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Nanomechanics of Murine Articular Cartilage Reveals the Effects of Chondroadherin Knockouts[1] MICHAEL BATISTA, ALAN GRODZINSKY, MIT, CHRISTINE ORTIZ, Massachusetts Institute of Technology, DICK HEINEGÅRD, Lund University, LIN HAN, Massachusetts Institute of Technology — With high resolution nanotechnology tools, quantification of cartilage biomechanical properties provides important insights into the role of low abundance matrix molecules on cartilage function and pathology. In this study, the role of chondroadherin (CHAD) on cartilage mechanical properties was assessed via atomic force microscopy-based nanoindentation (0.1-10 μm/s z-piezo displacement rates) of murine knee cartilage from wild type (WT) and CHAD knockout (KO) animals ages 1 year, 4 month, and 11 weeks (n$\geq$4 joints/age-group). A significant increase in indentation modulus, E, with indentation rate in all specimens ($p<0.05$, Friedman) suggested poro-viscoelastic behavior. For all age groups, CHAD KO significantly reduced E at all indentation rates ($p<0.05$, 2-way ANOVA); e.g., at 1-year, E was 0.77+/-0.1 MPa for WT (mean+/-SEM 1μm/s rate) and 0.25+/-0.07 MPa for CHAD KO cartilage. Lack of CHAD appears to delay development of load bearing extracellular matrix. This could affect the effective cross-link density of the tissue network and, hence, decrease local osmotic swelling while increasing the hydraulic permeability of the aggrecan-filled network. Ongoing studies are investigating the biochemical properties and nanostructure of CHAD KO joints.

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