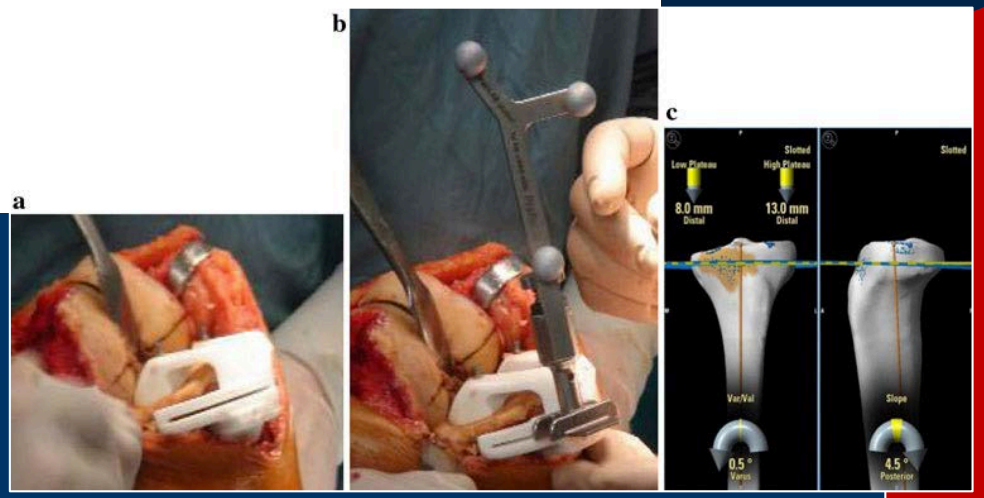
« Mistakes » up to **8°** for the frontal plane and **13°** for the sagittal plane



KNEE

Evaluation of the accuracy of a patient-specific instrumentation by navigation

Fabio Conteduca · Raffaele Iorio · Daniele Mazza · Ludovico Caperna · Gabriele Bolle · Giuseppe Argento · Andrea Ferretti



" (...) According to the above criteria, the custom cutting jigs were reliable in 34 out of 48 measurements (75 %) (...) "

Discussion

VISIONAIRE®
Patient Matched Technology

Conteduca KSSTA 2012

12 patients

Sagittal plane

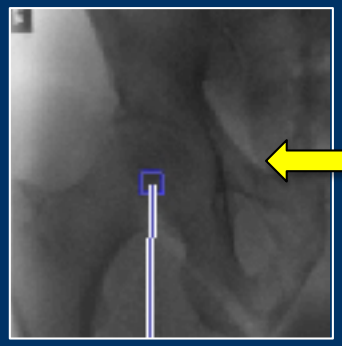
Tibia frontal	1.2° (0°-5°)
Tibia sagittal	3.8° (0°-7,5°)
Femur frontal	1.2° (0°-6°)
Femur sagittal	3.7° (0°-9°)

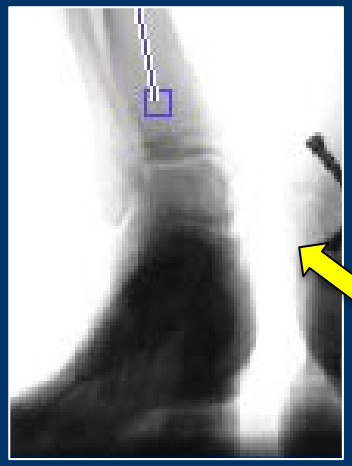
"In cases of the use of the custom made cutting jigs it is recommended to perform an accurate control of the alignment before making the cuts, for any step of the procedure"

Discussion

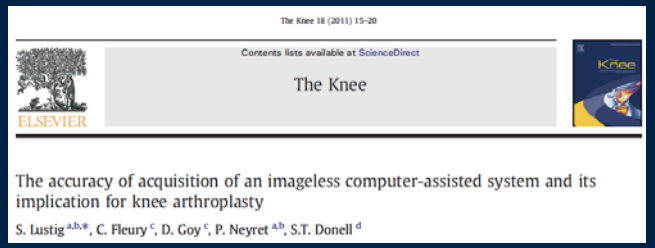
VISIONAIRE®
Patient Matched Technology

Preop MRI limited to the knee?





Limits


The Knee 18 (2011) 15–20

Contents lists available at ScienceDirect

The Knee

The accuracy of acquisition of an imageless computer-assisted system and its implication for knee arthroplasty

S. Lustig [a,b,*], C. Fleury [c], D. Goy [c], P. Neyret [a,b], S.T. Donell [d]

- Accuracy of the navigation system ? (1°-1mm)
- Parameters assessed are different between CAS and PSI ?

- Our results cannot be extrapolated to other systems

Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-013-2667-9

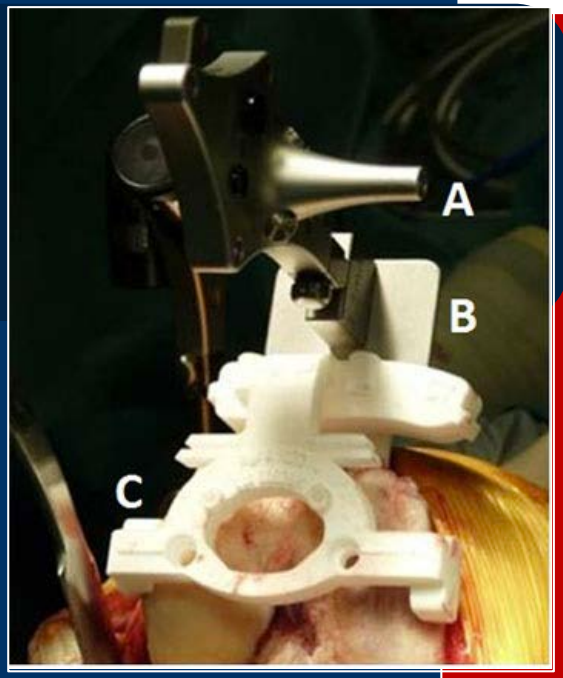
KNEE

Intra- and post-operative accuracy assessments of two different patient-specific instrumentation systems for total knee replacement

Andrea Ensini · Antonio Timoncini · Francesco Cenni · Claudio Belvedere · Francesca Fusai · Alberto Leardini · Sandro Giannini

n= 50

Trumatch® (Depuy)



"(...)Despite good coronal alignments of the single prosthetic components, the lower limb mechanical axis was not restored correctly in a number of patients. (...) "

PSI® (Zimmer)

n=30

Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-013-2670-1

KNEE

Patient-specific instrumentation for total knee arthroplasty does not match the pre-operative plan as assessed by intra-operative computer-assisted navigation

Corey Scholes · Varun Sahni · Sebastien Lustig · David A. Parker · Myles R. J. Coolican

" (...) the error for total coronal alignment exceeded 3° for 27 % of the sample (...) "

Clin Orthop Relat Res (2014) 472:263–271
DOI 10.1007/s11999-013-2997-4

Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

SYMPOSIUM: 2013 KNEE SOCIETY PROCEEDINGS

Patient-specific Guides Do Not Improve Accuracy in Total Knee Arthroplasty

A Prospective Randomized Controlled Trial

Jan Victor MD, PhD, Jan Dujardin MD,
Hilde Vandenneucker MD, Nele Arnout MD,
Johan Bellemans MD, PhD

2014

Visonaire® (SN)
Trumatch® (Depuy)
Signature® (Biomet)

Conclusion

- Unsatisfactory accuracy of the visionaire PSI system in that study,
- Origin of the error still to be determined
- Promising technology, need for improvement,
- Currently unacceptable risk for malalignment if used without intraoperative control.

MEDIOCRITY

IT TAKES A LOT LESS TIME
AND MOST PEOPLE WON'T NOTICE THE DIFFERENCE
UNTIL IT'S TOO LATE.

Thank you

Contents lists available at SciVerse ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Unsatisfactory Accuracy as Determined by Computer Navigation of VISIONAIRE Patient-Specific Instrumentation for Total Knee Arthroplasty

Sébastien Lustig MD, PhD [a,b], Corey J. Scholes PhD [a], Sam I. Oussedik FRCS [a], Vera Kinzel FRACS [a], Myles R.J. Coolican FRACS [a], David A. Parker FRACS [a]

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