MO RE precise flap creation, faster performance and an ability to deliver even smoother stromal beds are among the defining characteristics of the current generation of femtosecond lasers, according to researchers.

Speaking at a special session on femtosecond lasers held during the ESCRS W inter Refractive Meeting Perry S Binder MD said that the increased speed and decreased energy of the latest 60 kHz femtosecond laser (IntraLase FS, IntraLase Corp.) produces a smoother surface compared to LASIK flaps generated by 4th generation mechanical keratomes, added Dr Binder. "There is agreement that creating smoother stromal beds is the way forward, so we wanted to see how we could achieve this without compromising on the speed of the procedure. When the Femtosecond laser ablations are placed closer together it takes longer to create a given flap diameter. So we needed to develop a faster engine to achieve similar flap creation times because closer spot sizes translates into smoother surfaces," he said.

With its latest upgrade, which comes less than one year after the introduction of the FS30 30kHz system, IntraLase has sought to address one of the key concerns of eye surgeons relating to the longer time required to create a flap using the femtosecond laser. The new system can create 90um diameter LASIK flaps in 15-20 seconds, compared to 45 seconds or more with the 15kHz model, bringing it more into line with mechanical keratomes.

Dr Binder, who serves as co-medical director for IntraLase, and colleagues performed a scanning electron microscopic study comparing the stromal bed after IntraLase flap creation versus the stromal bed after Zyoptik XP microkeratome (Bausch & Lomb) flap creation. Intended flap thickness in the femtosecond eyes was 110um, and 120um in the microkeratome eyes using the 9.5mm ring. New blades were used for each microkeratome cut. The femtosecond spot/line size was 6x6um and the raster energy was 0.7 or 0.8µ. Three masked observers and a computerised quantitative surface analysis determined that the IntraLase stromal bed was significantly smoother than that produced by the microkeratome, he said.

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Dr Binder noted that a comparison of results for the 60 kHz laser versus those for the earlier 15 kHz and 30 kHz iterations showed a slight improvement in smoothness for the latest model due to the closer Femtosecond laser spots and raster lines used in this study. Also of interest, he said, was the fact that there was no opaque bubble layer observed in this series.

"Some surgeons prefer to wait for the opaque bubble layer to dissipate before proceeding with the ablation, but with the increased speed and reduced energy of the 60 kHz laser this is far less likely to create significant opaque bubble layers," he said.

Dr Binder said that the IntraLase FS60 was clearly a significant improvement on earlier versions of the technology. "What this study demonstrates is that by having an engine that can place spots and lines closer together and not increase the procedure time that you can have a much smoother surface, which translates into easier flap lifts and more rapid recovery of visual acuity," he said.

Easier for treating irregular corneas

A slightly different perspective on the pros and cons of using the IntraLase FS60 was offered by Andromachi Frangouli MSc MOICOptom, who cited an ability to treat more irregular and thinner corneas as among the more notable advantages of the femtosecond laser.

"One of the best aspects of this technology is that we could treat flatter, steeper and thinner corneas. The main disadvantages from the surgeon’s point of view are the fact that the suction is manual and it is a slightly slower procedure than with a mechanical keratome. However, from the patients' perspective they seem more comfortable with the technique of the femtosecond flap formation than with a mechanical blade. It is possible that this was due to the fact that it was the first week of our experience with the Femtosecond laser," she said.

In a retrospective study carried out by Andromachi Frangouli and her co-worker Dr O urania Frangouli, MD MRCOphth at 0 ptmax Laser Eye Clinics in Manchester, the refractive and complication results of 153 myopic (72 Femto & 81 Moria) and 39 hyperopic (11 Femto & 28 Moria) eyes treated with the Femtosecond laser for LASIK were compared to routine LASIK using a Moria microkeratome.

The study showed no statistically significant difference in uncorrected and best-corrected visual acuity outcomes between the IntraLase and Moria groups after three months' follow-up. There was also no statistically significant difference in the postoperative Mean Sphere Equivalent between the two groups both for myopic and hyperopic eyes.

In terms of complications, Dr Frangouli said there seemed to be a slightly increased incidence of dry eye in the femtosecond laser group, 24 per cent for the femto group compared to 12 per cent for the Moria group. There were also seven cases of loss of suction with the IntraLase, which were subsequently converted to uncomplicated Moria procedure. She also reported two cases of significant interface haze in the femtosecond group. There were seven retreatments in the IntraLase group and five in the Moria group, although Dr Frangouli noted that six of the IntraLase retreatments were attributed to central islands rather than problems with the laser per se.

Interface debris, of no clinical significance was also reported in the femtosecond laser group (16.7 per cent).

Other points of interest, she said, included the incidence of small bubbles on the limbus, conjunctiva and the hinge that resolved one day postoperatively, plus the fact that the flap edge seemed more pronounced in the femtosecond group.

"We also have a thinner flap with the IntraLase and therefore more likelihood of it dislocating and we would recommend securing it with a bandage contact lens," she added.

Dealing with opaque bubbles

The issue of bubbles in the stromal bed was also raised in a separate presentation by Sukumaran Ramanathan MD.

"In the first few cases, I found that iris recognition was a bit difficult because of the bubbles to the stroma. For that reason I decided to switch over to doing iris recognition before the flap cut," he said.

Dr Ramanathan presented a retrospective evaluation of the first 50 consecutive procedures of 27 patients carried out at the Ultralase Eye Clinic, Reading, U.K. The IntraLase FS60 was used to create the flap for LASIK and the Technolas 217/100Hz was used for wavefront-guided ablation with iris recognition in all cases.

In terms of visual outcomes, 43 eyes were within 0.50 D of their target correction (86 per cent) and 48 eyes (96 per cent) were within 1.0 D. A total of 35 eyes (70 per cent) had an uncorrected visual acuity of 6/6 or better, and 47 scored 6/12 or better (94 per cent). All eyes recorded best-corrected visual acuity of 6/12 or better.

Adverse events included epithelial abrasions in two eyes and severe photophobia in one patient. "This happened about seven days after the treatment and she had to take time off work for three days until that settled. We gave her topical corticosteroid drops which quickly resolved the situation but it was quite disabling for her," he said.

Dr Ramanathan also cited problems with interface debris in six eyes, one of which required a flap lift and wash out.

He emphasised, however, that such complications occur in only a small number of cases and his overall clinical experience with the femtosecond laser indicates that it is safe and reliable tool for creating LASK flags.

garrett23@eol.com
afangoulis@hotmail.com
ramanathan@atworld.com

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The procedure is continuing to evolve. The procedure is safest and most effective for patients who require corrections of no more than 5 D, he said. For corrections within 5 D, 76 per cent to 98 per cent of patients have results within 1 D of the goal. By contrast, for corrections of more than 5 D, only 59 per cent to 90 per cent have comparable results. In addition, the loss of two or more lines of BSCVA occurs in just zero to two per cent of patients undergoing corrections within 5 D, compared with seven per cent to 10 per cent of patients undergoing corrections of more than 5 D.

Dr O’Brart emphasised that ophthalmologists who perform hyperopic LASIK should use a large optical zone – at least 7.0mm. This has been associated with improved outcomes, including better safety and efficacy, and fewer high-order aberrations. Surgeons should also factor in considerations such as age when deciding appropriate for plano presbyopes or very low hyperopes - less than 0.75 D - and could be preferable in those circumstances.

knorr@eyes.de
davidobrart@aol.com
ghenr@vision-institute.com