

How to Proceed After Suction Loss in LASIK

Identify the underlying problems and inform the patient of your treatment plan.

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The art of LASIK surgery involves perfecting its steps and making sure each maneuver harmoniously contributes to excellent postoperative outcomes. Every step is important, and only when all falls into place will the surgeon produce a perfect LASIK procedure.

Flap creation may be considered one of the most crucial steps of LASIK. Without a good flap, the surgical procedure is severely compromised. Mechanical microkeratomers have improved over the past 2 decades, decreasing the number and severity of complications related to their use. Additionally, the development of femtosecond lasers has further elevated the level of security and predictability of flap creation.

By their principles, both the microkeratome and femtosecond laser require vacuum (albeit different levels) to fixate to the eye so that the flap can be securely created. If the vacuum is not high enough, most microkeratomers will not advance their head, which is supposed to increase the safety of this step. However, vacuum can be lost during surgery—and we all know that suction loss can be a challenging, delicate, and most stressful situation.

PREVENTING SUCTION LOSS

The best way to deal with suction loss is to prevent it. The surgeon should aim to recognize its risk factors and react in time to inhibit the vacuum loss. This begins with reminding the patient to relax; patients who tend to squeeze their eyes and those with pronounced Bell phenomenon should be observed closely, as the movements induced with these conditions often trigger sudden vacuum loss. Beware of the patient with pinguecula or pterygia, regardless how small or insignificant they may seem.

If you prefer a mechanical microkeratome for flap creation, perform a suction check test after the suction is

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stable and just before advancing the head. To administer the test, gently pull the ring upward and slightly tilt it sideways to provoke vacuum loss for 1 to 2 seconds. Should the suction still hold, it is safe to continue with flap creation. Rest the ring in its natural position and gently press the eye while advancing the head. Check that the eyelid speculum is open wide enough and that the sterile drape, the patient's eyelashes, or any other potential obstacle is not in the way of the advancing microkeratome head. If you are using a Moria microkeratome (Antony, France) or a Hansatome (Bausch + Lomb, Rochester, New York), be sure to pull away the skin of the lower eyelid. If this catches on the microkeratome head, the pinching sensation may cause the patient to squeeze his eyes, possibly inducing suction loss.

Flap creation may be challenging in older patients, particularly because the conjunctiva can be looser than that of younger patients. This condition may cause formation of false suction; the ring creates proper vacuum, but the conjunctiva is at risk for complete detachment from the sclera. If suction remains engaged after detachment, the conjunctiva may attach to the ring itself. This condition is usually discovered with the vacuum check test; if it should happen during the test, the surgeon should either abort the procedure or convert to surface ablation, should other conditions allow.

ADVANCING THE MICROKERATOME HEAD

Suction loss during advancement of the microkeratome head is the most difficult situation to resolve. The most important thing in that moment is not to panic. If the microkeratome warning alarm indicates that suction has been lost, stop the advancement of the head immediately by lifting your foot away from the footpedal. Stop to evaluate the situation and develop a strategy that will restore the corneal integrity. Flaps are quite tough, and even in situations like these, corneal integrity should most likely be reestablished.

Reattaching the ring to the globe and rebuilding vacuum is a bad idea with microkeratomers; however, it can be done with good results with the femtosecond laser if the surgeon can continue flap creation at the same depth and in the same plane. With microkeratomers, however, the first step is to retrocede the movement of the head. Most microkeratomers will stop any movement after vacuum is lost. Removal can be accomplished by bending and holding the tube to build false vacuum. Ideally, the microkeratome should retract without blade oscillation, which is the best way to prevent further damage to the flap.

If suction loss happened at the beginning of excursion of the microkeratome head, gently and continuously pull the head in the opposite direction of the flap hinge. This maneuver may successfully separate it from the flap, which should be held by its broad hinge. The surgical assistant can add balanced saline solution to help squeeze the flap from the microkeratome head. Once the microkeratome head is disengaged, this is the best time to examine the flap. If the flap hinge is too thick and does not provide enough space for a good ablation zone, do not dissect the flap, because it will never be regular enough for a good ablation. In the presence of an incomplete flap, lift it and examine its size and thickness. If it is large enough but too thin, do not make the ablation too deep, because of the inherent risk for corneal hazy scarring.

TAKE-HOME MESSAGE

- Prevent suction loss by recognizing the risk factors and reacting in time.
- Suction loss during advancement of the microkeratome head is difficult to resolve; the first rule is not to panic.
- Do not hand the microkeratome to the surgical assistant until you are sure that the flap with a hinge is complete.
- If performing femtosecond flap creation, an emphasis on correct timing may allow easy suction reengagement.

THE COMPLETE FLAP

It is extremely important to ensure that you actually see the flap in place. Never hand the microkeratome back to the surgical assistant until you are sure that the flap with a hinge is complete. A free cap is common in these cases; should it occur, do not lose or discard it under any circumstance. Once it is retrieved—having marked the cornea will pay off at this moment—reposition the cap and abort surgery.

With any microkeratome-related flap complication, the goal is to reposition the flap, place a bandage contact lens if erosions or free caps are present, and schedule follow-up visits until the problem is completely resolved.

FEMTOSECOND LASER FLAPS

If vacuum is lost before the raster flap cut, increase the pressure applied to the ring and do not move while the cone keeps the suction. In the event that the suction ring must be changed, apply the new suction ring and get rid of anything that may be stuck in either the tubes or the ring.

If suction loss happens during raster flap creation but before the sidecut, restart the cut with the same parameters, the same suction ring, the same cone, and in the same plane. This maneuver must be quick, because characteristic conjunctival shape is created after each suction. The new suction should be reapplied to ensure the same plane. If too much time lapses, a new conjunctival shape with a different corneal plane will form.

If suction loss happens during the sidecut, timing is crucial. If the sidecut is substantially complete, it can still be opened and the flap lifted without any problem. The best way to check whether the sidecut was complete is to check the cone; if the sidecut is visible on the cone glass, it means the cut was complete.

If suction loss occurs with more than 2 seconds left in the cut, it is risky to continue with use of that sidecut. However, use extreme caution when creating a second sidecut. If they are too close and both sidecuts are open, it creates thin pieces of flap tissue that can easily be lost. Moreover, there is future risk for epithelial ingrowth. Therefore, the second sidecut should be approximately 0.5 mm smaller than first.

HOW AND WHEN TO PROCEED

In any case of flap irregularity due to a free cap, an incomplete flap, or gentle haze and scarring, the refraction should most likely only change slightly over the following postoperative months. LASIK with new flap creation can be rescheduled approximately 3 months later, at the earliest. If significant scarring resulted from a free cap or a thin flap, surface ablation may alternatively be considered. Finally, if a

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permanent central corneal scar increases the corneal irregularity and decreases the quality of vision, transepithelial topography-guided PRK should be considered.

We do not recommend creating a second flap with the femtosecond laser after a previous mechanical microkeratome cut. The reason is that during the femtosecond cut, air bubbles tend to travel toward the previous cut. If a femtosecond laser is used in this situation, the difference in depths should be more than 40 µm; however, this is not advised in thin corneas.

CONCLUSION

Suction loss is a potential visually threatening LASIK complication that can often be avoided by understanding the underlying causes. Should it occur, the surgeon must master the techniques necessary to effortlessly disengage the microkeratome head and evaluate the condition of the flap. If the femtosecond laser is used, an emphasis on correct timing may allow easy suction reengagement.

The priority any time suction is lost should be restoration of the anatomical integrity of the cornea, rather than applying the laser ablation. Depending on the final refractive and topographic result at least 3 months later, the surgeon can plan either a new LASIK procedure or topography-guided surface ablation.

Sometimes patience is required of the patient and the surgeon. Proper patient counseling and an open dialogue about what happened and the upcoming treatment plan will keep the doctor-patient bond intact, which is important during this delicate and stressful situation. ■

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