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EFFECT OF CONTACT CONDITIONS ON THE MECHANICAL IMPEDANCE OF THE FINGER

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SUMMARY

The influence of physical factors on the mechanical impedance at the palmar surface of the finger have been investigated. The studies were conducted with 12 subjects using random vibration over the frequency range 10 to 1000 Hz. It was found that increases in contact force (from 0.25 to 8 N) caused large increases in the modulus of the point mechanical impedance over most of the frequency range. Increasing the area of contact with the finger (from 12.6 mm^2 to 78.5 mm^2) increased impedance at frequencies below 100 Hz and above 400 Hz. The location of contact with the finger also influenced the measured mechanical impedance. The resonance frequency increased from about 30 Hz, when vibration was applied to the proximal phalanx, to 600 Hz when vibration was applied to the distal phalanx. The additon of mass to the fingernail (0.5 to 8 g) reduced the resonance frequency from 700 Hz to 180 Hz and caused increased magnitudes of impedance at resonance by about a factor of 3. Flexing the finger affected impedance at frequencies between 50 and 200 Hz. The results show that the transmission of vibration to the fingers, and therefore the effects of vibration on the fingers, are highly dependent on some aspects of the contact between the fingers and the source of excitation. These variables are not currently quantified when assessing the severity of tool vibration, yet their optimisation may help to minimise some of the adverse effects of hand-transmitted vibration.

Key words: mechanical impedance, grip, hand vibration

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