TOPOGRAPHY-GUIDED ABLATION

Technique is suitable for many, but not all, cases of irregular astigmatism

by Roibeard O’Hineachain in Prague

Topography-guided corneal ablation is proving to be a useful technique for an increasing number of cases of irregular astigmatism, but there remain cases that require different approaches, said George D Kymionis MD, PhD, University of Crete, Heraklion, Crete, Greece.

“Topography-guided ablation differs from the more typical refraction-guided ablations in that they take corneal irregularities into account with the aim of providing the cornea with a more optically ideal shape.

“With refractive surgery using refraction-guided ablation, if you have a case with 5 D of myopia, you put the data into the excimer laser and the excimer laser would correct 5 D of myopia. With topography-guided ablation it’s not that simple. The topographer sends the topography data with all of the cornea’s irregularities to the excimer laser and the excimer laser ablates the cornea according to all of these irregularities,” Dr Kymionis explained.

Typical irregular astigmatism candidates for topography-guided ablation include patients with eccentric ablation and small optical zones after refractive surgery, patients with regular astigmatism after penetrating keratoplasty, trauma or keratitis, and patients with keratoconus, Dr Kymionis said.

In cases where the irregularity has resulted from previous LASIK, the usual technique is to re-lift the flap and perform a repeat procedure. In most other indications photorefractive keratotomy (PRK) with mitomycin-C is the procedure of choice, he added.

Case studies

To illustrate the benefits that topography-guided ablations can achieve, Dr Kymionis described several cases where the approach had resulted in improved refraction and visual quality.

For example, in one patient, previous refractive surgery had induced irregular astigmatism. A subsequent topography-guided ablation enlarged the cornea’s optical zone and thereby reduced all of the patient’s symptoms, including haloes and glare.

Another case Dr Kymionis described had bullous keratopathy following phacoemulsification. A Descemet’s-stripping automated endothelial keratoplasty procedure restored the endothelium, but there remained some residual irregular astigmatism because of a burn at the incision site.

“The phaco-burn induced a significant corneal flattening at the area of the incision, which caused 3.8 D of irregular astigmatism. After we performed the topography-guided ablation there was half a dioptre of irregular astigmatism,” Dr Kymionis said (see figure).

Modified technique for PRK Dr Kymionis noted that topography-guided PRK in irregular corneas requires a modified technique for removing the epithelium and applying mitomycin C.

He pointed out that in irregular corneas the epithelium acts as a masking agent with the result that epithelium thickness varies according to the amount of irregularity present. So, for example, in an eye with keratoconus the epithelium may be 50 microns thick over most of the cornea but only 30 microns over the apex of the cone.

“If you remove the epithelium with a mechanical brush or alcohol you cannot achieve good results. Therefore, my standard way to treat these patients is to remove the epithelium using PRK at 50 microns depth, with a seven millimetre optical zone,” he said.

Regarding the application of mitomycin-C, Dr Kymionis said that as most irregular corneas have undergone previous surgery, greater exposure to mitomycin-C may be necessary to exert adequate control over the healing process. He therefore recommended applying the agent to the cornea for two minutes at the end of the procedure.

Combining with cross-linking

Until recently, the great majority of corneal surgeons have regarded keratoconus and post-LASIK ectasia as contraindications for topography-guided ablations. The view was that it was unwise to remove tissue from an already weakened and thinned cornea. Therefore, implantation of intracorneal ring segments or deep anterior lamellar keratoplasty or penetrating keratoplasty were the preferred options in such cases, he said. However, the advent of corneal collagen cross-linking (CXL) has resulted in a new way of thinking of such cases, he noted.

“In these corneas we have two major problems. We have the irregular astigmatism that we can treat with topography-guided ablation and we have the problem of corneal instability that we can treat with CXL. If we combine both of them we can fix these corneas,” he said.

However, he cautioned that performing such ablations is inadvisable in keratoconic eyes with a preoperative thickness at the thinnest point of less than 450 microns.

Dr Kymionis noted that there remain some other types of irregular corneas that are also not amenable to topography-guided ablations. They include corneas less than 450 microns in thickness, for which intracorneal ring segments are a better option, and eyes with deep corneal scars which are best treated with deep anterior lamellar keratoplasty, he added.