Virtual Reality Simulation of Fascial Drag using the PHANToM 3.0 Haptic Interface

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BACKGROUND Osteopathic medical education requires extensive training in the palpatory diagnosis of tissue texture & motion abnormalities in the musculoskeletal system. One-on-one feedback from instructors is limited. The possibility of palpatory training on a haptic simulator offers an attractive adjunct to current educational methods. If the fidelity of the simulation can be made sufficient, such a simulation also offers the possibility of an objective measure of palpatory skill; which is currently lacking. We have developed the Virtual Haptic Back (VHB), a virtual reality simulation of the human back that contains haptic (relating to the sense of touch), graphic, and auditory feedback components. Tissue compliance differences reflective of soft tissue abnormalities, which are currently being tested with users, consist solely of altered spring stiffness constants. The purpose of this project was to explore the possibility of simulating another more complex aspect of palpatory diagnosis: the perception of the ease of tissue movement within a fascial plane, referred to as fascial drag,.
METHODS PHANToM 3.0 haptic interfaces (Fig. 1a) were programmed with General Haptic Open Software Toolkit (GHOST® SDK, C++) (SensAble Technologies, Woburn, MA) to reflect the contours and tissues textures of the back. A subtle, constant force in a plane tangential to the skin surface was superimposed on the underlying tissue spring stiffness constants, altering the ease of movement along the skin surface. This force was directed randomly in one of eight compass directions 45° apart (Fig.1b). Force intensity varied randomly from very subtle to obvious, set according to subjective feel by the development team, which included osteopathic physicians experienced in palpatory diagnosis.
RESULTS . Feedback from experts in palpatory diagnosis attested to the fidelity of the simulation.
CONCLUSION Evidence from this and companion studies (Williams, et al, Eurohaptics 2006 Proceedings; Howell et al. J. Am. Osteopath. Assn., in press) suggest that haptic simulations can be of value to students learning palpatory diagnosis. This module will undergo further refinement to be incorporated into future research.

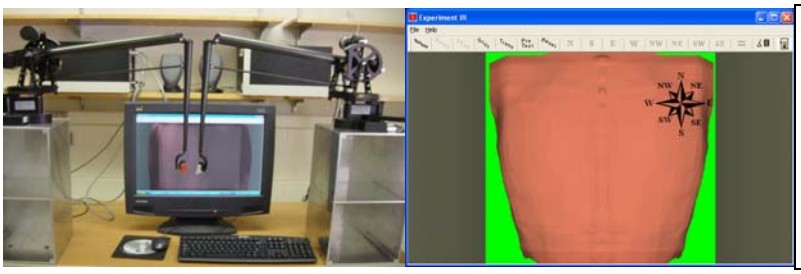

Fig. 1a (left). Users place fingers into receptacles of the PHANToM arms. Forces generated by electric motors simulate the contours and tissue textures of the back.
Fig. 1b (right). Graphical appearance of the back during the fascial drag test.

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