Management of incision failure due to suction loss in SMILE

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Small-incision lenticule extraction (SMILE), a flap-free refractive surgery, is becoming more popular because of its various advantages over flap-based procedure. The intraoperative complications associated with SMILE, such as suction loss, black spots, and opaque bubble layer, cause incomplete or defective laser passage into the stroma leading to difficult lenticule dissection. Other intraoperative complications such as cap perforation and lenticule tear can occur, which can also be attributed to difficult lenticule dissection. Postoperative complications such as dry eye, epithelial ingrowth, ectasia, and interface inflammation have also been reported. Suction loss, being the most common intraoperative complication, has to be managed adequately for easy dissection of lenticule and better surgery outcome. Suction loss can occur at different levels of lenticule creation. Cases with failed incision cut due to suction loss are discussed. The cases were managed by placing manual incision, and then lenticule was extracted.

CASE 1

A 22-year-old woman with a stable refraction for 1 year was willing to undergo refractive surgery. Her corrected distance visual acuity (CDVA) was 20/20 in both eyes, with −3.50 −0.50 × 170 in the right eye and −3.25 −0.75 × 15 in the left eye. Detailed history and slitlamp examination was performed. No ocular abnormalities were noted during the examination. Corneal topography was performed with Pentacam (OCULUS Optikgeräte GmbH) in both eyes. Quadwave map were within normal limits in both eyes (Figure 1). The central corneal thickness in the right and left eyes was 548 μm and 551 μm, respectively. Keratometry values were K1 44.1 diopter (D), K2 45.1 D and K1 43.6 D, K2 45.1 D in the right and left eyes, respectively. The Schirmer test was within normal limits. Patient was advised for SMILE procedure in both eyes.

Under topical anesthesia with 0.5% proparacaine, both eyes were treated in the same setting using VisuMax 500 kHz femtosecond laser (Carl Zeiss Meditec AG). The laser energy used was 180 nJ. The optical zone was kept at 6.50 mm, with flap diameter of 7.60 mm and flap thickness of 120 μm. The expected residual stromal bed was 347 μm in both eyes. Under aseptic precaution, the patient eyes were draped, and speculum was inserted. Using the table joystick, the eye was moved toward the suction contact glass. The patient was asked to look at internal fixation target, and the table was moved upward toward the suction glass. Proper centration was achieved by looking through the microscope and suction switched on. After completion of the femtosecond laser, suction was released and the patient eye moved toward the surgical scope. The procedure was performed first in the right eye, followed by the left eye. In the right eye, the procedure went uneventful. The lenticule was separated anteriorly followed by posterior separation and removed with the forceps.

The same procedure was followed in the left eye. Suction loss was noted during the last stage of the procedure. After the suction release, it was noted that there was failure in the
placement of the incision cut (Figure 2). Partial-thickness corneal incision was placed manually with 11 number steel blade (Figure 3, A). Lenticular plane was identified, separated carefully, and extracted out. Postoperatively, the patient was started on loteprednol etabonate eyedrops 0.5%, 4 times a day for 2 weeks; gatifloxacin eyedrops 0.5%, 4 times a day for 1 week; and lubricating drops, 6 times a day for 8 weeks. It was noted retrospectively that the patient was a regular contact lens user since many years. On careful examination, mild redundant conjunctiva was present, which might be the reason for suction loss. The patient experienced mild pain and irritation in both eyes. At first day postoperatively, her uncorrected visual acuity (UCVA) in both eyes was 20/25. At 1 week postoperatively, her UCVA in both eyes improved to 20/20. Corneal topography (Figure 4) performed at 3 months after refractive surgery was within normal limits.

CASE 2
An 18-year-old woman with stable refraction in both eyes was willing to undergo SMILE procedure in both eyes. Her CDVA was 20/20 with subjective refraction of $-3.50 -0.50 \times 180$ in both eyes. The central corneal thickness was 552 μm and 553 μm in the right and left eyes, respectively. Keratometry values were K1 42.5 D, K2 43.2D and K1 42.3 D, K2 43.1 D in the right and left eyes, respectively. The femtosecond laser settings were kept same as in case 1. The expected residual stromal bed was 384 μm in both eyes. SMILE was performed in both eyes by single surgeon following same procedure as discussed earlier. The patient was very apprehensive and bit uncooperative. The patient was continuously motivated and advised to fixate the eye on fixation light. Incision failure was noted in right eye after suction release, and manual incision was placed using an 11 number surgical blade. Left eye procedure was uneventful. Postoperatively, same medications were given as in case 1. UCVA on first postoperative day was 20/20 and remained the same at 6 weeks and 6 months postoperatively in both eyes, and no other complications were noted.

CASE 3
After a complete refractive preoperative evaluation, a 30-year-old man was scheduled for SMILE procedure in both eyes. His CDVA with $-1.50 \ D$ spherical in both eyes was 20/20. Keratometry values were K1 42.1 D, K2 42.6 D and K1 42.7 D, K2 42.8 D in the right and left eyes, respectively. The corneal thickness was 565 μm in both eyes. The laser settings and same procedure as discussed in case 1 was followed in both eyes. The expected stromal bed thickness was 416 μm and 421 μm in the right and
left eyes, respectively. In the right eye, the procedure was uneventful. In the left eye, manual incision had to be placed due to incision failure by femtosecond laser. The reason for suction loss in this case could not be determined. The UCVA at 1 week postoperatively was 20/20 in both eyes.

DISCUSSION

Suction loss during SMILE is more common than that seen in femtosecond LASIK because of longer duration required for the lenticule creation. The suction required during SMILE is lower than that required for microkeratome LASIK, but there are increased chances of suction loss. Some of the other factors that can contribute to suction loss are narrow palpebral fissure, recurrent squeezing of the eyelids, conjunctival chemosis, conjunctivochalasis, and interface fluid between the suction glass and the cornea. Other factors such as surgeons’ inexperience and larger cap diameter are also found to contribute for suction loss in SMILE. According to Wong et al., the suction loss is relatively rare with incidence of around 3.2%.

The management of suction loss is based on level at which the suction loss has occurred. In all the above-mentioned cases, failure in the incision cut was noted after the suction release, and manual incision with an 11 number surgical blade had been placed on the cornea, which was approximately one fourth depth of the cornea. In all cases, the postoperative outcome was significantly good without any complications. Kim et al. have published a case report in which failure in the incision cut with laser due to conjunctivochalasis was managed by manual incision with a diamond knife. In case 1, the patient had redundant conjunctiva with history of contact lens use for longer duration. The patient cooperation is most important throughout the procedure to avoid intraoperative complications. As it could be inferred from

Figure 3. A: Incision made manually with surgical blade. B: Incision depth confirmed in higher magnification. C: Anterior and posterior lenticular plane delineated. D: Anterior followed by posterior dissection of the lenticule. E: Lenticule extracted with forceps. F: Cornea after completion of the procedure.

Figure 4. Corneal topography of the left eye 3 months postoperatively.
case 2, slight movement of the eye ball can lead to suction loss. Ramirez-Miranda et al. have also reported to have performed manual incision using a crescent blade or graduated keratome in cases where there was failure of incision due to opaque bubble layer. Wang et al. have also placed manual incision with a surgical blade in their study in cases where incision cut failed due to suction loss and femtosecond laser did not perform scanning. In all the above-mentioned studies where manual incision was placed for the management of incision failure in SMILE due to suction loss, the postoperative outcome was not compromised in any of the cases. To the authors’ knowledge, this is the first case series to report 3 cases to be managed with manual incision in SMILE. Complications such as epithelial ingrowth and keratitis were not seen. Hence, it can be stated that manual incision could be considered as an option for the management of cases with incision failure during SMILE. The site of incision and adequate depth should be appropriate to avoid inadvertent complications. The experience and surgical skills of the surgeon do play an important role in the management of the cases with this method.

In conclusions, incision failure can occur during SMILE due to suction loss and is not uncommon. Even a mild conjunctival chemosis and chalasis can lead to suction loss. Thorough patient counseling preoperatively and constant interaction and motivation with patient during the laser is required, so that the patients do not lose their concentration. Incision failure during SMILE can be efficiently managed with manual incision without an uncompromised visual outcome.

**WHAT WAS KNOWN**
- The management of incision failure during suction loss is by docking and reapplication of the laser.

**WHAT THIS REPORT ADDS**
- In case of incision failure due to suction loss in SMILE, the incision can be manually made. It is a safe and an effective option. The postoperative results being the same as in the rest of other SMILE cases.

**REFERENCES**

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