Kinematic Alignment Technique For TKA

Charles C.J Rivière
ISTA 2019 - Keynote
What have we done so far?

- Systematic approaches

Constitutional alignment
What have we done so far?

- Systematic approaches
- Poor functional outcomes!

- Dissatisfaction 10 to 20%
- Residual symptoms > 50%
  - residual pain 33%
  - stiffness 41%
  - swelling or tightness 33%
  - knee ‘normal feeling’ 66%
  - difficulty with stairs 54%

National multi-center survey in USA
What have we done so far?

- Systematic approaches
- Poor functional outcomes!
  - Lack of precision?
  - Poor implant design?
What have we done so far?

- Systematic approaches

  - Poor functional outcomes!
    - Lack of precision?
    - Poor implant design?

...Intrinsic limitations?
…Intrinsical limitations?

1. No respect of constitutional knee anatomy:
   - FT joint
   - PF joint

2. No respect of physiological knee laxity
   - FT joint
   - PF joint

3. Technically demanding
   - Soft tissue balance
   - Aligning F component with TEA

Systematic techniques:
- Non physiological
- Poor reproducibility
Solution?

New implants alignment

Constitutional alignment

Patient-specific alignment techniques
- KA

Hybrid alignment techniques
- rKA

Systematic alignment techniques
- aMA
- MA
- AA
## MA technique
**“systematic approach”**

<table>
<thead>
<tr>
<th>F flexion</th>
<th>similar</th>
</tr>
</thead>
<tbody>
<tr>
<td>F distal cut</td>
<td>perpendicular to femoral mechanical axis</td>
</tr>
</tbody>
</table>
| F posterior cut | - external rotation/PCL  
- measured resect° or gap balancing |
| T frontal cut | perpendicular mechanical axis of tibia |
| T slope | 2 to 7° posterior slope |
| T rotation | towards ATT |

## KA technique
**“patient specific approach”**

<table>
<thead>
<tr>
<th>F flexion</th>
<th>parallel to frontal femoral slope after correction of wear</th>
</tr>
</thead>
<tbody>
<tr>
<td>F distal cut</td>
<td>≠</td>
</tr>
</tbody>
</table>
| F posterior cut | ≠ - neutral rotation/PCL  
≠ - measured resection tech only |
| T frontal cut | ≠ - parallel to frontal tibial slope after correction for wear |
| T slope | ≠ - slope of medial plateau |
| T rotation | ≠ - parallel to axis of lateral plateau |

**New surgical technique** (2007)
KA technique

"systematic approach"

"patient specific approach"

F flexion similar

F distal cut perpendicular to femoral mechanical axis parallel to frontal femoral slope after correction of wear

F posterior cut
- external rotation/PCL
- measured resect° or gap balancing
- neutral rotation/PCL
- measured resection tech only

T frontal cut perpendicular mechanical axis of tibia parallel to frontal tibial slope after correction for wear

T slope 2 to 7° posterior slope of medial plateau

T rotation towards ATT parallel to axis of lateral plateau

New surgical technique (2007)

Makes everyone the same ≠ ≠ ≠ ≠ ≠

Keeps everyone unique

(2007)
Cylindrical Axis (trans-condylar)

New surgical technique (2007)
- True Knee Resurfacing
- No Ligaments release
1. No respect of **constitutional knee anatomy**
   - FT joint
   - PF joint

2. No respect of **physiological knee laxity**
   - FT joint
   - PF joint

3. **technically demanding**
   - Soft tissue balance
   - Aligning F component with TEA
1. Respect of the constitutional knee anatomy:
   - FT joint
   - PF joint

2. Respect physiological knee laxity

3. Technically simple:
   - No soft tissue release
   - Ease for aligning F component with cylindrical axis

KA technique:
- More physiological
- More reproducible
Evidence:

- Functional performance:
  - 6 RCTs & 4 meta-analyses
Evidence:

- **Functional performance:**
  - 6 RCTs & 4 meta-analyses
- **Anterior Knee Pain:**
  
  \[ \text{KA} > \text{MA} \]  
  *(Odds Ratio 5)*

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**A randomised controlled trial of kinematically and mechanically aligned total knee replacements**

**TWO-YEAR CLINICAL RESULTS**

H. G. Dossett, N. A. Estrada, G. J. Swartz, G. W. LeFevre, B. G. Kwasman

We have previously reported the short-term radiological results of a randomised controlled trial comparing kinematically aligned total knee replacement (TKR) and mechanically aligned TKR, along with early pain and function scores. In this study we report the two-year clinical results from this trial. A total of 88 patients (88 knees) were randomly allocated to undergo either kinematically aligned TKR using patient-specific guides, or mechanically...
Evidence:

- **Functional performance:**
  - 6 RCTs & 4 meta-analyses

- **Anterior Knee Pain:**

- **Patients’ Satisfaction:**
  - $\text{KA} > \text{MA}$ (Odds Ratio 3)

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**Management Factorials in Total Knee Arthroplasty**

*Patient dissatisfaction following total knee replacement*

A growing concern?

D. Nam, R. M. Nunley, R. L. Barrack

From Washington

A national, multi-centre study was designed in which a questionnaire quantifying the degree of patient satisfaction and residual symptoms in patients following total knee replacement (TKR) was administered by an independent, blinded third party survey centre. A total of 90% of patients reported satisfaction with the overall functioning of their knee, but 86% felt their knee to be ‘normal’ with the reported incidence of residual symptoms and
Evidence:

- **Functional performance:**
  - 6 RCTs & 4 meta-analyses
- **Anterior Knee Pain:**
- **Patients’ Satisfaction:**
- **Complication/Survivorship:**

\[ \text{KA} = \text{MA} \]
Evidence:

- Functional performance:
  - 6 RCTs & 4 meta-analyses
- Anterior Knee Pain:
- Patients’ Satisfaction:
- Complication/Survivorship
- Implant migration (RSA)

KA = MA
Evidence:

- Functional performance:
  - 6 RCTs & 4 meta-analyses
- Anterior Knee Pain:
- Patients' Satisfaction:
- Complication/Survivorship
- Implant migration (RSA)
- Biomechanics

KA ≥ MA
Evidence:

- **Functional performance:**
  - 6 RCTs & 4 meta-analyses
- **Anterior Knee Pain:**
- **Patients’ Satisfaction:**
- **Complication/Survivorship**
- **Implant migration (RSA)**
- **Biomechanics**

\[ KA \geq MA \]

**KA TKA:**
Reduced edge loading

Reduced varus trust/lift-off
Evidence:
- Functional performance: 6 RCTs & 4 meta-analyses
- Anterior Knee Pain:
- Patients’ Satisfaction:
- Complication/Survivorship
- Implant migration (RSA)
- Biomechanics

KA ≥ MA

KA TKA:
- Reduced edge loading
- Reduced dynamic adduction moment

Reduced varus trust/lift-off
Reduced lever arm
More favourable dynamic HKA
Don’t be scared of restoring constitutional limb alignment

- Negligible influence on TKA LIFESPAN (obesity does not hinder good long-term TKA fixation)

TOTAL JRF applied on TKA

ADD° MOMENT → negligible influence on total JRF
Standing alignment has negligible influence on TKA failure/tibia component migration.

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**Effect of Postoperative Mechanical Axis Alignment on Survival and Functional Outcomes of Modern Total Knee Arthroplasties with Cement**

A Concise Follow-up at 20 Years*

Matthew E. Abdel, MD, Matthias Olivier, MD, Sebastien Paratte, MD, PhD, Robert E. Troxler, MD, Daniel J. Berry, MD, and Mark N. Figgina, MD

Does varus alignment adversely affect implant survival and function six years after kinematically aligned total knee arthroplasty?

Stephen M. Howell,1,2,4 Stelios Papadopoulos1,2,3,4 Kyle Kuznik1,2,3,4, Lillian R. Ghalay1,2,3,4, Maury L. Hull1,2,3

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Don’t be scared of restoring constitutional limb alignment.
Exceptional extreme deformities from developmental disease (e.g. Blount, Rickets, Volkman)

1. Adjusted KA TKA
2. Osteotomy + KA TKA
KA TKA is:

1. PHYSIOLOGICAL
2. SIMPLE (reproducible technique)
3. VERY GOOD OUTCOMES...so far!
4. Probably BIOMECHANICALLY FRIENDLY
5. Probably for EVERYONE (rKA TKA when severe deformity)
Mechanical alignment: The end of an era!

Half a century ago, Michael Freeman introduced the concept of right-angled femoral and tibial bone cuts in total knee arthroplasty (TKA) (mechanical alignment (MA)). A little later, John Insall raised the importance of balancing the utricular mediolateral and flexion-extension gaps. MA technique, subsequently, became the gold standard in total knee arthroplasty. The MA technique can be defined as "anterior," in that all parameters are implanted in a standardized fashion, without considering the individual native bone anatomy and physiological soft tissue laxity. MA technique is aimed at the knee adduction moment rather than the radiological knee alignment post-reconstruction. The outcomes of patients with at least 2 years follow-up showed that patients who underwent MA TKA had better clinical outcomes compared to those who underwent non-MA TKA (1). Furthermore, MA TKA can be a cost-effective procedure, with lower revision rates and lower costs compared to other surgical techniques (2).

However, recent studies have shown that MA TKA is not always the best option for every patient. MA TKA is associated with a higher risk of patellar fracture, patellar baja, and flexion contracture (3). These complications can significantly affect the patient's quality of life and require additional surgery. Therefore, it is crucial to individualize the surgical approach based on the patient's specific anatomical features and clinical needs.

In conclusion, MA TKA is a powerful tool in the armamentarium of the knee surgeon. However, it is crucial to consider the patient's anatomy, clinical presentation, and goals of treatment before deciding on the most appropriate surgical technique. MA TKA is not the one-size-fits-all solution, and a personalized approach is necessary to achieve the best possible outcomes for each patient.
To learn more...
Thank You
For Your
Attention

KEEP CALM
AND
SWITCH TO KA