P024 Mechanical environment of cartilage cells

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How relevant are loading regimes applied to cartilage cells and tissues *in-vitro*? Do cartilage cells normally experience a hydrostatic pressure, or anisotropic stresses capable of deforming them? How big are the stresses? We describe a technique for quantifying stresses in human cartilage, and show how they depend on loading, degeneration, and tissue damage.

Whole intervertebral discs and their adjacent vertebrae, and samples of articular cartilage-on-bone, were subjected to complex physiologically-relevant loading *in-vitro*. Stress distributions within the loaded tissue were investigated by pulling a subminiature pressure transducer through it. Transducer output is approximately equal to the average compressive stress acting perpendicular to its membrane.

In intervertebral discs, the nucleus and inner annulus exhibited a true hydrostatic pressure, whereas anisotropic stress concentrations occurred in the remaining annulus. Stress concentrations increased following “creep” loading which simulated diurnal changes in water content *in-vivo*. Stress concentrations also increased in degenerated discs, and could become extreme following structural damage to either the annulus or vertebral endplate. Articular cartilage did not contain regions of hydrostatic pressure. Stress concentrations varied with location, and increased after a few minutes of creep loading.

We conclude that the mechanical environment of cells in cartilage is influenced greatly by sustained loading, degeneration, and structural damage. Aberrant cell metabolism in degenerated tissue may be a consequence, rather than a cause, of structural failure.