Mechanical force in keloids

Keisuke Okabe, Tatsuya Kato, Shigeki Sakai, Noriko Aramaki–Hattori, Kazuo Kishi
Department of Plastic and Reconstructive Surgery, Keio University School of Medicine, Tokyo, Japan

Mechanotransduction is the process by which cells sense and respond to mechanical forces by converting them into biochemical signals. This process is currently under active study in various research fields, including in normal and aberrant skin wound healing. One potential consequence of aberrant wound healing is the development of hypertrophic or keloidal scars. Since multiple lines of evidence suggest that mechanical force plays key roles in the pathogenesis of these pathological scars, approaches that block, reshape, or augment elements of mechanotransduction may have therapeutic potential when applied during wound healing or scar growth. To identify molecular elements of mechanotransduction in keloids and hypertrophic scars that could potentially be targeted therapeutically, we have developed a mouse model where dorsal incisions are subjected to mechanical stress and a co-culture ex vivo model. When mechanical force was loaded on these models, both exhibited significant changes to their cytoskeletal structures and the expression of genes that have been found previously to participate in keloid pathology. Global analysis of the gene expression profiles of murine wounds that did and did not undergo mechanical stress revealed several stress-altered signaling molecules. Future studies on these candidate molecules may lead to the development of new therapeutics for keloids and hypertrophic scars.