beam that impacts on it is correspondingly large and the thermal effect, therefore, probably negligible. The iris is different, however. Its grid-like structure would be virtually transparent if it were not for the pigmented epithelium that is able to protect the retina like a light-blocking curtain. The distance between the cornea and the pigment of the iris is significantly less. This does not eliminate the possibility that, in individual cases, heating-up of the iris tissue may occur which then results in uveitic irritation. Thermal conduction via the network of iris vessels does not function during the incision process, because the circulation of blood is interrupted. The pigmented epithelium absorbs the radiation completely and could correspondingly be heated up. Other clinical references of potential thermal damage, however, are not available. Consequently, treatment of TLS is simple and effective.

The latency time required with Femto-LASIK has completely changed the processes in our operating theatres

Increasing treatment time

The treatment time with Femto-LASIK is thought to be too long and, as a result, not without risk. Even with conventional LASIK using the mechanical microkeratome, the retinal circulation is interrupted as a result of the suction process. The time from the suction to the release of the vacuum, however, is relatively short at around 30 seconds. We document the entire docking time for all procedures involving the femtosecond laser and found that, on average, the duration of the period for which the retinal circulation is interrupted is 91 seconds (range 63 to 140 seconds). This is considerably longer than with conventional technology. With the intervening upgrade of the femtosecond laser from 15 kHz pulse frequency to 30 kHz, the docking time can now be reduced by around 15 to 20 seconds. We have not been able to observe any clinically detectable sequelae of this interruption to the circulation, and there are no references to such in the literature. Neurological damage is not very likely because, from clinical settings and experimental evidence, we know that the threshold of the revitalization time, even for the highly differentiated neurosensory tissue, is around three to five minutes of oxygen deprivation.

The introduction of the femtosecond laser in treatment processes involving LASIK has, regardless of the medical issues, brought with it a considerable number of disadvantages. The actual process involving Femto-LASIK is tissue dissection as a consequence of a cavitation bubble layer positioned intracorneally. With the 30 kHz version of the femtosecond laser, microtissue bridges, which can hamper the lifting of the flap, can be ignored. Nevertheless, it takes some time for the fine gas bubbles to diffuse out of the tissue. In worst-case scenarios, the fine gas bubbles can merge and form a white, opaque layer (OBL; opaque bubble layer). With the femtosecond laser, the surgeon should wait for at least 15 minutes after the 'incision' is made before the flap can be opened. By then, the gases will have diffused and the excimer laser can dock with the Eyetracker when the cornea is again transparent. The fine gas bubbles do not affect the ablation rate. We have, however, seen two extreme cases of OBL, in which the gas diffused via the iridocorneal angle into the anterior chamber and collected under the apex of the cornea. Laser ablation was only performed in this case on the following day.

Subsequently, the latency time required with Femto-LASIK has completely changed the processes in our operating theatres. We now treat two patients with the femtosecond laser at a time. The first is ablated after femtolasering of the second with the excimer laser. In the interim period, the second patient's cornea 'recovers'. It is a very complex procedure.

It must also be borne in mind that the femtosecond laser is significantly larger than the excimer laser. This could have implications on cost if a clinic must relocate in order to accommodate the larger laser. Further, the financial outlay for the service, with this sensitive, high-performance equipment, is higher than with the excimer laser.

We have, however, seen some progress made and steps taken towards addressing issues associated with the femtosecond laser when, at the 2005 American Academy of Ophthalmology (AAO) meeting in Chicago, a new generation of devices received their global premiere. A collaborative agreement between a German research centre (Laserzentrum Hannover e.V.) and a Swiss ophthalmological device manufacturer (Ziemer Group, Switzerland) has given birth to a compact femtosecond laser that produces much higher pulse rates and considerably less pulse energy with even shorter pulse times. 20/10 Perfect Vision GmbH is another German competitor in the field that harbours much potential. It remains to be seen, however, how these new systems will prove themselves in clinical practice.

Is it worth it?

The use of the femtosecond laser in LASIK is first and foremost a worthwhile investment in patient safety. From a cost-effectiveness perspective, its use is only justifiable if a correspondingly high volume of patients, i.e., at least 500 treatments a year, can be achieved. ■

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