

Rationale and Outcomes of Kinematic Alignment in TKR

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1. Primary concept

Howell et al. recently proposed a technique called the “kinematically aligned” TKA (*Orthopedics, 2008*). This method strives to reproduce near-normal knee function by restoring pre-morbid joint levels and angles during TKA. To do this, the femoral component of the implant is placed in a slightly more valgus and internally rotated position, and the tibial component is placed in a slightly more varus and internally rotated position, compared with the placement of the implants in a mechanically aligned TKA.

2. Clinical results

A randomized controlled study has shown that a kinematically aligned TKA resulted in better pain relief, postoperative function, and range of motion than mechanically aligned TKA (Dossett HG, et al, *Bone Joint J, 2014*).

Howell et al. prospectively followed 214 consecutive patients (219 knees) treated with a kinematically aligned TKA. They reported varus alignment of the tibial component, knee and limb did not adversely affect implant survival or function at a mean of 6.3 years after kinematically aligned TKA. (*Int Orthop, 2015*)

A recent systematic review of kinematic alignment showed that the clinical outcomes of kinematically aligned TKA were comparable or superior to those of mechanically aligned TKA with a minimum 2-year follow-up. The implant survivorship and complication rate of the kinematically aligned TKA were similar to those of the mechanically aligned TKA. (*Lee et al, Knee Surg Sports Traumatol Arthrosc, 2017*)

3. Theoretical advantages and disadvantages of kinematic alignment

In our computer simulation (*Ishikawa, et al, Knee, 2015*), kinematically aligned TKA achieves sufficient femoral rollback and external rotation of the femoral component. These results suggest that kinematically aligned TKA results in close-to-more normal knee kinematics, providing better clinical results than

mechanical alignment TKA. However, contact stresses on the patellofemoral and tibiofemoral joints are increased considerably after kinematically aligned TKA. This might result in reduced implant longevity if the current prostheses commonly used are implanted with the kinematically aligned method.

Concerns remain on indication of kinematic alignment on severe varus deformity. In another computer simulation model (*Nakamura et al, Bone Joint Res, 2017*), bone models were constructed from one volunteer (normal) and three patients with three different knee deformities (slight, moderate and severe varus). Simulation showed near normal kinematics was observed in KA TKA even for severe varus deformity. However, KA TKA increased the contact force, stress and bone strain at the medial side for moderate and severe varus knee models.