CAN FINGER DEXTERITY BE MAINTAINED WITH LOW FINGER BLOOD FLOW?

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The purpose of this project was to determine if high finger blood flow is required to maintain finger dexterity during cold exposure. Eight male subjects were exposed to two tests and one familiarization session over a time period spanning from July to September, 2000. During test one (designated as *EHV*), the hands were heated indirectly by using an electrically heated vest to actively heat the body, which in turn, resulted in an increased vasodilative response in the hands. The hands were insulated with thin, non-heated gloves and Arctic mitts. During test two (designated as *EHG*), the hands were heated directly using electrically heated gloves. Arctic mitts were worn over the EHGs. The finger skin temperature (T_{fing}) during the EHG test was kept the same as the T_{fing} observed during the EHV test. During both tests, subjects sat in a lawn chair in a cold chamber maintained at -25°C (wind ~2km/h) for 3 hours. Arctic clothing insulation [0.556 m•k^2/W (3.6 Clo)] was worn over the body. During time 30-60 min and 135-165 min, subjects alternated between two finger dexterity tests [a C-7 rifle disassembly and assembly test (3-4 min duration) and 3 Purdue Pegboard (PP) tests (3-4 min duration)] during each 30 min test session. The Arctic mitts were removed during the dexterity tests. T_{fing} was measured using thermistors placed on the tips of the two "ring" fingers, and finger skin blood flow (Q_{fing}) was measured using laser Doppler probes placed immediately next to the thermistors on the fingertip. Forearm muscle temperature (T_{muscle}) was measured in the *m. flexor carpi radialis* muscle at a depth of 1.5 cm and a distance of approximately 9 cm distally from the medial epicondyle in the bulk of the muscle. Forearm surface temperature ($T_{surface}$) was measured using a thermistor. T_{fing} was maintained at 35.17±0.18°C and 34.37±0.25°C during EHV and EHG, respectively, when the subjects were sitting still. During the dexterity tests T_{fing} was on average 31.19±0.52°C and 29.53±0.86°C during EHV and EHG, respectively. Q_{fing} was stable at 224±27 PU for 3 hrs during EHV, whereas during EHG, Q_{fing} decreased from 133±26 PU to 39±8 PU in 2 hrs and remained at that low level for the last hour. T_{muscle} was 34.37±0.39°C and 32.62±0.39°C during EHV and EHG, respectively. $T_{surface}$ was 32.06±0.45°C and 30.43±0.47°C during EHV and EHG, respectively. C-7 rifle test performance was identical between conditions (i.e, 172±8 sec). PP test performance was not significantly different between EHV and EHG (i.e., PP scores of 22.2±1.2 and 20.5±1.9 points, respectively). Finger dexterity was similar between conditions despite a significantly lower Q_{fing} during EHG. The similar performances suggest that T_{fing} is a more important factor than Q_{fing} in maintaining finger dexterity. Finger dexterity can be maintained even when finger blood flow is low.

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