LASIK Flaps: There Is No Single “Right” Place for the Hinge

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Ergonomics and specific patient factors are more important determinants of hinge position than theoretical considerations.

The common wisdom in refractive surgery holds that superior (12 o’clock) hinge placement makes for better flaps and better outcomes. The theory is that, with a superior hinge, gravity can assist in flap adhesion, resulting in fewer striae. In addition, one would expect that movement of the superior tarsal plate over the flap during blink would create fewer problems with a superior hinge.

In the years when I used only the Automated Corneal Shaper (ACS), and so could make only nasal hinges, I thought that flaps with superior hinges would be useful in reducing complications and improving outcomes. I looked forward to using a keratome that would allow me to make a superior hinge.

However, now that I also use a Moria Carriazo-Barraquer (CB) keratome and can make flaps with any orientation, my personal experience does not confirm the value of a superior hinge. Rather, I have found that hinge position is not a factor in either refractive outcomes or in the incidence of striae and other flap complications. Good surgical technique and making sure that the flap is adhered is far more important in preventing flap complications than the position of the hinge.

Several aspects of surgical technique contribute to good flap adhesion: making a good initial flap (i.e., a flap with adequate depth and diameter); care of the flap during ablation; proper centration of the flap after ablation; and care to see that the flap is properly adhered.

With the large-diameter flaps one gets with the CB keratome, the hinge is relatively distant from the optical zone and has little impact on the procedure or the outcome—which is as it should be (Figures 1 and 2).

Changing Flap Orientation

The ACS unit that I have used for thousands of cases has only one suction ring. As a result, the flatter the cornea, the smaller the diameter of the flap made by the ACS. If the patient has relatively flat keratometry (< 41 D) and a nasal pupil, the surgeon has to be very careful to offset the suction ring in the nasal direction to ensure that the flap is centered over the pupil and that the hinge doesn’t interfere with the ablation.

One of the reasons I purchased the CB was to have more freedom in choosing flap diameters and hinge placement, including the freedom to make superior hinges. When using the ACS, I am personally most comfortable holding the suction ring in my right hand and the lid speculum in my left hand for the left eye, and reversing the hand position for the right eye. With the manual CB, I keep my right hand on the suction ring and use my left hand to move the keratome head and make the keratectomy. Because the pivot point on the CB’s suction ring is fixed, maintaining the hand position that I am most comfortable with in both eyes requires that I make an inferior hinge in left eyes and a superior hinge in right eyes.

To test this technique, I performed laser in situ keratomileusis (LASIK) on 100 right eyes with a superior hinge and on 100 left eyes with an inferior hinge. The results surprised me. I had similar retreatment rates in both eyes, and of the two flaps that had mild striae, both were in eyes with a superior hinge. Although the sample was only moderate in size, the conditions were perfectly equivalent: same surgeon, same technique, same drying time, etc. The conclusion I draw is that, using my technique, hinge position has no influence on complications or outcomes.

Could Inferior Be Better?

When thinking about the absence of complications in eyes with inferior hinges, it occurred to me that the inferior hinge might even have some advantages. We are all familiar with lagophthalmus and dry eye. The infe-
rior hinge lies directly in the lag line area and preserves the cornea and Bowman's layer in that region. While it hasn't been demonstrated (and my own data don't show it), one can speculate that there might be an advantage to the inferior hinge, at least in some patients.

I believe, however, that the real key to success in flap making is not hinge position but surgical technique. Compared to the importance of making sure that the flap is adequately adhered to the stroma, hinge position fades into insignificance.

The one situation in which hinge position may play a role is where the surgeon doesn't check flap adhesion. In that case, movement of the eyelid over the edge of an inferiorly hinged flap at every blink might be deleterious. But with good flap adhesion, lid movement over an inferior flap has no effect.

**Patient Factors**

In any given surgical situation, there can be reasons to want to position the hinge in an atypical fashion. For example, in a patient with a large pannus of neovascularization, the hinge could be positioned beneath the pannus to prevent intraoperative bleeding.

The are other atypical conditions. I recently operated on a patient with an intertemporal scar from a dermoid removal. I was able to locate the hinge superotemporally, such that the leading edge of the keratotomy was just outside the scar area. Similarly, if the patient has had a pterygium removed, the surgeon will want to start the keratotomy at the very leading edge of the old scar and pannus. This prevents irregularities of the flap edge that might in turn lead to epithelial ingrowth or striae.

It is not usual for patients to present for LASIK because of pterygia that are causing contact lens intolerance or poor lens fit. Most of these pterygia are small and nonprogressive. I prefer to place the hinge toward the head of the pterygium. This way, if the pterygium grows, it will grow across the hinge and won't jump the LASIK gutter. It makes sense with a nasal pterygium, for example, to use a nasal hinge.

**Loose Epithelium**

There are some patients who, although they show no clinical signs of a basement membrane disorder prior to LASIK, have very loose epithelial attachments and will develop epithelial sloughing at the time of the keratectomy. If this is severe in the first eye, the surgeon may stop the procedure.

Often, however, the patient has only regional areas of epithelial weakness. Unfortunately, even when the looseness is only regional, if the keratome starts its cut in an area where the epithelium is loose, it can pull the epithelium away like a hand opening a curtain. This leaves a much larger defect than if the surgeon had cut in the other direction.

For patients in whom this condition is limited to sectors of the corneal periphery, I will change the orientation of my hinge, so that the first place the microkeratome cuts is the cornea 180 degrees away from the area of epithelial weakness. I have found that the areas of looseness are usually similarly positioned in the two eyes. By orienting my keratectomy to take advantage of this, I can have a much smaller area of defect and better visual outcome in the second eye.

When the case is aborted after the first eye, the surgeon can note where the microkeratome started. If the surgeon and patient are bold enough to want to operate on the second eye after the first has stabilized, one of the considerations should be starting the flap 180 degrees away from the region of weakness found on the cornea the first time.

**Hyperopic Patients**

The CB keratome has multiple suction rings that allow the surgeon to create an appropriate size flap, irrespective of the keratometry values. This is particularly important in hyperopic ablations, where a very large keratectomy is needed.

As the flap diameter increases, avoiding areas of neovascularization becomes more of a challenge. Freedom to place the hinge where the surgeon wants it can...
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PRK is an elective procedure with the alternatives including, but not limited to, eye glasses, contact lenses, radial keratotomy, or automated lamellar keratectomy.

Approval of the application is based on a U.S. study of 275 eyes with preoperative manifest refraction 20/40 or better, and 60% were corrected to 20/20 or better, and 53.1% were corrected to 20/20 or better without spectacle or contact lenses. For the retreated eyes that had reached the 6 month visit, 100% were corrected to 20/40 or better and 57.1% were corrected to 20/20 or better without spectacle or contact lenses. The study showed that the following adverse events occurred in at least 1% of the subjects at 12 months or greater post-treatment: pre-treatment BSCVA (vision corrected with eyeglasses) 20/20 or better with a post-treatment BSCVA worse than 20/25 (1.1%); moderate corneal haze (1.2%); patient discomfort or pain (1.2%); increased intraocular pressure (1.2%); and undercorrections >1.0 D (4.9%).

Induced Cylinder

Induced cylinder was one of the factors that I investigated when comparing inferior to superior hinge placement. I found no induced astigmatism with either the superior or inferior hinge. It should be noted that I was using the CB keratome and making large flaps, which are useful in preventing induced astigmatism.

With small flaps, the hinge is sometimes close to the ablation area. Even if there is no ablation of the flap itself (which sometimes happens to novice refractive surgeons), the hinge edge can produce local changes in hydration. The extra water absorbs laser energy, and slightly less tissue is removed in areas adjacent to the hinge. With a small flap and a hinge close to the ablation area, induced cylinder or undercorrected cylinder can occur because of hinge placement. This is a potential problem with the ACS.

If a hinge is within 2.5 mm of the visual axis, the procedure should be aborted. A new flap can be made in 3 months. (I use the same depth plate and a marker, so that the suction ring is oriented properly prior to the keratectomy.) With an adequately large flap, however, the hinge will be far enough from the ablation zone so as to have no effect on the correction.

Anatomical Issues

The chance of a suction problem increases dramatically in patients with unusual anatomical structures. When patient anatomy makes keratome placement difficult, the surgeon who is committed to a superior hinge at any cost can get into trouble. Rather than struggling to create a superior hinge, the surgeon is better advised to position the hinge where it is safest for the patient and easiest for the surgeon.

As an example, I had one patient with a highly protuberant brow in whom the only way I could use the keratome was by making superficial hinges in both his eyes. There was no other orientation in which the keratome could be made to fit in his orbit. Had my goal been to have a superior hinge at all costs, I would have risked an irregular keratectomy.

Laser Factors

I have a colleague in South Africa who, like me, uses the Moria CB keratome, but, unlike me, uses it with the electric motor to make superior hinges in both eyes. Because he employs the CB in conjunction with a LaserSight LSX laser, he has more room to work under the laser head than I have with my VISX Star S2.

With keratomes like the Hansatome or the CB, the motor sticks up vertically from the suction ring, and if there is limited space between the patient and the laser, the tip of the motor or the cord can touch the under surface of the laser during the keratectomy. This can slow down the keratome and jeopardize the keratectomy. Using the CB manually, I am sure to have a clear path for the keratectomy, because the pneumatic tubing in the CB unit is considerably shorter than the electric motor. Thus, using the CB in manual mode gives me more room under the laser head, as well as the flexibility to use the keratome with a variety of lasers.

Lasers designed for LASIK, like the LaserSight LSX or the Technolas 217, have more spacious working distances. Thus, my South African colleague can make superior hinges easily, even using the electric motor to move the keratectomy head.

THE BOTTOM LINE

A study of 100 patients who received LASIK with an inferior hinge in one eye and a superior hinge in the other eye found no difference between eyes with respect to complication rates, retreatment rates, or refractive outcome. There was no evidence that hinge position was a factor. Using the Moria Carriazo-Barraquer keratome, I have the freedom to position the hinge in a place that meets specific patient needs, while allowing the surgery to be comfortable for me. With large flap diameters, induced astigmatism is not an issue.

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