

Δ Stay Cool: Evaluation of External Fixation Pin Temperature Within the MRI Bore

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Purpose: The purpose of the study is to: (1) report the thermal changes encountered at the pin/skin interface in a cadaver with a knee-spanning external fixator inside the MRI bore and (2) report on the quality of the MRI sequences collected in the same model.

Methods: Three external fixation systems were placed on 2 cadaveric limbs in an identical knee-spanning configuration. Fiberoptic thermal probes were placed at the pin/skin interface of a femoral and tibial pin. A control probe was embedded in the proximal soft tissues of the thigh. The 6 limbs then underwent MRI knee scans using a 1.5-T magnet. Real-time thermal data were collected with fiberoptic temperature sensors. A Pearson correlation coefficient was performed on the tibial and femoral pins versus the control with R² representing an estimate of the effect of the control temperature on the pins. A value of P < 0.05 indicates no significant change from the control. Two radiologists blinded to the fixator evaluated the images for image quality using a standardized 5-point grading scale ranging from Grade 1, representing severe artifact affecting the entire image, to Grade 5, representing no artifact.

Results: The control temperature on all limbs increased during the scan as the limb temperatures neutralized to the surrounding air (19-22°C). On average across all systems studied, the femoral pins were 1.31°C cooler than the control probes (range, -0.04 to 3.04) and the tibial pins were 1.87°C warmer than the control probes (range, -1.64 to -2.32). There was a significant correlation between the temperatures of the control probe and the temperatures of both the femoral and tibial pins for all frames (P < 0.001). This implies that the temperature changes of the femoral and tibial pins were the similar to the control with no independent effect from the MRI magnet. The average quality of the images of the knee was rated at 4.58 (range, 4.33-4.67), meaning there was minimal to no artifact affecting image interpretation.

Conclusion: Clinically inconsequential thermal changes that did not differ from the control were detected at the pin/skin interface throughout the entire scan for each of the external fixation models. The overall image quality and interpretability of the images collected were excellent for each model.

Δ OTA Grant

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.