Nanopatterning Regulates Architecture of intercellular communication during mesenchymal cell condensation

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Data from the World Health Organization indicates that musculoskeletal conditions are the leading contributor to disability worldwide affecting between 20 to 33% of people. Although many musculoskeletal conditions can be managed in primary care, some of them require of surgical intervention. In such cases, and especially in tissues with a limited capacity of self-repair as cartilage and tendon, regenerative medicine approaches became significantly relevant.
We have developed nanopatterned cell carriers of tunable cell adhesive properties that improve mesenchymal stem cell preconditioning in vitro towards cartilage tissues, showing that extracellular matrix (ECM) information propagates into chondrogenic condensates and its effect on intercellular communication during chondrogenesis.
We inhibited myosin activity and blocked integrin receptors in condensates formed on substrates with low or high ligand density, and quantified Cx43 protein production. Cx43 decreased in both cases, indicating that the mechanism driving the previously observed results is dependent on actin contractility and integrin sensing of nanopatterned ligands. This shed light into the mechanism of how matrix inputs regulate morphogenesis by propagating information into forming tissue. Preliminary results on the implantation of the obtained cell constructs in vivo show increased efficiency in the regeneration of cartilage defects.