

Golden Trade-Offs Management For TKA: A Mini Review

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Pain relief and restoration of function including high-flexion activities are part of successful TKA. This depends on many factors among them:

- 1-Preoperative ROM
- 2-Implant design
- 3-Intraoperative soft tissue balancing
- 4-Posterior Tibial slope (PTS)
- 5-Femoral rollback and external femoral rotation during flexion (J Victor, *et al.* 2006).

Balancing these requirements is not simple because the human knee flexion occurs in six degrees of freedom in space including rotation along the horizontal axis (Flexion), translation along the sagittal axis (roll-back of the femur) and rotation over the coronal axis (femoral external rotation). Computer-assisted surgery (CAS) does not take the place of clinical judgment [1] but can be used by the surgeon to make surgical decisions. CAS modeling depends on the definition of geometrical landmarks [2].

In the literature, there are many anatomical landmarks definition and angular measurements documented with its possible relation to clinical situations. These parameters summarized in the table 1 below.

PCO = Posterior Femoral Condylar Offset
LPCO = Lateral Posterior Condylar Offset
MPCO= Medial Posterior Condylar Offset
Medial Posterior Condylar Offset (MPCO)/Lateral Posterior Condylar Offset (LPCO) Ratio
PCRA = Posterior Condylar Rotation Angle
MATO = Medial Anterior Trochlear Offset
LATO = Lateral Anterior Trochlear Offset
MATO/LATO Ratio
TRA = Trochlear Rotation Angle
PCOR = Posterior Condylar Offset Ratio = PCO / max AP diameter of the femoral component
sTEA = surgical Trans-Epicondylar Axis
cTEA = clinical Trans-Epicondylar Axis
PCA = Posterior Condylar Angle = angle between the surgical TEA and PCL
CTA = Condylar Twist Angle = Angle between the clinical TEA and PCL
FATL = Femoral Anterior Tangent Line
NWR = femoral Notch Width Index

TA = Trochlear Angle
PFSD = Patello-Femoral Space Distance
MS AP D = Medial Sulcus AP Distance
MS ML D = Medial Sulcus ML Distance
MS AP/ML ratio = Medial Sulcus AP/ML ratio
FAR = Femoral aspect ratio = ration between AP and ML tibial diameter

Basically, used are

Surgical Transepicondylar axis (sTEA [3]): Axis that connected the center of the sulcus of the medial epicondyle and the most prominent point of the lateral epicondyle.

Clinical Transepicondylar (cTEA): Axis that connected the most prominent points of the medial and lateral epicondyles. Posterior condylar angle = angle between the surgical TEA and PCL.

Condylar twist angle: angle between the clinical TEA and Posterior Femoral Condylar Offset (PCL [4]).

Femoral anterior tangent line (FAT line [5]) is a useful index for appropriate rotational alignment of femoral component, both before and during TKA (jig used).

Femoral notch width index (NWI) [6].

The surgeon’s ability to reproducibly identify the bone landmarks accurately used in measured resection techniques is limited [7] therefore surgeons should be aware of the variability of the distal femur in patients undergoing TKA and perform additional measurements preoperatively to achieve proper alignment [8]. CAS would add additional elements that help the balance techniques achieving the golden (trade-offs management) approaches for TKA.

Gender dependent Landmarks and angle variations

TKA has shown in all series that between 65% and 70% of the patients are women, and independent of AP dimension, women tended to have a narrower ML dimension (Chin KR., *et al.* 2002).

Femoral ML: AP Ratios for the Female Knee show a clear tendency for all implants to become a problem with ML oversizing for a given AP diameter, Particularly with larger sizes. women have a femoral aspect ratio higher for smaller knees and proportionately lower for larger knees [9].

For the same anteroposterior (AP) measurement [10] in female

1. The mediolateral (ML) is smaller
2. The Anterior aspect of the femur, lateral condyle higher and more proximal than the medial condyle also the anterior condyle is less prominent
3. The patella more lateralized
4. The anatomical-axis-change angle demonstrated internal rotation of the female knee
5. The sulcus significantly flatter. Flatter sulcus with larger Q-angle in the female knee+ Internal femoral rotation in female knees along their transepicondylar axes lead to patellar instability (patella lateral subluxation) and patellar malt racking (more wear)

Some technical remarks

In hybrid approach Resection Technique [11] (Gap Balancing and Measured Resection Technique), landmarks are used widely and this require a sound understanding of the native rotational geometry of the knee for correct positioning of the femoral component in the axial plane in TKR [12].

2 mm decrease in posterior condylar offset reduced postoperative flexion by 12.2° (Belleman., *et al.* 2002). Traditional femoral implant when used with less-prominent anterior femoral aspects will lead to anterior knee pain, especially on the most lateral side.

Resection additional bone from the posterior femur will decrease the femoral offset theoretically [13] and decrease flexion as a result of impingement.

Femoral external rotation during flexion reduces the Q-angle and patellar shear force and patellofemoral joint reaction force decreases [14]. this could augment ratio of wear of polyethylene inserts (Hyuksoo Han., *et al.* 2015).

Increased lateral joint opening and Lift-off [15,16] associated with increased internal rotation of the femoral component.

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