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Microtubules contribute to maintain nucleus shape in epithelial cell monolayer DOMINIQUE TREMBLAY, LUKASZ ANDRZEJEWSKI, ANDREW PELLING, University of Ottawa — INTRODUCTION: Tissue strains can result in significant nuclear deformations and may regulate gene expression. However, the precise role of the cytoskeleton in regulating nuclear mechanics remains poorly understood. Here, we investigate the nuclear deformability of Madin-Darky canine kidney cells (MDCK) under various stretching conditions to clarify the role of the microtubules and actin network on the mechanical behavior of the nucleus. METHODS: A custom-built cell-stretching device allowing for real time imaging of MDCK nuclei was used. Cells were seeded on a silicone membrane coated with rat-tail collagen I. A nuclear stain, Hoechst-33342, was used to image nuclei during stretching. We exposed cells to a compressive and non-compressive stretching strain field of 25%. Nocodazole and cytochalasin-D were used to depolymerize the microtubules and actin network. RESULTS: Nuclei in control cells stretched more along their minor axis than major axis with a deformation of 5% and 2% respectively. This anisotropy vanished completely in microtubule-deprived cells and these cells showed a very high nuclear deformability along the minor axis when exposed to a compressive stretching strain field. CONCLUSIONS: The microtubules drive the anisotropic deformability of MDCK nuclei in a monolayer and maintain nuclear shape when exposed to compressive strain. Such intrinsic mechanical behavior indicates that microtubules are essential to maintain nuclear shape and may prevent down regulation of gene expression.

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