

Cap Preserving Smile Enhancement

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EOS2019

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Retreatment, Do We Want To Keep it SMILE?

Retreatment in our hospital is almost 0.5%

Options for retreatment:

- Surface ablation (PRK)
- Standard femtoflap with same parameters
- Circle procedure + Excimer laser
- **Cap Preserving SMILE Enhancement (CAPSE), Smile over Smile**

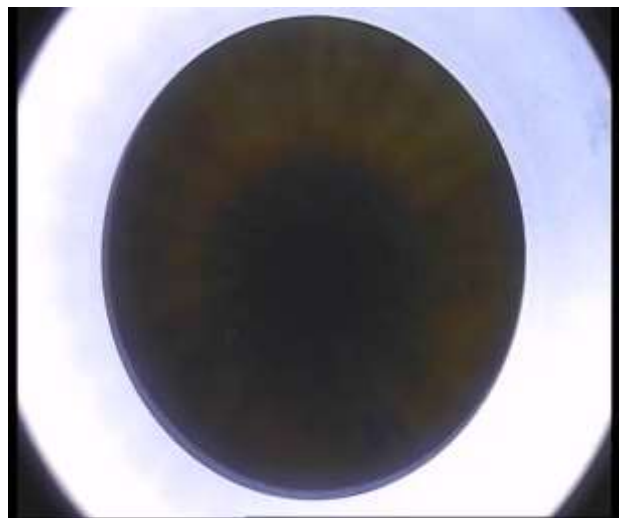
Cap Preserving SMILE Enhancement

- Preservation of Bowman's Membrane
- Cornea Never heal
- Using the primary incision
- Using the primary cap
- Creation of new inferior surface cut
- Creation of new side cut
- Within the primary lenticule cut
- Average K reading



Cap Preserving SMILE Enhancement

- Primary cap thickness is 100-110 microns
- Primary ablation zone (lenticule diameter) is 6.5 – 6.7 mm
- Residual stromal bed after Re-Treatment is 250 microns
- Re-Treatment lenticule is 0.2 mm smaller than the primary one, and of minimum thickness 18 microns
- **Re-treatment lenticule centration is the crucial key step (SEDKY marker)**



SEDKY Re|ExSMILE Re-Treatment marker

Duckworth & Kent

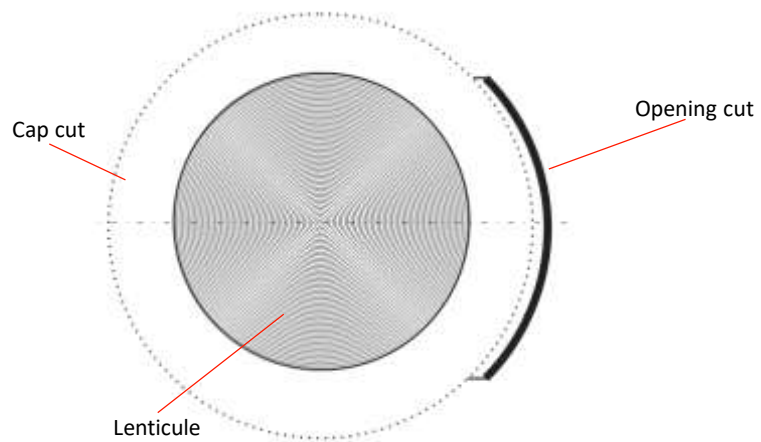


- 4 footplate to mark the primary lenticule edge.
- Central marking pin to be use as the re-treatment docking reference point
- Can be done on S/L or under the microscope
- 2 sizes , 6.50 mm & 6.3 mm
- Duckworth & kent P4599



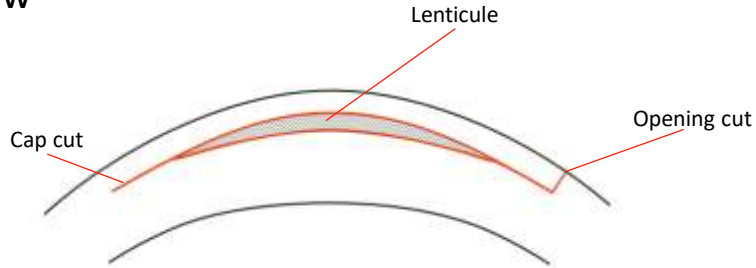


SMILE Surgery Cuts Top View



SMILE Surgery Cuts

Side View



Note that the aspect ratio of the figures has been altered for illustrative purposes (vertical compression factor = 10x).

Corneal Remodeling

Aspect ratio of cross-cut figures

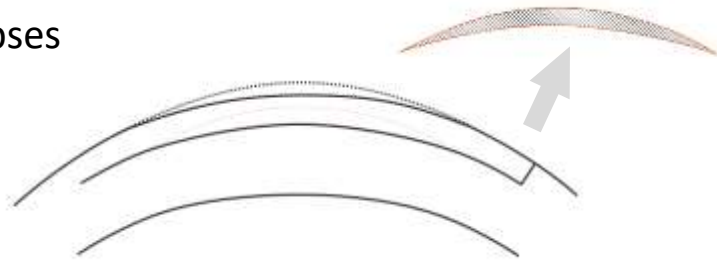


CROSS SECTION OF A TYPICAL LENTICULE FOR A SPHERICAL CORRECTION. Shown with the correct aspect ratio (sphere = -5 diopters, cylinder = 0 diopters, diameter = 6mm, minimum lenticule thickness = 15 μ m, side cut angle = 90°). Note that the curvatures are as shown and the ratio between axial and lateral dimensions (e.g. diameter and side cut length) is realistic.

Note that the aspect ratio of all other cross-section figures of this presentation has been altered for illustrative purposes (vertical compression factor = 10x).

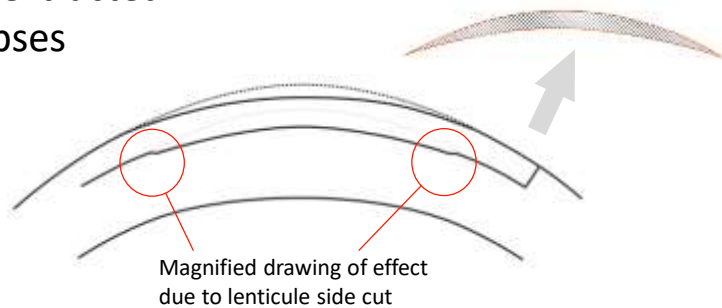
Corneal Remodeling

Lenticule extracted
Cap collapses



Corneal Remodeling

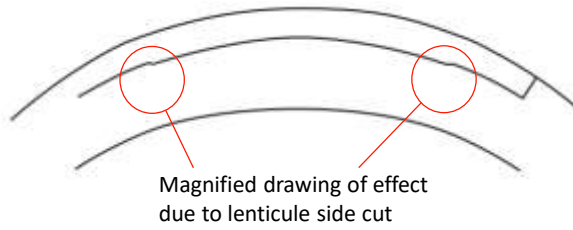
Lenticule extracted
Cap collapses



Note that for illustrative purposes the “imprint” of the lenticule side cut has been magnified and that the aspect ratio of this figure has been altered (vertical compression factor = 10x).

Corneal Remodeling

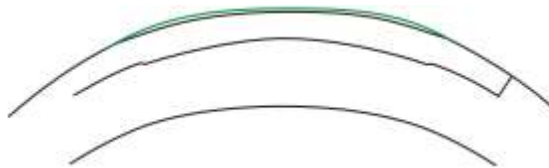
Cap collapsed



Corneal Remodeling

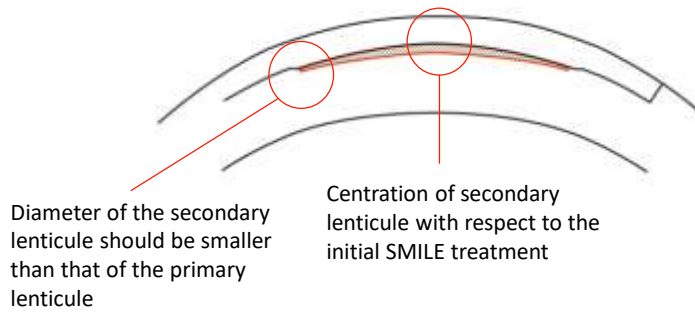
Epithelial Hyperplasia after SMILE Surgery

Side View



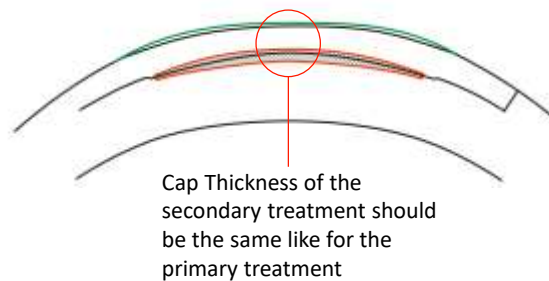
Corneal Remodeling

Secondary SMILE Surgery (w/o Hyperplasia) Side View



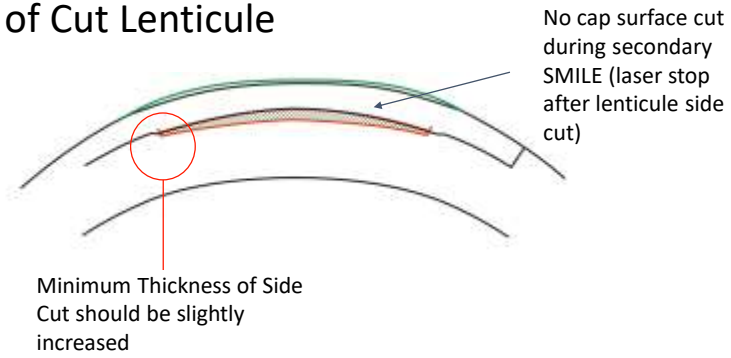
Corneal Remodeling

Secondary SMILE Surgery (with Hyperplasia) Side View of Planned Lenticule



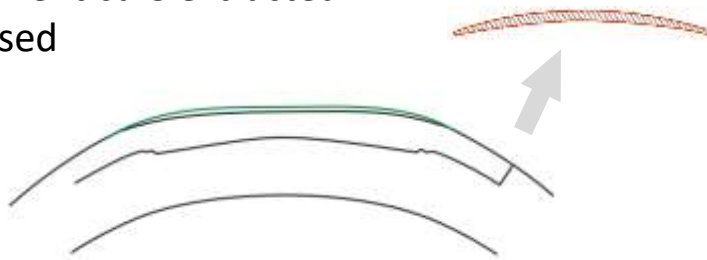
Corneal Remodeling

Secondary SMILE Surgery (with Hyperplasia) Side View of Cut Lenticule



Corneal Remodeling

Secondary Lenticule extracted Cap collapsed



RESEARCH ARTICLE

Open Access

Cap-preserving SMILE Enhancement Surgery

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Abstract

Background: Different enhancement procedures have been suggested for reduction of residual refractive error after SMILE. The aim of this study is to evaluate an improved cap-preserving technique for enhancement after SMILE (Re-SMILE).

Methods: A retrospective case series was conducted at the tertiary care eye clinic on 9 eyes with myopia or myopic astigmatism (spherical equivalent -0.5 and -1.2 D) undergoing SMILE procedure who received second enhancement. This was either because the mean spherical equivalent was more than $+1.0$ D and therefore planned to have second procedure for need of further refractive correction or astigmatism. Assessment after the primary SMILE procedure was conducted at 1 day, 1 week, 1 month and 3 months postoperatively. Assessment after Re-SMILE was conducted at 1 day, 1 week, 1 month, 3 months, 6 months and 1 year postoperatively. The assessment included full ophthalmic examination, objective and subjective refraction, and testing of binocular vision and alignment.

Results: Postoperatively, the mean refractive spherical equivalent (SRSE) values were -0.3 ± 0.4 D after primary SMILE ($n = 9$) and -0.17 ± 0.17 D after Re-SMILE. It was -0.13 ± 0.08 D after SMILE. SRSE was significantly improved after first procedure ($P < 0.001$). The side effect of primary SMILE (dry eye) was 100% and the incidence of Re-SMILE and the efficacy rates were 5.5% after primary SMILE and 1.11% after Re-SMILE.

Conclusions: Current cap-preserving Re-SMILE is an effective procedure in reducing residual refractive error after primary SMILE in high myopes.

Keywords: SMILE, SMILE enhancement, Cap-preserving SMILE enhancement, Re-SMILE

Background

Lasik in-situ keratomileasom (LASIK) and photorefractive keratectomy (PRK) have been the two standard keratorefractive procedures. Small incision lenticule extraction (SMILE) was developed to reduce the corneal biomechanical consequences of LASIK and PRK. In numerous studies, the SMILE procedure was shown to be safe, predictable, and effective in treating myopia and myopic astigmatism [1–3].

As in any refractive procedure, residual refractive errors might occur. For example, Horiuchi et al. published that 30% of eyes have 0.5 D and 0% have 0.5 D of residual refractive error three months after SMILE in eyes with

moderate to high myopia (mean refractive spherical equivalent (MRSE) -7.19 ± 1.38 D) [4].

Different enhancement procedures have been suggested for the reduction of residual refractive error after SMILE. Surface ablation, such as in PRK, causes postoperative pain and can lead to corneal haze. The Circle system, which converts the SMILE cap into a complete LASIK flap followed by further laser ablation similar to LASIK, has also been suggested as an enhancement procedure [5]. Another suggestion is the creation of a LASIK flap within the SMILE cap followed by ablation. However, this procedure comes with a risk of creating the existing cap surface or creation of gas breakthrough [6].

One great benefit of SMILE is the preservation of the anterior layer of the cornea, stroma and Bowman's membrane. All enhancement procedures mentioned above share the disadvantage of being the SMILE enhancement

and therefore planned in two-step procedure (in eyes of four patients) or because of unanticipated stromal enhancement (three eyes of three patients). To preserve the SMILE benefits, an extra step was undertaken, we were for the cap-preserving technique. Enhanced corneal keratometry, keratometry, topography, topography and pachymetry were obtained in all eyes. These patients were not specifically enrolled to receive this surgery for the research aim but when we reached goal parameters for a second cap-preserving Re-SMILE technique we collect and analyzed the available data retrospectively.

Primary SMILE

Preoperative assessment included full ophthalmic examination, objective and subjective refraction including uncorrected distant visual acuity (UDVA) and corrected distant visual acuity (CDVA) and corneal topographic scans (Diagnostics, OCULUS OptikoGraphics GmbH, Wetzlar, Germany) imaging.

The primary SMILE surgery was performed using the VisuMax femtosecond laser system with the following parameters (peak cap thickness of 180 to 185 μ m, cap diameter of 7.5 to 7.7 mm, cap side cut angle 70°, 3 cuts system positioned at 100° and sagittal at 80°). The lens-side diameter (apical area) was 6.5 mm, transition radii of 0 to 0.3, and diameter of 0.8 mm. Incision side cut angle of 80° and edge thickness thickness of 18 μ m. Table 1 shows the other surgical parameters used in the primary SMILE procedure that varied from case to case.

At the end of the procedure, we performed good hygiene to the cap, scrub from the center to the periphery, to avoid any potential complications from the standard hygiene of the lid and the cap the next week type 100000.

Postoperative treatment included topical steroids and antibiotics 4 times per day for 10 days and low-dose steroid 4 times daily for one to two months. Follow-up visits were on the first day, one week, one month and 3 months postoperatively. Follow-up visits included full ophthalmic examination, objective and subjective refraction, and testing of binocular vision. In the planned one-step procedure, Distance was done after one month if the refractor was consistent with the postulated one and stable over the first postoperative week the distance was postponed to Re-SMILE, after further counseling. Figure 1 shows the details of each step.

Re-SMILE

The eye stability the enhancement was those with uncorrected near 0, reading distance of 40 cm less than 3 D, residual spherical of at least 250 μ m, and those with no suspicion of ectasia based on topography.

All Re-SMILE procedures were performed using the same laser device as in the primary SMILE procedure. The Softe SMILE Enhancement Centering Marker (Fig. 2) was utilized in the execution of the Re-SMILE procedure. Some refractive laser settings were modified with respect to the primary SMILE treatment.

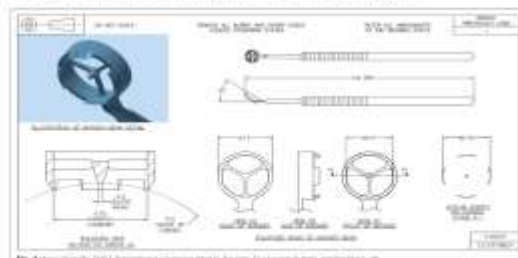


Fig. 3 Flow of SMILE Enhancement Centering Markers. (a) SMILE Cap Placement. (b) Centering Marker Placement. (c) Laser Ablation

Take Home Message

- The Re-Treatment technique is simple & predictable.
- Preserving the strongest part of the cornea.
- Needs to modify the VisuMax software.
- Not applicable for residual Hyperopia or Mixed Astigmatism
- **Centration of the second lenticule is the key stone step of the technique.**

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Thank You

