Introduction

Most surgeons utilize one of three axis options in conventional total knee arthroplasty (TKA), the transepicondylar axis (TEA), Whitside’s line (WSL) or the posterior condylar axis (PCA) with an external rotation correction factor. Many surgeons believe the TEA to be the gold standard for determining rotation however it can be difficult to access intraoperatively. WSL and PCA have been used as surrogates for determining axial rotation in conventional TKA but may also be prone to error. MRI based preoperative planning systems overcome intraoperative limitations while accounting for the individual anatomy of each patient, thus helping optimize femoral component rotation. The goal of this study was to examine if coronal plane deformity had any effect on the relationship of conventional referencing options such as WSL and PCA to the TEA.

Methods

Utilizing a preoperative planning software based on MRI, we compared the preoperative posterior femoral condyle resections for three different axis options in 176 TKA. The difference in bone resection amount was used to determine the rotational differences between the axis options in all knees. Assuming that the TEA was the ideal rotational axis, we compared the TEA to both WSL and PCA. A 1-sample t-test and paired t-test were then used to determine if there was a significant rotational difference between the various axis options when accounting for degree and direction of preoperative deformity in the coronal plane.

Results

In the overall population of 176 knees (42 valgus, 134 varus), neither WSL or PCA approximated the TEA accurately (p=0.016 and 0.001). In major valgus deformity (>5 degrees), WSL was found to approximate the TEA (p=0.45) while PCA did not approximate the TEA (p=0.047). In minor valgus deformity, both WSL and PCA approximate the TEA (p=0.94 and 0.94). In minor varus deformity (<5 degrees) both WSL and PCA approximate the TEA (p=0.12 and 0.06). In major varus deformity (≥5 degrees) neither WSL or PCA approximate the TEA (p=0.024 and p=0.001).

Discussion

Based on MRI data, our study indicates that preoperative coronal plane deformity should help determine the specific referencing option utilized for femoral component rotation in TKA. Broad application of either WSL or PCA to all patients regardless of preoperative deformity did not accurately approximate TEA in femoral component rotation. When WSL and PCA both approximate or do not approximate the TEA, we recommend using the option with a lower standard deviation, and thus less variability. Although this MRI based technology is not in widespread use, we believe Figure 1 can assist the majority of surgeons determine when to use WSL or the PCA based on preoperative coronal plane deformity when the TEA is not a feasible option.