Cell mechanical properties in keratinocytes are regulated by cell-cell adhesions

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Mechanical forces translated into biophysical signals play a crucial role in physiological processes such tissue development, homeostasis or cell differentiation. During keratinocyte differentiation, cells undergo characteristic changes in cellular and nuclear morphology, and changes in cell-cell interactions, including the assembly of adherens junctions and desmosomes. Here, we show that keratinocyte mechanical properties are dependent on calcium-induced adherens junctions and desmosomes. Cells were cultured as a monolayer on circular and elliptical micro-patterns in low calcium medium then stimulated with 1.8 mM Ca for 24 h. The Young's moduli of cell monolayers were measured by atomic force microscopy and increased in high calcium medium. This response was blocked by knockdown of cell-cell adhesion linkers a-catenin or desmoplakin I and II. In addition, the displacement of keratin network significantly decreased in cells cultured in high calcium medium. Finally, calcium-induced increases in nuclear size depended on both junctional proteins, while nuclear elongation on elliptical patterns depended specifically on a-catenin

Together, these results demonstrate that cell-cell interactions induced by calcium regulate collective cell mechanical properties, which alters cellular and nuclear morphology. On-going studies are investigating the impact of these changes on chromatin remodeling and gene expression.