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Considering femtosecond lasers and microkeratomes

by Matt Young EyeWorld Staff Writer

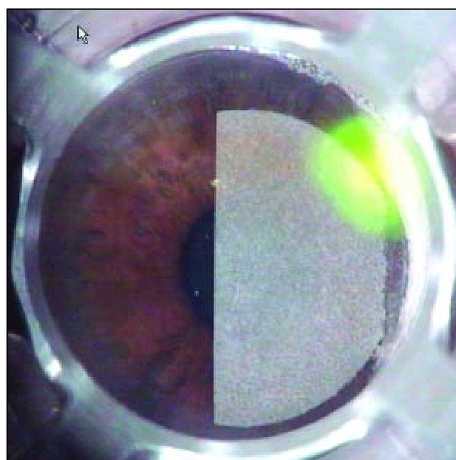
Surgeons consider the pros and cons of both technologies

As the IntraLase FS laser (IntraLase Corp., Irvine, Calif.) and the microkeratomes continue to evolve, both still have many advantages and drawbacks that should be considered when choosing the best flap cutter for your practice.

Regarded by some as the emerging gold-standard of flap cutting, the femtosecond laser, approved as IntraLase in the United States, is heralded by proponents first and foremost for its safety profile, which should be the first consideration for any surgeon.

During the cutting procedure, IntraLase has the ability to avoid buttonholes and free flaps, which have been traditional concerns about microkeratomes. Some proponents also say that because flap cutting can be digitally programmed with IntraLase, it leads to better predictability, which is essential in borderline safe cases, such as when patients have thin corneas. The technology's advocates also note that flaps with IntraLase also may lead to faster visual recovery and better contrast sensitivity.

Microkeratome loyalists



IntraLase procedure using the 30 KHz engine and pocket software on a left eye.
Source: Perry S. Binder, M.D.

However, others say that they would never switch from a microkeratome because they are perfectly content with their results, which are getting better and better with the latest generation devices. Not only are they avoiding buttonholes like never before, but they also are achieving small flap thickness standard deviations.

Furthermore, microkeratome proponents say while their results are equivalent to IntraLase's, their per-procedure and microkeratome purchase costs are much lower.

While microkeratomes have become more sophisticated, so is IntraLase, ramping up on speed and decreasing its own complication set, making your flap-cutting choice a difficult one, but easier with this in-depth comparison.

That leaves some practitioners wondering which they should choose—microkeratomes or femtosecond lasers. Here's a look at some practitioners personal experiences—and preferences.

A faster, better femtosecond

When the IntraLase FS laser was first released, it used a 10 kHz engine, which made a flap in 95 seconds, said **Perry Binder, M.D.**, associate clinical professor at the University of California, San Diego, and co-medical director for IntraLase.

But IntraLase continued to make engine upgrades to the laser, releasing a 15 kHz laser, which made a cut in 57 seconds, a 30 kHz laser, which made a cut in 38 seconds, and now, the company is poised to release even higher kHz laser, he said.

The latest engine, which Dr. Binder said is 60 kHz, makes a flap in 18 to 20 seconds and is substantially faster than all previous incarnations.

The result is that less energy is required for such procedures with faster engines, Dr. Binder said.

"If you decrease energy going into the eye, you eliminate energy-related problems," Dr. Binder said. For instance, he said, the higher kHz engines appear to have elimi-

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nated the earlier problem of Transient Light Syndrome (TLS).

That and other laser improvements have convinced more and more surgeons to adopt technology. IntraLase placed 156 new lasers worldwide for the 2005 fiscal year, increasing the company's total installed laser base to 371.

Edward J. Holland, M.D., clinical professor of ophthalmology, University of Cincinnati, and **Eric D. Donnenfeld, M.D.**, Ophthalmic Consultants of Long Island, N.Y., plan to join the ranks of IntraLase users soon.

"If you can customize the size and thickness of the flap, definitely there's an advantage," Dr. Holland said. "It's more predictable, especially in patients with thin corneas."

Dr. Donnenfeld added, "The worst fear of refractive surgeons is having a poor flap formation." IntraLase solves that problem and surgeons are starting to see better corneal beds with the technology, he said.

Steven C. Schallhorn, M.D., director of cornea services, Naval Medical Center, San Diego, said he believes a femtosecond laser will become the industry standard for flap cutting.

In a study presented at a recent ASCRS•ASOA Symposium & Congress, Dr. Schallhorn reported that in 100 eyes treated with IntraLase versus 99 eyes treated with microkeratomes, both photopic 5% and mesopic 25% contrast acuity were significantly better in the femtosecond group at one and three months post-op, and visual recovery also was faster. He plans to publish the results in a peer-reviewed journal.

IntraLase still has some kinks that need to be worked out.

"If you make a thin flap and you had any previous defects, the gasses can break through the flap thickness through those holes and interfere with the incoming laser beam so you don't get a cut," Dr. Binder said. "If that happens you have to wait for day or two and come back and make a cut deeper about 40-50 microns. It's a delay, but not the end of the world."

The IntraLase also costs $425,000 and per-procedure fees are about $160 per eye, company officials said. That makes the laser far pricier than using microkeratomes, which according to Schallhorn, generally cost $60,000 to $70,000 to purchase and $60 to $70 per blade.

Some surgeons report that the drawbacks of IntraLase leave them feeling the cost/benefit ratio of microkeratomes are better for a few reasons: their cost advantage, the inability to produce buttonholes with the latest devices, their better understood complication set, and a study showing comparable results between the technologies.

Other surgeons said that the cost of the IntraLase is well worth the price when you consider the added safety and reliability of the technology.

But because no study is definitive about which technology is better, it's important to listen to surgeon experience.

The cost/benefit advantage of microkeratomes

Unlike IntraLase proponents, microkeratome advocates often call the technologies' results comparable. Their arguments to stick with blades hinge upon studies and personal experience that show in their hands, microkeratomes provide equivalent results and are cheaper, so why buy an IntraLase? They also point to a unique set of complications with IntraLase and a better understood set of complications with the microkeratome as reasons for sticking with tried-and-true blades.

One of the leading studies microkeratome advocates call on to back their arguments is the Tan Tock Seng Hospital (TTSH) Eye Flap Study, which was supported by Bausch & Lomb (Rochester, NY).

According to the TTSH study, the XP achieved equivalent standard deviation in flap thickness compared to the femtosecond laser. The standard deviation was 16.1 microns (US) and 14.4 microns (OCP) with the XP versus 16.2 microns (US) and 15.9 microns (OCP) with the IntraLase.

"Basically the results from a clinical perspective were no different," said **Scott MacRae, M.D.**, professor of ophthalmology, professor of visual science, University of Rochester Medical Center, Rochester, N.Y.

While other study results have favored IntraLase in terms of inducing fewer higher-order aberrations and other advantages, Dr. MacRae said differences have not been significant enough for patients to notice visually. One exception might be patients who need immediate visual recovery, Dr. MacRae said, pointing to results by the Schallhorn study.

"If you are a Navy pilot and getting back to the aircraft carrier in a week, it's worth [extra money] to use IntraLase," Dr. MacRae said. "But for the average person it's of marginal visual benefit."

But Schallhorn, who works directly with Navy pilots, disagreed. He said all future patients should benefit from femtosecond flap precision. If a surgeon creates predictable, thin flaps, their patients get all the advantages of LASIK's fast visual recovery and approach the safety levels of PRK.

Achieving flap precision

Like IntraLase proponents, Dr. MacRae sees value in thinner, more precise flaps, but he thinks those also can be made with the latest microkeratomes.

"The more you drive down standard deviation, the more flexibility you have in terms of reducing flap thickness and getting a more predictable result," Dr. MacRae said. But both the IntraLase and microkeratomes can achieve thinner, more precise flaps, he said. His buttonhole rate with microkeratomes is only about one in 10,000, he said. Meanwhile, a buttonhole also can be created during the flap lift process after IntraLase, he said. His flap thickness standard deviation also is about 13 microns, which leads to a very low defect rate, he said.

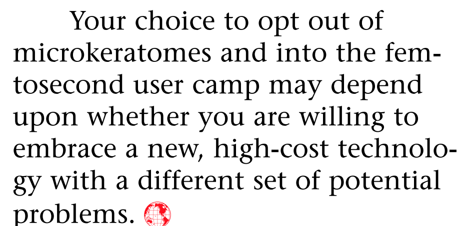
"It seems to be almost impossible to produce buttonhole with the Zyoptix XP (B&L) microkeratome," said **Robert K. Maloney, M.D.**, director, Maloney Vision Institute, Los Angeles. Dr. Maloney said his patients, who were treated with the XP, haven't experienced buttonholes in the last six months. Even more impressive, he said he couldn't even produce a buttonhole when he deliberately tried to do so.

"I tried to create a buttonhole in an eye bank by lowering the pressure in the eye to zero," Dr. Maloney said. Because there was no pressure in the eye, the microkeratome should have produced a buttonhole, but it did not.

But the mechanical microkeratome has a limited number of different suction ring diameters, which give different diameter flaps, and a limited number of different heads, which give different thickness flaps, so it can not provide the vast number of flap diameters and thicknesses (which the IntraLase can) that would allow for truly customized flaps, said **Daniel S. Durrie, M.D.,** Durrie Vision, Overland Park, Kan.

"Eventually, people will take pachymetry readings, probably measure the corneal diameter, identify the visual axis, do a perfect-size perfect-thickness perfect-location flap to get the best visual and biomechanical results," which will best be done with IntraLase, he said.

In the end, most experienced LASIK surgeons have used microkeratomes and are familiar with them (although newer microkeratomes appear to have better results).



Your choice to opt out of microkeratomes and into the femtosecond user camp may depend upon whether you are willing to embrace a new, high-cost technology with a different set of potential problems.

Editors' note: Dr. Binder is co-medical director of IntraLase. Dr. Donnenfeld is a consultant for Bausch & Lomb and Advanced Medical Optics. Dr. Durrie is a clinical investigator for IntraLase. Dr. Holland has no financial interests related to his comments. Drs. MacRae and Maloney are consultants for Bausch & Lomb. Dr. Schallhorn has no financial interests related to his comments.

Contact Information

Binder: 858-455-6800, garrett23@aol.com
Donnenfeld: 516-766-2519, eddoph@aol.com
Durrie: 913-491-3330, ddurrie@durrievision.com
Holland: 859-331-9000, eholland@fuse.net
MacRae: 585-341-7817, Scott_macrae@urmc.rochester.edu
Maloney: 310-208-3937, drmaloney@maloneyvision.com
Schallhorn: 619-532-6702, scschallhorn@nmcsd.med.navy.mil