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3D Printing of Bone Spurs Before Surgical Removal During Total Knee Arthroplasty

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Project Title: 3D Printing of Bone Spurs Before Surgical Removal During Total Knee Arthroplasty

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Project Background: In the United States, total knee arthroplasty (TKA) is the most performed orthopaedic operation. Among the 700,00 patients who received TKA, 21-25% underwent revision due to knee instability. Proper stability of a TKA depends on soft tissue balance for proper alignment in flexion and extension, and improper soft tissue modification is the primary cause of early implant failure. Soft tissue balancing can be complicated by presence of osteophytes on the distal femur or proximal tibia, which may require removal. The three-dimensional structure of osteophytes is often difficult to visualize with imaging, which could cause incomplete removal. Utilizing 3D models of these osteophytes may mitigate the risk of complication after implantation by enabling more efficient and effective soft tissue adjustment for knee tracking and balancing.

Proposed Methods: We are writing a research proposal for the Rothman Institute to engage in a pilot study. We will use de-identified MRI or CT imaging to print the distal femoral and proximal tibial components of the knee, including osteophytes. The surgeon will use the model preoperatively or during surgery to gain a more comprehensive visual understanding of factors which may affect soft tissue balancing. After approximately 10 trials, we will ask the surgeons

for feedback in addition to measuring outcomes such as change in OR time or revision rate. We aim to apply for IRB approval for a larger study.

Results: The 3D model concept is supported by orthopaedic surgeons and residents who perform TKA. We anticipate reduced OR time.

Conclusions: Feedback from orthopaedic surgeons suggests potential utility for 3D models in the OR. Although CT is a better imaging modality than MRI for 3D printing the models, CT scans are not commonly performed prior to TKA. Our next steps include IRB approval and determination of whether the models will be best utilized preoperatively or during surgery.

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