ReLEx SMILE Method to Expansion and Create Scaffolds from Corneal Fibroblasts

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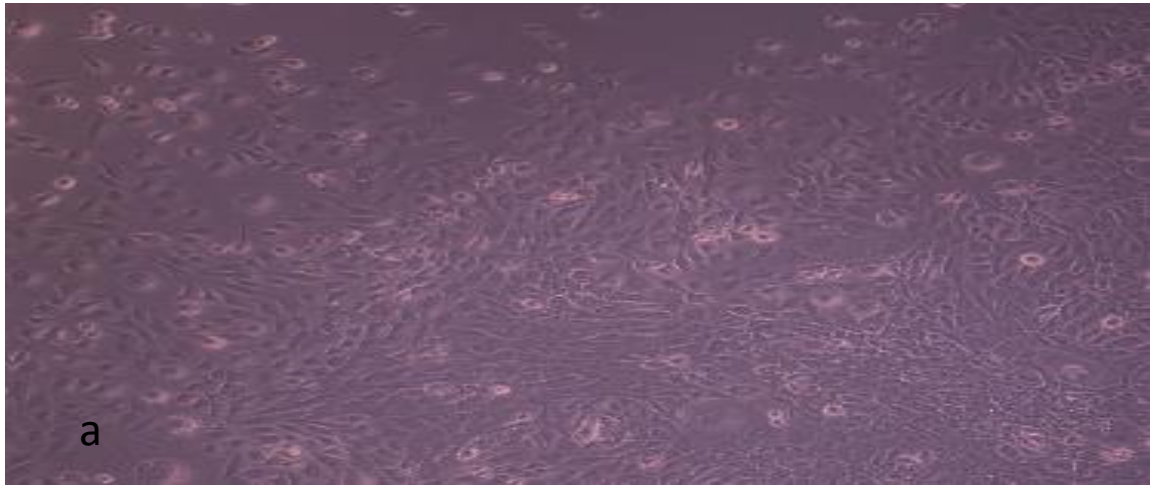
ReLEx SMILE is the femtosecond laser vision correction method by removing the lenticule through a small corneal incision for the correction of myopia and myopic astigmatism.

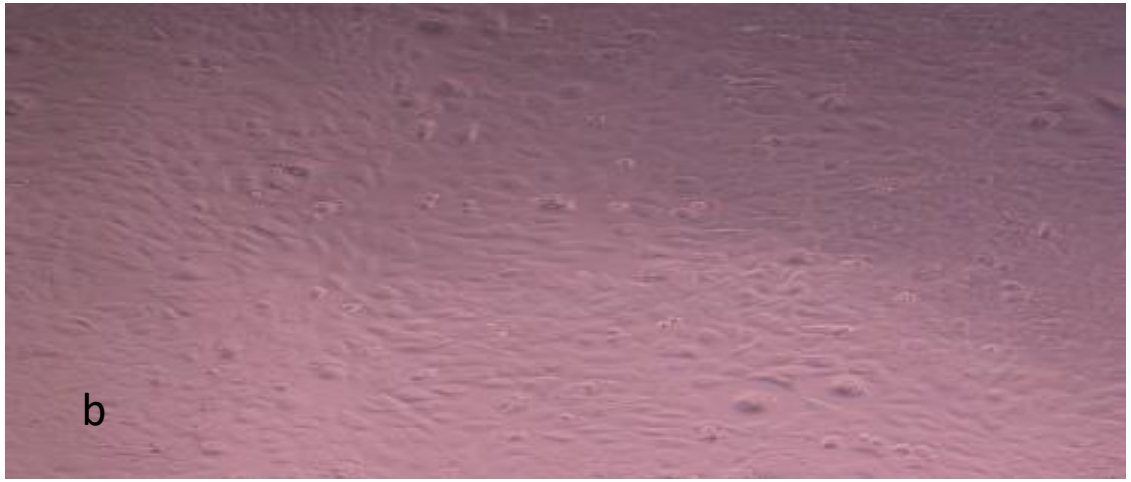
Corneal stromal fibroblasts involved in corneal wound healing. Unfortunately, traditional methods of treatment corneal epithelium and stromal cells defect are insufficient. Corneal stromal cells may be used as alternative source for corneal wound healing and as cell therapy in the treatment of keratoconus and limbal stem cell deficiency.

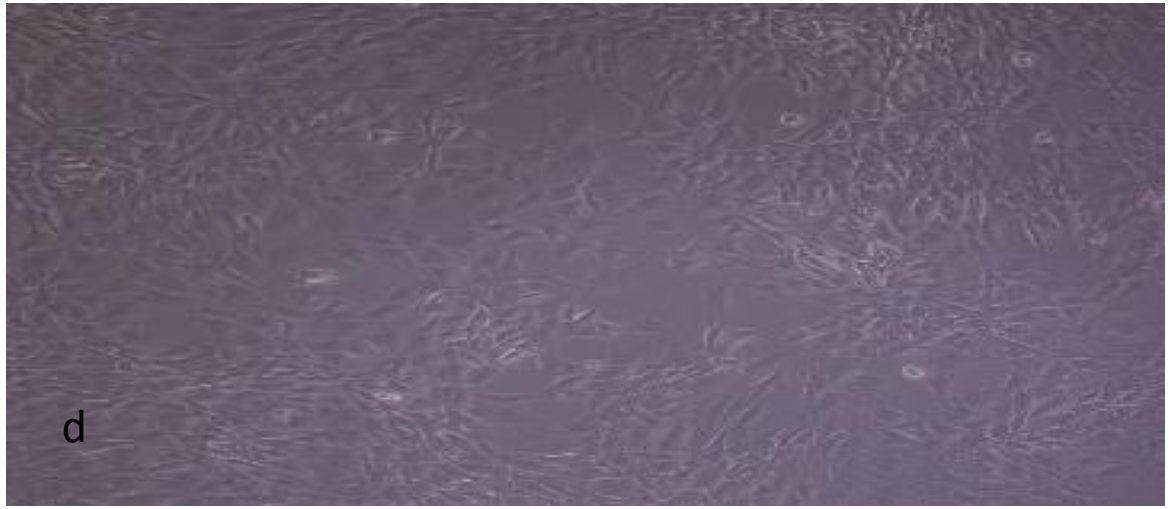
The aim of the study was to assess the possibility to use human corneal fibroblasts (hCFs) obtained during ReLEx SMILE as a source for three-dimensional (3D) corneal stromal constructs.

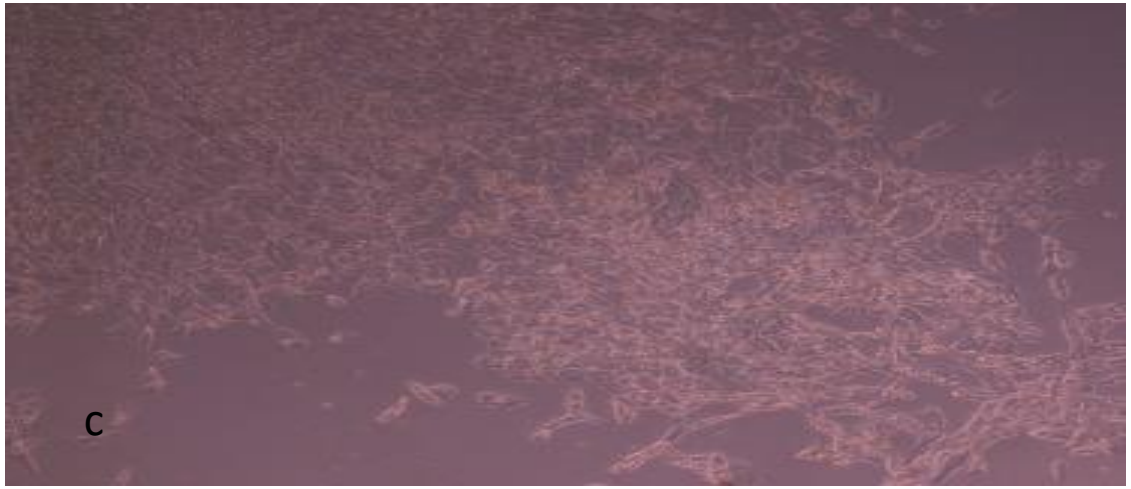
Corneal fibroblasts (keratocytes) are an essential component of cornea and are necessary to repair corneal injury. Corneal fibroblast disorder may be as key events in the development of keratoconus. During 3-4 weeks culture of hCFs in plastic flask T25 we expanded to 2-3 $x10^6$ cells with a dendritic morphology. Primary hCFs were positive to CD73 (99.0±1.0%), CD90 (95.0±2.0%), CD105 (22.0±2.0%), and negative to CD34 (0.0±0.0%), keratocan (0.0±0.0%), lumican (0.0±0.0%), and ALDH1A1 (2.2±0.5%) surface markers. So, isolated from lenticules keratocytes changed phenotype, loss keratocytes surface markers and expressed mesenchymal stem cell/fibroblast surface markers.

Our results suggest that 3D corneal stromal construction on the bases of polyethylene glycol plus platelet lysate may be used for corneal damage treatment.









The morphology of human corneal fibroblasts (hCFs) in 2D and 3D model. a, 2D of hCFs (x10, native); b, 3D of hCFs into polyethylene glycol corneal stromal construct (x10, native); 3D of hCFs into polyethylene glycol plus platelet lysate corneal stromal construct (x10, native); d, 3D of hCFs into polyethylene glycol plus Methyl Cellulose corneal stromal construct (x10, native).