초음파 프로브의 인간공학적 설계 및 평가

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Ergonomic Design and Evaluation of Ultrasound Probe

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ABSTRACT

Objective: The present study presents a systematic design and evaluation process for ultrasound (US) probe. **Background:** Use of an US probe suitable to the hand and operating motion of the probe can contribute to prevention of sonographers from musculoskeletal disorders at work. **Method:** Existing US probe grip designs were compared with each other using subjective measures to identify preferred design features for a new probe grip design. An in-depth analysis of the relationships between grip design variables and hand dimensions was conducted along with the consideration of preferred grip postures of vaginal probe and hand measurements. Various US probe designs were evaluated by a mix of sonographers and medical doctors in terms of EMG activities of the upper extremity muscles, motion ranges of the upper extremity joints, and subjective satisfaction measures. A randomized controlled testing was administered for the probe designs in a simulation workstation at a designated speed for a set of tasks including tilting, pushing, and rotating of US probe. **Results:** The subjective satisfaction results were found effective to identify preferred design features in detail, while the EMG and motion analysis results to identify a preferred probe design overall in terms of muscular load at the hand and postural comfort of the forearm. **Discussion:** The proposed US probe design evaluation can be applied to the development of an ergonomic design for usability and prevention of sonographers from work-related musculoskeletal disorders.

Keywords: Ultrasound probe, Ergonomic design, Ergonomic evaluation, Preferred design, Benchmarking, Digital body scanning

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