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One surgeon's perspective

Surgeons may put down the blade for femtosecond laser

Laser offers versatility to program flap thickness and flexibility for manipulating hinge position

By Cheryl Guttman
Reviewed by William W. Culbertson, MD

Miami—Versatility, predictability, and safety are the top three reasons why LASIK surgeons should consider switching from a mechanical microkeratome to the femtosecond laser (IntraLase Corp.) for flap creation, said William W. Culbertson, MD.


Dr. Culbertson

"Using the femtosecond laser has taken the negative excitement out of LASIK and put the fun back in," said Dr. Culbertson, professor of ophthalmology, Bascom Palmer Eye Institute, University of Miami School of Medicine, Miami. "Just as we gave away our Graefe knives for phacoemulsification and RK blades for the excimer laser, I think more and more surgeons will be giving up their blade microkeratomes for the femtosecond laser."

In defending his perspective that the femtosecond laser is a better choice, Dr. Culbertson began with a review of the challenges associated with mechanical microkeratomes. The drawbacks include those relating to blade translation, e.g., abrasions, overhydration of the interface, and creation of buttonholes and irregular and incomplete flaps. The second and third relate to inconsistencies in flap geometry and dimensions.

"The flap thickness depends on the blade-to-plate gap; and as the blade goes across the cornea, there can be thicker or thinner areas and creation of meniscus-shaped flaps," Dr. Culbertson said. "With the mechanical microkeratomes there also are risks of creating flaps that are too small or with hinges that are too short, too long, or completely severed."

Take-Home Message

The femtosecond laser (IntraLase Corp.) is the preferred tool for LASIK flap creation because it has many advantages compared with mechanical microkeratomes, according to William W. Culbertson, MD. He cites its versatility in selecting flap thickness, diameter, and hinge characteristics, as well as predictability and dependability for avoiding serious complications.

Evaluation of flaps using high-frequency ultrasound demonstrates that flaps created with a mechanical microkeratome have a meniscus shape (thinner in the center than in the periphery) while the femtosecond laser-created flaps are planar (uniformly thick from side to side).

In addition, there are differences in edge shape and thickness between the flaps. The femtosecond laser flaps have thinner, more vertical edges compared with the thicker, more beveled edges of flaps made with the mechanical microkeratomes.

> One of the major advantages of the femtosecond laser is the versatility to program flap thickness across a wide range.

"This difference has important implications because the femtosecond laser flap fits more tightly when replaced, like a manhole cover," Dr. Culbertson said. "Furthermore, based on the meniscus shape of the flap, the mechanical microkeratome could be expected to cut more collagen fibers in the periphery than the femtosecond laser. With unpredictability factored in, there is a real possibility of going quite deep in the periphery, and Jose Barraquer, MD, showed us 45 years ago that there is a risk for ectasia with increased flap thickness."

He added, by cutting deeper in the periphery, the mechanical microkeratome also may sever more sensory nerves and potentially therefore lead to more problems with dry eye.

One of the major advantages of the femtosecond laser is that it offers surgeons the versatility to program flap thickness across a wide range and the assurance of achieving predictable results.

"The standard deviation of mean flap thickness in the femtosecond laser studies generally ranges between 10 and 15 µm, and the overall range is also fairly tight," Dr. Culbertson said. "Similar results have been reported for some mechanical microkeratomes, but the average standard deviation is closer to 24 µm."

Using the femtosecond laser, flap diameter can be easily varied, and it has been shown by Perry S. Binder, MD, of San Diego, that flap diameter is independent of corneal topography when using the femtosecond laser.

"That is not true with the blade microkeratomes," Dr. Culbertson said.

Flexibility

The femtosecond laser also offers flexibility for manipulating hinge position to be superior, temporal, or nasal depending on the surgeon's preference or tailored to the patient. In addition, flap centration can be manipulated to be concentric to an eccentric pupil.

Both mechanical and the femtosecond laser microkeratomes produce flaps with smooth interfaces. Comparisons of visual outcomes after LASIK procedures performed with the two devices show the proportion of eyes achieving 20/20 uncorrected visual acuity is similar on the first day after surgery with either device and as good or better with the femtosecond laser at later assessment intervals.

Dr. Culbertson acknowledged problems can occur using the femtosecond laser, but added those problems are minor. They include creation of unliftable flaps, which are torn at edges, or gas bubbles, as well as the development of interface keratitis at the side-cut area or the good acuity photophobia syndrome, which can last for a few weeks. In addition, the femtosecond laser procedure costs more and takes more time.

"The latter disadvantages are offset by the avoidance of side effects and serious complications," Dr. Culbertson said. "With the femtosecond laser you don't get epithelial abrasions, irregular mangled flaps, buttonholes, or incomplete flaps; there is a lower incidence of postoperative striae and epithelial ingrowth; and there is no unexpected hyperopic shift due to flap creation or ectasia if the flap turns out thicker than planned." OT

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