# Why I Still Use the Microkeratome

Always consider preoperative data to reduce or avoid complications.

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The goal of any refractive procedure is to create a corneal pattern that optimizes visual acuity and minimizes optical aberrations. One of the most promising and exciting developments has been LASIK, which is the most widely performed procedure for the correction of refractive errors. Using a microkeratome to create the flap is a critical component of LASIK. For years, the microkeratome has been the feared sprite, mostly because of its potential cause of hardly resolvable complications. Although there is an associated learning curve, the modern automated microkeratome is a reliable, effective, and safe tool; I prefer it over the femtosecond laser.

In LASIK patient satisfaction studies, 97% of myopic patients have a postoperative UCVA of 20/25 in at least one eye at 6 months. Overall, this is secondary to factors including extensive surgical experience, ongoing outcome monitoring and nomogram adjustment, careful patient selection, and updating the technology. Compared with PRK, LASIK has a shorter recovery period, avoids pain and poor visual acuity during the first 2 weeks postoperatively, and eliminates the repair processes secondary to interaction between the epithelium and stroma, which is responsible for anterior corneal opacity (ie, haze) and refractive instability that are sometimes observed several months after PRK.[1]

The surgical correction of hyperopia is challenging. Many procedures have been developed, however, only with limited success due to poor predictability and stability and sight-threatening complications. LASIK for hyperopia is gaining popularity because it is possible to ablate the corneal midperiphery, preventing strong epithelial regression with an overlying flap. In a previous study, we evaluated the efficacy and safety of hyperopic corrections with PRK and LASIK. In 100 eyes (56 patients) that underwent primary PRK, the mean refraction was 2.85 ±1.10 D. In a second group of 100 eyes (50 patients) that underwent primary LASIK, the mean refraction was 4.49 ±1.20 D. After 24 months, the mean manifest refractive spherical equivalent (MRSE) was 0.34 ±0.92 D (36% ±0.50 D), the mean UCVA was 0.87 ±0.10, and 46% of eyes had a UCVA of 20/20 in the PRK group. In the LASIK group, the mean MRSE was 0.29 ±0.66 D (70% ±0.50 D), the mean UCVA was 0.89 ±0.10, and 64% of eyes had UCVA of 20/20. Although PRK and LASIK were both effective and safe, PRK was associated with an initial and transient myopia, pain, and late regression. LASIK resulted in minimal pain and was associated with rapid refractive stability.[2]

LASIK is now also the preferred post-penetrating keratoplasty (PK) treatment for ametropia, because PRK has a poor predictability and a high risk of complications. Unfortunately, the standard LASIK procedure when used in post-PK corneas may result in irregular astigmatism and undercorrection. To improve refractive outcomes, the two-step LASIK approach (ie, hinged flap creation plus refractive excimer laser ablation) and topography-guided excimer laser ablation were proposed. We recently published a series of 12 eyes (12 patients) that underwent successful PK for keratoconus to evaluate two-stage LASIK.[3] We found that the two-step technique and customized ablation allows better outcomes for the correction of refractive errors after PK.

Creating the flap is a critical step. Recent studies show that the incidence of complications is proportional to surgical experience.[4] Complication rates vary from 2% in the first 200 procedures to 0.2% thereafter. For example, the suction ring of the microkeratome should not remain on the eye for more than 20 to 30 seconds because of elevated intraocular pressure (IOP) in this phase (more than 65 mm Hg).[5]

Corneal flap creation has been associated with intra- and postoperative risks including corneal flap size (eg, free cap, small cap, large cap, incomplete cap), corneal flap depth (eg, buttonhole, epithelial tear, thin flap, full-thickness anterior chamber penetration), corneal flap form (eg, wrinkled, edematous, irregular, shrunken), flap location (eg, flap displacement), corneal hinge (eg, short, large, absent, burns), flap striae, epithelial ingrowth, and keratectasia. It is probable that the microkeratome choice affects the percentage of risks and complications, because each microkeratome creates its own morphologic features during excision of corneal tissue. Instrument designs, mechanics of tissue excision and blade oscillation, and instrument traverse combine with a surgeon's skill to influence the configuration of lamellar keratotomy. The quality of the cutting edge may be influenced by the relationship between the speed of the pass and the rate of blade oscillation/rotation. Therefore, it seems that a lower feed during oscillation/rotation results in a smoother pattern of the cutting edge.

During preoperative assessment, it is mandatory to pay attention to the keratometric power and videokeratographic pattern of the cornea. Steep corneas with an average keratometry (K)-reading greater than 48.00 D present a higher risk for perforated buttonhole flaps. A free cap (ie, flap without a hinge) is possible in flat corneas that have an average K-reading less than 40.00 D.

One of the most feared complications after LASIK is progressive iatrogenic keratectasia. Its etiology is still under debate, however, corneal thickness, amount of thinning, IOP, type or quality of structural tissue, keratoconus, ocular trauma, and eye size may be contributing factors. Potential errors could be caused by any three factors.

Estimating the ablation depth is related to the width of the optical zone and profile of the corneal ablation. The ablation rate per pulse is higher for the middle stroma than for Bowman's layer and anterior stroma. Based on PRK nomograms, the ablation depth in LASIK could be greater than expected. Errors in the calculation of overall corneal thickness with pachymetry can occur, especially in the presence of atypical focally thinner regions not detected by the three to four standard measurements over the corneal center.

Another factor could be related to the estimated or real flap thickness, especially using a manually guided microkeratome. Undoubtedly, keratectasia has suggested a greater prudence in setting the quantity of underlying flap tissue of the residual corneal bed. For example, from the measurement of 250 µm, it is passed between 280 and 300 µm. The problem is in the difference from the estimated and real flap thicknesses, especially using a manual microkeratome. The value of the estimated residual corneal bed is theoretical, and the real flap thickness is often unknown. Some differences in creating the corneal flap with a manual or automated microkeratome have been reported. Flap cuts are thicker with slower microkeratome advancement and thinner with faster microkeratome advancement. Moreover, a manual microkeratome creates a larger flap diameter and increased flap thickness in the direction of the hinge.

On the contrary, an automated microkeratome creates a flap that is thinner in the direction of the hinge. In 2002, we studied the thickness, diameter, and hinge length of LASIK flaps and correlated data with preoperative keratometric power and central corneal thickness as well as patients' refraction, gender, and age. Corneal flaps were created using the Hansatome automated microkeratome (Bausch & Lomb, Rochester, New York) with a 160-µm plate and a 9.5-mm suction ring. Mean corneal flap thickness was 142.6 ±20.8 µm, mean flap diameter was 9.9 ±0.3 mm, and mean hinge length was 6.2 ±0.4 mm. Differences between the mean keratometric power and flap hinge length, mean keratometric power and flap diameter, preoperative spherical equivalent and flap diameter, and the corneal thickness and flap hinge length were statistically different.[6] We repeated this study in 2006, using the Zyoptix XP microkeratome (Bausch & Lomb) with a 140-µm plate and a 9.5-mm suction ring. Mean corneal flap thickness was 142.8 ±20.7 µm, mean flap diameter was 9.7 ±0.3 mm, and mean hinge length was 5.3 ±0.3 mm. Statistically significant correlations were found between preoperative corneal thickness and flap thickness, mean keratometric power and flap hinge length, and preoperative corneal thickness and flap hinge length.

It is probable that the choice of a different microkeratome affected the percentage of risks and intraoperative complications. Both the Hansatome and Zyoptix XP were safe and effective instruments to create a corneal flap, however, these studies stressed the importance of considering preoperative data (eg, mean keratometric power, corneal thickness) to reduce or avoid complications.

Is it possible to obviate these complications secondary to the use of a conventional microkeratome by using an intrastromal femtolaser? According to the literature, femtosecond-created flaps are very reliable and precise (10–15 µm). Patel et al[7] compared corneal haze and visual outcomes between fellow eyes randomly treated by a femtosecond laser or microkeratome. At 1 month, the flap thickness was 143 ±16 µm with the femtosecond laser and 138 ±22 µm with the mechanical microkeratome. There was no statistical difference in variances. Therefore, it was deduced that the method of flap creation did not affect visual outcomes during the first 6 months after LASIK. In fact, although early corneal backscatter was greater after femtosecond versus mechanical microkeratome LASIK, patients did not perceive any difference in vision.[6] ■

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