Shifting from Manual to Machine: AAHKS Survey Reveals Rising Technology Adoption in Total Knee Arthroplasty

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INTRODUCTION: Technological advancements have increasingly shaped total knee arthroplasty (TKA). Robotics and navigation systems are employed to help achieve alternative alignment and balancing accuracy and reproducibility, though current literature offers mixed evidence on whether they improve long-term clinical and patient outcomes compared to manual techniques. Despite this, national adoption continues to rise. This study evaluated temporal trends in technology use among members of the American Association of Hip and Knee Surgeons (AAHKS) over the past decade.

METHODS: A web-based survey was distributed to AAHKS members in early 2025. Of 498 responses, 456 complete submissions were analyzed. The survey assessed surgeon demographics and preferred alignment methods for TKA at three time points: 2024, 2019, and 2014. Descriptive statistics were used to summarize adoption trends, and McNemar's test evaluated changes across time points.

RESULTS: Use of robotics or navigation increased from 14.2% in 2014 to 27.8% in 2019 and 51.3% in 2024 ($p < 0.0001$). Manual measured resection declined from 54.0% to 27.2% ($p = 0.0001$). Gap balancing also decreased from 24.7% to 12.7% ($p = 0.06$). Caliper-based techniques grew modestly from 3.4% to 5.9% ($p = 0.02$), while freehand and anatomic approaches remained rare (<3%). Among current technology users (n = 296), image-based robotics was most common (57%), followed by imageless robotics (28%), hand-held navigation (14%), and augmented reality (1%).

DISCUSSION AND CONCLUSION: Over the past decade, AAHKS members have demonstrated a substantial shift toward technology-assisted TKA, with image-based robotics as the dominant modality. Despite limited evidence showing superior clinical outcomes of image-based vs imageless technology vs manual techniques, adoption continues to accelerate. This is likely influenced by evolving alignment philosophies and perceived benefits in precision. These trends highlight the need for high-quality studies to better define these techniques and evaluate their long-term clinical and economic value.