MyKA™

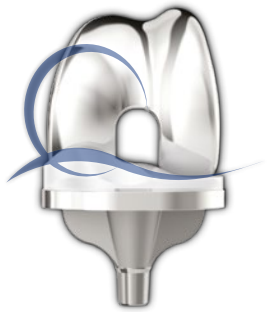
KINEMATIC ALIGNMENT PLATFORM

Medacta International

A comprehensive platform for personalized TKA

MYKA.MEDACTA.COM

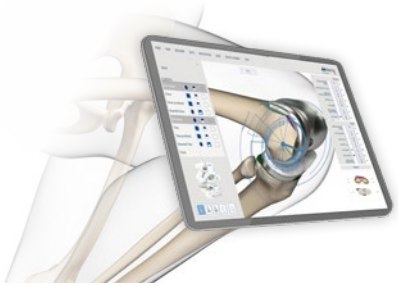
Functional **stability** and **patient-specific kinematics**



GMK® SPHERE

Dedicated **Kinematic Alignment metal instrument set**

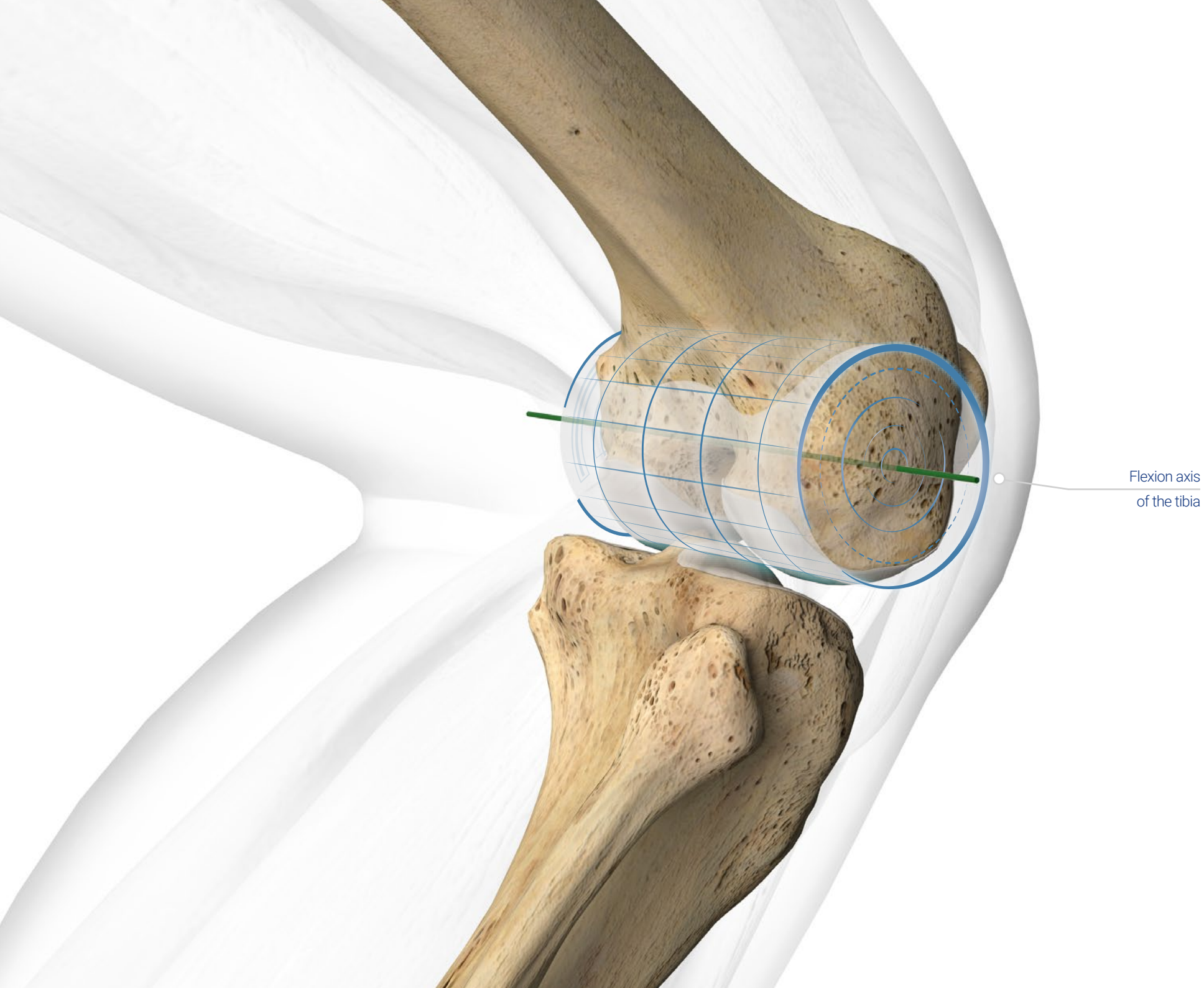
Patient-specific 3D planning optimizing **kinematics**



MyKnee® KA

M.O.R.E. INSTITUTE

Tailored **education program** and **scientific events**


Flexion axis
of the tibia

Contents

What is Kinematic Alignment?

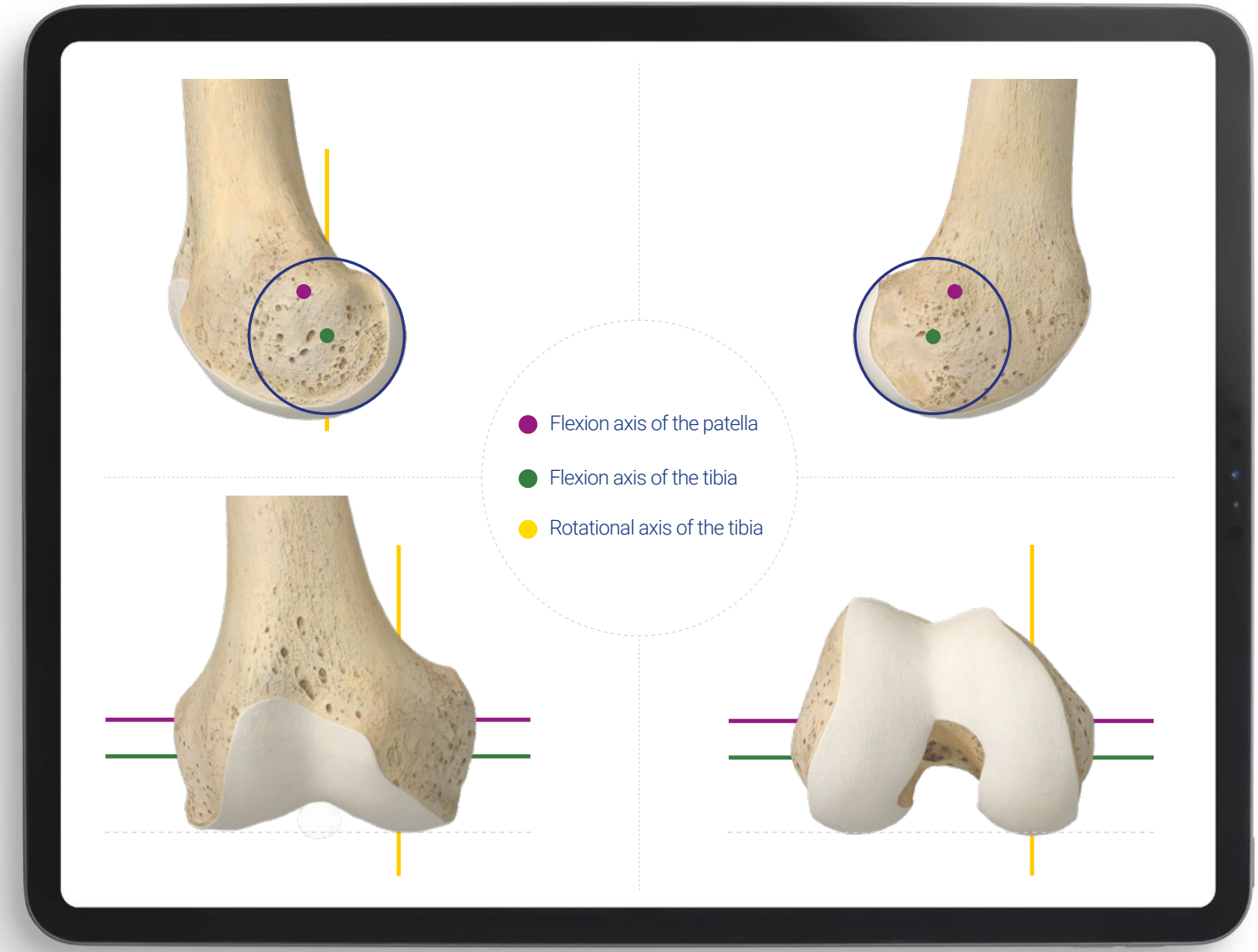
Kinematic Alignment TKA aims to personalize joint line reconstruction through anatomic resurfacing, with little to no ligament releases.

Kinematic Alignment places the implant in a custom position for each patient, so as to restore the native femoral and tibial joint line, as well as limb and knee alignment, which are unique to each individual.

By restoring the native alignment, the prosthetic component is aligned to the three axes that describe the normal knee kinematics, i.e.[1]:

- Transverse axis in the femur, around which the tibia flexes and extends
- Longitudinal axis in the tibia, around which the tibia rotates internally and externally on the femur
- Transverse axis in the femur, around which the patella flexes and extends

Aligning the **flexion-extension axes** of the femoral component to the natural knee kinematic axes of the patient's individual knee has proved to lead to better overall functional outcomes[2].


Flexion axis of the patella
Flexion axis of the tibia
Rotational axis of the tibia

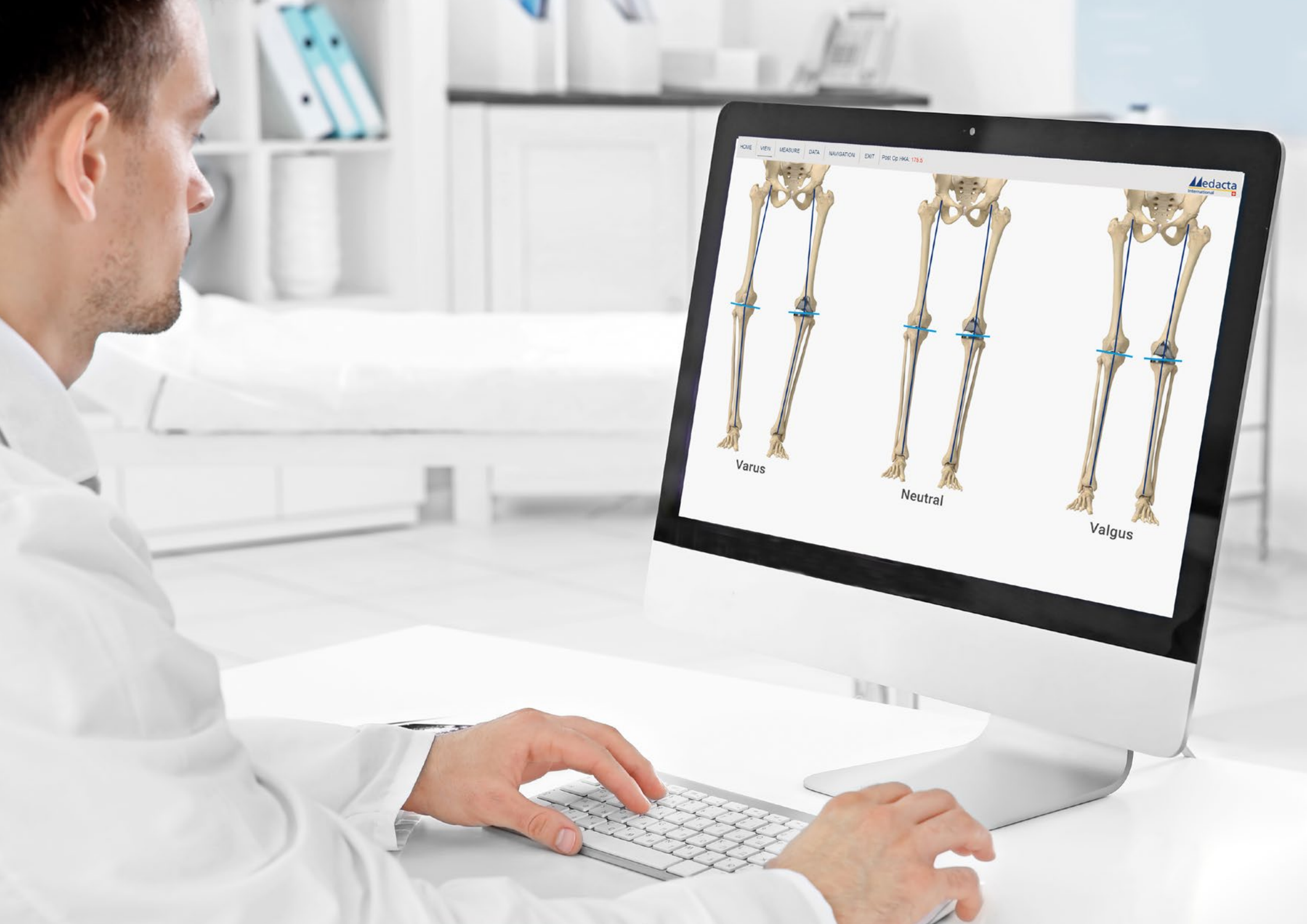
Why Kinematic Alignment?

To restore native patient alignment, i.e. the angles and level of the femoral and tibial joint line, the prosthetic components are positioned so as to restore the native knee flexion-extension axes. It has been reported[3] that the Joint Line Orientation Angle (JLOA) in the coronal plane is parallel to the floor in the native knee and perpendicular to the weight-bearing axis of the body in bipedal stance. One study has reported[4] that after KA-TKA, patients could stand with their knees more parallel to the floor and bear weight more centrally during gait compared to MA-TKA patients. This may explain the subjective consistently positive feedbacks of the early and mid-term clinical outcomes.

Several articles have reported that patients who underwent Kinematic Alignment TKA had significantly better outcomes in terms of pain relief, function and a more “normal-feeling” knee[5,6].

Our mission is to restore the native function of the knee and give our patients their lives back.

Dr. Howell


HOME
VIEW
MEASURE
DATA
NAVIGATION
EXIT
Post Op HKA 179.5
Medacta International
Varus
Neutral
Valgus

GMK Sphere

Based on the knee anatomy and the kinematic studies[7] performed by Prof. Michael Freeman and Prof. Vera Pinskerova, **GMK Sphere** is a medially stabilized total knee implant designed to deliver maximum functional stability with the goal of increasing TKA patient satisfaction during activities of daily life and decreasing postoperative knee pain. GMK Sphere is a medially stabilized implant that has been proven to reproduce the natural motion of the knee[8,9,10].

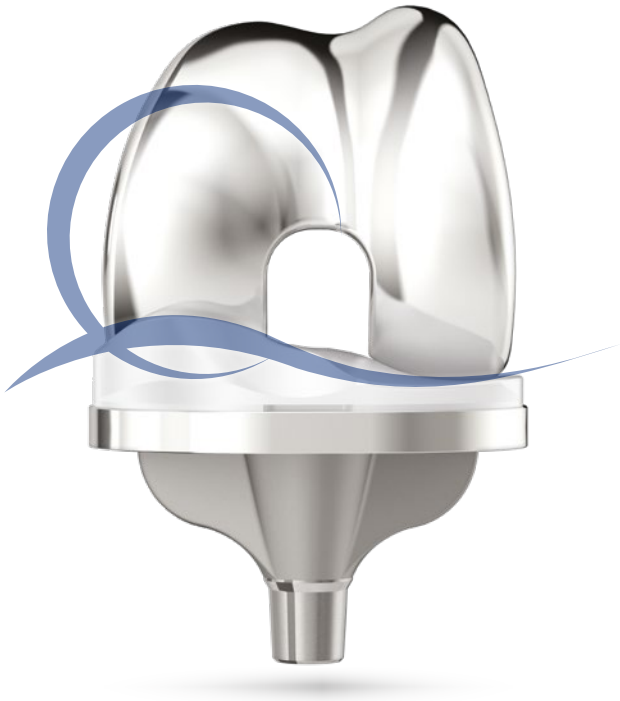
In order to better replicate the native knee anatomy and kinematics GMK Sphere's design features a **congruent medial compartment** and a **flat lateral compartment.** By providing stability on the medial compartment and freedom of movement on the lateral compartment GMK Sphere allows the **"medial-pivoting motion"**. This kind of movement has been proven to better replicate the natural knee motion[11,12].

DISCOVER THE STABILITY

GMK Sphere
sphere.medacta.com

GAK® SPHERE

MEDIALLY STABILIZED KNEE



Stability for life

Kinematic Alignment meets Kinematic Design

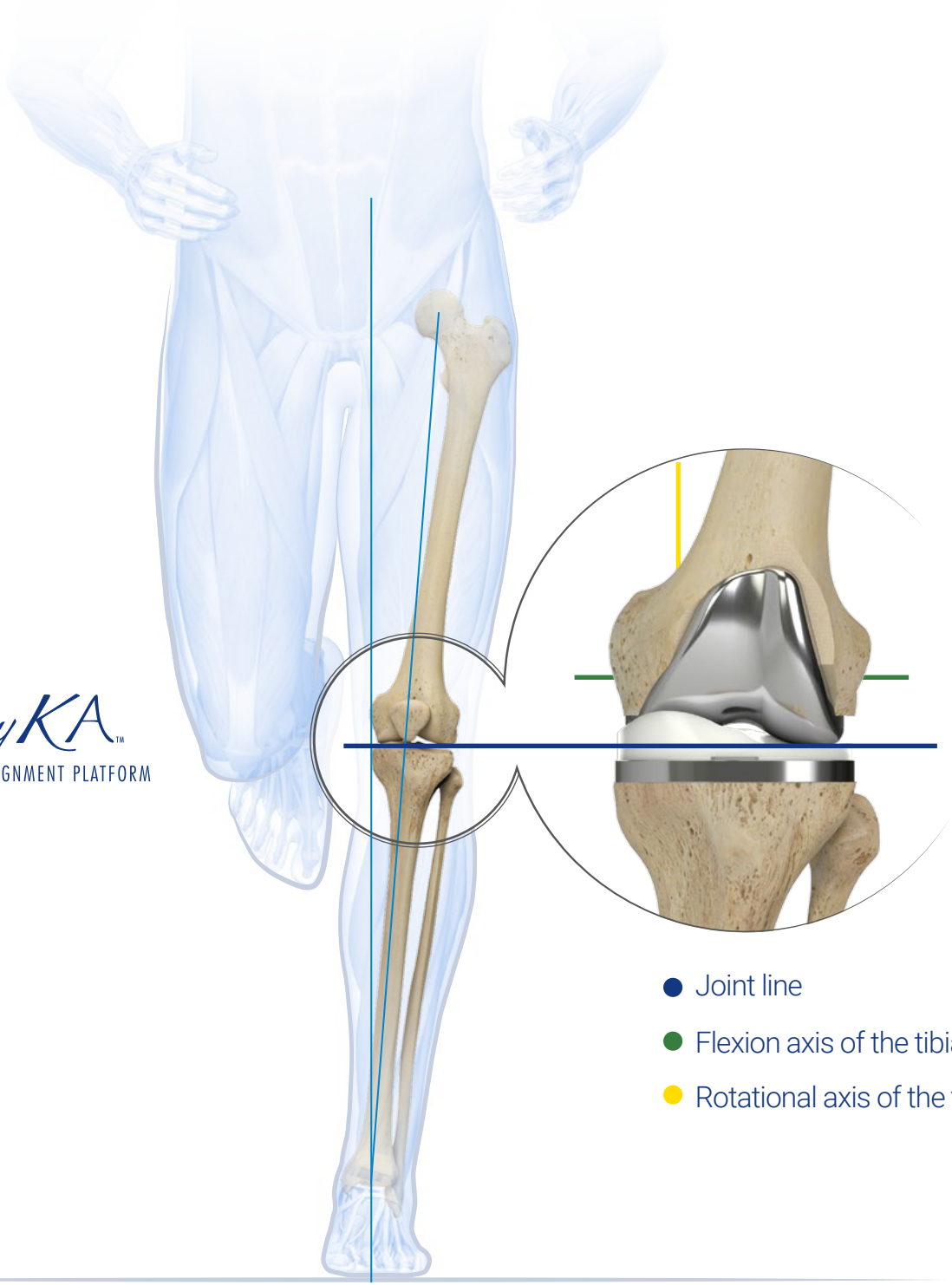
GMK Sphere and Kinematic Alignment are based on similar observations on the knee and share the same ultimate goals:

- RESTORE THE KINEMATIC AXES OF THE KNEE
- RESTORE THE NATIVE LAXITY OF THE KNEE

DISCOVER MORE ABOUT MYKA

MyKA
myka.medacta.com

MyKA™
KINEMATIC ALIGNMENT PLATFORM



GMK® SPHERE
MEDIALLY STABILIZED KNEE

- Joint line
- Flexion axis of the tibia
- Rotational axis of the tibia

Kinematic Alignment meets Kinematic Design

RESTORE THE KINEMATIC AXES OF THE KNEE

One of the main principles of Kinematic Alignment is that the axis of the cylinder that approximates the femoral condyles is the flexion-extension axis[13]. GMK Sphere is an implant that helps to restore the kinematic axes. Indeed, GMK Sphere is a single radius implant, that follows the same flexion-extension axis throughout the motion of the knee. The GMK Sphere medial ball in-socket provides stability to the knee and allows to reproduce the natural motion of the knee. The **medial ball in-socket** allows also to keep the kinematic axis in the right A-P position throughout flexion, thus avoiding paradoxical motion[14]. The features of GMK Sphere allow the restoration of the flexion-extension axis and the reproduction of the natural motion of the knee, making GMK Sphere a particularly suitable implant for Kinematic Alignment.

DISCOVER MORE ABOUT MYKA

GMK Sphere
Design Rationale
sphere.medacta.com

GAAK® SPHERE
MEDIALLY STABILIZED KNEE

Section 4 Supplementary figures

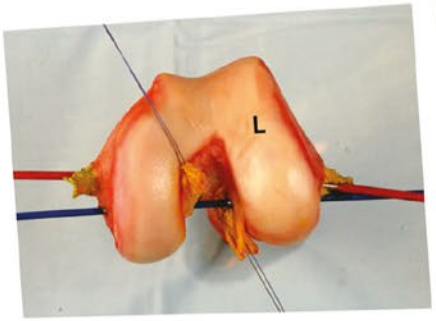


Fig. 16

Cadaver femur.
The red rod passes through the transepicondylar line and the attachment of both collateral ligaments. The blue rod passes through the Flexion Facet Centres and through the attachment of the LCL and both cruciate ligaments.

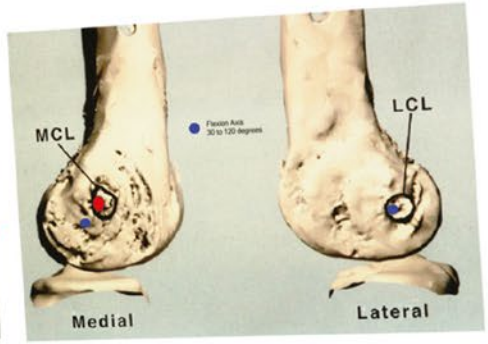


Fig. 17

CT reconstructions of the medial and lateral aspects of the distal femur. The red dot is the Extension Facet Centre and coincides with the attachment of the MCL. The blue dot marks the FFCs medially and laterally and on the lateral side coincides with the attachment of the LCL.

Kinematic Alignment meets Kinematic Design

RESTORE THE NATIVE LAXITY OF THE KNEE

During their studies,[15] Prof. Freeman and Prof. Pinskerova observed that the lateral ligament is tense in extension while it is lax in flexion. The laxity of the lateral compartment was also pointed out by Dr. Howell[16], who confirmed the presence of an unequal balancing in flexion and extension. With GMK Sphere, the medial ball-in-socket provides stability to the knee, while allowing patient specific laxity on the lateral compartment.

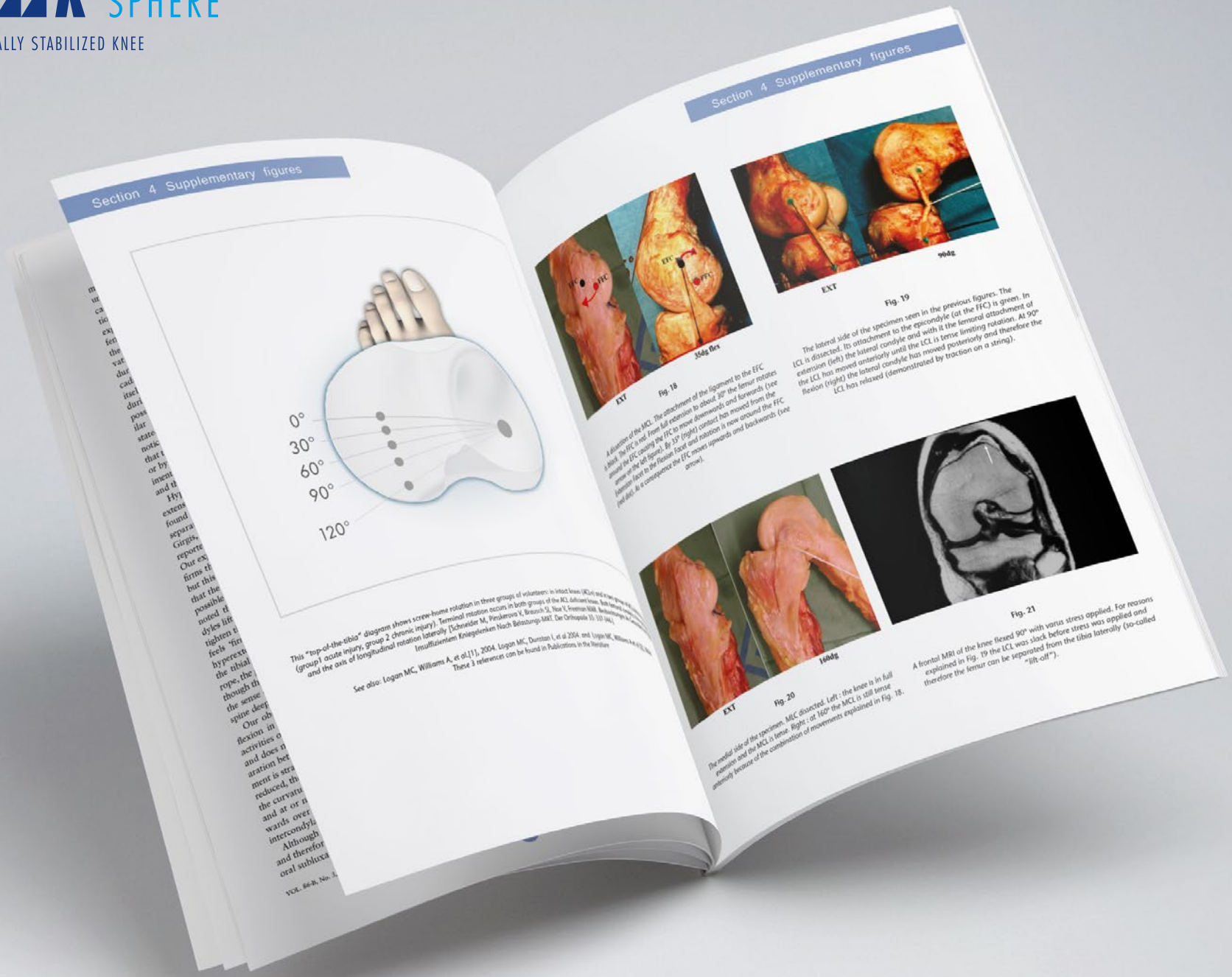
The GMK Sphere **trochlea groove** has been designed **asymmetrical** (6° diverging), 7mm deep and **lateralized** by 2mm with respect to the midline of the femoral component. This allows for a more natural medial-lateral translation of the patella during flexion-extension and can reduce stress on either the natural patella or the patellar implant.

DISCOVER MORE ABOUT MYKA

GMK Sphere
Publication Review
sphere.medacta.com

GAAK® SPHERE

MEDIALLY STABILIZED KNEE



GMK Sphere anatomical design

GMK Sphere has also some fitting features to best adapt to a broad spectrum of anatomic profiles:

- **13 femoral sizes**, with 2mm increments in AP and ML.
- **7 insert thicknesses,** from 10 to 20mm, with 1mm increments between 10 and 14mm and 3mm increments between 14 and 20mm.
- **Anatomically shaped tibial baseplate** to best fit the asymmetrical profile of the tibia.

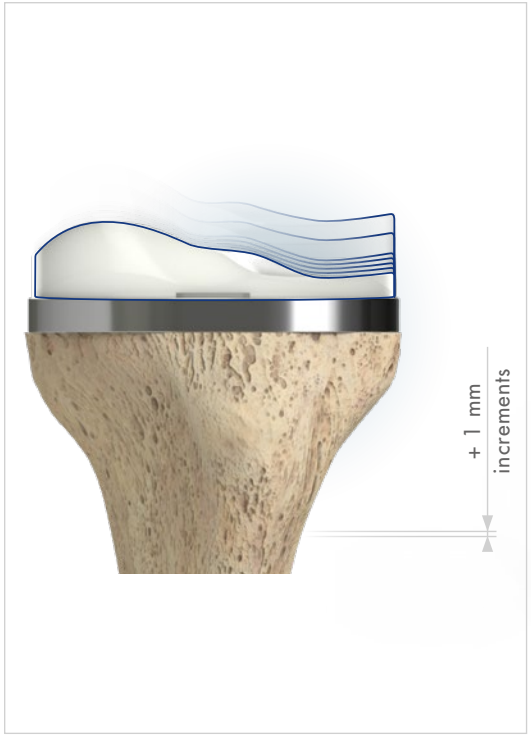
The combination of 13 femoral sizes and inserts with 1mm increments allows the surgeon to «fine-tune» the ligament balance according to the KA principles and to improve stability throughout the whole range of motion.

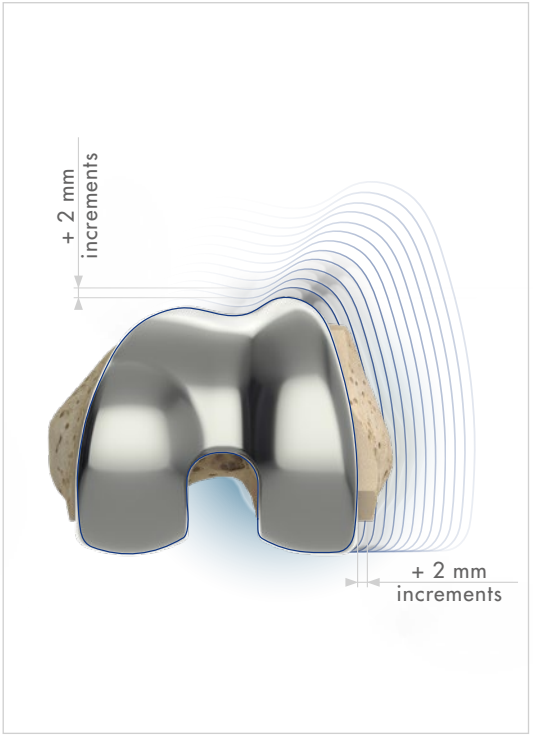
EXPLORE MORE

GMK Sphere
Specification Guide
sphere.medacta.com

GMK® SPHERE

MEDIALLY STABILIZED KNEE





Calipered Technique

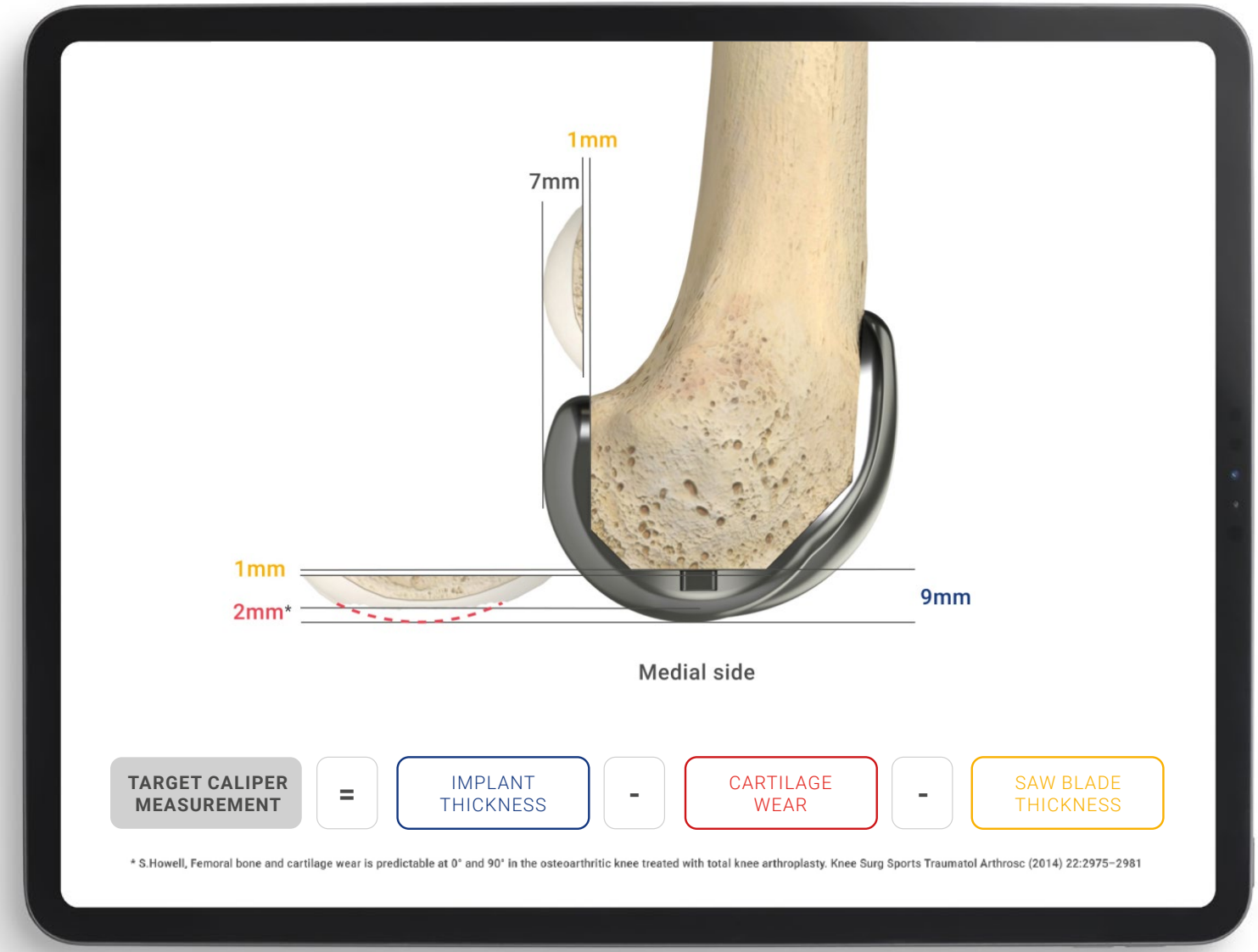
Kinematic Alignment is a true “resurfacing” of the knee, in which the implant thickness replaces the exact amount of bone and cartilage removed.

Medacta has developed, together with leading expert Dr. S. Howell, a dedicated instrument set that allows to kinematically align the implant using the calipered technique. The Calipered Technique allows the restoration of the native pre-arthritic alignment by measuring all the bone cuts and accounting for cartilage wear.

The “worn” side of the guide is 2mm thicker

WATCH THE TECHNIQUE IN ACTION

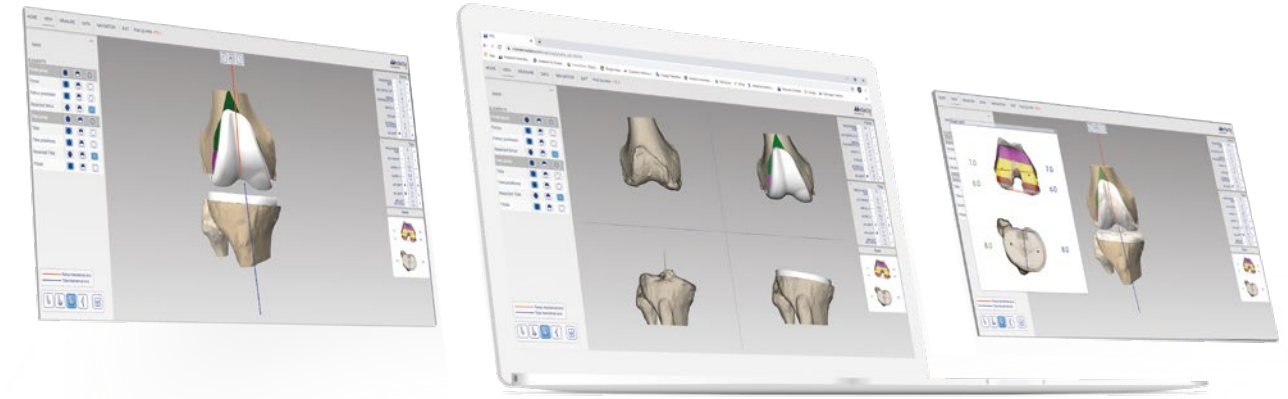
MyKA Calipered Technique
Watch S.Howell, MD, video on Calipered Kinematic Alignment
medacta.tv


1mm
7mm
1mm
2mm*
9mm
Medial side
TARGET CALIPER MEASUREMENT
=
IMPLANT THICKNESS
-
CARTILAGE WEAR
-
SAW BLADE THICKNESS
* S.Howell, Femoral bone and cartilage wear is predictable at 0° and 90° in the osteoarthritic knee treated with total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc (2014) 22:2975–2981

MyKnee KA

Kinematic Alignment can also be achieved by using the proven accuracy[17,18] of Medacta's MyKnee 3D printed patient-specific solution. A web-based 3D preoperative plan is drawn to kinematically align the implant based upon the same rationale of Calipered Kinematic Alignment Technique.

The MyKnee patient-specific guides are designed using preoperative MRI and CT scans in order to kinematically align the implant mimicking each patient's native anatomy. MyKnee KA also allows the surgeon to set some boundaries to the planning, which is helpful to streamline the learning curve phase.



ROBERT GREENHOW, MD

MyKnee KA
Learn more from the experts
medacta.tv

CRAIG LOUCKS, MD

MyKnee KA
Learn more from the experts
medacta.tv

myKnee® KA

PATIENT MATCHED TECHNOLOGY
IN KNEE REPLACEMENT

MyKA Educational Program

The M.O.R.E. Institute offers effective and continuous education to surgeons, with the aim to **improve patient outcomes** and **surgical proficiency**. The M.O.R.E. Institute was built, and has been growing, around the concept of sharing experience within the international medical community. It has become a unique and global education platform, tailored to everyone's needs.

The MyKA Educational Program can count on an evergrowing network of Kinematic Alignment experts all over the world, and offers dedicated symposia and Learning centers, as well as user meetings for continuous education and discussion.

Courtesy of Stephen Howell M.D.
Adventist Health Lodi Memorial Medical Center, Lodi, CA

Medacta International

Strada Regina - 6874 Castel San Pietro - Switzerland

Phone +41 91 696 60 60 - Fax +41 91 696 60 66

www.medacta.com - info@medacta.ch

REFERENCES

[1] Howell SM, et Al., Kinematically aligned total knee arthroplasty. In: Scott S (ed) Insall and Scott Surgery of the Knee, 6th edn. Elsevier, Philadelphia, 2017; PA, pp 1784–1796

[2] Calliess T, et Al., PSI kinematic versus non-PSImechanical alignment in total knee arthroplasty: a prospective, randomizedstudy. Knee Surg Sports Traumatol Arthrosc 2017; 25:1743–8.

[3] Hutt J, Massé V, Lavigne M, Vendittoli PA (2016) Functional joint line obliquity after kinematic total knee arthroplasty. Int Orthop 40:29–34

[4] Matsumoto T, et Al., Radiological and clinical comparison of Kinematically versus mechanically aligned total knee arthroplasty. Bone Joint J 2017;99-B:640–6

[5] Dosset et al. A randomised controlled trial of kinematically and mechanically aligned total knee replacements. Bone Joint J 2014; 96-B:907–13

[6] Lee et al. Kinematic alignment is a possible alternative to mechanical alignment in total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc DOI 10.1007/s00167.017.4558-y

[7] Freeman MAR, Pinskerova V "The movement of the normal tibio-femoral joint", J Biomech. 2005 Feb;38(2):197-208

[8] Banks et al. Can a total knee arthroplasty be both rotationally unconstrained and anteroposteriorly stabilised? Joint Res 2016;5:80–86.

[9] P.E.Müller,V. Jansson. Femorotibial kinematics and load patterns after total knee arthroplasty: An in vitro comparison of posterior-stabilized versus medial-stabilized designe.

[10] P. Schütz. Kinematic Evaluation of the GMK Sphere Implant During Gait Activities: A Dynamic Videofluoroscopy Study. Journal of Orthopaedic Research DOI 10.1002/jor.24416.

[11] Martelli, S., Pinskerova, V., 2002. The shapes of the tibial and femoral articular surfaces in relation to tibo-femoral movement. Journal of Bone and Joint Surgery [BR]: 84B, 607–613.

[12] Pinskerova, V., Johal, P., Nakagawa, S., Sosna, A., Williams, A., Gedroyc, W., Freeman, M.A.R. Does the femur roll-back with flexion? Journal of Bone and Joint Surgery—British Volume. 86B, in press.

[13] Eckhoff et al. Three-dimensional mechanics, kinematics and morphology of the knee viewed in virtual reality The Journal of Bone & Joint Surgery, Volume 87-A, Supplement 2, 2005.

[14] D)Morra EA, Greenwald AS "Simulated kinematic performance of The GMK-Sphere Total Knee Design During A Stand to Squat Activity", Study Report 2013. Schütz, P.; Taylor, W.R.; Postolka, B.; Fucentese, S.F.; Koch, P.P.; Freeman, M.A.; Pinskerova, V.; List, R. Kinematic evaluation of the GMK sphere implant during gait activities: A dynamic videofluoroscopy study. J. Orthop. Res. 2019, 37, 2337–2347

[15] Pinskerova V, Samuelson KM, Stammers J, Maruthainar A, Sosna A, Freeman MAR. The knee in full flexion: an anatomical study. J Bone Joint Surg [Br] 2009;91-B:830-834.

[16] Roth JD, Hull ML, Howell SM. Varus-Valgus Laxity of the Normal Knee at 0° and 90° Flexion: Implications in Gap-Balancing TKA. Paper presented at: Annual Meeting of the Orthopaedic Research Society2014; New Orleans, LA

[17] Anderl W et al, CT-based patient-specific vs. conventional instrumentation: Early clinical outcome and radiological accuracy in primary TKA; Knee Surg Sports Traumatol Arthrosc. 2014.

[18] Koch P, Müller D, Pisan M,Fucentese S, Radiographic accuracy in TKA with CT-based patient-specific cutting block technique, Knee Surg Sports Traumatol Arthrosc. 2013 Oct;21(10):2200-5.

REDEFINING BETTER
IN ORTHOPAEDICS
AND SPINE SURGERY

MEDACTA.COM

Please verify approval of the devices described in this document with your local Medacta representative.