

# **SMILE PROCEDURE IN PATIENT WITH AMBLYOPIA REFRACTIVE : DO OR DON'T?**

Nyoman Yenny Khristiawati<sup>1</sup>,

<sup>1</sup>Medicine Study Program, Faculty of Medicine, Universitas Mahasaraswati Denpasar, Bali,  
Indonesia

Corresponding author: Nyoman Yenny Khristiawati

Faculty of Medicine, Universitas Mahasaraswati Denpasar, Bali, Indonesia/JEC Eye

Hospitals and Clinics.

Telp +6281283050584

Email: [yenny@unmas.ac.id](mailto:yenny@unmas.ac.id)

## **BACKGROUND**

Excimer (excited dimer) laser photoablation can be used to remove corneal tissue with submicron accuracy, without thermal build up or adjacent tissue damage. Myopia can be corrected by removing tissue from the central cornea resulting in central flattening and reduced refractive power. Femtosecond lasers emit light pulses of short duration (10–15s) at 1053 nm wavelength that cause photodisruption of the tissue with minimum collateral damage. This enables bladeless incisions to be performed within the tissue at various patterns and depth with high precision, safety and repeatability. Femtosecond laser can be used for many anterior refractive procedures; LASIK flap creation, SMILE, corneal graft surgery, astigmatic keratectomy, and channel cutting for insertion of intracorneal ring segments.<sup>1</sup>

Small Incision Lenticule Extraction or known as SMILE is a corneal based refractive surgery procedure. SMILE is a femtosecond-only procedure that removes stromal tissue (the lenticule) without a flap. The femtosecond laser creates the posterior surface, vertical sides and anterior surface of the lenticule, and a small tunnel for extraction of the lenticule. The cap thickness (above the lenticule) is typically 100–120 µm. The lenticule thickness depends on the refractive error. SMILE shows excellent efficacy, safety, predictability, and avoids flap-related complications. There is reduced damage to Bowman's layer with better biomechanical integrity and corneal stability. The basal nerve plexus is minimally disrupted, reducing dry eye and patient discomfort.<sup>1</sup>

## CASE PRESENTATION

A Man, 18 years old, came to Eye Clinics with complaints of high myopia and want to eyeglasses free for his educational purpose. Patient already use eyeglasses since 5 years prior with astigmatism family history. From examination his Best Corrected Visual Acuity (BCVA) was RE S-3.00 C-4.50x180 0.5, LE S -2.50 C-4.50x170 0.5. From slit lamp ocular examination anterior segment both eyes are normal, and funduscopy examination also normal. Intraocular pressure was 16/17 mmHg. Patient want to do screening for SMILE procedure and planned to do SMILE screening at the day. Patient was diagnosed with RLE Myopia astigmat + Amblyopia refractive. Patient was informed that he had amblyopia and SMILE will only gave maximum visual acuity he similar with his visual acuity using eyeglasse and will not achieve 1.0 visual acuity. Patient and family agreed and understand, so SMILE procedure will be done.



Fig. 1. Slit lamp examination of anterior segment both eyes

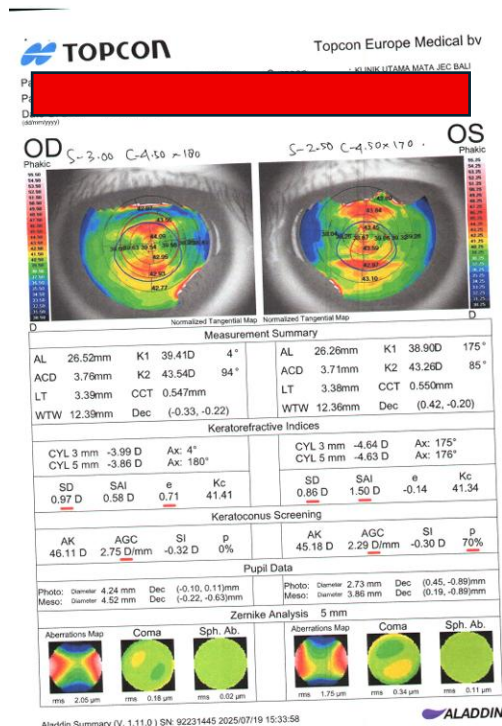


Fig. 2. Corneal Tomography

|                                                         |                                                                                                                                  |                                                 |                                                                                                                                                                    |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         |                                                                                                                                  | Formula :SRK8/T<br>Target Ref plane<br>n:1.3375 |                                                                                                                                                                    |
| <b>OD</b>                                               |                                                                                                                                  | <b>OS</b>                                       |                                                                                                                                                                    |
| right                                                   | K1 : 28.57 D @ 8.53 mm @ 1.0°<br>K2 : 43.44 D / 7.77 mm @ 91.0°<br>RSE : 8.15 mm / 41.50 D<br>Cyl : -3.87D @ 1.0°<br>ACD: 3.83mm | left                                            | AL : 26.21 mm (SNR-236.0)<br>K1 : 38.75 D @ 8.71 mm @ 170.0°<br>K2 : 43.83 D / 7.77 mm @ 80.0°<br>RSE : 8.21 mm / 41.29 D<br>Cyl : -5.08D @ 170.0°<br>ACD: 3.75 mm |
| <b>RayOne Aspheric</b>                                  |                                                                                                                                  | <b>RayOne Aspheric</b>                          |                                                                                                                                                                    |
| <b>Eyecyl HSAS 600 Aspheric</b>                         |                                                                                                                                  | <b>Eyecyl HSAS 600 Aspheric</b>                 |                                                                                                                                                                    |
| A const: 118.6                                          |                                                                                                                                  | A const: 118.3                                  |                                                                                                                                                                    |
| ROL(D)                                                  | REF(D)                                                                                                                           | ROL(D)                                          | REF(D)                                                                                                                                                             |
| 15.5                                                    | -0.88                                                                                                                            | 15.5                                            | -1.05                                                                                                                                                              |
| 15.0                                                    | -0.32                                                                                                                            | 15.0                                            | -0.69                                                                                                                                                              |
| 14.5                                                    | -0.18                                                                                                                            | 14.5                                            | -0.33                                                                                                                                                              |
| 14.0                                                    | 0.17                                                                                                                             | 14.0                                            | 0.02                                                                                                                                                               |
| 13.5                                                    | 0.51                                                                                                                             | 13.5                                            | 0.36                                                                                                                                                               |
| 13.0                                                    | 0.85                                                                                                                             | 13.0                                            | 0.71                                                                                                                                                               |
| 12.5                                                    | 1.18                                                                                                                             | 12.5                                            | 1.05                                                                                                                                                               |
| Emme. ROL: 14.25                                        |                                                                                                                                  | Emme. ROL: 14.02                                |                                                                                                                                                                    |
| <b>OPTIMA PMMA</b>                                      |                                                                                                                                  | <b>OPTIMA PMMA</b>                              |                                                                                                                                                                    |
| <b>AVANSEE 3 PIECE</b>                                  |                                                                                                                                  | <b>AVANSEE 3 PIECE</b>                          |                                                                                                                                                                    |
| A const: 118.7                                          |                                                                                                                                  | A const: 118.7                                  |                                                                                                                                                                    |
| ROL(D)                                                  | REF(D)                                                                                                                           | ROL(D)                                          | REF(D)                                                                                                                                                             |
| 16.0                                                    | -1.17                                                                                                                            | 16.0                                            | -1.17                                                                                                                                                              |
| 15.5                                                    | -0.82                                                                                                                            | 15.5                                            | -0.82                                                                                                                                                              |
| 15.0                                                    | -0.47                                                                                                                            | 15.0                                            | -0.47                                                                                                                                                              |
| 14.5                                                    | -0.12                                                                                                                            | 14.5                                            | -0.12                                                                                                                                                              |
| 14.0                                                    | 0.22                                                                                                                             | 14.0                                            | 0.22                                                                                                                                                               |
| 13.5                                                    | 0.56                                                                                                                             | 13.5                                            | 0.56                                                                                                                                                               |
| 13.0                                                    | 0.89                                                                                                                             | 13.0                                            | 0.89                                                                                                                                                               |
| Emme. ROL: 14.32                                        |                                                                                                                                  | Emme. ROL: 14.32                                |                                                                                                                                                                    |
| <b>Axial Length Values</b>                              |                                                                                                                                  |                                                 |                                                                                                                                                                    |
| AL                                                      | SNR                                                                                                                              | AL                                              | SNR                                                                                                                                                                |
| 26.5 mm                                                 | 5.0                                                                                                                              | 26.2 mm                                         | 5.2                                                                                                                                                                |
| 26.5 mm                                                 | 5.3                                                                                                                              | 26.2 mm                                         | 3.9                                                                                                                                                                |
| 26.5 mm                                                 | 5.4                                                                                                                              | 26.2 mm                                         | 10.3                                                                                                                                                               |
| 26.5 mm                                                 | 5.0                                                                                                                              | 26.21 mm                                        | 21.6                                                                                                                                                               |
| 26.5 mm                                                 | 4.7                                                                                                                              | 26.21 mm                                        | 5.1                                                                                                                                                                |
| 26.5 mm                                                 |                                                                                                                                  | 26.21 mm                                        | 7.3                                                                                                                                                                |
| <b>Anterior Chamber Depth Values</b>                    |                                                                                                                                  |                                                 |                                                                                                                                                                    |
| ACD: 3.83 mm                                            |                                                                                                                                  | ACD: 3.75 mm                                    |                                                                                                                                                                    |
| 3.83 mm                                                 | 3.83 mm                                                                                                                          | 3.83 mm                                         | 3.83 mm                                                                                                                                                            |
| 3.76 mm                                                 | 3.74 mm                                                                                                                          | 3.76 mm                                         | 3.74 mm                                                                                                                                                            |
| <b>White to White Values (Chang Waring Chord)</b>       |                                                                                                                                  |                                                 |                                                                                                                                                                    |
| WTW : 11.9 mm                                           | Pup : 5.7 mm                                                                                                                     | WTW : 12.0 mm                                   | Pup : 4.3 mm                                                                                                                                                       |
| Ix: -0.3 mm by: 0.0mm                                   | Pc: 0.2 mm Py: 0.0mm                                                                                                             | Ix: 0.3 mm by: -0.1mm                           | Pc: -0.1 mm Py: 0.1mm                                                                                                                                              |
| WTW : 12.3 mm                                           | Pup : 5.4 mm                                                                                                                     | WTW : 12.1 mm                                   | Pup : 5.0 mm                                                                                                                                                       |
| Ix: -0.1 mm by: -0.2mm                                  | Pc: 0.3 mm Py: 0.0mm                                                                                                             | Ix: 0.2 mm by: -0.2mm                           | Pc: -0.2 mm Py: 0.0mm                                                                                                                                              |
| WTW : 11.8 mm                                           | Pup : 5.6 mm                                                                                                                     | WTW : 12.0 mm                                   | Pup : 5.5 mm                                                                                                                                                       |
| Ix: -0.3 mm by: 0.1mm                                   | Pc: 0.2 mm Py: 0.0mm                                                                                                             | Ix: 0.3 mm by: -0.1mm                           | Pc: -0.2 mm Py: 0.2mm                                                                                                                                              |
| Carl Zeiss Meditec - IOLMaster 500   JEC-BALI @DENPASAR |                                                                                                                                  |                                                 |                                                                                                                                                                    |

Fig. 3. IOL Master



Fig. 4. Fundus Photograph

|              |                               |                                                 |            |
|--------------|-------------------------------|-------------------------------------------------|------------|
|              |                               | JEC<br>Eye Hospitals and Clinics<br>ReLEx SMILE |            |
|              |                               | TABEL PERHITUNGAN PASIEN                        |            |
|              |                               | <b>OD</b>                                       | <b>OS</b>  |
|              |                               | <b>547</b>                                      | <b>550</b> |
| Pachymetri   | Sph -3.00 Cyl. -4.50 Axis 180 | Sph -2.50 Cyl. -4.50 Axis 170                   |            |
| Manifest Ref | Sph 0.00 Cyl. 0.00 Axis 0     | Sph 0.00 Cyl. 0.00 Axis 0                       |            |
| Target Sisa  | Sph -3.00 Cyl. -4.50 Axis 180 | Sph -2.50 Cyl. -4.50 Axis 170                   |            |
| Treatment    |                               |                                                 |            |
| Plan         | 110                           | 110                                             |            |
| Cap          |                               |                                                 |            |
| Thickness    |                               |                                                 |            |
| Optical Zone | 6.0                           | 6.0                                             |            |
| Lenticule    | 109                           | 103                                             |            |
| Thickness    |                               |                                                 |            |
| RST          | 331                           | 337                                             |            |
| K1           | 39.41 @ -4 38.90 @ 175        |                                                 |            |
| K2           | 43.54 @ 94 43.26 @ 85         |                                                 |            |

Fig. 5. SMILE calculation

After SMILE Procedure, patient was discharged with medication Cravit eyedrop every 3 hours RLE, P-pred eyedrop every 3 hours RLE, and Hyalup eyedrop every hours RLE. patient suggested to control on next day. On follow up on 1<sup>st</sup> day Uncorrected Visual Acuity (UCVA) RE 0.5 LE 0.4. Patient feel his vision is getting better, minimal glare, but he still complaint of dry eye symptomp. Using slit lamp examination, we found well healed SMILE incision on RLE, no tear on cap incision, and no epithelial ingrowth was found. Patient suggested to continue his medication, avoid water on eyes for 3 days, and control on next week.

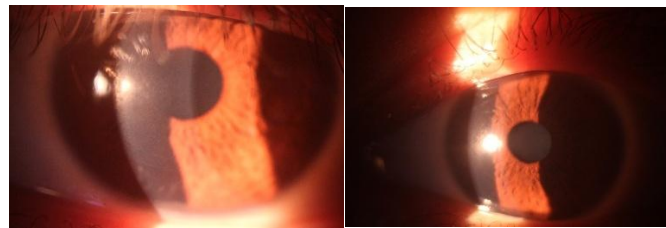


Fig. 6. Slit lamp examination on 1<sup>st</sup> day after SMILE

## Discussion

The myopic eye brings pencils of parallel rays to focus at points anterior to the retina. The secondary focal point of the eye is in the vitreous. Rays diverging from a point on the far-point plane of the eye will be brought to focus on the retina without the aid of accommodation. For instance, a  $-2.00$  D myope who is capable of 1 D of accommodation reads without effort at a half meter and can keep the image clear up to one-third of a meter by accommodating. The spectacle correction of myopia involves placing a diverging lens in front of the eye so that the secondary focal point of the lens coincides with the far point of the eye. Pencils of parallel rays striking the lens will diverge when they leave the lens as though they originated from the far point of the eye; hence, they will be brought to focus on the retina. Refractive surgical correction of myopia is achieved by flattening the front surface of the eye. When the myopic error is fully corrected, pencils of parallel rays are brought to focus on the retina.<sup>2</sup>

Amblyopia is a condition of reduced visual function, usually in one eye but sometimes in both, that is not improved by correcting any refractive error or pathological obstacle to vision, e.g. cataract. Causes are form deprivation and abnormal binocular interaction producing degraded retinal images in the sensitive or critical period of visual system development, particularly in the first 2–3 years of life, decreasing with age, up to 7 years of age. During this sensitive period amblyopia can develop as well as respond to treatment.<sup>2</sup>

Refractive amblyopia may result from anisometropia (unequal refractive error between the two eyes). The eye which provides the brain with a clearer image typically becomes the dominant eye. The image in the other eye is blurred, which results in abnormal development of one half of the visual system. Refractive amblyopia is usually less severe than strabismic amblyopia and is commonly missed by primary care physicians because of its less dramatic appearance and lack of obvious physical manifestation, such as with strabismus.<sup>3</sup>

Small Incision Lenticule Extraction or known as SMILE is a corneal based refractive surgery procedure. SMILE is a femtosecond-only procedure that removes stromal tissue (the lenticule) without a flap. The femtosecond laser creates the posterior surface, vertical sides and anterior surface of the lenticule, and a small tunnel for extraction of the lenticule. The cap thickness (above the lenticule) is typically 100–120 µm. The lenticule thickness depends on the refractive error. SMILE shows excellent efficacy, safety, predictability, and avoids flap-related complications.<sup>1,2</sup>

Refractive surgical options continue to evolve and expand. Since the publication of the first edition of this book, refractive surgery has become increasingly popular. Corneal-based procedures continue to be the most popular type of refractive procedure performed today. Keratorefractive procedures have undergone many improvements and the range of procedures available is greater than ever before.<sup>2,4</sup>

Similar with other procedure, SMILE also has some contraindication for our concern. There are relative contraindications and absolute contraindications. Amblyopia is not a contraindication for SMILE, but patient had to have a realistic expectation for their condition.

| <b>Relative contraindications</b>                          |                                                            |
|------------------------------------------------------------|------------------------------------------------------------|
| LASIK                                                      | SMILE                                                      |
| Mild dry eye disease                                       | Moderate dry eye disease                                   |
| Recurrent corneal erosions                                 | Recurrent corneal erosions                                 |
| History of herpes simplex keratitis or zoster ophthalmicus | History of herpes simplex keratitis or zoster ophthalmicus |
| Atopic disease                                             | Atopic disease                                             |
| Autoimmune disorders                                       | Autoimmune disorders                                       |
| Thin corneas (dependent on pre-operative refraction)       | Thin corneas (dependent on pre-operative refraction)       |
| Glaucoma                                                   | Glaucoma                                                   |
| Mild Irregular or abnormal corneal topography              | Mild Irregular or abnormal corneal topography              |
| Pregnancy                                                  | Pregnancy                                                  |
| <b>Absolute contraindications</b>                          |                                                            |
| Unstable refraction (>0.50 D over previous 12 months)      | Unstable refraction (>0.50 D over previous 12 months)      |
| Residual bed thickness $\geq$ 300 microns                  | Residual bed thickness $\geq$ 250 microns                  |
| Keratoconus or abnormal or irregular topography            | Keratoconus                                                |
| Significant corneal scarring                               | Mild corneal scarring                                      |
| Visually significant cataract                              | Visually significant cataract                              |
| Uncontrolled systemic or ocular disease                    | Uncontrolled systemic or ocular disease                    |
| Unrealistic patient expectations                           | Unrealistic patient expectations                           |

**Table 1. Relative and absolute contraindications of LASIK and SMILE procedures**

In this case, diagnosis made by thorough medical history and physical examination. Patient was diagnosed with Myopia Astigmat and Amblyopia Refractive RLE and willing to do SMILE for educational purpose. Patient understood about SMILE procedure and prognosis of his vision after SMILE with amblyopia condition. Because all examination result was normal so patient decide to continue procedure planned.

## **Conclusion**

In conclusion, Amblyopia is not a contraindication for SMILE procedure. Patient undergo SMILE procedure had increased visual acuity and sharpness that also can help amblyopia condition to reach better visual acuity. Through careful assessment, appropriate treatment strategies, and patient education, patien can effectively get SMILE procedure and improving their quality of life.

## **Reference**

1. Timothy L. Jackson. Moorfields Manuals of Ophthalmology. London : Jaypee Brother Medical Publishers. 2020.
2. Damien GR, Ghanem ST. Refractive Surgery. London : Elsevier. 2020.
3. Dimitri T. Azar. Refractive Surgery. London : Elsevier. 2020.
4. Muthia Aya Syahmalya, Rani Himayani, Mukhlis Imanto, Ety Apriliana, Yusran. Ambliopia : Prevalensi, Faktor resiko,Klasifikasi, dan Terapi. 2022. Jurnal Medika Hutama. Vol 03 No 04.