The Dynamic Haptic Robotic Training (DHRT) system was developed to simulate these diverse patient anatomies during Central Venous Catheterization (CVC) training" Chen et al (2018).

Abstract:

INTRODUCTION: High-tech simulators are gaining popularity in surgical training programs because of their potential for improving clinical outcomes. However, most simulators are static in nature and only represent a single anatomical patient configuration. The Dynamic Haptic Robotic Training (DHRT) system was developed to simulate these diverse patient anatomies during Central Venous Catheterization (CVC) training. This article explores the use of the DHRT system to evaluate objective metrics for CVC insertion by comparing the performance of experts and novices.

METHODS: Eleven expert surgeons and 13 first-year surgical residents (novices) performed multiple needle insertion trials on the DHRT system. Differences between expert and novice performance on the following five metrics were assessed using a multivariate analysis of variance: path length, standard deviation of deviations (SDoD), average velocity, distance to the center of the vessel, and time to complete (TtC) the needle insertion. A regression analysis was performed to identify if expertise could be predicted using these metrics. Then, a curve fit was conducted to identify whether learning curves were present for experts or novices on any of these five metrics.

RESULTS: Time to complete the insertion and SDoD of the needle tip from an ideal path were significantly different between experts and novices. Learning curves were not present for experts but indicated a significant decrease in path length and TtC for novices.

CONCLUSIONS: The DHRT system was able to identify significant differences in TtC and SDoD between experts and novices during CVC needle insertion procedures. In addition, novices were shown to improve their skills through DHRT training.

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Reference:
Chen, H.E., Yovanoff, M.A., Pepley, D.F., Sonntag, C.C., Mirkin, K.A., Han, D.C., Moore, J.Z. and Miller, S.R. (2018) Can Haptic Simulators Distinguish Expert Performance? A Case Study in Central Venous Catheterization in Surgical Education. Simulation in Healthcare. December 29th. .

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