In Robotic TKA is Non-Weightbearing Imaging the Best Approach for Planning?

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INTRODUCTION: Some robotic-assisted total knee arthroplasties (RA-TKA) utilize non-weightbearing computer tomography (CT) for surgical planning. However, preoperative plans may be affected by weightbearing status and lower extremity rotation. Alternatively, weightbearing 3-Dimensional (3D) EOS imaging has been proven to be useful for preoperative assessment of alignment. The purpose of this study was to compare planned resections during RA-TKA for neutral mechanical alignment between a non-weightbearing CT-based robotic system and 3D weightbearing EOS imaging.

METHODS: We performed a single-center retrospective review of 62 patients who underwent RA-TKA between 2021–2022. Planned resections to achieve neutral limb alignment were recorded from the CT-based robotic system including the medial distal femur (MDF), lateral distal femur (LDF), medial proximal tibia (MPT), and lateral proximal tibia (LPT) resections. Thickness of these planned resections were then compared with resections planned from preoperative EOS weightbearing imaging to similarly achieve a neutral limb alignment. Overall limb alignment was also recorded from the robotic system and compared to the preoperative EOS radiographs. All preoperative and postoperative radiographic measurements were independently performed by two investigators.

RESULTS: The mean absolute difference between MDF resection on the robotic system and preoperative EOS was $3.10 \text{ mm} \pm 1.71 \text{ mm}$ (p=0.09). The mean absolute difference for LDF resections was $1.44 \text{ mm} \pm 1.14 \text{ mm}$ (p<0.01). For the proximal tibia resections, the mean absolute difference for MPT resections was $1.11 \text{ mm} \pm 0.91 \text{ mm}$ (p<0.01). Mean absolute difference for LPT resections was $1.05 \text{ mm} \pm 0.64 \text{ mm}$ (<0.05). Mean absolute difference for preoperative limb alignment was $3.36^{\circ} \pm 3.24^{\circ}$ (<0.01).

DISCUSSION AND CONCLUSION: The planned resections to achieve neutral limb alignment in a non-weightbearing CTbased robotic system were significantly different than planned resections using weightbearing 3D imaging, by up to 3mm. Weightbearing and rotation may affect planned bone resection measurements and subsequently implant position in RA-TKA, but the clinical impact of this remains unknown.