

SISTEMI PSI

Dott. V. Costa – Istituto Ortopedico Galeazzi



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Qualità ed appropriatezza
Better and Faster



16-17
Settembre
2021



MILANO, ENTERPRISE HOTEL

**V CONGRESSO NAZIONALE
ORTHOPEA**

COORDINATORE: PAOLO PERAZZO



the demand for total **knee arthroplasties (TKAs) in the USA will grow by 484%**, from 719,000 annual TKA procedures in 2015 to 3.48 million by 2030, while the demand for total hip arthroplasties (THAs) will grow by 172%, from 332,000 to 572,000 annual THA procedures over the same time period³. This is in part due to THAs and TKAs becoming increasingly common in younger patients, as joint arthroplasty procedures in patients **under 65 years increased by 109% between**

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REVIEW ARTICLE

Patient-Specific Orthopaedic Implants

Jack M Haglin, BS¹, Adam E M Eltorai, MS³, Joseph A Gil, MD^{2,3}, Stephen E Marcaccio, BS³, Juliana Botero-Hincapie, BS⁴, Alan H Daniels, MD^{2,3}

¹Brown University, ²Division of Spine Surgery, Department of Orthopaedic Surgery, ³Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA and ⁴University of Antioquia School of Medicine, Medellin, Colombia

75% di pazienti soddisfatti...ma il 25% di 700K impianti sono 175 m

L. Shan et Al: Intermediate and long-term quality of life after total knee replacement: a systematic review and meta-analysis. J Bone Joint Surg Am, 97 (2015), pp. 156-168

MIGLIORARE LA VELOCITÀ CHIRURGICA (riduzione tempi di intervento)

MIGLIORARE POSIZIONAMENTO DEGLI IMPIANTI

RIDURRE INVASIVITÀ (VIOLAZIONE DEL CANALE MIDOLLE)

GIOCARE D'ANTICIPO PER UNA MIGLIORE GESTIONE

CONTENERE I COSTI

PERSONALIZZAZIONE DELLA MEDICINA (CHIRURGIA ASSISTITA)

PERCHÈ NASCE



Customized Joint Implants Popular Among Orthopedic Surgeons: Clinical Efficacy Important Internationally

iData Research released a new survey, sampling a total of 14,760 health professionals attended the American Academy of Orthopaedic Surgeons Conference in 2014.

Vancouver, BC ([PRWEB](#)) February 11, 2015 -- According to a new extensive survey of hundreds of physicians that was conducted by iData Research (www.idataresearch.com), nearly half of surveyed orthopedic surgeons who attended the AAOS (American Academy of Orthopaedic Surgeons) Conference see a benefit to using custom joint implants.

Many surgeons gave unique feedback as to why, or why not, they choose to employ custom implants. The option to provide **better implant fit and individualization for anatomical differences ranked highly**. However, ease-of-use for custom implants was not a prevalent reason.

According to a 2014 survey of nearly 15,000 AAOS (American Academy of Orthopaedic Surgeons)

orthopaedic health professionals, only **17%** of them see benefit to using patient

Kinematic Alignment Total Knee Replacement with Personalized Instruments

[William G. Blakeney](#) ^{1 2}, [Pascal-André Vendittoli](#) ^{1 3} [Charles Rivière](#) ¹, [Pascal-André Vendittoli](#) ²

Excerpt

There is a very wide variation in patients' knee anatomy. The precise restoration of this anatomy during total knee arthroplasty (TKA) may improve knee balance, clinical function and patient satisfaction. In the early ages of TKA, implant sizes and surgical precision were limited. The amount of deviation from a patient's anatomy that may impact on clinical results is not clear. However, in the era of personalized joint replacement, we believe that a precision of within 2 mm or 2° should be the goal. Performing a kinematically aligned (KA) TKA requires accurate planning of resections and precise tools to achieve the set goals. Patient-specific instrumentation is a very attractive solution. These patient-specific instruments (PSI) are constructed based upon preoperative planning using either tomographic or magnetic resonance imaging. 3D models of the patient's knee, hip and ankle are reconstructed and anatomical landmarks are identified to set the parameters of tibia and femur resections according to the surgeon's preferences. Compared to standard instruments, computer navigation or robotic surgery, PSI results in a shorter operating time and decreased instrumentation. PSI is a simple, standardised solution for a patient-specific restricted KA protocol in TKA, with many benefits to the surgeon and patient.

Knee Surg Sports Traumatol Arthrosc 2017 Jun;25(6):1743-1748.

PSI kinematic versus non-PSI mechanical alignment in total knee arthroplasty: a prospective, randomized study

[Tilman Calliess¹](#), [Kamil Bauer¹](#), [Christina Stukenborg-Colsman¹](#), [Henning Windhagen¹](#), [Stefan Budde¹](#), [Max Ettinger²](#)

Conclusion: Kinematic alignment is a favourable technique for TKA.

J Bone Joint Surg Am . 2017 Mar 15;99(6):521-530.

Efficacy of Patient-Specific Instruments in Total Knee Arthroplasty: A Systematic Review and Meta-Analysis

[Emmanuel Thienpont](#)¹, [Pierre-Emmanuel Schwab](#), [Peter Fennema](#)

Conclusions: PSI improves the accuracy of femoral component alignment and global mechanical alignment, but at the cost of an increased risk of outliers for the tibial component alignment. The impact of the increased probability of tibial component malalignment on implant longevity remains to be determined. Meta-analyses indicated significant differences with regard to operative time and blood loss in favor of PSI. However, these differences were minimal and, by themselves, not a substantial justification for routine use of the technology.

Knee Surg Sports Traumatol Arthrosc 2020 May;28(5):1560-1567.

Design improvement in patient-specific instrumentation for total knee arthroplasty improved the accuracy of the tibial prosthetic alignment in the coronal and axial planes

[Kazumasa Yamamura](#)¹, [Yukihide Minoda](#)², [Ryo Sugama](#)¹, [Yoichi Ohta](#)¹, [Suguru Nakamura](#)¹, [Hideki Ueyama](#)¹, [Hiroaki Nakamura](#)¹

Conclusions: This is the first report to evaluate the effect of improvement in PSI design on the postoperative alignment using 3D method, and it clearly showed that the modification significantly improved the accuracy of alignment and reduced the deviations.

Knee 2016 Mar;23(2):186-90.

Favourable rotational alignment outcomes in PSI knee arthroplasty: A Level 1 systematic review and meta-analysis

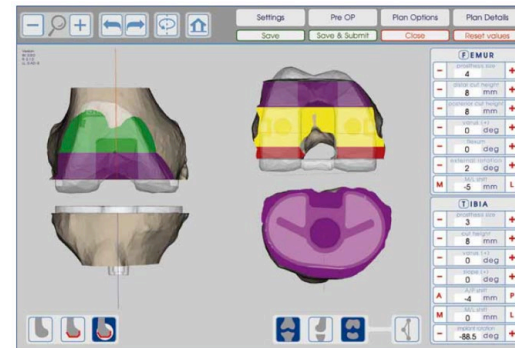
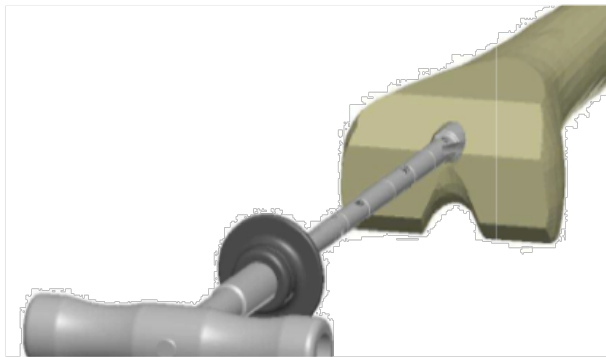
[A Mannan](#)¹, [T O Smith](#)²

Affiliations expand

Conclusions: This Level 1 meta-analysis demonstrates **favourable femoral rotational alignment** outcomes in PSI knee arthroplasty. Only limited data is available for tibial rotational outcomes. Further studies with standardised "gold-standard" measurement criteria are required to clarify tibial rotational outcomes in PSI TKA.

PERCHÈ ADOTTARE IL SISTEMA

1. Migliore posizionamento delle componenti
2. Ridurre aggressività chirurgica



3. Velocità di esecuzione chirurgica

PERCHÈ ADOTTARE IL SISTEMA

4. Riduzione delle resezioni ossee
5. Riduzione del tempo-costo-assemblaggio-sterilizzazione rispetto strumentario classico
6. Planning pre operatorio affidabile e preciso
7. Tecnica riproducibile

COME FUNZIONA

1 Acquisizione CT o RMN



2 Replica in 3D del ginocchio da protesizzare



3 Pinificazione 3D e fabbricazione di guide di taglio in nylon



4 Finalizzazione della riparazione della chirurgia



MOLTE LE SOLUZIONI POSSIBILI

2008



OtisKnee
(Stryker)



Signature
(Biomet)



2009



MyKnee
(Medacta)



Visionaire
(S&N)



Trumatch
(DePuy)

2010



PSI
(Zimmer)

DIFFERENTI OPZIONI SUL MERC

TIPO DI STRUMENTARIO

POSIZIONAMENT
O PINS

GUIDE DI
TAGLIO

DIFFERENTI OPZIONI SUL MERC

TIPO DI TECNOLOGIA PER
ACQUISIZIONE IMMAGINI

RMN

TAC

DIFFERENTI OPZIONI SUL MERC

SCELTA DI ALLINEAMENTO

MECCANICO

CINEMATICO

SCANNE
R
HANCHE
GENOU
CHEVILL

SANNER
JAMBE
COMPLE
TE

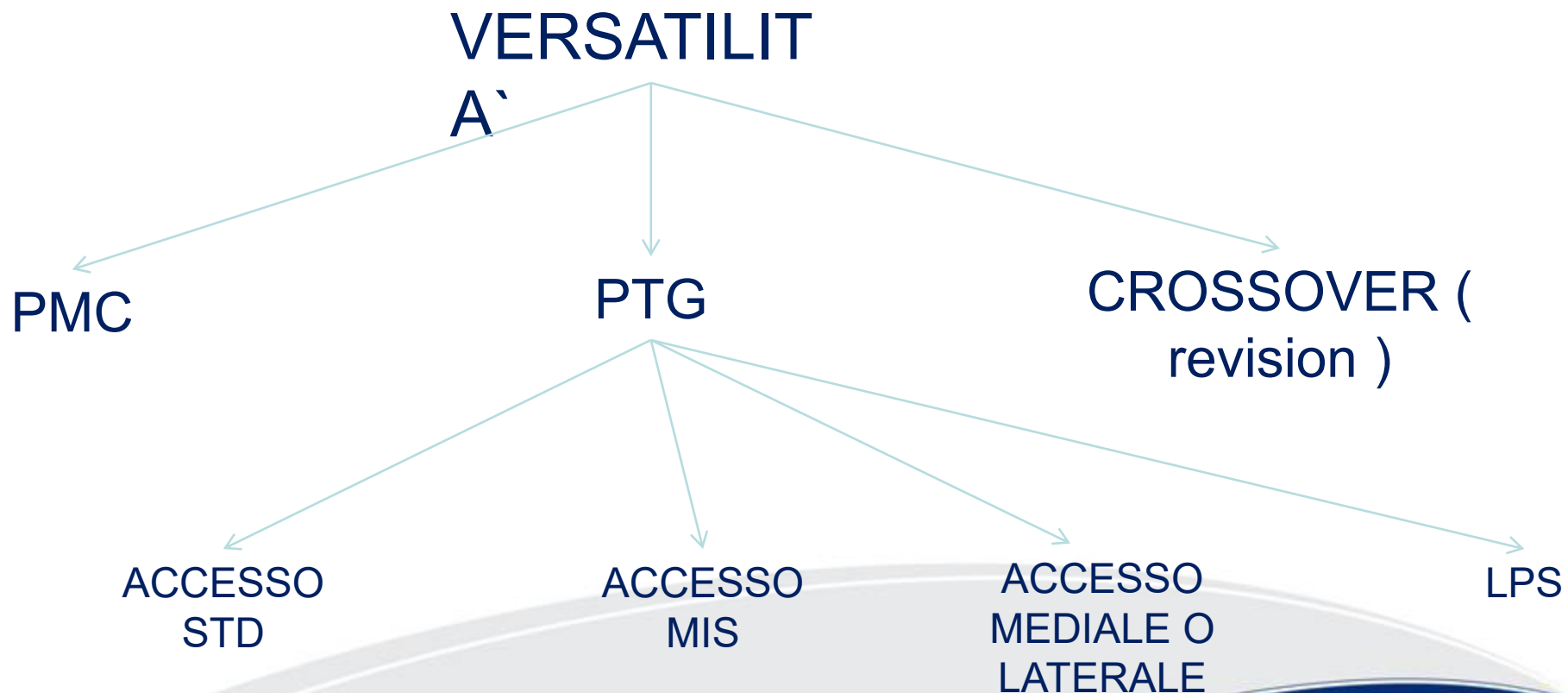
Rx Gd
AXE

IRM

DIFFERENTI OPZIONI SUL MERC



DIFFERENTI OPZIONI SUL MERCATO



LA MIA ESPERIENZA CON IL SISTEMA

246 protesi con sistema PSI dal 10.12.2015 al 04.07.2021 F

5 Revisioni con sistema PSI Crossover



Il sistema MYKNEE-MIS

Sistema di guida di taglio su misura basato su immagini TAC e permette elaborazione di un planning con ricostruzione 3D o planning sulle immagini della TAC

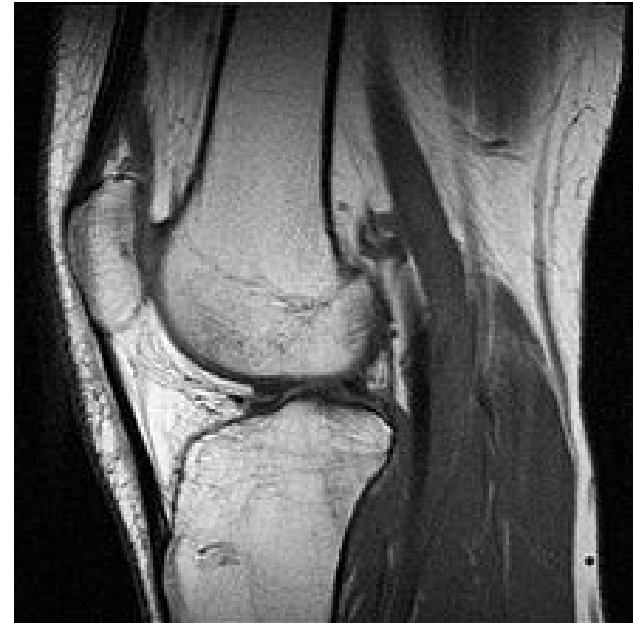


ACQUISIZIONE DELLE IMMAGI

TAC




RMN



**TAC più precisa con stabilità della maschera di taglio
maggiore come dimostrato da White D et al, 2008**

White D et al. "Accuracy of MRI vs CT imaging with particular reference to patient matched templates for total knee replacement surgery", The International Journal of Medical Robotics and Computer Assisted Surgery 2008; 4; 224 -231

Trasferimento delle immagini al laboratorio

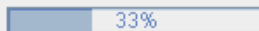
 **WAITING FOR IMAGES**

Please upload the DICOM set clicking on the "Upload DICOM" button.

Upload dicom

No.	Size
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3. 07141430/01781100	520 KB
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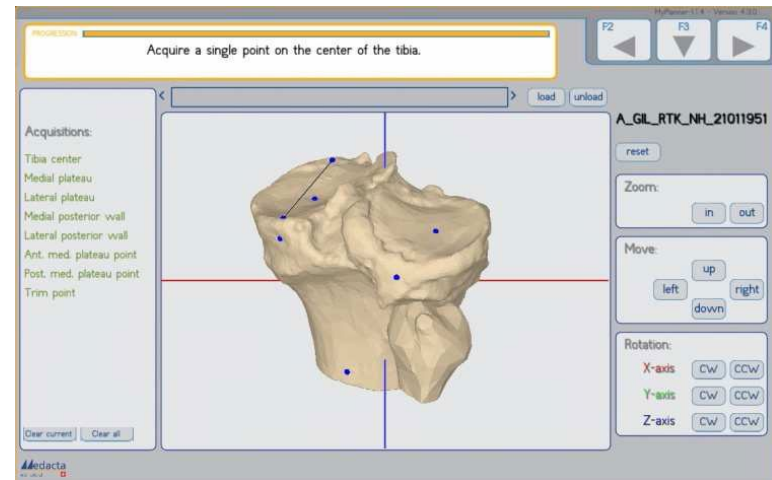
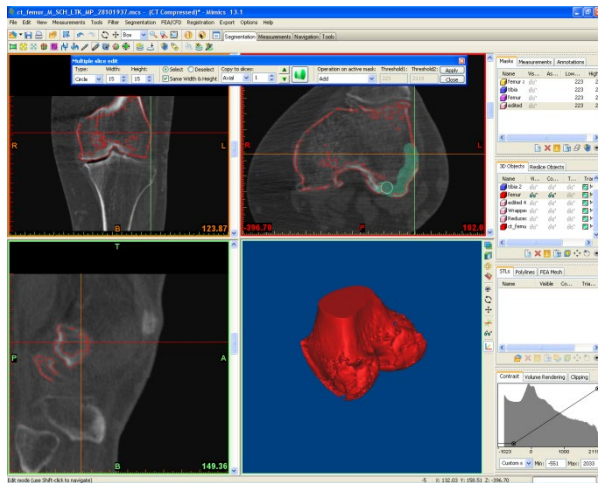
Upload Process

Status: Creating zip file....
File: 01800464
Files: 395 of 1188
Progress:  33%
Bytes sent:
Time left: 00:09:22

Buttons: Add, Remove, Upload, Cancel

Summary
Files: 1188 Total size: 603.55 MB

RICOSTRUZIONE DEL MODELLO OSSEO 3D



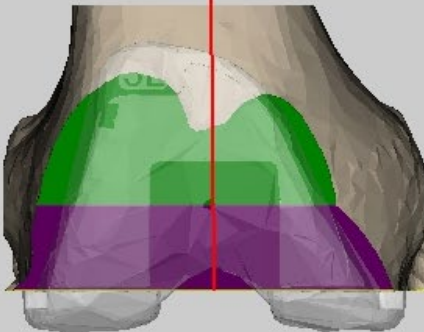
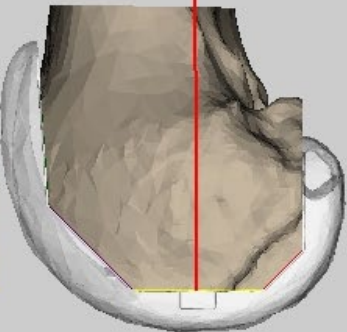
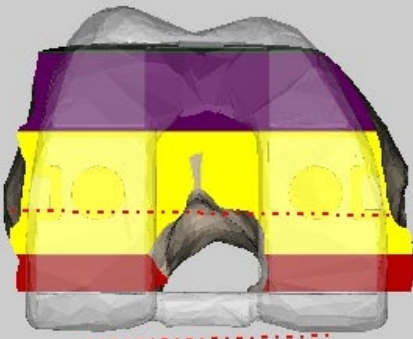
Si sfruttano gli osteofiti come punti »guida « e di appoggio delle guide di taglio

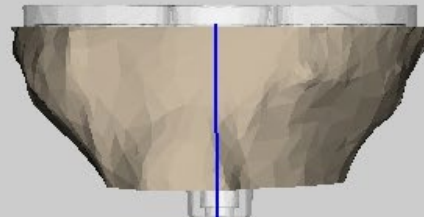
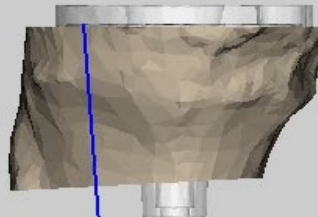
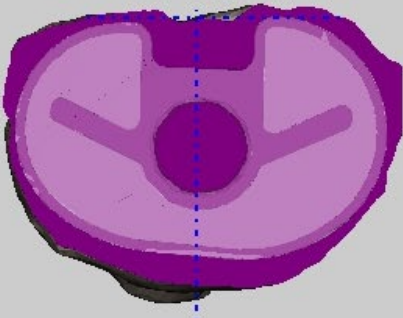
Validazione del planning

[-] [🔍] [+]
[↶] [↷]
[🔄] [🏠]

Settings Plan Options Pre OP Plan Details




Save Save & Submit Reset Values









FEMUR		
-	prosthesis size 3	+
-	distal cut height 8 mm	+
-	posterior cut height 8 mm	+
-	varus (+) 0 deg	+
-	flexum 1 deg	+
-	external rotation 1 deg	+
M	M/L shift -4 mm	L

TIBIA		
-	prosthesis size 3	+
-	cut height 8 mm	+
-	varus (+) 0 deg	+
-	slope (+) 3 deg	+
A	A/P shift -8 mm	P
M	M/L shift 2 mm	L
-	implant rotation -88.5 deg	+

Version
W: 0.0.0
R: 0.1.0
LL: 0. AD: 0

Fabbricazine



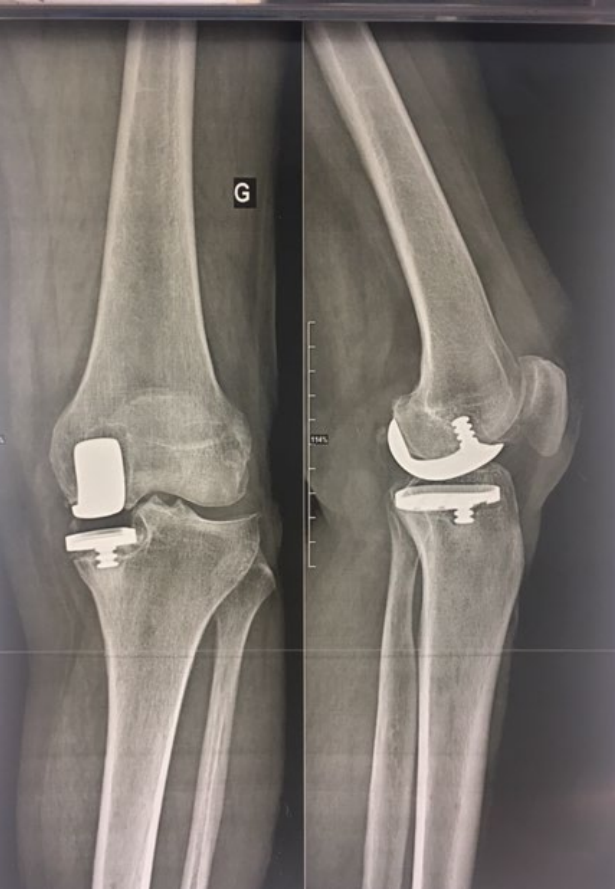
Ridotto strumentario

Solo 3 settimane il tempo di
fabbricazione





ALCUNI CASI



CT BASED REV.1 - 01.dic.2017

MyKnee Surgical Planning Report

<p>CASE CODE F_ABR_LSK_VC_23051945 SURGEON vitore COSTA SURGERY DATE 2018-01-15 SURGICAL APPROACH Medial PRODUCT GNM-Sphere BLOCKS MIS</p>	<p>PRE-OP LONG AXIS</p>	<p style="text-align: center;">CAUTION</p> <p style="font-size: 8px;">This case is based on CT data:</p> <p style="color: red; font-weight: bold; font-size: 10px;">REMOVE FROM THE BONE THE CARTILAGE AND SOFT TISSUES COVERING THE CUTTING BLOCK CONTACT AREAS.</p> <p style="font-size: 8px;">All measurements shown are from the bone and do not include the thickness of the cartilage.</p>
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LEFT TOTAL KNEE	PRE-OP	POST-OP
HKA	172,5	177,0
Femoral Valgus (from bone)	1,5	0,0
Tibial Varus (from bone)	15,0	3,0
Tibia Posterior Slope	6,0	4,0
Epicondyles vs Post. Cond.	6,0	

IMPLANTS	DEFAULT	CHANGED
Femoral Implant Size	3	
Tibial Implant Size	2	

FEMUR

CAUTION: the images below show the patella in full extension.

FEMORAL RESECTIONS [mm]	DEFAULT	CHANGED
Lateral Posterior Cut	6	
Medial Posterior Cut	8	
Lateral Distal Cut	8	
Medial Distal Cut	9	

FEMORAL ANGLES [deg]	DEFAULT	CHANGED
Varus	0	
Flexum	2	

ROTATION [deg]	DEFAULT	CHANGED
External Rotation vs. Post. Condyles	3	

CAUTION

Accurately clear the posterior condyles from any osteophytes and overhanging bone.

TIBIA

TIBIAL RESECTIONS [mm]	DEFAULT	CHANGED
Lateral Tibial Cut	9	
Medial Tibial Cut	-2,5	0

TIBIAL ANGLES [deg]	DEFAULT	CHANGED
Varus	0	3
Posterior Slope	4	

COMMENTS

REPRISE PUC GENOU G PAR PTG MY KNEE

CONFIDENTIAL

myknee@medacta.ch

M08.59 rev.7



MyKnee Surgical Planning Report

CT BASED REV.2 - 10.mar.2020

CASE CODE	P_GAG_RSK_VC_16041941	
SURGEON	viktore COSTA	
SURGERY DATE	2020-03-30	
SURGICAL APPROACH	Medial	
PRODUCT	GMK-Sphere	
BLOCKS	MIS+MIS	

RIGHT TOTAL KNEE	PRE-OP	POST-OP
HKA	175.5	180.0
Femoral Valgus (from bone)	2.5	0.0
Tibial Varus (from bone)	6.5	0.0
Tibia Posterior Slope	3.5	4.0
Epicondyles vs Post. Cond.	4.0	

PRE-OP LONG AXIS

CAUTION

This case is based on CT data.

REMOVE FROM THE BONE THE CARTILAGE AND SOFT TISSUES COVERING THE CUTTING BLOCK CONTACT AREAS.

All measurements shown are from the bone and do not include the thickness of the cartilage.

FEMUR

CAUTION: the images below show the patella in full extension.

L
M
L
M
P
A
L
M

	DEFAULT	CHANGED
FEMORAL RESECTIONS [mm]		
Lateral Posterior Cut	7.5	10
Medial Posterior Cut	10	
Lateral Distal Cut	8	
Medial Distal Cut	10	
FEMORAL ANGLES [deg]		
Varus	0	
Flexum	1	0
ROTATION [deg]		
External Rotation vs. Post. Condyles	3	0

CAUTION

Accurately clear the posterior condyles from any osteophytes and overhanging bone.

M
L

TIBIA

L
M
A
P

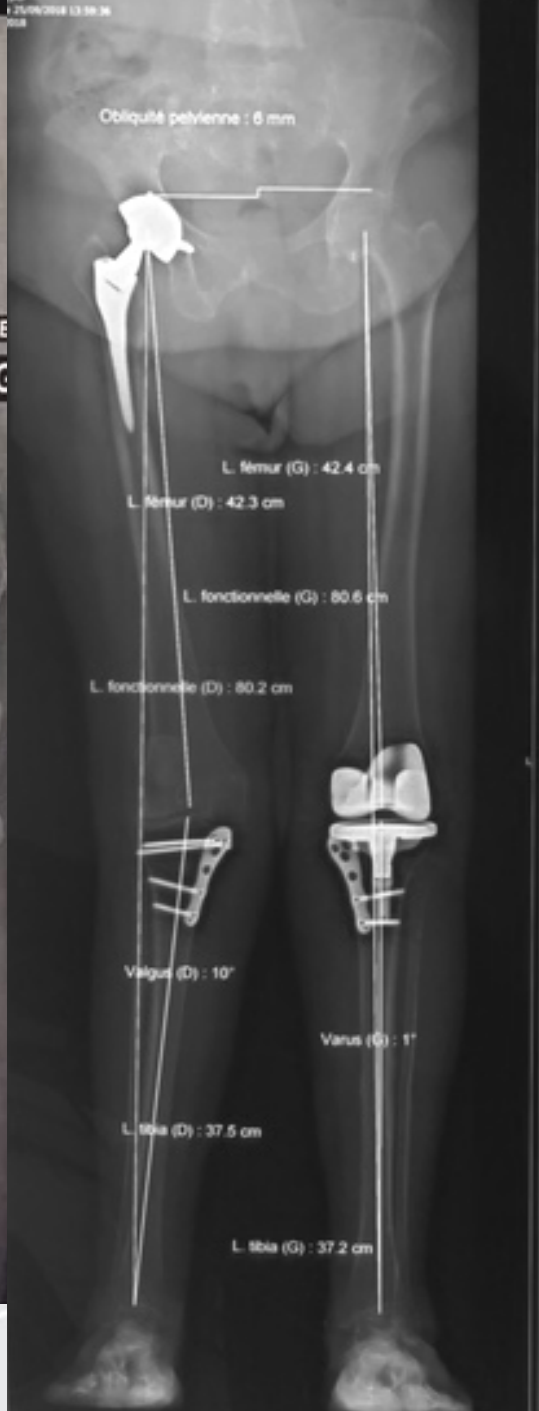
	DEFAULT	CHANGED
TIBIAL RESECTIONS [mm]		
Lateral Tibial Cut	10	5.5
Medial Tibial Cut	4.5	0
TIBIAL ANGLES [deg]		
Varus	0	
Posterior Slope	3.5	4

	DEFAULT	CHANGED
TIBIAL RESECTIONS [mm]		
Lateral Tibial Cut	10	5.5
Medial Tibial Cut	4.5	0
TIBIAL ANGLES [deg]		
Varus	0	
Posterior Slope	3.5	4

COMMENTS

DATE FICTIVE / INTERVENTION LE 30.03





Pre-Operative Planning Report

5081947

PRE-OP LONG AXIS

CAUTION
This case is based on CT data:
REMOVE FROM THE BONE THE CARTILAGE AND SOFT TISSUES COVERING THE CUTTING BLOCK CONTACT AREAS.
All measurements shown are from the bone and do not include the thickness of the cartilage.

FEMUR

show the patella in full extension.

CAUTION
Accurately clear the posterior condyles from any osteophytes and overhanging bone.

TIBIA

COMMENTS
SCANNER CE JOUR 071117

7

mylinee@medacta.ch M08.59 rev.7

Considerazioni finali

Posizionamento più preciso: **NO**

Chirurgia più veloce: **NO**

Accessi mini invasivi: **SI**

Ridotte perdite ematiche: **SI, ma....**

Musculoskelet Surg 2020 Aug;104(2):195-200.

Single-use, patient-specific instrumentation technology in knee arthroplasty: a comparative study between standard instrumentation and PSI efficiency system

S Giannotti¹, F Sacchetti², C Citarelli³, V Bottai³, N Bianchi³, G Agostini³, R Capanna³

Our results confirm only the improvement on reducing blood loss. In our opinion, this technique should be used in selected patients when the surgeon could have some difficulties to perform femoral cuts on coronal plane or when patients need to have a very little blood loss due to other conditions.

Considerazioni finali

Posizionamento più preciso: **NO**

Chirurgia più veloce: **NO**

Accessi mini invasivi: **SI**

Ridotte perdite ematiche: **SI, ma....**

Rispetto del canale midollare: **SI**

Riduzione delle tappe di resezione ossea: **NO**

Riduzione ingombro stoccaggio materiale, tempi e costi di sterilizzazione: **SI**

Attrattivo per i pazienti perché aderente ai dettami di una medicina personalizzata: **SI**