

Variation in coronal alignment with different computer assisted methods

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Introduction: This study retrospectively analyzed the kinematic patterns of 200 computer navigated TKA patients to determine the correlation of preoperative to postoperative kinematic profiles of the knees in the coronal plane. One method utilized matched resection while the other utilized gap balancing techniques to determine if any differences resulted. It was hypothesized that the matched resection would give more differences in flexion compare to the gap balancing technique utilizing a tibia cut first and flexion and extension alignment and gap balancing techniques.

Methods: Two hundred consecutive computer assisted TKAs were analyzed. The preoperative profile of deformity throughout a range of flexion was compared and differences in flexion and extension calculated. The change in alignment from before and after TKA in the operating room was then calculated and compared. Any flexion alignment greater than 3 degrees from neutral was considered an outlier. The deformity in 90 degrees of flexion was then compared to full extension both before and after TKA was performed to see if any difference resulted. One hundred consecutive TKAs were analyzed from one institution where a matched resection algorithm was utilized (Stryker Navigation, Kalamazoo, MI USA). The other 100 consecutive TKAs were analyzed from another institution where a gap balancing technique using a tibia cut first algorithm was utilized (OrthoPilot, Aesculap, Inc, Tutlingen, Germany). Differences in coronal plane alignment were then compared at full extension and 90 degrees flexion for comparison.

Results: The overall alignment profile in flexion and extension were no different for either technique. When outliers were considered to be those knees greater than 3 degrees from the neutral mechanical axis then differences were found in the two techniques. In full extension varus knees were neutrally aligned on average in both groups (-0.2 ± 1.1 in 80 matched resection TKAs and -0.2 ± 0.9 in 80 gap balancing TKAs). In the varus knees there were a higher number of outliers in the matched resection group in both full extension and flexion (3 out of 80 in full extension and 18 out of 80 knees range -12 to 5 degrees) versus the gap balancing group (1 out 80 in full extension and 7 out of 80 knees range -7 to 4 degrees in flexion). Six of the 20 valgus knees in the matched resection group had outliers in flexion after TKA (-4.5 ± 1.5 degrees) where the matched resection group had 1 outlier in flexion out of 20 knees. All of these patients had acceptable alignment from full extension (-0.6 ± 1.1 degrees).

During TKA the surgeon makes a judgment according to anatomical landmarks how the femoral component should be aligned in the transverse plane. During matched resection depending upon the perceived epicondylar or AP axis of Whiteside, the component may or may not equally replace the posterior condyles of the femur to square up the flexion gap. Most valgus osteoarthritic knees that succumb to TKA have been described as having a hypoplastic lateral femoral condyle. This type of deformity will lend itself to a good alignment throughout a range of motion when replaced with a symmetric condylar implant since the filling of the lateral flexion space will allow the knee to be placed in neutral alignment. This series of valgus knees shows that when a hypoplastic lateral femoral condyle is not present that normalizing motion in flexion is difficult and that the knee tends to be placed in varus in flexion. Both varus and valgus knees however, resulted in fewer outliers in the gap balancing series suggesting that this methods may be better at aligning the femoral component and balancing the flexion gap.

Discussion: During TKA the surgeon makes a judgment according to anatomical landmarks how the femoral component should be aligned in the transverse plane. During matched resection depending upon the perceived epicondylar or AP axis of Whiteside, the component may or may not equally replace the posterior condyles of the femur to square up the flexion gap. Most valgus osteoarthritic knees that succumb to TKA have been described as having a hypoplastic lateral femoral condyle. This type of deformity will lend itself to a good alignment throughout a range of motion when replaced with a symmetric condylar implant since the filling of the lateral flexion space will allow the knee to be placed in neutral alignment. This series of valgus knees shows that when a hypoplastic lateral femoral condyle is not present that normalizing motion in flexion is difficult and that the knee tends to be placed in varus in flexion. Both varus and valgus knees however, resulted in fewer outliers in the gap balancing series suggesting that this method may be better at aligning the femoral component and balancing the flexion gap.