



Michael C Knorz

Refractive surgeons review surface ablation pros, cons, and alternate solutions

Cheryl Guttman
in New Orleans

ALTHOUGH LASIK quickly rose to become the predominant method for laser vision correction after it was introduced, various factors subsequently fuelled a resurgence of interest in surface ablation techniques, and these procedures have regained popularity particularly among European refractive surgeons.

At a refractive surgery subspecialty meeting held during the annual meeting of the American Academy of Ophthalmology, leading ophthalmic surgeons debated the pros and cons of surface ablation.

Michael C Knorz MD, professor of ophthalmology, University of Heidelberg, Germany undertook the task of discussing the cons of surface ablation. Nonetheless, he emphasised that it remains a great tool that belongs in the refractive surgeon's armamentarium. However, its use should be limited to certain patients, said Dr Knorz.

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The disadvantages of surface ablation are underlined by comparing it to LASIK, as surface ablation is associated with more postoperative discomfort, a slower visual recovery, and worse efficacy and safety results. Any previous advantage of surface ablation for minimising induced higher order aberrations has also been eliminated with use of a femtosecond laser for flap creation, said Dr Knorz.

He cited a prospective study conducted by Daniel Durrie MD and Stephen Slade MD that compared wavefront-guided thin-flap LASIK (SBK with a femtosecond laser-created 100 micron, 8.5mm flap) and advanced surface ablation in fellow eyes of 50 bilaterally operated patients.

That study showed that at follow-up visits through the first month after surgery, the advanced surface ablation procedure was associated with more pain and lower patient satisfaction. Visual

outcomes were significantly better in the LASIK eyes on the first day after surgery and remained so through at least three months. In contrast to expectations, changes in higher order aberrations from baseline were similar in the two groups of eyes at six months.

Dr Knorz also referred to a meta-analysis undertaken by Shortt et al. that found surface ablation was associated with poorer efficacy and safety outcomes compared with LASIK. Published in *Ophthalmology* in 2006, the meta-analysis included data from prospective, randomised controlled studies comparing LASIK and PRK for treatment of myopia. The authors also reviewed prospective data from FDA case series of myopic LASIK and PRK and similarly concluded from those results that LASIK was a more effective and safer procedure.

In favour of surface ablation

Dimitri T Azar MD discussed the pros of surface ablation. He emphasised its safety advantages. Compared with LASIK, surface ablation avoids flap and microkeratome-related complications and minimises the risk of ectasia, said Dr Azar, professor and head of the department of ophthalmology, University of Illinois, Chicago.

"Understandably, ectasia is more likely to occur after LASIK because that procedure increases corneal weakening and decreases its biomechanical stability. Post-LASIK ectasia can occur after surgery in myopic patients, especially in eyes where keratoconus was not diagnosed pre-operatively, but there is also an increased risk after treatments involving thick flaps or deep ablations," he said.

Surface ablation can also be a viable alternative for treating higher levels of myopia if it is performed with mitomycin-C (MMC) for haze prophylaxis, and it may be a better alternative to phakic IOL implantation in certain situations. In particular, surface ablation might be considered for patients with shallow anterior chambers, low endothelial cell counts, a history of progressive endothelial cell loss, early cataracts, or high astigmatism, Dr Azar said.

"Over the next years, surgeons can expect to see continued evolution in the indications and boundaries for surface ablation," Dr Azar said.

SBK – best if both worlds?

John Marshall MD, professor of ophthalmology, Kings College, London, UK, reviewed the research that explains the problems of pain and haze after surface ablation procedures, the adverse effects of LASIK on corneal biodynamics, and the rationale for SBK. He explained that haze

after PRK is the result of interactions between cytokines released simultaneously from surgically injured epithelial cells and stromal keratocytes. While the newer surface ablation techniques of LASEK and epic-LASIK showed some benefit for controlling haze, they failed to completely eliminate it.

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"After LASEK and epi-LASIK, the epithelial cells still release cytokines, but there is an uncoupling between those mediators and the signals coming from the stromal keratocytes. Nevertheless, lifting of the epithelium in those surface ablation procedures leads to rupture of the hemidesmosomes on the basal border of the basal epithelial cells, no matter how much care surgeons take to leave the cells intact. These are cells that have been damaged and so will release cytokines that lead to haze," Dr Marshall explained.

He added that conceptually, LASEK could be a better procedure if the epithelial cells are killed when the flap is lifted and then replaced so that the tissue serves purely as a biological bandage.

By avoiding epithelial damage, LASIK mitigated the postoperative problems of haze and pain associated with surface ablation procedures. However, studies from Dr Marshall and his colleagues raised concern about its effect on corneal biomechanical stability. Recognising that the traditional LASIK flap cut through the cornea in its weakest areas both in terms of depth and eccentricity, studies were undertaken using sophisticated measurement techniques to investigate the effects of various flap features on corneal biodynamics.

Results from that research indicated benefits of thinner, narrower, and planar flaps. With the opportunity for reliable creation of such flaps using the femtosecond laser, the idea of SBK was born.

Findings from the study from Drs Durrie and Slade along with other

emerging data are suggesting that SBK may fulfil its promise of providing the biomechanical stability of PRK without its pain and haze. Larger and longer-term experience is needed to better define the efficacy and safety profile of SBK, according to Dr Marshall.

Dr Marshall suggested that biomechanical stability after SBK might be further increased by changing the edge angle of the flap so that it is more oblique. Surface ablation procedures may also be further improved using a technique Dr Marshall termed "pharmacologically modulated PRK" where novel modalities are used to control the wound healing process responsible for haze and pain.

He told attendees that research conducted to date indicates use of a simple sugar, mannose 6-phosphate, and aptamer technology represent two possible strategies. Mannose 6-phosphate blocks receptor sites on keratocytes and has been shown to prevent haze in testing in animal models. The aptamers are engineered to selectively differentiate between activated and latent keratocytes in order to allow targeted wound healing control.

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