The information gained from this syringe was able to be implemented into a haptic simulator for CVC insertions, showing its utility. Survey results showed that experts, fellows, and residents had an overall positive outlook on the haptic simulator's ability to teach haptic skills" Pepley et al (2018).

Abstract:

Accurate force simulation is essential to haptic simulators for surgical training. Factors such as tissue inhomogeneity pose unique challenges for simulating needle forces. To aid in the development of haptic needle insertion simulators, a handheld force sensing syringe was created to measure the motion and forces of needle insertions. Five needle insertions were performed into the neck of a cadaver using the force sensing syringe.

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Based on these measurements a piecewise exponential needle force characterization, was implemented into a haptic central venous catheterization (CVC) simulator. The haptic simulator was evaluated through a survey of expert surgeons, fellows, and residents. The maximum needle insertion forces measured ranged from 2.02 N to 1.20 N. With this information, four characterizations were created representing average, muscular, obese, and thin patients. The median survey results showed that users statistically agreed that "the robotic system made me sensitive to how patient anatomy impacts the force required to advance needles in the human body." The force sensing syringe captured force and position information. The information gained from this syringe was able to be implemented into a haptic simulator for CVC insertions, showing its utility. Survey results showed that experts, fellows, and residents had an overall positive outlook on the haptic simulator's ability to teach haptic skills.

Reference:

Pepley, D.F., Yovanoff, M.A., Mirkin, K.A., Miller, S.R., Han, D.C. and Moore, J.Z. (2018) Integrating Cadaver Needle Forces Into a Haptic Robotic Simulator. Journal of Medical Devices. 12(1), p.0145011-145015.

doi: 10.1115/1.4038562.

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