From Bench to Bedside - Application of iPSC-based Technology on Retinal Diseases

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Abstract:

The development of induced pluripotent stem cells (iPSCs) has opened a new era for stem cell research. How to quickly, efficiently, and safely produce specific-lineage differentiation from pluripotent-state cells and iPSCs is still an open question. To overcome this critical obstacle, we performed proteomic analysis to find that Parp1, a key factor for DNA repair, plays a crucial role in regulating the efficiency of cellular reprogramming. Furthermore, the generation of patient- or disease-specific iPSCs therefore holds promising potential for the drug industry and regenerative medicine. Following this concept with using iPSC technology, we have reprogrammed T cells from patients with dry type aged macular degeneration (AMD) into induced pluripotent stem cells (iPSCs) via integration-free episomal vectors and differentiated them into RPE cells that were used as an expandable platform for investigating pathogenesis of the AMD and in-vitro drug screening. Moreover, we demonstrated a plasma treated and laminin coated PDMS film that can enhance the attachment, sustain the survival, and facilitate the functional maturation of iPSC-differentiated retinal pigment epithelial cells (dRPE) seeded on it. The dRPE/PDMS-PmL implant was able to enhance the response to light stimuli in vivo. Taken together, our findings provide the pre-clinical examinations for the prospective clinical application of Human iPSCs, including dRPE/PDMS-PmL subretinal implant, in treating aging degeneration diseases like AMD.