A new laser thermal keratoplasty approach to central corneal reshaping that combines intrastromal collagen shrinkage and collagen cross-linking (CXL) may provide an alternative to corneal ablative techniques for the treatment of both myopia and hyperopia, said John Kanellopoulos MD, Athens, Greece, at the 15th Winter Meeting of the ESCR.

“This epithelium-sparing corneal reshaping and stabilising technique represents a novel and minimally invasive approach in refractive manipulation of the cornea without tissue removal,” Dr Kanellopoulos said.

The technique involves the utilisation of a cooled sapphire applanation disc and a continuous wave infra-red laser to create three concentric ring-like areas of intrastromal shrinkage, followed by CXL using 0.1 per cent riboflavin solution and 10mw/cm2 UV irradiation to stabilise the resulting change in corneal refraction, he explained.

“Depending on the placement of these predetermined rings you can get considerable corneal flattening with no epithelial defect, and that is the big difference between this and other thermal procedures,” he said.

In order to leave the epithelium intact following the corneal cross-linking procedure, the technique uses benzalkonium chloride, 0.1 per cent riboflavin sodium phosphate drops. The formulation appears to loosen the hemidesmosome links between the corneal epithelial cells and allow large riboflavin molecules to sink into the corneal stroma and allow cross-linking.

He noted that in a laboratory study in which he performed the procedure in 12 cadaver corneas pre- and postoperative evaluation with placido disc topography, Pentacam tomography showed significant uniform cornea flattening of 4.0 D to 8.0 D in a round central zone 5.0mm in diameter.

He added that he has also recently carried out the procedure in a keratoconus patient who was awaiting a keratoplasty procedure. He noted that Bowman’s membrane and the epithelium of the patient’s eye remained intact. Moreover the shrinkage effect was undiminished at one year’s follow-up.

“Our small clinical study showed a significant refractive change immediately post-delivery that was consistent in all the cases, and the procedure did not induce significant astigmatism or higher order aberrations,” he said.

Dr Kanellopoulos noted that further investigations of the technique have shown that the refractive effect titrated from hyperopic to myopic corrections, depending on the depth of the collagen shrinkage. That is, more deeply placed rings produce a steepening effect while those placed closer to the surface have a flattening effect. Furthermore, numbers of rings and diameters have a direct linear refractive effect for the same, he said.

There have been several thermal keratoplasty techniques introduced in the past, he noted. Some, like laser thermal keratoplasty and conductive keratoplasty have produced good initial refractive results in hyperopic patients, but have been prone to regression over time. More recently Avedro Keraflex MTK, a contact procedure that directs microwave thermal energy onto the anterior cornea, has been shown to immediately induce a circular epithelial defect, he said.

In contrast, Dr Kanellopoulos said that the collagen shrinkage treatment did not affect the corneal epithelium. The absence of thermal effect on the corneal epithelium may also reserve the nerve plexus. Moreover, the laser used enabled easy avoidance of endothelial damage by constraining collagen shrinking to the 50 per cent depth of the cornea, he added.