Kinematically Aligned (KA) TKA Is A Good Alignment Option!

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Disclosures

- Consultant Zimmer Biomet
- Consultant Think Surgical
- On Editorial Board of American Journal of Sports Medicine and Orthopedics

Five Talking Points

- How does KA use caliper measurements to restore native alignment & kinematics?
- What do meta-analyses conclude about outcomes and alignment of KA vs MA?
- What is the rate and mechanism of tibial component failure of KA vs MA?
- How accurate is calipered KA vs navigated & robotic MA at hitting alignment target?
- Can KA treat severe varus & valgus deformities?

Summary

<table>
<thead>
<tr>
<th>Kinematic Axes</th>
<th>Native Laxities</th>
<th>Calipered KA</th>
<th>Low Forces</th>
<th>Function &amp; Survival</th>
</tr>
</thead>
</table>

HOW DOES KA USE CALIPER MEASUREMENTS TO RESTORE NATIVE ALIGNMENT & KINEMATICS?
Native Limbs are Symmetric Within ± 3°
For Measurements in the Coronal Plane
• HKA Angle KA target is ± 3° from native
• DLFA KA target is ± 3° from native
• PMTA KA target is ± 3° from native
Eckhoff, J Arthro, 2016
Calipered KA

Three Kinematic Axes
• Tibia flexes and extends about the green line centered in each femoral condyle
• Patella flexes and extends about the magenta line
• Tibia internally-externally rotates about the orange line
• Each axis is parallel or perpendicular to the native joint line
Hollister, CORR, 1993; Coughlin, J Arthro 2003; Iranpour, CORR, 2010
Calipered KA

KA Sets Femoral Component Coincident with Native Distal and Posterior Joint Lines
Howell, JBJS, 2010
Calipered KA

Caliper Measurements of Femoral Bone Resections Quality Assures KA
Resections Should Equal Condyle of Component after Compensating for Wear and Kerf
Howell, Insall Scott 2017
Calipered KA
WHAT DO META-ANALYSES CONCLUDE ABOUT OUTCOMES AND ALIGNMENT OF KA VS MA?

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Implant Failure</th>
<th>Accuracy of KA</th>
<th>All Deformities</th>
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<tbody>
<tr>
<td>Calipered KA</td>
<td>Functional outcome as measured by Knee Society Score favored KA (Courtney, J Arthro, 2017)</td>
<td>▪ Functional outcome as measured by Knee Society Score favored KA (Courtney, J Arthro, 2017)</td>
<td>▪ KA provided better function and flexion (Li, J Knee Sure, 2017)</td>
<td>Clear Advantages of KA TKA Over MA TKA</td>
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<td></td>
<td>KA oriented the joint line more parallel to the floor similar to the native knee, with limb and knee alignment similar to MA (Li, KSSTA, 2017)</td>
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WHAT IS THE RATE AND MECHANISM OF TIBIAL COMPONENT FAILURE OF KA VS MA?

Nedopil, Int Orthop, 2017

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<td>▪ No varus tibial loosening</td>
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Mechanisms of Failure Were Posterior Loosening and Posterior Insert Wear

- Five patients had posterior tibial loosening
- 3 patients had posterior insert wear
- No patient had varus failure of tibial component

Nedopil, Int Orthop, 2017

Cause Was Positioning Tibial Component In More Posterior Tibial Slope than Native

p = 0.0012

Ritter, JBJS, 2016

The Effect of Alignment and BMI on Failure of Total Knee Replacement

- After MA TKA, 0.9% of 6070 patients failed within 2-22 year f/u
- MA failure was associated with varus alignment of knee and tibial component
- Hence, KA is the best way to decreases the risk of varus tibial loosening

Ritter, JBJS, 2016

HOW ACCURATE IS CALIPERED KA VS NAVIGATED & ROBOTIC MA AT HITTING ALIGNMENT TARGET?
Studied 102 KA TKAs With a Normal Contralateral or Native Limb

- Age 68 ± 8 yrs.
- Males 49, Females 53
- Kellgren-Lawrence 36% IV, 57% III, 7% II
- Deformity 20° varus to -30° valgus
- Radiographs measured independently of treating surgeon

95% of KA TKA Had a Hip-Knee-Ankle Angle ± 3° From Contralateral Native Limb

97% of KA TKA Had a Distal Lateral Femoral Angle ± 3° From Contralateral Native Femur

97% of KA TKA Had a Proximal Medial Tibial Angle ± 3° From Contralateral Native Tibia

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Improved Accuracy of Component Positioning with Robotic-Assisted Unicompartmental Knee Arthroplasty

Data from a Prospective, Randomized Controlled Study

- Stunt K. Bell, M.D., M.B.Ch.B., F.R.C.S., J.J. Anthony, P.E., D.A. Jones, M.B.B.S., F.R.C.S.,

- Accuracy of KA

<table>
<thead>
<tr>
<th>Degrees</th>
<th>HKA</th>
<th>DLFA Angle</th>
<th>PMTA Angle</th>
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<tbody>
<tr>
<td>95</td>
<td>3</td>
<td>3</td>
<td>95</td>
</tr>
<tr>
<td>98</td>
<td>2</td>
<td>3</td>
<td>97</td>
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5/22/2017 Page 6 of 7

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Take Home Messages

• Calipered KA relies on mm measurements to restore native alignment & kinematics
• Meta-analyses conclude KA provides better outcomes and alignment than MA
• KA has negligible risk of varus tibial loosening; restoring native slope reduces risk of posterior tibial component failure
• Calipered KA more accurately aligns limb and knee to target than navigated & robotic MA
• KA effectively treats severe varus and valgus deformities

THANK YOU