The capsular tension ring (CTR) was originally introduced to reinforce the zonules in eyes with zonular dehiscence and to prevent capsular phimosis and shrinkage leading to IOL decentration. The first CTR was originally designed by Drs. Witschel and Legler and presented at the Cataract, IOL, and Refractive Surgery symposium in May 1993. Since then, different types of rings have been developed such as the capsular edge ring (Nishi Ring; Alcon Laboratories, Inc., Fort Worth, TX), the modified capsular tension ring (MCTR; Cionni Ring; Morcher GmbH, Stuttgart, Germany), the coloboma ring, and aniridia rings (Morcher Aniridia Ring; Morcher GmbH). The CTR designed by Morcher received FDA approval in October 2003. Ophtec USA (Boca Raton, FL) anticipates FDA approval of its CTR soon.

The CTR appears to be a safe and efficacious device that improves the outcome of cataract surgery when the stability of the capsular bag is compromised. Such instability is common in postvitrectomy eyes, eyes with previous trauma, and those with pseudoexfoliation syndrome, floppy capsule syndrome, Weill-Marchesani syndrome, Marfan's syndrome, homocysteinuria, spherophakia, and high myopia. Surgeons can implant CTRs into the capsular bag with the aid of forceps, injectors, or traction sutures, usually after hydrodissection. Because it is an open ring with a diameter larger than the bag itself, a CTR effectively stabilizes the capsular bag by exerting a mild centripetal pressure equally balanced all over the equatorial region of the bag.

The following articles were reviewed for clarification of the aforementioned issues:

nation at 6 months showed a well-centered IOL in all 20 eyes in which an IOL was implanted. The reported success rate of phacoemulsification with in-the-bag posterior capsule IOL and CTR implantation in eyes with zonular dialysis of up to 150º was 90.47%. Eyes that had a reduced final BCVA (worse than 20/40) were attributed to fundus pathology coexisting with the zonular dehiscence. If the zonular dehiscence is greater than 180º, the CTR may not be able to adequately stabilize the capsular bag, and the bag may tilt, dislocate, or collapse. Additionally, the IOL may tilt and become decentered or subluxated.

For the aforementioned cases, the investigators used an MCTR, developed by Robert Cionni, MD, which features a loop for scleral fixation. They reported the outcome of using this MCTR in four eyes with extreme zonular dialysis. In each case, the new ring provided excellent support and centration of the capsular bag and IOL intraoperatively as well as postoperatively. More recently, Cionni et al studied the effect of the MCTR in 90 eyes with congenital loss of zonular support (Weill-Marchesani syndrome, idiopathic ectopia lentis, and Marfan’s syndrome). The MCTR provided good centration of the capsular bag and the posterior capsule IOL in 94% of the cases, and the BCVA was 20/40 or better in 80% of the eyes. They also reported that 10% of the sutures broke and recommended using a 9–0 rather than a 10–0 suture for stability.

Bayraktar et al evaluated the effect of an endocapsular tension ring in preventing zonular complications during the phacoemulsification of cataracts associated with pseudoxfoliation syndrome. The prospective randomized study comprised 78 eyes with cataract and pseudoxfoliation syndrome that were randomly divided into two groups. The investigators implanted CTRs in 39 eyes. The 39 eyes that did not have a CTR implanted served as controls. Five eyes (12.8%) in the control group and no eyes in the CTR group had intraoperative zonular separation. Posterior capsule rupture without zonular separation occurred in three eyes (7.7%) in the control group and in two (5.2%) in the CTR group. Capsular IOL fixation was achieved in 37 eyes (94.9%) in the CTR group and 31 eyes (74.3%) in the control group (P=.026). The UCVA was significantly better in the CTR group (P=.012).

Lee et al reported the extent of IOL tilting and decentration in 40 eyes of 20 patients who were followed for 2 months. Each patient had an IOL in one eye and an IOL and CTR in the other eye. The extent of IOL decentration was statistically less in eyes with both an IOL and a CTR versus those with an IOL only. The mean decentration in the IOL-CTR group was 0.42 ±0.17 mm at 60 days as opposed to 0.57 ±0.16 mm in the IOL-only group. The amount of IOL tilting was also significantly less in the IOL-CTR group (CTR-IOL, 2.47 ±0.40º at 60 days; IOL-only group, 3.06 ±0.56º).

**CTR USE IN CONGENITAL CATARACT AND PREVENTION OF PCO**

Dick et al reported several advantages of using a CTR in cases of congenital cataract. A modified capsular bending ring and an acrylic IOL with a sharp optic edge design were implanted in the capsular bag. All operated eyes demonstrated a well-centered IOL. Investigators reported the band-shaped, sharp-edged capsular bending ring facilitated the creation of a sharp, discontinuous bend in the equatorial capsule, which prevented anterior and posterior capsule opacification. They also found that the insertion of a CTR reduced the breaks in the posterior capsule and made it easier for the surgeon to create a posterior continuous curvilinear capsulorrhexis.

CTRs were also found to prevent the incidence of posterior capsulorrhexis in cases of presenile and senile cataract. D’Eliseo et al reported that PCO formation dropped from 36.1% in the control group to 7.7% in the group using CTRs. This was again attributed to the sharp edge of the CTR, which causes capsular bending and contact pressure leading to the inhibition of epithelial cell migration.

**COMPLICATIONS WITH CTR USE**

Intraoperative complications most commonly included tearing of the capsulorrhexis and an increase of the pre-existing zonular dehiscence that resulted in vitreous prolapse and further dislocation of the bag (9% in Jacob et al; 12% in Bayraktar et al).

Reported postoperative complications included corneal edema (9% in Jacob et al); mild iritis (24% in Jacob et al); persistent iritis (3.3% in Cionni et al); increased IOP (2.2% in Cionni; 14% in Jacob et al); broken sutures (10% in Cionni et al); retinal detachment (1.1% in Cionni et al); the loss of BCVA (1.1% in Cionni et al); and the development of PCO (20% in Cionni et al).

**THE BOTTOM LINE**

CTRs appear to be an effective device for improving the outcome of complicated cataract surgery in eyes with zonular weakness.

Implanting a CTR during the phacoemulsification procedure may reduce intraoperative zonular separation, bag subluxation, posterior capsular rupture, vitreous loss, and lens drop into the vitreous. Use of the device also increases the success rate of in-the-bag IOL implantation.

Postoperative benefits of CTR use appear to include improved IOL centration, less IOL tilt, less capsular contraction, and less anterior and posterior capsular opacity formation in both the pediatric and adult age groups.
Panel Members:

Helen J. Abdelmalak, OD, is a resident in optometry at the Wang Vision Institute in Nashville, Tennessee. She holds no financial interest in any product mentioned herein. Dr. Abdelmalak may be reached at (615) 321-8881; dra@wangvisioninstitute.com.

Y. Ralph Chu, MD, is Clinical Assistant Professor at the University of Minnesota. He holds no financial interest in any product mentioned herein. Dr. Chu may be reached at (952) 835-1235; yrchu@chulasereye.com.

Jay Pepose, MD, PhD, is Professor at Washington University St. Louis in Missouri. He holds no financial interest in any product mentioned herein. He may be reached at (636) 728-0111; jpepose@peposevision.com.

Arun Gulani, MD, is Assistant Professor, Department of Ophthalmology; Director of Refractive Surgery; and Chief, Cornea and External Disease for the University of Florida at Jacksonville. He holds no financial interest in any product mentioned herein. Dr. Gulani may be reached at (904) 504-0090; arungulani@jax.ufl.edu.

Walid Haddad, MD, is a cornea fellow at the Wang Vision Institute in Nashville, Tennessee. He holds no financial interest in any product mentioned herein. Dr. Haddad may be reached at (303) 470-8388; md@walidhaddad.com.

Paul Karpecki, OD, FAAO, is Clinical Director, Cornea, Cataract, and Refractive Surgery at the Moyes Eye Institute in Kansas City, Kansas. He holds no financial interest in any product mentioned herein. Dr. Karpecki may be reached at (816) 746-9800; pkarpecki@moyeseye.com.

Tracy Swartz, OD, MS, is Educational Director at the Wang Vision Institute in Nashville, Tennessee. She holds no financial interest in any product mentioned herein. Dr. Swartz may be reached at (615) 321-8881; drswartz@wangvisioninstitute.com.

Ming Wang MD, PhD holds no financial interest in any product mentioned herein. Dr. Wang may be reached at (615) 321-8881; drwang@wangvisioninstitute.com.

Keming Yu, MD, PhD, is a cornea fellow at the Wang Vision Institute in Nashville, Tennessee. He holds no financial interest in any product mentioned herein. Dr. Yu may be reached at (615) 321-8881; yukening66@hotmail.com.