Mechanical Microkeratome Versus Femtosecond Laser

Two surgeons debate the best technology to use for flap creation.

BY MAJA BOHAC, MD; AND CHRISTOPHER L. BLANTON, MD

Is There Still A Place for Mechanical Microkeratomes?

By Maja Bohac, MD

LASIK has come a long way since its inception 20 years ago, and it remains a preferred method of choice for most refractive surgeons. Excimer lasers have undergone fine-tuning to provide superior refractive results, and today's refractive goal extends beyond 20/20 vision.

Mechanical microkeratomes are constantly improving and are still viable alternatives to femtosecond lasers. The latest generation of linear microkeratomes has overcome the problem of flap thickness variability. With the appropriate use of nomograms and a variety of blades, surgeons are able to cut predictable, almost planar flaps of the desired thickness and shape (Figure 1). According to our data, flap thickness variability with the One Use-Plus SBK microkeratome (Moria) is comparable to that of the Ziemer LDV femtosecond laser (15 µm vs 10 µm, respectively).

The incidence of intra- and postoperative complications has changed over time. Linear microkeratomes overcame earlier problems with buttonholes, making epithelial defects now the most common complication. Early femtosecond lasers introduced complications related to energy, such as deep lamellar keratitis and transient light sensitivity syndrome, which have been addressed in newer models.

We use two femtosecond lasers (Femto LDV and Technolas 520F; the latter by Technolas Perfect Vision GmbH) and two microkeratomes (M2 and One Use-Plus SBK) in our refractive practice. For a video demonstration of surgery with a mechanical microkeratome, visit eyetube.net/?v=mosol; for surgery with a femtosecond laser, visit eyetube.net/?v=kotop. When our first femtosecond laser was installed a few years ago, it served as a great marketing tool. Initially, we were aiming for 100% femtosecond laser procedures; however, our current rate of femtosecond flaps is only 30%, mainly on patients' requests. When we compared complication rates, resection and stromal bed quality, flap thickness, postopera-

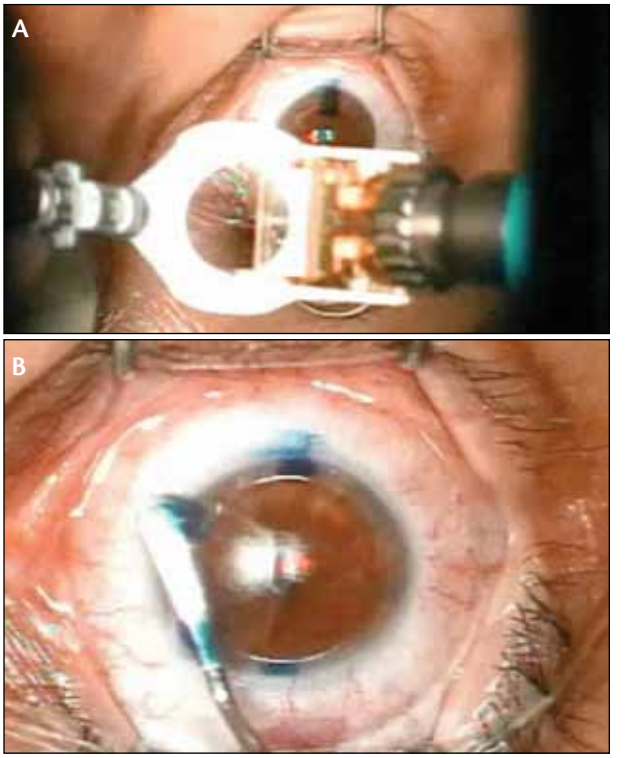

Figure 1. (A) A mechanical microkeratome is used for flap creation. (B) The generated flap is predictable, almost planar, and of the desired thickness and shape.

WATCH IT NOW AT EYETUBE.NET

Using your smartphone, photograph the QR code to watch the video on Eyetube. If you do not have a QR reader on your phone, you can download one at www.getscanlife.com.

mechanical microkeratome: eyetube.net/?v=mosol

femtosecond laser: eyetube.net/?v=kotop

eyetube Ophthalmic Video Resource

tive refractive results, and induction of higher-order aberrations, we did not observe any significant differences between the mechanical and laser technologies.

Disadvantages of the femtosecond laser include increased intraoperative discomfort due to a large patient interface and longer blackout phenomena compared with microkeratomes. Surgeon control and intraoperative visibility during flap creation have decreased with the femtosecond laser, and the number of poorly centered flaps has increased, which is problematic in hyperopic patients. Another challenge is positioning the interface in patients with small interpalpebral fissures and deep orbits, which we have found to be almost impossible. With the Technolas 520F, we had problems with tissue bridges and flap lifting, so we mainly use it for the Intracor procedure.

One significant obstacle with femtosecond laser flap creation was workflow. Because we perform nearly 70 procedures per operating day, doubling the amount of time needed for preparation of the femtosecond laser and the operation itself posed a logistical problem. We would allocate extra time if we had found any real benefit for our patients with femtosecond laser flap creation, but, as noted above, we have not seen significant differences in results with the two technologies.

In my opinion, microkeratomes and femtosecond lasers are still evolving, and both have a place in refractive surgery. A flap is still a flap, and it represents a risk for ectasia in patients with suspicious topography, no matter how thin and reliable it is. There are some patients who will benefit from femtosecond laser technologies, such as those with basement membrane dystrophies. Additionally, the psychological effect of the message *all laser, no blade* has an impact on some patients. However, considering the equivalent performance of the two technologies, the cost of the femtosecond laser is disproportionately high for it to become the preferred method of choice in a majority of our uncomplicated LASIK cases.

TAKE-HOME MESSAGE

- With the appropriate use of nomograms and a variety of mechanical microkeratome blades, flaps are predictable and of the desired thickness and shape.
- The primary advantage of the femtosecond laser for LASIK flap creation is the freedom to customize the flap for each individual eye.

Maja Bohac, MD, practices with Svjetlost Eye Clinic, Zagreb, Croatia. Dr. Bohac states that she has no financial interest in the products or companies mentioned. She may be reached at e-mail: maja.bohac@svjetlost.hr.

Advantages of the Femtosecond Laser: Freedom to Choose

By Christopher L. Blanton, MD

The primary advantage of the femtosecond laser for LASIK flap creation is the freedom to customize the flap for each individual eye. Numerous parameters can be adjusted, but in this article I focus on five specific concepts: diameter, depth, sidecut, shape, and raster pattern.

Diameter. The diameter of the LASIK flap can be adjusted to precisely match the ablation bed, independent of corneal curvature. The surgeon simply selects the diameter of choice, with the obvious advantage of making larger flaps for hyperopic patients. Microkeratome suction rings also have different diameters; however, because the size choices are limited and flap dimensions are at the mercy of the patient's corneal curvature, imprecise diameters can result. The larger hinge angle created by microkeratomes also further limits the size of the stromal bed.

Depth. The ability to make very thin flaps has created a huge safety advantage with regard to the prevention of ectasia. Some microkeratomes have recently demonstrated improvement in this regard, but they have not reached the level of precision that is currently available with the femtosecond laser. Surgeons can routinely make 100-µm flaps with a standard deviation of approximately 10 µm using the femtosecond laser.

Sidecut. Some lasers, for instance the Intralase iFS system (Abbott Medical Optics Inc.), are capable of creating a bevel-in flap edge, allowing the surgeon to essentially tuck the flap into position. This creates a stronger, safer flap (Figure 2; eyetube.net/?v=bisib).[1,2] The meniscus flaps created by microkeratomes, by contrast, are capable of slippage.

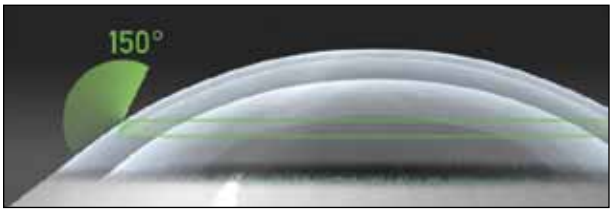

Figure 2. A bevel-in flap edge allows the LASIK flap to be tucked into position.

Courtesy of Abbott Medical Optics Inc.

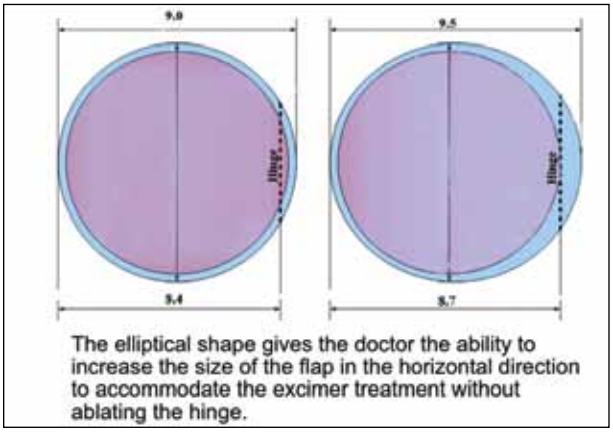

Figure 3. An elliptical flap shape creates a larger stromal bed.

Shape. Another significant advantage of the femtosecond laser is the capability to create an elliptical flap. This flap shape allows the surgeon to push the hinge peripherally, thus obtaining a larger stromal bed, which is useful for hyperopic patients and for corneas that have with-the-rule astigmatism (Figure 3). Unfortunately, microkeratomes have no way of accomplishing this.

Raster pattern. Finally, the raster pattern can be customized in so many ways that it requires detailed description. First, the spot-line separation can be adjusted not only to affect the ease of flap lift (video available at eyetube.net/?v=semil) but also to create a speedier flap. The beauty of this capability is that the surgeon can choose whichever quality he or she finds most important for each particular patient and eye. Energy levels can also be adjusted to create an easier flap lift. Additionally, this parameter might be adjusted to decrease the amount of energy applied to the eye, potentially reducing inflammation. The fact that the flap and stromal bed are created by plasma formation from laser-induced photodisruption instead of a blade adds a level of safety.

CONCLUSION

The comparison of LASIK flap creation with a femtosecond laser versus a microkeratome reveals that the laser allows a greater degree of freedom, making this device superior to bladed technology. Each eye is as individual as a fingerprint, and the ability to precisely adjust so many features means safer procedures with significantly better outcomes. Surgeons and patients alike should appreciate the liberty to choose the best highly customized flap for each case. ■

WATCH IT NOW AT EYETUBE.NET

Using your smartphone, photograph the QR code to watch the video on Eyetube. If you do not have a QR reader on your phone, you can download one at www.getscanlife.com.

flap creation with the iFS:
eyetube.net/?v=bisib

flap lift with the iFS:
eyetube.net/?v=semil

Christopher L. Blanton, MD, is the President and CEO of Inland Eye Institute, Ontario, California. Dr. Blanton states that he is a paid consultant to Abbott Medical Optics Inc., and Allergan, Inc. He may be reached at e-mail: blanton007@aol.com.

1. Knorz MC, Vossmerbaeumer, U. Comparison of flap adhesion using the AMADEUS microkeratome and the Intralase iFS femtosecond laser in rabbits. *J Refract Surg*. 2008;24(9):875-878.
2. Knox Cartwright NE. Sub-Bowman keratomileusis versus conventional LASIK. Paper presented at: the American Society of Cataract and Refractive Surgery; April 6, 2008; Chicago.

Weigh in on this topic now!

To take this survey online, using your smartphone, photograph the QR code. If you do not have a QR reader on your phone, you can download one at **www.getscanlife.com.** Alternatively, to take the survey you can visit **research.net/s/CRSTEuro5**.

1. In what percentage of cases do you use the mechanical microkeratome for flap creation?
- ☐ 0%
- ☐ 1% to 20%
- ☐ 21% to 50%
- ☐ 51% to 75%
- ☐ 76% to 99%
- ☐ 100%

2. In what percentage of cases do you use the femtosecond laser for flap creation?
- ☐ 0%
- ☐ 1% to 20%
- ☐ 21% to 50%
- ☐ 51% to 75%
- ☐ 76% to 99%
- ☐ 100%