

Noninvasive assessment of visco-elasticity in the presence of accumulated soft tissue fluid.

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BACKGROUND: The diagnosis of compartment syndrome is made by clinical examination, but direct compartmental measurements are important and serve an adjunctive role in establishing the diagnosis. This study examines a noninvasive screening method for differentiating compartmental syndrome from edema without elevated internal pressure. **MATERIALS AND METHODS:** The study groups consisted of 16 normals, 22 subjects with edema, and 2 subjects with compartmental syndrome. Force-displacement curves on the posterior and anterior surface of the extremity at mid-calf of each extremity were recorded using a noninvasive mechanical tester. A cyclic force peaking at 120 N was applied over a skin area of 1.5 cm². In a uniform applied force environment, the peak force would be comparable to an applied pressure of 60 mm Hg. Mechanical parameters associated with tissue softness (SOFT), degree of hysteresis, and departure from linear elastic behavior were calculated. In seven subjects, direct intracompartment pressure readings were obtained by the Stryker method. **RESULTS:** Posterior SOFT was significantly larger than anterior SOFT, as expected, for all study groups, except those with compartmental syndrome. SOFT for subjects with compartment syndrome fell below the 99% confidence interval of all other groups in the affected compartment(s). Departure from linear elastic behavior values were also depressed in the posterior compartment for subjects with compartment syndrome as compared with the other groups. Degree of hysteresis was significantly increased for pitting edema. Extremities with nonpitting edema were not distinguishable from normal extremities for the levels of applied pressure used in this study. **CONCLUSION:** Noninvasively measured mechanical properties were significantly different between normal tissues and tissues with pitting and nonpitting edema. The mechanical properties of the extremity with compartmental syndrome were different than those with edema as well as normal extremities. A noninvasive mechanical tester is seen as a possible clinical tool to diagnose and monitor compartmental syndrome.