

# Noise Related Injury during Robotic versus Manual Total Knee Arthroplasty

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**INTRODUCTION:** Occupational noise exposure during the use of robotic equipment poses a risk to orthopaedic surgeons that has not been quantified in the literature. According to guidelines set by NIOSH, noise exposure levels at or above 85 decibels as an 8-hour time-weighted-average (TWA) are considered hazardous. This study aimed to determine whether the noise of robotic instruments used in total knee arthroplasty (TKA) increases the risk of developing noise-induced hearing loss (NIHL) when compared to traditional instruments. We hypothesized that if noise measurements are compared during TKAs using the manual technique, the Mako Robotic-Arm Assisted Surgery, and the CORI Surgical System; then the Mako group will have the highest measurements.

**METHODS:** Intraoperative audio was recorded during either manual, Mako, or CORI TKAs. The DecibelX application was used to record the duration of exposure, average decibel level, maximum decibel level, TWA, noise dose percentage of maximum allowable daily noise, and noise dose percentage projected forward over 8 hours. A one-way ANOVA and post-hoc testing were performed. Statistical significance was set at a  $p < 0.05$ .

**RESULTS:** Fifty-eight audio recordings were analyzed. No significant difference was found in mean duration of exposure or mean maximum decibels. The mean average decibel level was 90.2 dB for manual TKA, 97.1 dB for Mako, and 93.0 dB for CORI ( $p < 0.001$ ) (Figure 1). The mean TWA was 81.2 dB for manual TKA, 88.3 dB for Mako, and 83.2 dB for CORI ( $p < 0.001$ ) (Figure 2). The mean noise dose for manual TKA was 87.6%, 234.3% for Mako, and 93.0% for CORI ( $p < 0.001$ ) (Figure 3). Mean projected noise dose for manual TKA was 545.7%, 1917.4% for Mako, and 723.0% for CORI ( $p < 0.001$ ) (Figure 4). For significant variables, post-hoc testing showed a difference between Mako and manual TKAs, and Mako and CORI TKAs.

**DISCUSSION AND CONCLUSION:** This study provides valuable insights into the noise exposure levels associated with different knee arthroplasty surgeries. The Mako procedure was associated with significantly higher average decibel levels, TWA, daily noise dose, and noise dose projected forward over 8 hours compared to manual and CORI TKAs. With a mean TWA of 88.3 dB, the Mako procedure is above the limit of 85 dB set by the NIOSH occupational noise exposure guidelines and is in the range of noise levels that are known to cause NIHL over time. Further research is warranted to explore the causes of the observed differences in noise levels among these procedures and to develop strategies for minimizing noise exposure and its potential adverse effects on surgical teams.

