

BRIEF COMMUNICATION



Longitudinal evaluation of corneal tomography after small incision lenticule extraction

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Small incision lenticule extraction (SMILE) has become a favourable choice of refractive surgery because of safety, efficacy, stability, and predictability [1]. Despite preserving stability, corneal ectasia was reported [2]. Previous studies [3–5] demonstrated anterior corneal surface was profoundly flattened after SMILE whereas posterior corneal surfaces remain inconclusive. In this study, the longitudinal changes in both anterior and posterior corneal surfaces up to one year after SMILE were evaluated using Scheimpflug camera-based system.

The data of myopic patients who underwent uneventful ReLEx SMILE were reviewed at pre-operative, and 1-, 3-, 6- and 12-months post-operative visits. Eyes requiring subsequent refractive procedures were excluded. The data were arranged into three myopia groups according to pre-operative spherical equivalents [SE]: Low (<4 dioptres [D] SE), moderate (4 to 8 D SE) and high (>8 D SE).

The tomographic data were compared between pre-operative, and 1-, 3-, 6-, 12-months post-operative visits (PO) using the generalize estimated equation and Bonferroni pairwise comparison. Correlation between lenticule thickness (LT) and residual stromal bed thickness (RSB) with the amounts of changes in maximum anterior (MAE) and posterior (MPE) elevation were analysed using the Pearson correlation.

Two-hundred thirty-two eyes of 119 patients (41 males, 78 females) with mean spherical errors of -4.90 ± 1.93 D (range -10.25 to -0.17) and mean cylindrical errors of -1.18 ± 0.81 D (range -4.00 to 0.00) were included. Fifty-nine (25.43%), 143 (61.64%) and 30 (12.93%) eyes were arranged in low, moderate, and high myopia groups respectively. Tomographic parameters of all patients at each visit were shown in Table 1 and Fig. 1. Anterior keratometric power (K) significantly decreased from pre-operative to 1-month PO ($P < 0.01$), then followed by a slight increase at 3-months PO (1 mo vs 3 mo; P value < 0.01) and was stable thereafter. Anterior Q, MAE, posterior Q and MPE significantly increased from pre-operative to 1-month PO ($P < 0.01$). Anterior Q, posterior Q and MPE showed stability after 1-month PO ($P = 0.13$, 1.00 , 1.00 , respectively) while MAE displayed a significant decrease from 1 to 3-months PO ($P < 0.01$), and showed no significant change thereafter. Posterior K showed an initially significant decrease at 1-month PO ($P = 0.02$), then followed by an increase with no significant difference between pre-operative and 12-months PO ($P = 0.66$). All tomographic parameters demonstrated the same trends in each subgroup of low, moderate, and high myopia.

Increase in LT and decrease in RSB correlated significantly with the backward change of MAE ($r = -0.43$ and 0.032 respectively;

Table 1. Pre-operative and post-operative data at 1, 3, 6, 12 months of all participants.

Parameters (Diopters) [Mean ± SD]	Pre-operation (n = 232)	Post-operation			
		1 month (n = 207)	3 months (n = 202)	6 months (n = 187)	12 months (n = 166)
Anterior keratometric power	44.13 ± 1.45	39.88 ± 1.82*	40.02 ± 1.78*, [†]	40.11 ± 1.89*	40.04 ± 1.89*
Anterior asphericity	-0.32 ± 0.10	0.55 ± 0.37*	0.50 ± 0.37*	0.47 ± 0.36*	0.47 ± 0.36*
Maximal anterior corneal elevation	8.78 ± 4.24	15.94 ± 6.31*	14.30 ± 5.7*, [†]	14.02 ± 4.34*	13.75 ± 4.59*
Posterior keratometric power	-6.39 ± 0.25	-6.38 ± 0.25*	-6.38 ± 0.25	-6.37 ± 0.25*	-6.37 ± 0.26
Posterior asphericity	-0.35 ± 0.12	-0.31 ± 0.12*	-0.31 ± 0.15*	-0.32 ± 0.23	-0.33 ± 0.12*
Maximal posterior corneal elevation	18.08 ± 6.79	20.02 ± 8.44*	20.36 ± 11.01*	18.90 ± 6.66*	19.17 ± 6.40*

*Statistically significant change compared with pre-operative ($P < 0.05$).

[†]Statistically significant change compared with previous visit ($P < 0.05$).

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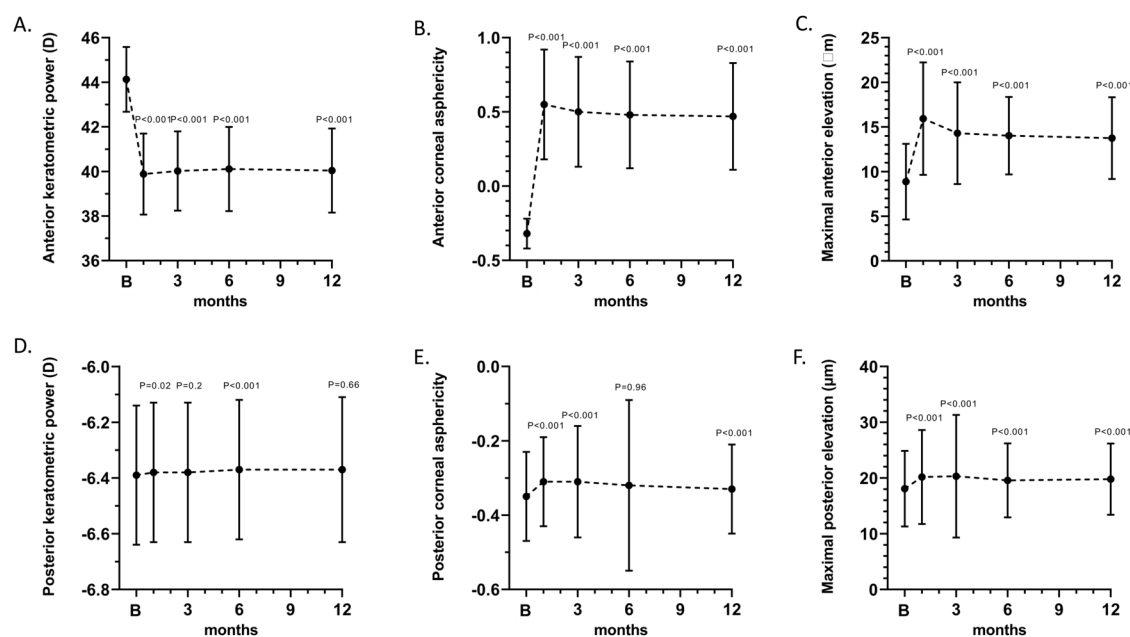


Fig. 1 Anterior and posterior corneal parameters at pre-operative and post-operative visits of all participants. **A** anterior keratometric power, **B** anterior corneal asphericity, **C** maximal anterior elevation, **D** posterior keratometric power, **E** maximal posterior elevation. *P* value compared pre-operative with post-operative visits using generalize estimated equation and Bonferroni pairwise comparison.

both $P < 0.01$). There was no correlation between LT and RSB with the change of MPE ($P = 0.91$ and 0.31 , respectively).

In conclusion, anterior cornea significantly flattened after SMILE, while posterior cornea demonstrated a slight but significant forward displacement. The anterior cornea stabilized as early as 3 months while the posterior cornea stabilized as early as 1 month after SMILE. Therefore, we suggest that the anterior corneal parameters at 3-months and MPE at 1-month after SMILE should respectively be used as baseline to follow-up regression and post-operative ectasia. The amount of posterior corneal displacement was not associated with pre-operative refraction, LT or RSB.

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AUTHOR CONTRIBUTIONS

VS was responsible for designing the protocol, writing the protocol and report, conducting the research, data analysis, interpreting results, writing the manuscript, and updating reference list. PC was responsible for conducting the research, data analysis, interpreting results and writing the manuscript. JS, NK, VP and UR were responsible for conducting the research and final proving of the manuscript.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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