ULTRA-THIN DSAEK

Hybrid endothelial keratoplasty technique safer than DMEK but has similar visual outcomes

by Roibeard O’Heineachain in Vienna

A n endothelial graft consisting of the endothelium, Descemet’s membrane, and an ultra-thin layer of stroma provides nearly the same visual acuity benefits as Descemet’s membrane endothelial keratoplasty (DMEK), but involves less difficulty in terms of donor tissue preparation and manipulation, according to Massimo Busin MD, Villa Serena Hospital, Forli, Italy.

“About half of my patients undergoing this procedure have 20/20 vision at six months, which scores well against DMEK. We don’t get hyperopization because the peripheral edge is very thin, and cylinder is negligible with the three millimetre incision we use. Furthermore, we don’t have a primary graft failure, and endothelial cell loss at one year is the same as with DSAEK,” Dr Busin told the XXIX Congress of the ESCR.

Dr Busin noted that Descemet’s stripping automated endothelial keratoplasty (DSAEK) is currently the gold standard for the treatment of endothelial disease. Since it leaves the anterior corneal surface unchanged, it does not result in the types of refractive errors that occur after penetrating keratoplasty (PKP). At most it will cause a slight hyperopic shift, due to the increased curvature of the cornea’s posterior surface, and a slight amount of astigmatism, due to the incisions made during surgery.

However, DSAEK has its limitations in that although best-corrected visual acuity of 20/40 or better occurs in up to 80 per cent of patients who have undergone the procedure, it is 20/20 or better in only around a third of patients at best. The loss of best-corrected visual acuity apparently results from the stroma-to-stroma interface.

DMEK’s disadvantages Better results have been reported for DMEK, a newer alternative procedure that uses only the donor endothelium and Descemet’s membrane for graft tissue. Notably, in a study by the procedure’s inventor, Gerrit Melles MD from the Netherlands, 45 per cent have achieved a BCVA of 20/20.

But DMEK also has its own drawbacks, he said. In fact, preparation and manipulation of the donor material is so difficult and unpredictable that up to 16 per cent of grafts may be lost before surgery and up to 63 per cent of DMEK procedures can have detachments, with up to eight per cent primary graft failure, Dr Busin said.

“The delivering and positioning as well as the attachment are the main surgical challenges with this technique. Those who prepare the tissue routinely come down to one-to-two per cent rate of tissue waste. With DSAEK the rate is practically zero. But detachment rate remains the main postoperative problem: many patients do experience one detachment and some of them even two or three detachments before the graft finally attaches properly,” he added.

Dr Busin and others have attempted to improve on results obtained with DMEK by including a ring of stroma on the periphery to aid in the handling of the tissue. However the technique remains highly complex and is particularly unsuited to more complicated cases.

“Not only are special surgical skills required for DMEK, it is a longer procedure and more complicated. It is also not suitable for a lot of eyes which would certainly benefit from a closed system approach like DSAEK and a DMEK would be, and that is the main problem with the technique,” Dr Busin said.

New technique provides best of both worlds To develop an epithelial graft that makes the preparation and handling of the donor tissue as easy as with DSAEK while providing the same optical clarity as DMEK Dr Busin looked to the analogy of a LASIK flap. DSAEK resembles LASIK in many respects since it involves the creation and placement of a flap-like piece of donor tissue and creates a stroma to stroma interface.

However, unlike DSAEK, LASIK results in 20/20 uncorrected visual acuity in the majority of patients.

The reason may be the thinness of the flap in LASIK. In addition, research has shown that DSAEK grafts less than 130 microns in thickness result in improved visual outcomes. Dr Busin therefore developed a technique for preparing ultrathin DSAEK graft material using a double-pass microkeratome approach.

“The technique of ultra-thin DSAEK differs from ordinary DSAEK in terms of graft preparation and graft delivery. I didn’t try to prepare the donor tissue with a single pass because if you cut with a wide slit the risk of perforation is high. The wider the slit of your microkeratome head the higher is the error. A 400 or 450 micron microkeratome head can cut 500-600 and then you perforate, so I came up with the two-pass procedure, first one cut with a 300 micron and the second cut based on the pachymetry that you find.”

Once the graft has been prepared it can be placed into a glide, which allows its insertion into the anterior chamber through a 3.0mm incision. Dr Busin noted that he uses the bimanual technique to insert the donor tissue, drawing it across the anterior chamber from the temporal side. Furthermore, if the graft is initially decentred it can easily be manoeuvred into place through the simple expedient of externally applying pressure to the appropriate region of the cornea.

“We get significantly thinner grafts with a double-pass technique that are easy to handle as with DSAEK. Furthermore, by starting the two cuts from opposite directions, the second cut is deeper exactly where the first cut was shallower. As a result, the risk of perforation is minimised and the final shape of the graft is planar. Visual recovery after UT-DSAEK is the same as after DMEK with a similar percentage of patients reaching 20/20. In addition, cell loss is the same as with DSAEK and you can barely tell the difference between the two on OCT,” Dr Busin concluded.