

Does Kinematic Alignment and Flexion of a Femoral Component Designed for Mechanical Alignment Reduce the Proximal and Lateral Reach of the Trochlea?



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INTRODUCTION

Kinematically aligned total knee arthroplasty (TKA) uses a femoral component designed for mechanical alignment (MA) and sets the component in more internal, valgus, and flexion rotation than MA^{1,2}. It is unknown how much kinematic alignment (KA) and flexion of the femoral component reduces the proximal and lateral reach of the trochlea; two reductions that could increase the risk of abnormal patella tracking (Figure 1)³⁻⁸.

METHODS AND MATERIALS

- 1 We simulated MA and KA of the femoral component in 0° of flexion on 20 three-dimensional bone models of normal femurs.
- 2 The mechanically and kinematically aligned components were then aligned in 5°, 10°, and 15° of flexion and downsized until the flange contacted the anterior femur.
- 3 The reductions in the proximal and lateral reach from the proximal point of the trochlea of the MA component set in 0° of flexion were computed.

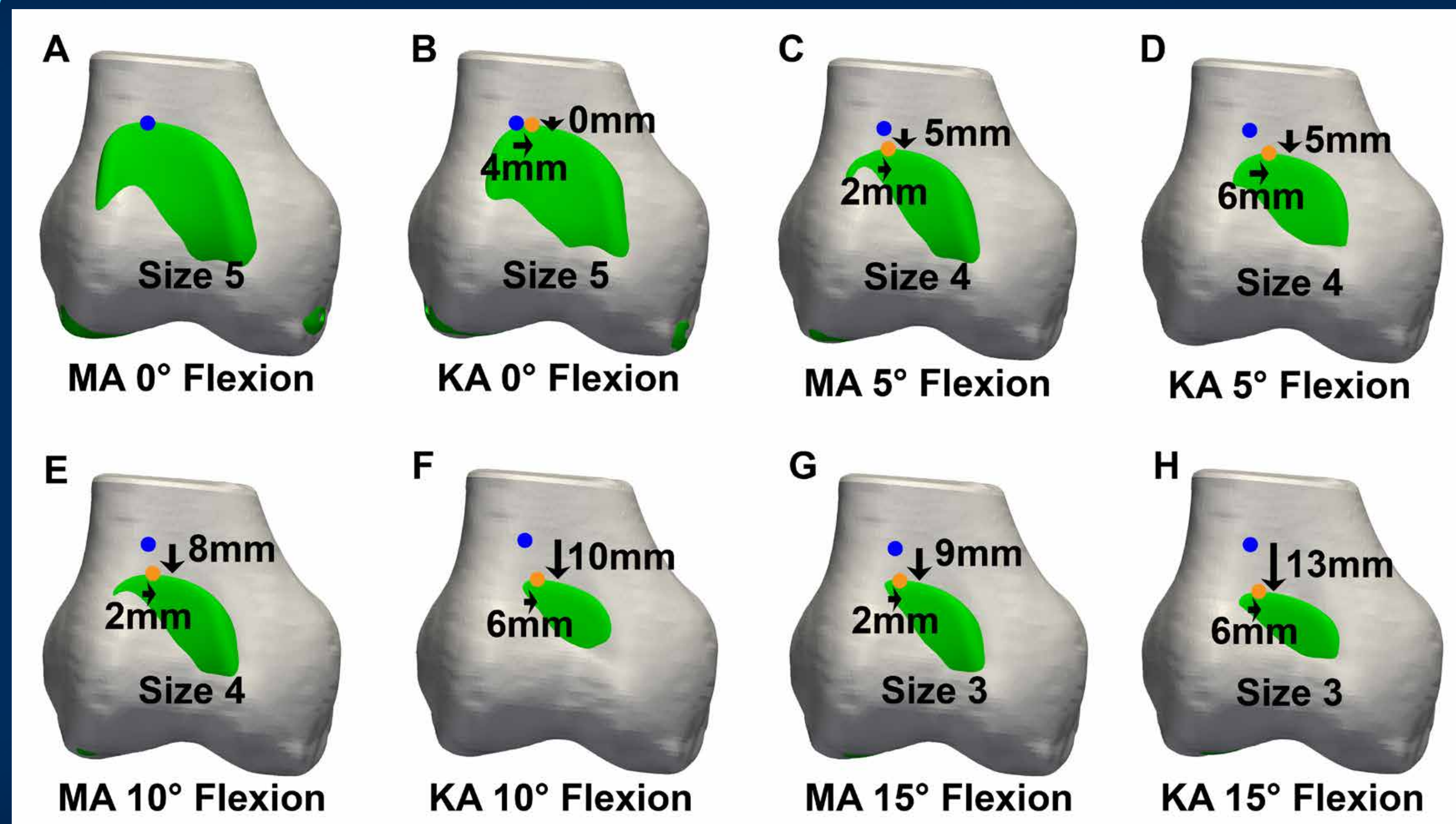


Figure 1. The composite shows a right distal femur and the reductions in proximal reach (arrow pointing distal), lateral reach (arrow pointing medial) and femoral component size from the MA femoral component in 0° of flexion (A) for the KA femoral component in 0° (B), 5° (D), 10° (F) and 15° of flexion (H) and the MA femoral component in 5° (C), 10° (E), and 15° of flexion (G).

RESULTS

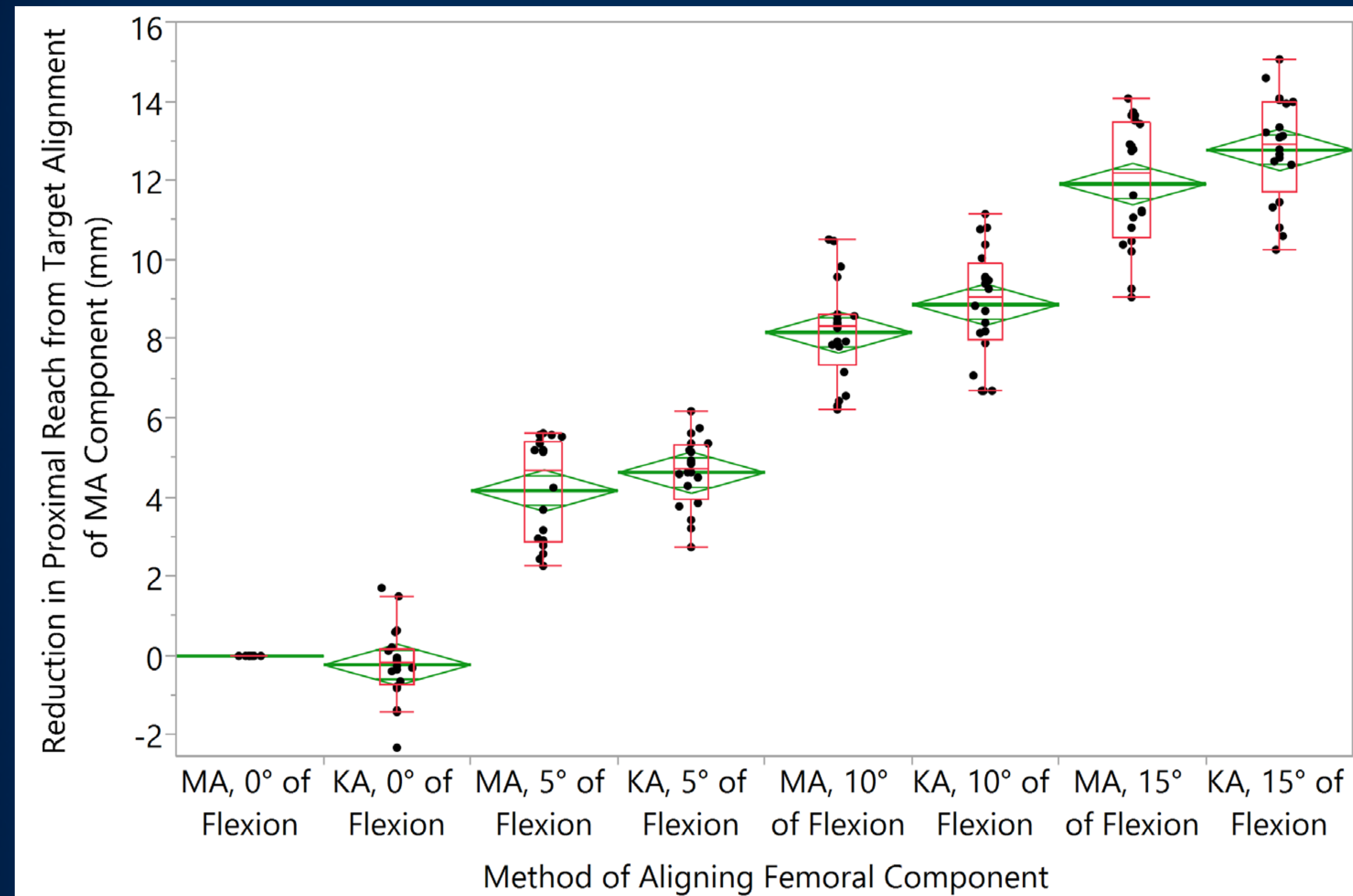


Figure 2. The graph displays the diamond (green), which illustrates the mean and 95% confidence interval, and an outlier quartile box plot (red), which shows the variability in the reduction in proximal reach from the proximal point of the

mechanically aligned femoral component set at 0° of flexion from flexing the mechanically aligned and kinematically aligned femoral components 5°, 10°, and 15°. KA at 0° of flexion did not reduce the proximal reach. Flexion of the MA and KA femoral component 5°, 10°, and 15° reduced the proximal reach an average of 0.8 mm per degree of flexion.

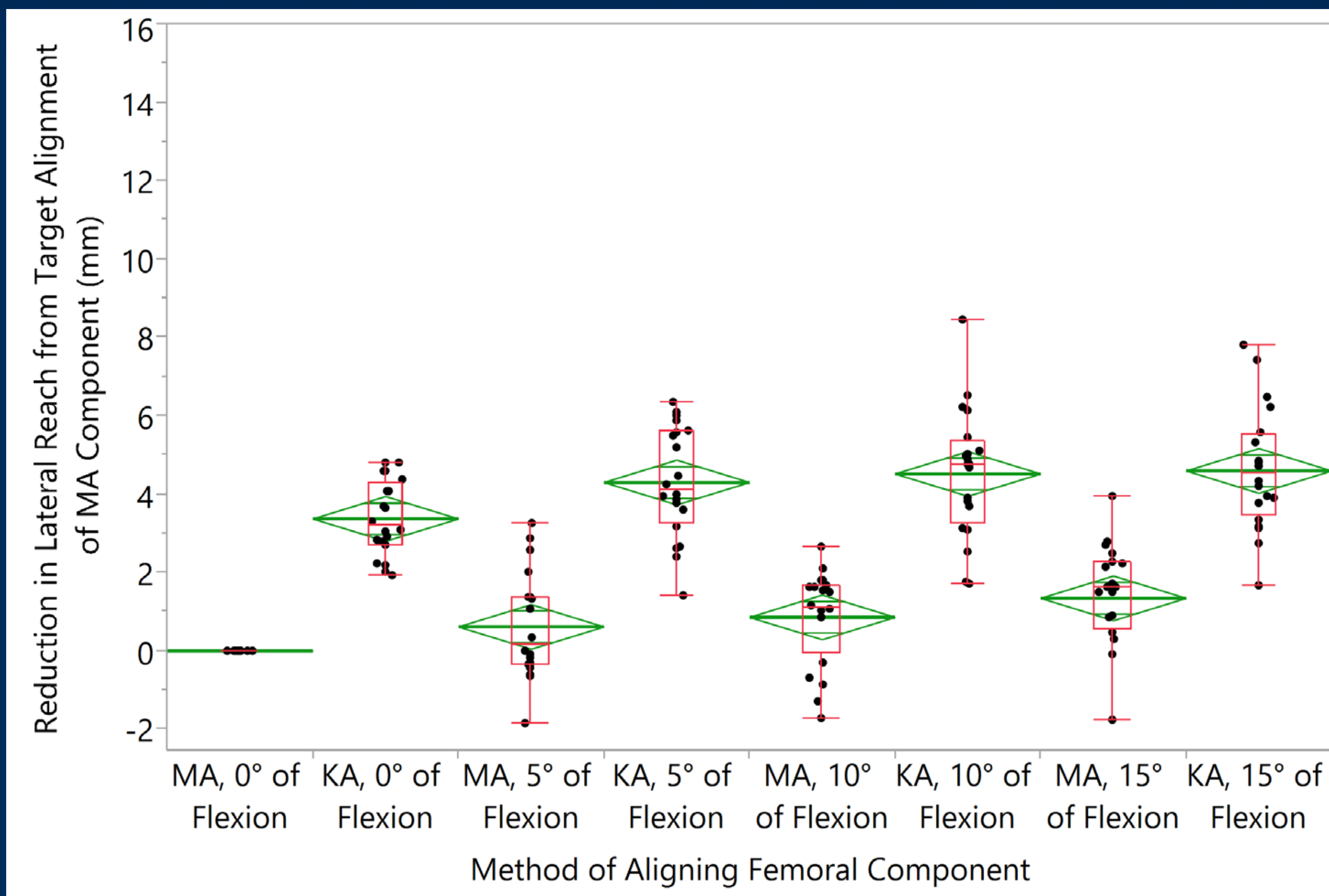


Figure 3. The graph displays the diamond (green), which illustrates the mean and 95% confidence interval, and an outlier quartile box plot (red), which shows the variability in the reduction in lateral reach from the proximal point of the mechanically aligned femoral

component set at 0° of flexion from flexing the mechanically aligned and kinematically aligned femoral components 5°, 10°, and 15°. KA at 0° of flexion reduced the lateral reach an average of 3 mm. Flexion of the MA and KA femoral component 5°, 10°, and 15° reduced the lateral reach an average of 1 mm and 4 mm regardless of the degree of flexion respectively.

DISCUSSION

Arthroplasty surgeons and biomechanical engineers striving to optimize patella tracking might consider developing surgical techniques to minimize flexion of the femoral component when performing KA and MA TKA to promote early patella engagement, and consider designing a femoral component with a trochlea shaped specifically for KA.