A n improved laser thermal keratoplasty technique known as optimal keratoplasty (Opti-K, NTK Enterprises) has shown promising initial results in delivering excellent near and distance vision for emmetropic and hyperopic presbyopes, according to Michael Berry PhD.

“Opti-K has been used to improve uncorrected near visual acuity in emmetropic presbyopes while retaining or even improving uncorrected distance visual acuity – a truly optimal result that is linked to corneal multifocality produced by optimal keratoplasty. It is also effective for hyperopic presbyopes,” Dr Berry told delegates attending the Aegaeon Cornea meeting.

Dr Berry said that the safety and effectiveness of Opti-K have been evaluated in a clinical study carried out by Dr Jonathan Rodgers in Nassau, Bahamas, and are also currently being evaluated in an ongoing trial in the US.

“With this technique, we have a totally safe, completely non-invasive procedure which I think Hippocrates the father of medicine would have appreciated in terms of the ‘do no harm’ maxim. It is simple, rapid and comfortable for the patient. The downside is that the effect is only temporary, but so too are patients’ prescriptions for eyeglasses in this age group which change with progressive loss of accommodation and progressive hyperopic shift,” he said.

While the technique has clear similarities with laser thermal keratoplasty and conductive keratoplasty, Dr Berry said that the key difference is that Opti-K is not limited to a one-off procedure.

“As far as we can tell, the technique is repeatable indefinitely. We have done so little to the cornea that we can come back time and again and just repeat whatever we have done initially. So we really hope that many physicians will prescribe this for their patients to give them rejuvenated vision. I think there is certainly a market for a totally non-invasive procedure as many patients simply do not want to have their eyes touched or otherwise probed or invaded,” he said.

Dr Berry explained that Opti-K offers surgeons an improved method of laser thermal keratoplasty that is performed using a continuous wave laser for anterior stromal heating together with a sapphire applanation window for epithelial protection.

Outlining the surgical steps, Dr Berry said that after administration of topical anaesthetic, the sapphire applanation window/suction ring (SAWSR) is positioned over the eye. The crosshair reticule on the sapphire window is used for centration on the pupil and suction is then applied with a pneumatic syringe in order to flatten the cornea. A handpiece is docked onto the SAWSR using pre-aligned permanent magnets. The handpiece contains 16 optical fibres that are pre-aligned in a pattern of two concentric rings with eight fibres per ring. The cornea is then irradiated by laser light over a 2.5 second period, with each spot irradiated for 150 milliseconds. During each irradiation, the corneal epithelium is kept cool and undamaged while the anterior corneal stroma is heated to produce extracellular matrix change.

“The result is a familiar treatment pattern to LTK and CK practitioners, with one important difference: all of the opacifications are purely intrastromal and the epithelium is not damaged,” said Dr Berry. This is achieved by balancing the heating of the laser with conductive cooling by the sapphire window in order to move the maximum of the temperature distribution away from the epithelium and relocate it to the anterior stroma, added Dr Berry.

To date over 200 patients have been treated at Nassau, divided evenly between hyperopic presbyopes and emmetropic presbyopes. Presenting the data of the emmetropic presbyopes with a preoperative spherical equivalent between -0.25 D to +0.75 D, Dr Berry said that 63 eyes received primary treatments, 41 went on to receive secondary treatments, and of those patients seven received tertiary treatments. The mean add for each patient was about 2.0 D.

“Nowadays we are using staged secondary treatments for everyone and we have developed a protocol where patients are very comfortable by trying to give them three-quarters of the treatment in the primary procedure and then a month or so later, topping them off and adjusting for patient to patient variability with the same secondary treatment,” he said.

While initial treatments comprised a monovision protocol, this was soon discarded when it became evident that the non-dominant eye being treated for near vision was not losing any distance visual acuity.

“This was a pleasant surprise so we rapidly switched to a multifocal vision protocol in which both eyes were treated for best near vision. The patient usually sees well both at distance and near immediately post treatment,” he said.

Corneal multifocality is provided by the Eight-Fold Way in which Opti-K produces alternating steepened and flattened sectors of topographical change. The multifocal pattern extends from the cornea centre to the periphery so that multifocality is achieved for all pupil sizes.

Another advantage of the procedure is the fact that the patients encounter no visual recovery or neuroadaptation problems.

“This technique is immediately neuroadapted by all our patients and we have no adaption lag and no problems with night vision or other visual symptoms. With respect to safety, there have been zero safety issues, with no adverse events or loss of two or more lines of best-corrected visual acuity. Nor have there been any problems of induced astigmatism, which was something that plagued LTK and CK in the past,” he said.

In terms of the regression of near vision over time, Dr Berry said that most patients achieved J1 in the immediate postoperative period, followed by a quick decline between one week and one month postoperatively, usually stabilising at J2 thereafter.

“There are only four patients at 24 months postoperatively, but even those are above J3 which is thought to represent functional near visual acuity. Looking at the early hyperopic presbyopes who were treated with Opti-K, complete regression seems to take place within five years. However, we believe overall ocular surface health is part of the equation here and we see a correlation between initial poor ocular surface health and eventual outcomes, so we can probably improve on this in the future,” he said.

An update: with nine patients at 24 months post-secondary Tx, mean B-UDVA is retained or slightly improved (since some patients had pre-Tx values less than 20/20) while mean B-UNVA has remained stable at ca. J2. (See Figures 1 and 2.)

The Nassau Clinical Study was a Bahamian-American collaboration. K Jonathan Rodgers, FRCS (C), DABO performed Opti-K Txs at the Vision Rejuvenation Center (see www.vrbbahamas.com) in collaboration with Harry G Glen MD and Michael Berry PhD.