



How Does Computer Technology Influence TKA Implant Placement For Surgeons In Fellowship Training?

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Abstract

Implant malalignment during TKA may lead to suboptimal outcomes. Accuracy studies are typically performed with experienced surgeons; however, it is important to study less experienced surgeons when considering teaching hospitals where younger surgeons are operating. Therefore, the purpose of this study was to assess whether computer-assisted TKA (CATKA) allows for more accurate and precise implant position to plan when compared to manual TKA (MTKA) when the surgery is performed by less experienced surgeons.

Two surgeons, currently in their fellowship training and having minimal CATKA experience, performed a total six MTKA and six CATKA on paired cadaveric knees. Computed tomography (CT) scans were obtained for each knee pre- and post-operatively. CT scans were analyzed to compare post-operative implant position to the pre-operative planned position. Mean system errors and standard deviations were compared between CATKA and MTKA for the femoral component sagittal, coronal, and axial planes and the tibial component in the sagittal and coronal planes. A 2-Variance testing was performed using an $\alpha=0.05$.

CATKA had greater accuracy and precision to plan than MTKA for: femoral axial plane ($1.1^{\circ}\pm 1.1^{\circ}$ vs. $1.6^{\circ}\pm 1.3^{\circ}$), coronal plane ($0.9^{\circ}\pm 0.7^{\circ}$ vs. $2.2^{\circ}\pm 1.0^{\circ}$), femoral sagittal plane ($1.5^{\circ}\pm 1.3^{\circ}$ vs. $3.1^{\circ}\pm 2.1^{\circ}$), tibial coronal plane ($0.9^{\circ}\pm 0.5^{\circ}$ vs. $1.9^{\circ}\pm 1.3^{\circ}$) and tibial sagittal plane ($1.7^{\circ}\pm 2.6^{\circ}$ vs. $4.7^{\circ}\pm 4.1^{\circ}$). There was no statistical difference between surgical groups or between the two surgeons performing the cases.

With limited CATKA experience, the fellows showed increased accuracy and precision to plan for femoral and tibial implant positions. Furthermore, these results are comparable to what has been reported for an experienced surgeon performing CATKA.

1 Introduction

Implant malalignment during TKA may lead to suboptimal outcomes.[1-2] Accuracy studies are typically performed with experienced surgeons [3-4]; however, it is important to study less experienced surgeons when considering teaching hospitals where younger surgeons are operating. Therefore, the purpose of this study was to assess whether computer-assisted TKA (CATKA) allows for more accurate and precise implant position to plan when compared to manual TKA (MTKA) when the surgery is performed by less experienced surgeons.

2 Materials and Methods

Two surgeons, currently in their fellowship training and having minimal CATKA experience, performed a total six MTKA and six CATKA on paired cadaveric knees. Computed tomography (CT) scans were obtained for each knee pre- and post-operatively. CT scans were analyzed by independent reviewers to compare post-operative implant position to the pre-operative planned position. Mean system errors and standard deviations were compared between CATKA and MTKA for the sagittal, coronal, and axial planes and the tibial component in the sagittal and coronal planes. A 2-Variance testing was performed using an $\alpha=0.05$.

3 Results

CATKA had greater accuracy and precision to plan than MTKA for: femoral axial plane ($1.1^{\circ}\pm 1.1^{\circ}$ vs. $1.6^{\circ}\pm 1.3^{\circ}$), coronal plane ($0.9^{\circ}\pm 0.7^{\circ}$ vs. $2.2\pm 1.0^{\circ}$), femoral sagittal plane ($1.5^{\circ}\pm 1.3^{\circ}$ vs. $3.1^{\circ}\pm 2.1^{\circ}$), tibial coronal plane ($0.9^{\circ}\pm 0.5^{\circ}$ vs. $1.9^{\circ}\pm 1.3^{\circ}$) and tibial sagittal plane ($1.7^{\circ}\pm 2.6^{\circ}$ vs. $4.7^{\circ}\pm 4.1^{\circ}$). For all component planes, the computer-assisted cohort had improved implant placement accuracy and precision to plan (Figure 1). However, there was no statistical difference between groups. On average, computer-assisted final component position was 2.2 times more accurate and 1.6 times more precise to plan than the manual cohort.

For 5 of the 6 cadavers, the overall MTKA component error to plan was greater when comparing specimen pairs and procedural order, than CATKA. The first CATKA case performed by surgeon 2 had higher stacked errors when compared to the MTKA procedure performed on the same cadaver. It was noticed that the stacked errors decreased after this first CATKA case, indicating a learning curve.

4 Discussion and Conclusion

Literature has shown a surgeon's experience may influence how well they perform conventional TKA, with one study reporting reduced patient reported outcomes for low-volume surgeons [5]. Computer technology is designed to provide surgeons assistance with overall implant alignment and placement [3-4]. Results from this study indicate that with limited CATKA experience, fellows were able to place TKA components more accurately and precisely to plan when compared to conventional TKA. Furthermore, these results were comparable to what has been reported for an experienced surgeon performing computer-assisted TKA [3]. This indicates less experienced surgeons may be able to obtain the same level of implant placement accuracy to plan as an experienced surgeon when performing computer-assisted TKA.

5 Figures and Tables

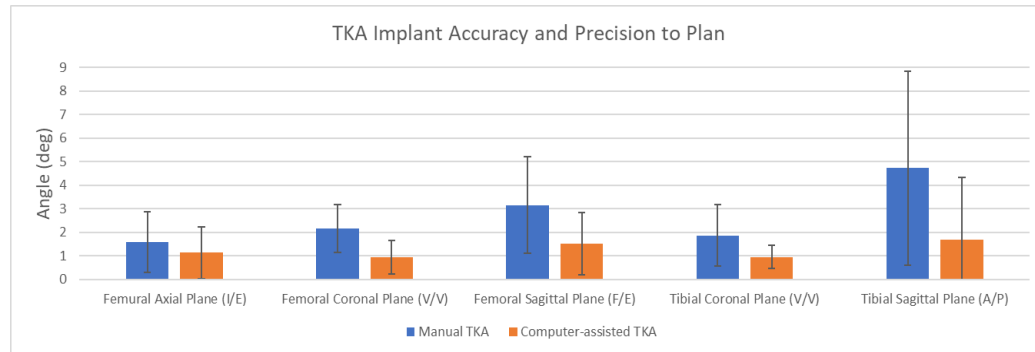


Figure 1. Comparison of manual to computer-assisted total arthroplasty implant position error to plan for the femoral and tibial components. Where the bar graphs represented implant placement accuracy to plan and errors bars represent standard deviation or precision of implant placement to plan.

References

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