Reshaping and customization of SMILE-derived biological lenticules for intrastromal implantation

Iben Bach Damgaard, MD 1,2
Andri Kartasasmita Riau, PhD 2,3
Yu-Chi Liu, MD, MCI 2,4,5
Min Li Tey 2,6
Gary Hin-Fai Yam, PhD 2,5
Jodhbir Singh Mehta, FRCS 2,3,4,5

1 Department of Ophthalmology, Aarhus University Hospital, Aarhus, Denmark
2 Tissue Engineering and Stem Cell Group, Singapore Eye Research Institute, Singapore
3 School of Materials Science and Engineering, Nanyang Technological University, Singapore
4 Singapore National Eye Centre, Singapore
5 Ophthalmology and Visual Sciences Academic Clinical Programme, Duke-NUS Graduate Medical School, Singapore
6 Yong Loo Lin School of Medicine, National University of Singapore

Conflicts of interest: Dr. Mehta is a consultant for Ziemer and Carl Zeiss Meditec, Inc. The remaining authors have no conflicts of interests.

Word count: 4199 incl. abstract.

Financial support: This research was supported by the Singapore National Research Foundation under its Translational and Clinical Research (TCR) Programme (NMRC/TCR/1021-SERI/2013) and administered by the Singapore Ministry of Health’s National Medical Research Council

Correspondence:

Assoc Prof Jodhbir S. Mehta
Singapore Eye Research Institute,
The Academia, 20 College Road, Discovery Tower Level 6, Singapore 169856
Tel: +65-6227-7255; Fax: +65-6227-7290
E-mail: jodmehta@gmail.com
Supplementary information

**Figure S1**: Energy Dispersive X-ray spectrographs (EDX) of the surface elemental composition for (A) lasered and non-lasered uncoated lenticules and (B) 3-APTES coated lenticules before and after PTK treatment. No differences in the atomic components (carbon and oxygen) were detected between the PTK-treated and the control group either before or after excimer laser ablation. As biological tissue is largely made of carbon and oxygen atoms, the resulting tissue surface after laser ablation would still inevitably contain the same amount of carbon and oxygen. In order to introduce a new element, which does not exist in the tissue (e.g. silicon atom), the lenticule surface was coated with 3-APTES. As depicted in Figure S3B, this EDX result suggests that the 3-APTES coating, which would be in nanolevel thickness, had largely been removed by the laser ablation.
**Figure S3**: TUNEL and DAPI staining for a non-lasered control lenticule and PTK-treated surface. Total cell density, indicated by DAPI (4',6-diamidino-2-phenylindole) and TUNEL-positive cells, were lower in the lasered section for all lenticules, which could be explained by cell vaporization by excimer laser ablative effect.
**Figure S4**: OCT images of PTK treated and control lenticules during over hydration (C: lasered, D: non-lasered) and after dehydration in a moist chamber (A: lasered, B: non-lasered). The average central thickness of the lasered lenticules was significantly lower than for the non-lasered control lenticules, both during over hydration (storage in PBS overnight, p<0.001) and after 5 hours on filter paper in a moist chamber (p<0.001).