Despite the considerable progress in cataract surgery, IOL decentration and posterior capsular opacification are still potential handicaps to surgical success. Capsular tension rings (CTRs) can help to minimize the incidence of these complications. The first description of a silicone capsular ring was published by Hara et al1 in 1991; however, this model did not adapt to different capsular bag sizes. Nagamoto et al2 subsequently showed that their 12.5-mm polymethyl methacrylate (PMMA) ring could fit into the capsular bag and provide adaptability for surgical maneuvers. Today, different sizes of CTR are available, and their selection depends on whether the patient has emmetropia, low myopia, or high myopia.

INDICATIONS

CTRs are commonly used to manage cataract cases complicated by zonular dehiscence (traumatic or iatrogenic), zonular weakness (pseudoexfoliation syndrome), or ectopia lentis (idiopathic, Marfan syndrome, Weill-Marchesani syndrome).3,4 Jiraskova and coauthors4 found that, in eyes with zonular dialysis, the condition was associated with eye trauma in 46.9% of eyes, Marfan syndrome in 25%, pseudoexfoliation syndrome in 18.7%, and high myopia in 9.4%.

When a zonular defect is present, a CTR can be inserted at any stage of the procedure to reestablish the capsular contour and to prevent capsular aspiration, vitreous herniation into the anterior chamber, IOL decentration, and closure of the capsular opening. The CTR is helpful for stabilizing a loose lens, supporting the contour of the capsule, and stretching the posterior capsule. CTRs maintain the configuration and stability of the capsular equator by improving zonular integrity. Therefore, it helps to avoid postoperative shrinkage of the anterior capsular opening and prevent IOL decentration.

Do-Hyung Lee et al5 compared the extent of IOL decentration and tilt in 40 eyes of 20 patients who underwent cataract surgery. Eyes were divided into two groups based on whether a CTR was implanted. IOL decentration was statistically significantly less in eyes that received a CTR than in those with an IOL only. Additionally, Jacob et al6 showed that the rate of surgical success was 90.47% in 21 eyes (19 patients) with less than 150º of zonular dialysis when a CTR was inserted along with posterior chamber IOL implantation. All IOLs remained well centered 6 months after implantation.

In patients with pseudoexfoliation syndrome, CTR implantation is recommended to support the zonules after cataract surgery and prevent in-the-bag IOL dislocation.7 In the presence of Marfan syndrome, elongation or disintegration of zonular fibers may lead to lens decentration; the same complication may be seen with Weill-Marchesani syndrome, which is characterized by microspherophakia and zonular degeneration. In one case report, the IOL in an eye with a CTR remained centered but the eye without a CTR developed significant capsular fibrosis and contraction with lens decentration.8 In eyes with severe ectopia lentis, scleral fixation of a CTR is a good option to ensure postoperative IOL stability.4 CTRs can also be used in less common indications such as prolonged silicone tamponade of the vitreous cavity, iris coloboma, and aniridia. Because prolonged silicone tamponade of the vitreous cavity may lead to zonular atrophy, a large CTR should be implanted before phacoemulsification to avoid zonular failure. Use of a coloboma shield CTR for large sector iris defects or iridodialysis can prevent glare and monocular diplopia. Multisegmented coloboma rings for congenital aniridia are also available.4

SURGICAL TECHNIQUES

Identification of zonular weakness or defect is an important step before CTR insertion. The direction of insertion is • CTRs maintain the configuration and stability of the capsular equator by improving zonular integrity.
• Complications of CTR insertion can include perforation of the capsule, extension of the zonulysis, and spontaneous extrusion.
determined by the location of the zonular dialysis.6 Bonnie An Henderson, MD; and Rupert Menapace, MD, share their surgical techniques on page 76. The CTR can be inserted at any stage of the procedure and can be rotated clockwise or counterclockwise in the bag.

COMPLICATIONS

CTRs are useful devices in cataract surgery in the presence of zonular weakness or dialysis; however, complications may occur. First, an inappropriate CTR insertion technique can induce complications. For instance, the leading end of the CTR is necessary to prevent complications.

Second, premature CTR release may cause the ring to hit the ocular wall of the ciliary body, pushing the capsular bag in the opposite direction and resulting in extension of the zonulysis.4 Third, in the presence of a large capsulorrhexis, spontaneous extrusion of the entire CTR into the ciliary sulcus can occur. Fourth, complications can occur when the hook is released from the eyelet once the CTR is in the bag. A cyclodialysis spatula can be inserted through an anterior chamber paracentesis, to push the CTR downward.9 Insertion of a CTR to overcome zonular weakness does not guarantee long-term zonular stability or perfect IOL position within the capsular bag.

Capsular contraction syndrome remains a concern after phacoemulsification and lens implantation. Clinically, capsular contraction may decrease the size or change the shape of the capsulorrhexis after cataract surgery, and contraction forces may cause IOL decentration.10 In many cases, CTR implantation reduces the amount of contraction; however, we have reported10 severe capsulorrhexis contraction despite the use of a PMMA CTR after cataract surgery and acrylic IOL implantation in a patient with zonular weakness.

Despite the presence of a CTR, capsular shrinkage and closure of the capsulorrhexis can cause significant visual loss after surgery. Faschinger and Eckhard11 reported the development of anterior capsular phimosis in two patients with a silicone IOL despite the presence of CTRs. In another study, two patients with bilateral pseudoexfoliation syndrome and intraoperative zonular dehiscence had phacoemulsification with the use of CTRs.12 Between 10 and 12 weeks postoperatively, three eyes developed significant visual loss secondary to capsular shrinkage and occlusion of the capsulorrhexis. All eyes underwent Nd:YAG laser radial anterior capsulotomy, anterior capsulotomy, or both. Visual acuity was restored in all eyes despite slight IOL decentration. Waheed et al12 emphasized the need for close observation of all cases with zonular dehiscence or with risk factors for capsular contraction syndrome, especially in the first 3 months after surgery.

Furthermore, CTR subluxation and dislocation is a risk for patients with severe and progressive zonulopathy. Scherer et al13 described two patients with pseudoexfoliation syndrome in whom late spontaneous dislocation of in-the-bag IOL and CTR occurred 3 and 6 years after cataract surgery. In both cases, the IOL and the CTR were removed through a scleral tunnel incision and an anterior chamber IOL was implanted.

CONCLUSION

Surgical management of cataract associated with zonular dialysis is a challenge for ophthalmic surgeons. The addition of CTRs to our arsenal has made phacoemulsification and in-the-bag IOL implantation easier. However, close follow-up is necessary to prevent complications.

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