

Evaluation of a Vibro-Tactile Display Prototype for Physiological Monitoring

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Visual displays and auditory alarms are used to convey physiological parameters in an operating room. However, the exponential growth of the number of these parameters and the high probability of false alarms amplify the demands on clinician attention. We have extended existing tactile technology to improve situational awareness and produce a practical clinical advisory device.

A vibro-tactile display, using two vibrating motors applied to the volar surface of the forearm, see Figure 1. It was compared to an auditory alarm in a simulated clinical environment. The ease of learning stimulation patterns, identification rate, identification accuracy, response time and user acceptance were compared in 10 participants with no anesthesia training .

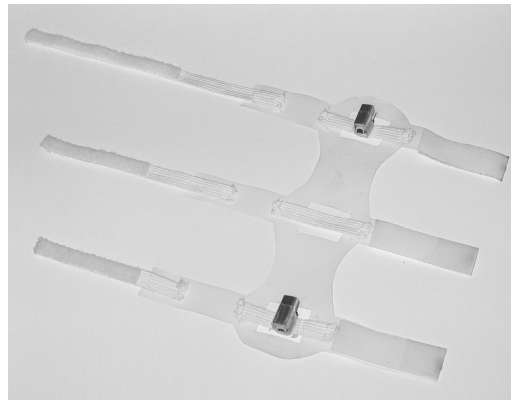


Figure 1. Vibro-tactile display prototype

The vibro-tactile alarm was easier to learn than the auditory alarm ($p < 0.05$). The performance of the vibro-tactile alarm was significantly better than the auditory alarm in identification rate ($p < 0.002$) and accuracy ($p < 0.002$). Surprisingly, the combined vibro-tactile and auditory alarm was not better than the vibro-tactile alarm alone due to an increased rate of misinterpreted alarms. Most users preferred the vibro-tactile alarm although the current prototype did cause some discomfort.

The optimal site, stimulation modality and stimulation pattern for a clinically useful tactile display remain to be determined. This investigation suggests that the vibro-tactile alarm is superior to the auditory alarm in attracting attention with a lower misinterpretation rate. The reduced performance of the combined vibro-tactile and auditory alarm compared to the vibro-tactile alarm alone warrants further investigation. The vibro-tactile alarm shows considerable promise as an alarm modality in clinical practice but requires further testing and refinement especially with regard to comfort.