Optimizing +

unicompartmental knee arthroplasty with robotic-assisted surgery

Prof. Etienne CAVAIGNAC

Clinique Universitaire du Sport

CHU TOULOUSE, France

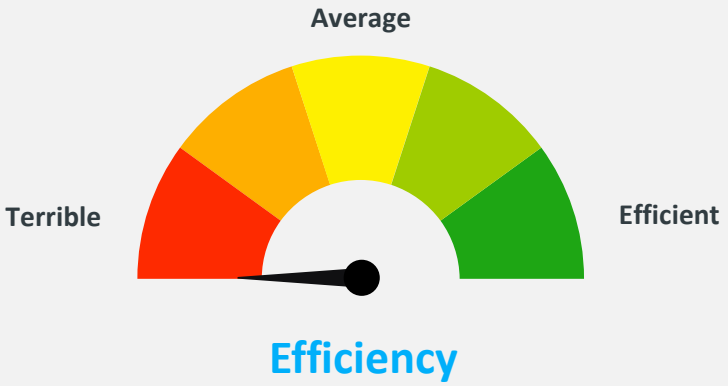
Requirements for surgical solution

Knee

- Personalized
- Appropriate (Ligament)
- Appropriate (Bone)

General

- Accurate
- Reproducible
- Reliable
- Predictable / **Clarity**
- Simple
- Fast

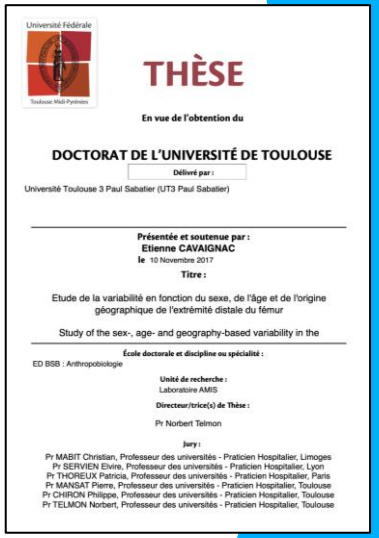


Education AND Have FUN !!!!!!

Personalization!!!

True personalization?

- PhD
- Anthropobiology



Université Fédérale

Toulouse Midi-Pyrénées

THÈSE

En vue de l'obtention du

DOCTORAT DE L'UNIVERSITÉ DE TOULOUSE

Délivré par :

Université Toulouse 3 Paul Sabatier (UT3 Paul Sabatier)

Présentée et soutenue par :
Etienne CAVAIGNAC
le 10 Novembre 2017

Titre :

Etude de la variabilité en fonction du sexe, de l'âge et de l'origine géographique de l'extrémité distale du fémur

Study of the sex-, age- and geography-based variability in the

École doctorale et discipline ou spécialité :
ED BSB : Anthropobiologie

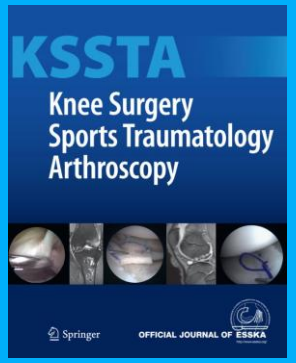
Unité de recherche :
Laboratoire AMIS

Directeur/trice(s) de Thèse :

Pr Norbert Telmon

Jury :

Pr MABIT Christian, Professeur des universités - Praticien Hospitalier, Limoges
Pr SERVIEN Elvire, Professeur des universités - Praticien Hospitalier, Lyon
Pr THOREUX Patricia, Professeur des universités - Praticien Hospitalier, Paris
Pr MANSAT Pierre, Professeur des universités - Praticien Hospitalier, Toulouse
Pr CHIRON Philippe, Professeur des universités - Praticien Hospitalier, Toulouse
Pr TELMON Norbert, Professeur des universités - Praticien Hospitalier, Toulouse

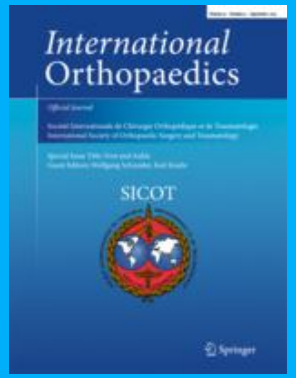


KSSTA

Knee Surgery Sports Traumatology Arthroscopy

Springer

OFFICIAL JOURNAL OF ESSKA



International Orthopaedics

SICOT

Springer

Contents lists available at ScienceDirect

Forensic Science International

journal homepage: www.elsevier.com/locate/forsciint

Forensic Anthropology Population Data

Geometric morphometric analysis reveals sexual dimorphism in the distal femur

Etienne Cavaignac [a,b,*], Frederic Savall [a], Marie Faruch [a], Nicolas Reina [a,b], Philippe Chiron [b], Norbert Telmon [a]

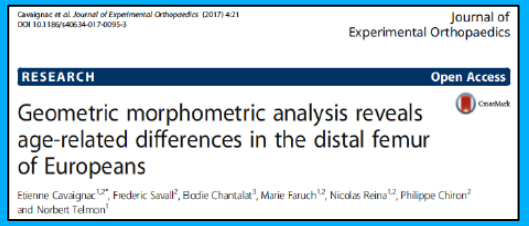
[a] Laboratoire AMIS, UMR 5288 CNRS, Université Paul Sabatier, 37 allée Jules Guesdes, 31000 Toulouse, France
[b] Institut de l'appareil locomoteur, Hôpital Pierre-Paul Riquet, CHU Toulouse, France

Knee Surgery, Sports Traumatology, Arthroscopy
https://doi.org/10.1007/s00167-019-05410-9

KNEE

Sexual and ethnic polymorphism render prosthetic overhang and under-coverage inevitable using off-the shelf TKA implants

Ke Li[1] · Mo Saffarini[2] · Jeremy Valluy[2] · Marie-Charlotte Desseroit[3] · Yannick Morvan[3] · Norbert Telmon[4] · Etienne Cavaignac[4,5]



Cavaignac et al. Journal of Experimental Orthopaedics (2017) 4:21
DOI 10.1186/s40634-017-0095-3

Journal of Experimental Orthopaedics

RESEARCH Open Access

Geometric morphometric analysis reveals age-related differences in the distal femur of Europeans

Etienne Cavaignac[1,2*], Frederic Savall[2], Elodie Chantalat[1], Marie Faruch[1,2], Nicolas Reina[1,2], Philippe Chiron[2] and Norbert Telmon[1]

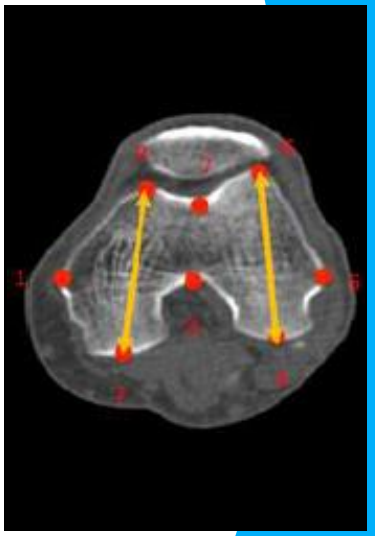
Morphometric evaluation of the knee in Chinese population reveals sexual dimorphism and age-related differences

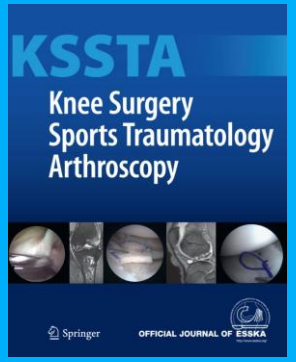
Differences in shape, not only in size

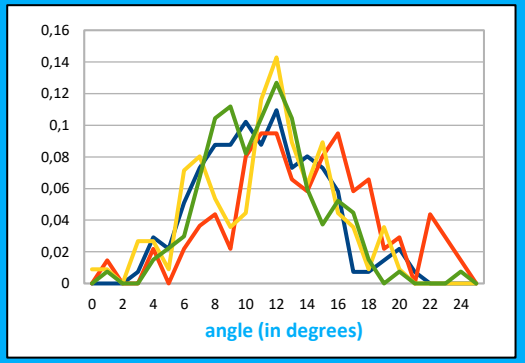
Personalization!!!

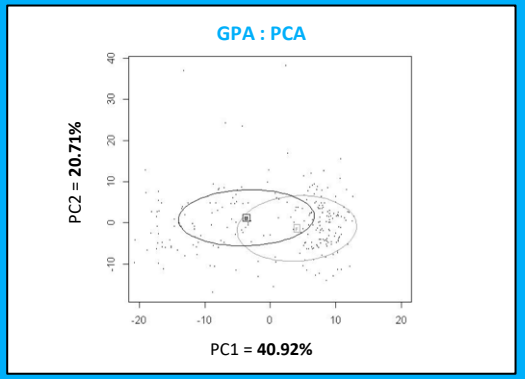
True personalization?

- PhD
- Anthropobiology







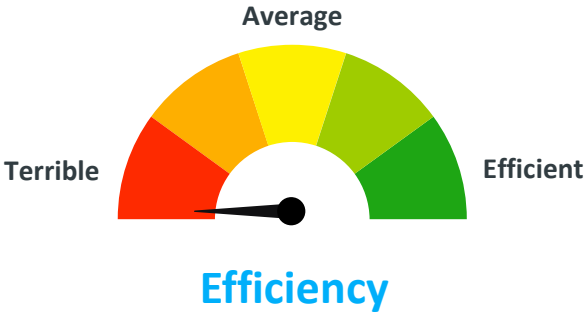


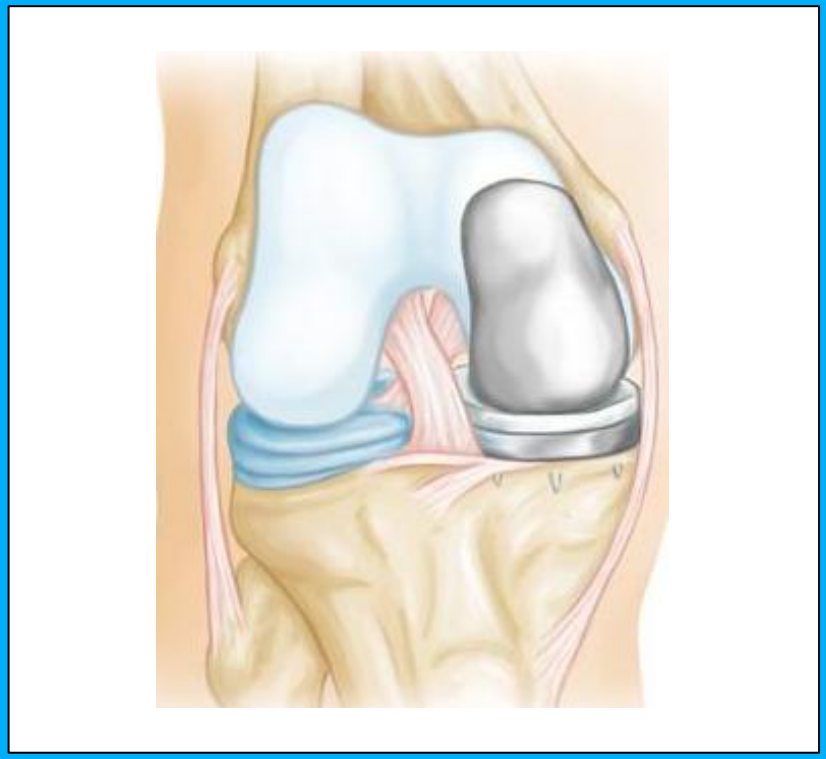
Variability….

Personalization!!!

True personalization?

- Replace only what is necessary





True personalization….

Why partials?

FASTER RECOVERY*

Less invasive

Lower morbidity rates[1-4]

IMPROVED FUNCTION[2]

Maintain kinematics

HIGH PATIENT SATISFACTION[5-6]

Forgotten Joint Scores, KSS[7-8]

Better proprioception

***Compared to TKA procedures**

1. Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip, Knee & Shoulder Arthroplasty: 2020 Annual Report. Adelaide: AOA, 2020.
2. Wilson HA, et al. BMJ. 2019;364:l352.
3. Kalbian, IL, et al. Bone Joint J. 2019;101-B(7 Supple C):22-27.
4. Schwab P, et al. Knee Surg Sports Traumatol Arthrosc. 2014;23:3494-3500.
5. Geller JA, et al. J Arthroplasty. 2011;26(8):1468–1474.
6. Biswas D, et al. J Arthroplasty. 2014;29(1):101–105.
7. Casper DS, et al. J Arthroplasty. 2019;34(8):1611-1616.
8. Zuiderbaan H, et al. Knee Surg Sports Traumatol Arthrosc. 2017;25:681-686.

Why partials?

FASTER RECOVERY*

Less invasive

Lower morbidity rates[1-4]

	UKA	TKA	*P* value
Use of second opioid prescription	50.2%	60.5%	0.006
Use of opioids after 5 prescriptions	5.8%	13.7%	0.001
	***Kalbian,** I, et al: Bone and Joint Journal. 2019;101B(7 Supple C):22-27.*		
Mean perioperative blood loss (pre tourniquet release)	20 cc	110 cc	<0.0001
	***Schwab P**, et al. Knee Surgery, Sports Traumatology, Arthroscopy. 2014;23:3494-3500.*		

***Compared to TKA procedures**

1. Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip, Knee & Shoulder Arthroplasty: 2020 Annual Report. Adelaide: AOA, 2020.
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Why partials?

HIGH PATIENT SATISFACTION[5-6]

Forgotten Joint Scores, KSS[7-8]

Better proprioception

	UKA	TKA	*P* value
FJS at 1 year	73.9 ± 22.8	59.3 ± 29.5	0.002
FJS at 2 years	74.3 ± 24.8	59.8 ± 31.5	0.002

***Zuiderbaan H,** et al: Knee Surgery, Sports Traumatology, Arthroscopy. 2017;25:681-686.*

***Compared to TKA procedures**

1. Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip, Knee & Shoulder Arthroplasty: 2020 Annual Report. Adelaide: AOA, 2020.
2. Wilson HA, et al. BMJ. 2019;364:l352.
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5. Geller JA, et al. J Arthroplasty. 2011;26(8):1468–1474.
6. Biswas D, et al. J Arthroplasty. 2014;29(1):101–105.
7. Casper DS, et al. J Arthroplasty. 2019;34(8):1611-1616.
8. Zuiderbaan H, et al. Knee Surg Sports Traumatol Arthrosc. 2017;25:681-686.

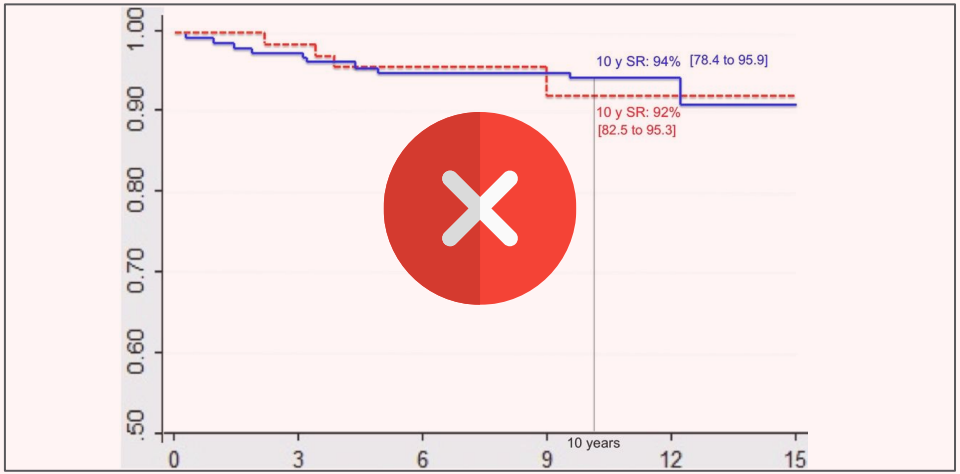
Current challenges with conventional UKA result in reduced usage, despite improved outcomes compared to TKA

TKA = total knee arthroplasty; UKA = unicompartmental knee arthroplasty.

1. National Joint Registry. 19th Annual Report. 2022. 2. Murray DW, et al. BJJ. 2018;100-B:432–435.

■ KNEE

Obesity has no adverse effect on the outcome of unicompartmental knee replacement at a minimum follow-up of seven years



BMI > 30, n=90

BMI < 30, n=200

Contraindications → NONE except lack of ACL and stiff knee

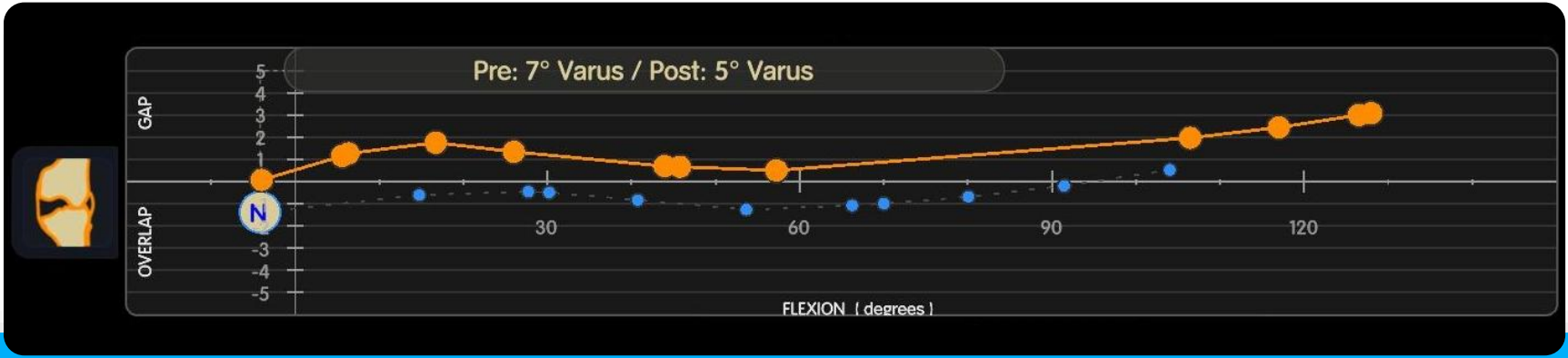
Appropriate

True personalization that takes into account the ligaments!!!!

Measurement of tension

Plan for correction

➡ Clarity



Variability….

Appropriate

True personalization that fits in the knee!!

Several sizes

Low profile

Size	AP	SI
1	40	28.8
2	42	30.6
3	44	32.3
4	46	34.0
5	48	35.9
6	50	37.7
7	52	39.6
8	54	41.3
9	56	43.2
10	58	45.2

Variability….

Reproducible

Accuracy and reproducibility

All **parameters**

Improved **accuracy and reliability**[1,2*]

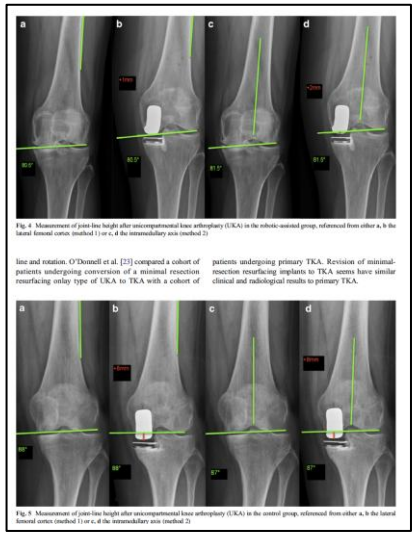
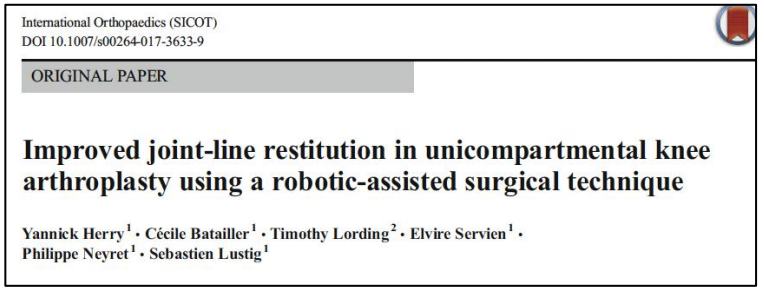


Fig. 4 Measurement of joint-line height after unicompartmental knee arthroplasty (UKA) in the robotic-assisted group, referenced from either a, b the lateral femoral cortex (method 1) or c, d the intramedullary axis (method 2)

line and rotation. O'Donnell et al. [23] compared a cohort of patients undergoing conversion of a minimal resection resurfacing onlay type of UKA to TKA with a cohort of patients undergoing primary TKA. Revision of minimal-resection resurfacing implants to TKA seems have similar clinical and radiological results to primary TKA.

Fig. 5 Measurement of joint-line height after unicompartmental knee arthroplasty (UKA) in the control group, referenced from either a, b the lateral femoral cortex (method 1) or c, d the intramedullary axis (method 2)



International Orthopaedics (SICOT)
DOI 10.1007/s00264-017-3633-9

ORIGINAL PAPER

Improved joint-line restitution in unicompartmental knee arthroplasty using a robotic-assisted surgical technique

Yannick Herry[1] · Cécile Batailler[1] · Timothy Lording[2] · Elvire Servien[1] · Philippe Neyret[1] · Sebastien Lustig[1]

Knee Surgery, Sports Traumatology, Arthroscopy
https://doi.org/10.1007/s00167-018-5081-5

KNEE

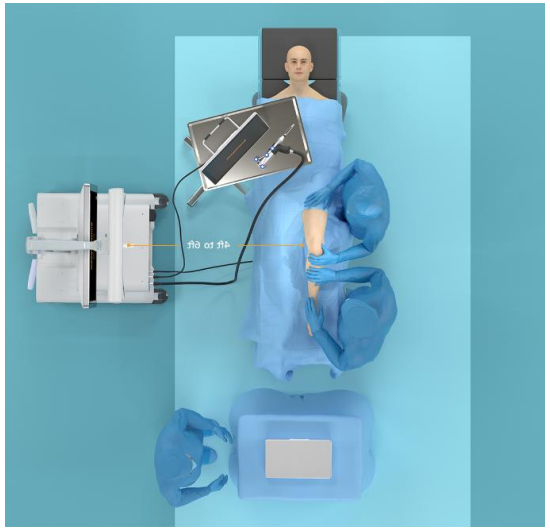
Improved implant position and lower revision rate with robotic-assisted unicompartmental knee arthroplasty

Cécile Batailler[1] · Nathan White[1] · Filippo Maria Ranaldi[1] · Philippe Neyret[1] · Elvire Servien[1] · Sébastien Lustig[1]

Power is useless without control!!

Simple?

- Portable
- Installation
- 2 rooms



Efficiency….

Simple

Fast?

Portable

Installation

Friendly

Comparable surgical time
to other techniques[6,7]

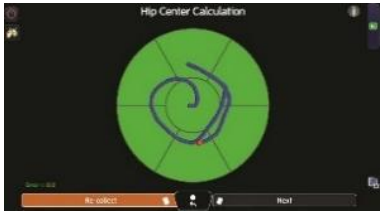

Knee Surgery, Sports Traumatology, Arthroscopy
https://doi.org/10.1007/s00167-020-06051-z

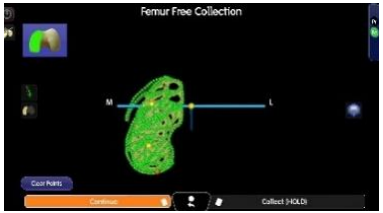
KNEE

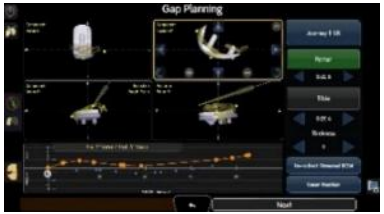
Is robotic-assisted unicompartmental knee arthroplasty a safe procedure? A case control study

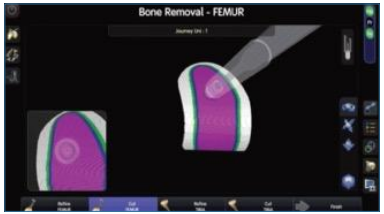
Guillaume Mergenthaler[1] · Cécile Batailler[1] · Timothy Lording[2] · Elvire Servien[1,3] · Sébastien Lustig[1,4]

Registration | Image-free smart mapping | Gap Assessment







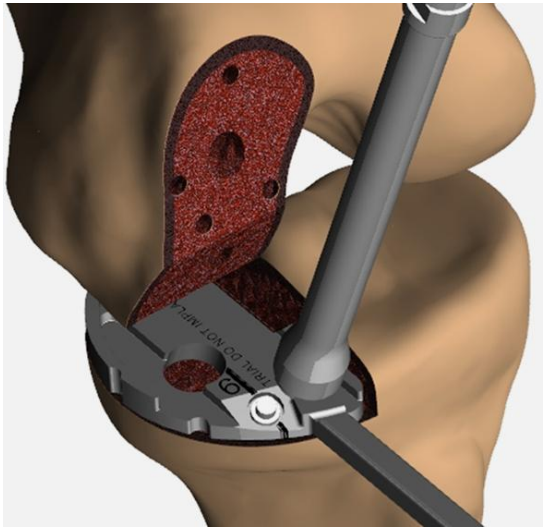


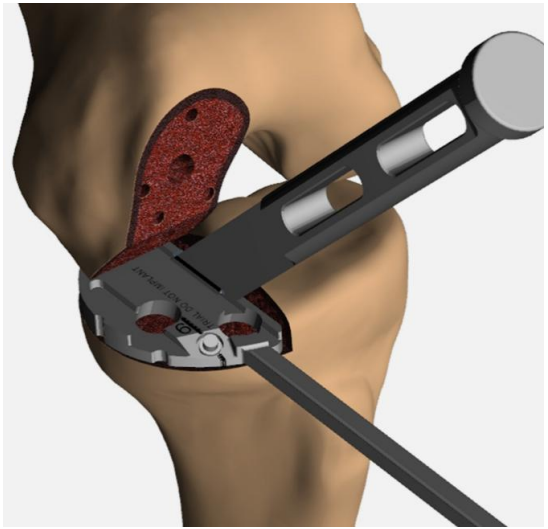
Planning | Precision Milling | Post-op Gap Assessment

Efficiency….

Simple?

- Better **implants**
- Tibial **baseplate**





Efficiency….

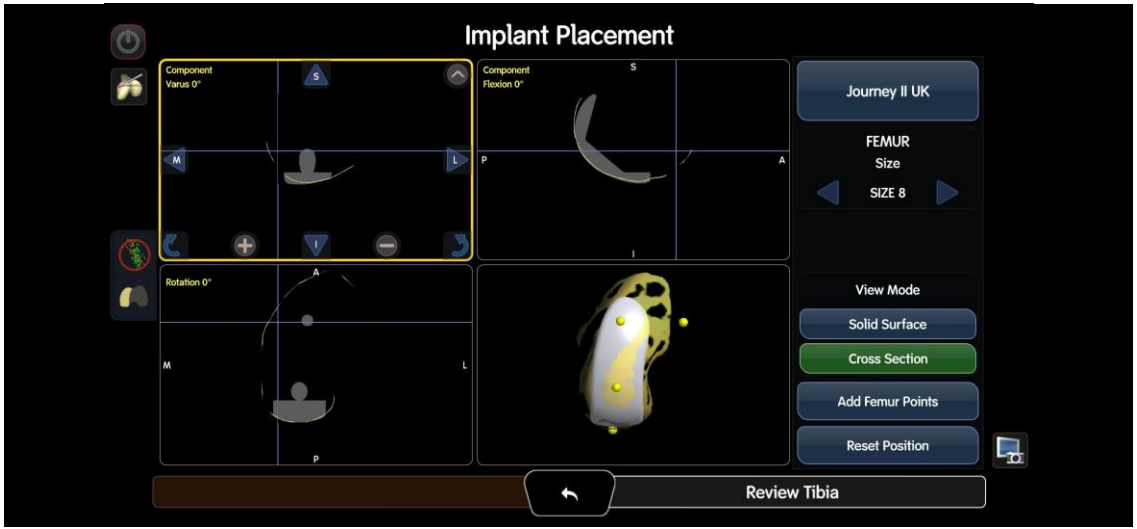
Simple

Reliable and predictable: CLARITY

We do want we want

Careful with Femur:

- Always too big
- Always too lateral



Everything is under your control

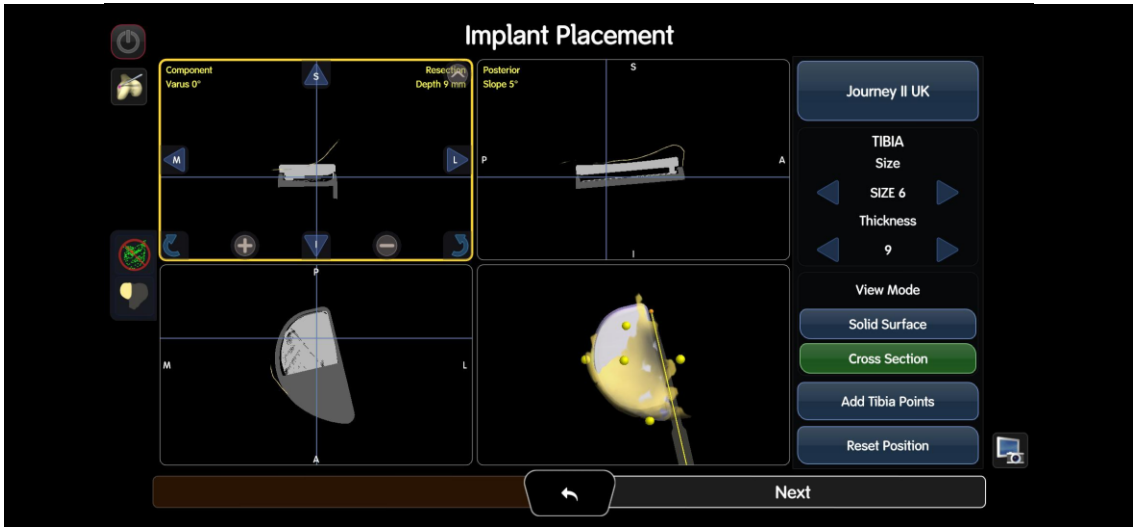
Simple

Reliable and predictable: CLARITY

We do want we want

Careful with Tibia:

- Always too big
- Always too posterior

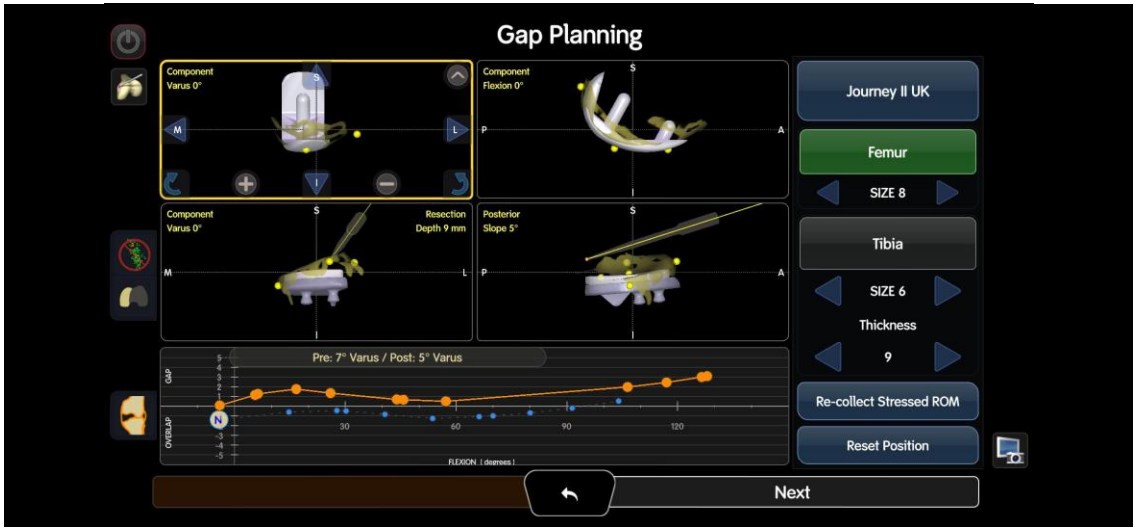


Everything is under your control

Reliable and predictable

We know the outcome

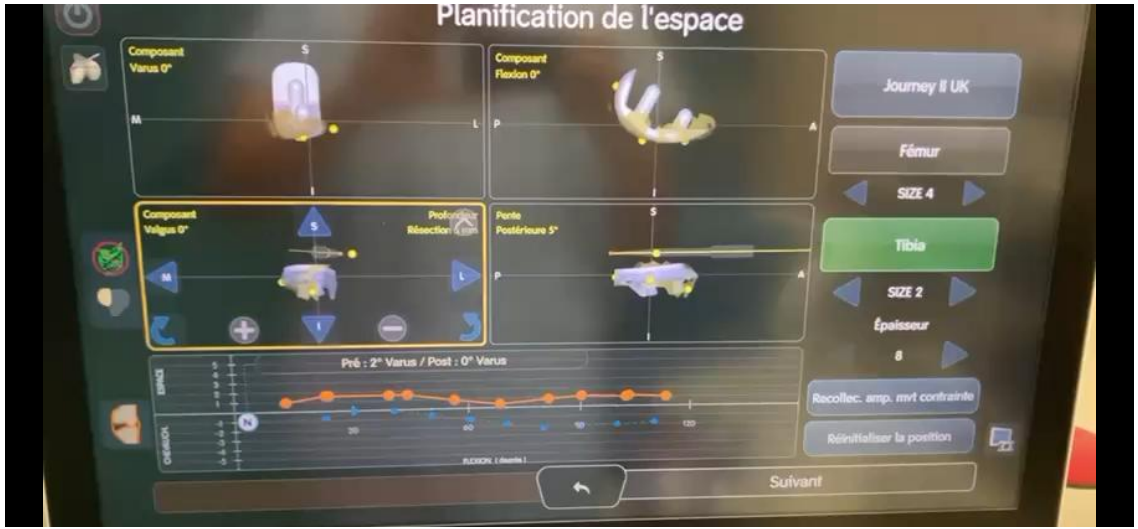
Clarity



CLARITY

EDUCATION!!!

Understand gaps



A nice image is better than a long speech!

CORI™ Surgical System with RI.KNEE ROBOTICS software

Image-free (no CT or MRI)
pre-operative mapping

Re-designed portable,
handheld robotics

Intra-operative planning,
smart mapping, full ROM data collection

CT = computed tomography; MRI = magnetic resonance imaging; ROM = range of motion

Clinical advantages of Smith+Nephew robotic-assisted UKA

Improved **accuracy and reliability**[1,2*]

Improved **implant survivorship**[3*]

Earlier recovery and **improved PROMs**[4-6*]

Comparable surgical time to other techniques[6,7]

*Compared to conventional UKA. PROM = patient-reported outcome measure; UKA = unicompartmental knee arthroplasty.

1. Herry Y, et al. Int Orthop. 2017;41:2265–2271. **2.** Batailler C, et al. Knee Surg Sports Traumatol Arthrosc. 2019;27:1232–1240. **3.** Battenberg A, et al. J Robot Surg. 2020;14:55–60. **4.** Canetti R, et al. Arch Orthop Trauma Surg. 2018;138:1765–1771. **5.** Crizer MP, et al. Adv Orthop. 2021;1–8. **6.** Mergenthaler G, et al. Knee Surg Sports Traumatol Arthrosc. 2021;29:931–938. **7.** Wallace D, et al. Bone Joint J. 2014;96B(SUPP16). **8.** Nherera LM, et al. Adv Orthop. 2020;3460675. **9.** Yeroushalmi D, et al. J Knee Surg. 2020;35:39–46.

Just the facts!

If you do not push the boundaries, you will never know where they are.

T.S. Eliot

But maintain CONTROL with robotics

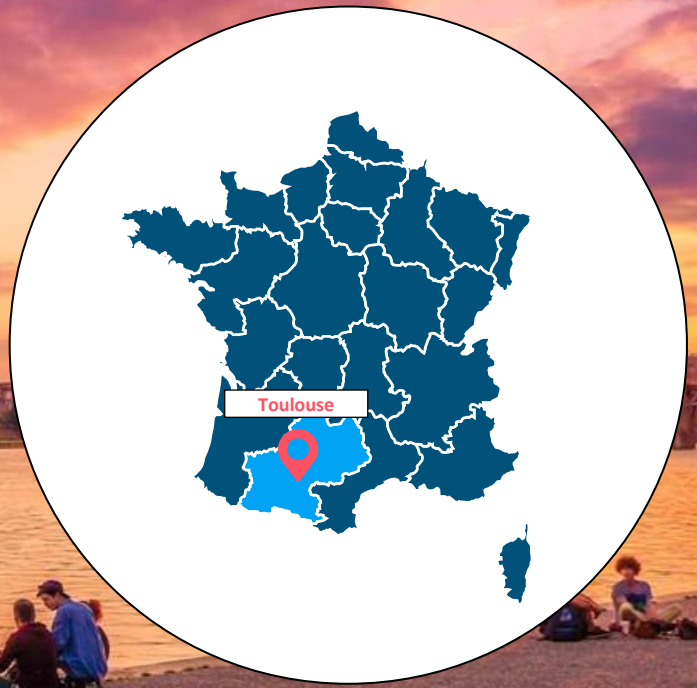
Choose your style / have fun

TKA

UKA

But maintain CONTROL with robotics

Thank You



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