ASCRS EyeWorld
The Newsmagazine of the American Society of Cataract & Refractive Surgery
STORM EYE/ASCRS Clinical Update
June 1-4, 2006



**OPINIONS AND COMMENTARY**

# A case for individualized, precise cuts

**by Mike P. Holzer, M.D.**

*Focusing on the Femtec Femtosecond Laser*

**F**emtosecond laser technology now allows surgeons to perform many different procedures and make more precise cuts than ever before.

The IntraLase (IntraLase Corp, Irvine, Calif.) was the first femtosecond laser available. Now, surgeons can use the Femtec femtosecond laser (20/10 Perfect Vision, Heidelberg, Germany) to perform everything from penetrating keratoplasty (PKP) to astigmatic keratotomy (AK).

While the Femtec laser is similar to the IntraLase, it does have some special characteristics including a patented patient interface, which mimics corneal curvature.

**The Femtec laser can be used to perform procedures such as penetrating keratoplasty, astigmatic kertatomy, creation of LASIK flaps, and more.**

**Source: Mike P. Holzer, M.D.**

As a result, the natural shape of the cornea can be maintained and less suction is needed when attaching the device to the eye than with the IntraLase. Because there is less suction on the eye, there is also less pressure inside the eye during the procedure. As a result, patients no longer experience vision blackouts during a procedure.

## Cutting flaps

In other respects, the Femtec creates flaps in much the same way as they are made by the IntraLase. The Femtec laser uses cavitation spots within the stroma to cleave the flap plane.

We found the cuts to be very precise. We recently studied the accuracy of the Femtec in cutting laser flaps and compared this to thicknesses achieved with mechanical microkeratomes. While the thickness of more than 1600 LASIK flaps showed a range of standard deviations between 15 and 30 microns, depending upon the flap thickness, pre-op corneal pachymetry and microkeratome used. Meanwhile, the Femtec showed a standard deviation of approximately 10 microns.

Another advantage the Femtec has over mechanical microkeratomes is the ability to individualize each LASIK procedure and chose between any hinge position, flap diameter and thickness. This can be particularly important in cases with thin corneas where the Femtec laser allows cutting of thinner flaps and helps to avoid post-op complications like corneal ectasia.

## Penetrating keratoplasty

One technique that we believe holds promise with the laser is penetrating keratoplasty. With this technology practitioners can not only attain a precise cut that is perpendicular to the surface, they can also choose the angulation of the cut.
The cuts are computer controlled, so surgeons can choose the size and shape of the cuts. They could, for example, make triangular cuts. Or, if a patient has a scar, the surgeon can cut that specific part of the cornea. By contrast with a traditional trephine you are limited to the predefined diameter of the device.
While initially it was only possible to cut 300 microns into the cornea at a time, the laser has subsequently been programmed to go much deeper. It is now possible to cut up to 1,200 microns deep with the Femtec laser.
We recently studied the histopathology of these cuts in five PKP patients. In both the donor tissue and the recipient's cornea, the incisions were made with the Femtec laser.
We found that there were no changes in the corneal stroma— there was no laser-induced damage of the corneal tissue. Both the angulation of the incisions and the thickness of the excised cornea were also very precise. Patients also enjoyed good rehabilitation after the procedure.

## Other possibilities

Another technique that we have found promising with the Femtec laser is intrastromal corneal tunnel preparation for intracorneal ring segments in keratoconus patients. It is possible with the laser to precisely control tunnel creation, for example dialing in the exact depth of the tunnel on the laser.
By contrast the conventional approach is much more surgeon dependent. Because practitioners can rely on the computer to be accurate, it is possible for example to cut closer to the limbus if necessary. For example, if the cornea is very thin, with the Femtec laser you can press the limits while with the mechanical system you need to be more cautious not to perforate the cornea. It takes less than one minute to prepare a tunnel with the Femtec laser, the rings can be easily inserted and then the tunnel closed with just one suture.
We have found that it is also possible to make AK incisions using the Femtec laser. Once you have precisely connected the eye to the laser it remains stationary. As a result, the incision can be placed exactly where you would like and using the computer can calculate exactly how long you would like to make the incision. The procedure is much less surgeon dependent and more reliable as a result.
Overall, I think that the Femtec's ability to precisely cut corneal tissue and to individualize those cuts is a big advantage in creating LASIK flaps. With mechanical microkeratomes by contrast, you have mostly just two diameters and two flap thicknesses from which to choose.
Also, for PKP on the horizon, I think that it will be interesting to see if cuts can be angulated with the Femtec laser, or perhaps whether cuts with edges can be made. For example, if the donor tissue fits better on the cornea it may be possible to remove stitches earlier and ultimately to improve results.

## ABOUT THE AUTHOR

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