

Why the Femtosecond Laser?

I believe this technology aids in achieving increased safety and greater precision.

BY MARK TOMALLA, MD

We have been routinely using the Femtec femtosecond laser (20/10 Perfect Vision AG, Heidelberg, Germany) at the Clinic for Refractive and Ophthalmology in Duisburg, Germany, since 2004. We have used this innovative technology—since its conception—for various approved indications such as lamellar and perforating keratoplasty, astigmatic keratotomy, implantation of intracorneal ring segments in the treatment of progressive keratoconus,^{1,2} and flap preparation prior to LASIK.

Currently, we are working with the modern 40-kHz version of the Femtec. The patented spherical patient interface of the laser means that only moderate suction energy is required. The intervention itself is made with minimum applanation to respect the anatomical structures and avoid visual blackout during the surgery. Therefore, procedures are considerably less stressful and spare the endothelium.

Compared with mechanical microkeratomes, use of the femtosecond laser in flap preparation enables greater precision of the intended flap depth, with considerably lower standard deviation.^{3,4} The flap can also be individually adapted for each LASIK procedure; the hinge position, flap diameter, and thickness can be selected as needed. The use of the femtosecond laser is especially advantageous in thin corneas. Because the cornea is flattened to approximately 35.00 D, we can incise more safely even in cases of greater astigmatism. The incision is made under complete visual control and, if necessary, may be interrupted at any time.

The following case, in which we decided to perform a

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two-step intervention, is exemplary for our procedure. After cataract surgery, a 68-year-old patient had a refraction of $+1.0-4.0/35^\circ = 0.63$. Pachymetric measurement showed $569 \mu\text{m}$ at the thinnest point.

As a parameter for flap preparation, we selected a diameter of 8.5 mm with superior hinge position, a flap thickness of $140 \mu\text{m}$, and a cutting angle of 90° . The entire intervention with the femtosecond laser lasted approximately 45 seconds. I have found that the exact cutting angle considerably facilitates repositioning of the flap.

We performed the LASIK itself as a second operation, because we have observed that in patients with greater astigmatism, less tissue must be ablated in a two-step surgical procedure. Tension can be removed from the cornea by the flap incision alone. As soon as the value is stable, LASIK is performed in a second session.

One day postoperatively, the patient's vision was identical to the preoperative value. In addition, we measured a reduction in astigmatism. Preoperatively, the astigmatism was 3.50 D, and 4 weeks postoperatively, the astigmatism was 3.25 D. Immediately after LASIK was performed, the patient's refraction was $-0.25 = 0.80$. This

value remains stable 12 months postoperatively.

We now routinely perform femto-LASIK in Duisburg. We consider the greater precision in flap preparation and the possibility of an individualized intervention to be important advantages over a mechanical microkeratome. We also believe that oval flap forms could be used in future astigmatism cases. Additionally, the surgeon could create an intrastromal pouch, comparable to preparation of an implantation tunnel for intracorneal ring segments in the treatment of progressive keratoconus, in which intracorneal inlays can be reversibly implanted.

Although this precise, innovative, and versatile femtosecond technology has its price, we believe that it will replace the mechanical microkeratome in the foreseeable future. Because the aim of refractive laser correction is to further increase safety and precision in corneal

surgery, femtosecond laser technology is a step toward achieving this aim. ■

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