Anterior capsular contraction syndrome (ACCS) is a complication of cataract surgery characterized by capsular contraction and excessive fibrosis and constriction of the anterior capsulorhexis margin. Developing as the end stage of a progressive process that begins with fibrosis and opacification of the capsulorhexis margin, ACCS is believed to result from metaplasia and fibrosis of residual lens epithelial cells (LECs). It has the potential to affect refractive and functional outcomes by causing obstruction of the visual axis and shifts in the position of the intraocular lens (IOL). Measures that can limit the development of anterior capsule opacification (ACO) and anterior capsular contraction (ACC) are therefore important for maintaining a successful outcome with refractive cataract surgery.

Factors associated with an increased risk of these events include a small diameter capsulorhexis, zonular weakness, uveitis, pseudoexfoliation syndrome, retinitis pigmentosa, and diabetes mellitus, among others. IOL material also appears to play a role, as capsule contraction is reported to be greater with silicone versus acrylic IOLs and with hydrophilic acrylic versus hydrophobic acrylic lenses.

Two IOL platforms that are commonly used in the United States—TECNIS® (Johnson & Johnson Surgical Vision, Inc.) and AcrySof® (Alcon Laboratories)—are 1-piece hydrophobic acrylic implants. According to research discussed here, the development and degree of ACO and capsulorhexis phimosis are greater with the AcrySof® platform than with a TECNIS® IOL and the findings may be explained by design differences between the implants.

**Reviewing the evidence**

As the specialty council lead physician for the department of ophthalmology at Mercy Clinic, Springfield, Missouri, I am responsible for identifying the best quality materials to use for surgical procedures and clinical evaluation. Although I was aware of the potential for ACO and capsulorhexis phimosis to affect outcomes after cataract surgery, my interest in these complications was heightened by information included in a video presented at the 2017 ASCRS Film Festival. In this video, Japanese researchers studied the potential linkage between ACCS and various IOL designs [TECNIS® ZCB00V, AcrySof® SN60WF; and a hydrophobic IOL from Hoya]. They analyzed a serial of postoperative slit-lamp photographs with these lenses to compare ACCS results, then explored the relationship between IOL design, aqueous humor, and ACCS through cultured rabbit lens epithelial cells.

Searching the literature for related studies uncovered a paper from Austrian investigators reporting outcomes from 1, 3, and 5 years of follow-up in a randomized, controlled, prospective, double-blind study of patients (50 at 1 and 3 years; 25 at 5 years) undergoing bilateral cataract with implantation of an AcrySof® SA60AT in one eye and the TECNIS® ZCB00 in the fellow eye. At all 3 follow-up intervals, ACO was present in a significantly greater percentage of eyes implanted with an AcrySof® IOL compared with the TECNIS® IOL group: 18.0% vs 2.7%, respectively at 1 year (P=.03); 92.0% vs 24.0% at 3 years (P<.01); and 100% vs 52% at 5 years (P<.01).

The AcrySof® IOL was also associated with more severe ACO. Using a grading scale of 0 (none) to 4 (constriction of the capsulorhexis opening), mean scores in the AcrySof® and TECNIS® IOL groups were 0.30 and 0.04, respectively, at 1 year, 1.44 and 0.26, respectively, at 3 years, and 1.8 and 0.6, respectively, at 5 years (P<.02 for all comparisons). In addition, grade 2 (moderate diffuse opacification with folds) or greater ACO was present in 80% of eyes with an AcrySof® IOL versus 8% of eyes implant-
ed with a TECNIS® IOL. Capsular phimosis was also observed in a significantly higher percentage of eyes with an AcrySof® IOL compared with the TECNIS® IOL at 1 year (18% vs 0%), 3 years (30% vs 0%), and 5 years (48% vs 4%; P<.01 for all comparisons) (Figure).

In a prospective, randomized, contralateral-eye controlled study, 50 patients undergoing bilateral cataract surgery received the AcrySof® IQ SN60WF IOL and the TECNIS® ZCB80 IOL in fellow eyes. Evaluations of slit-lamp photographs obtained at 2 and 3 years postoperatively showed that significantly more eyes developed ACO after implantation of the AcrySof® IQ SN60WF IOL compared with the TECNIS® ZCB80 IOL at both timepoints (P=.02 and P=.005, respectively).

In the United States, another recent publication retrospectively compared the incidence of ACCS in eyes implanted with the SN60WF (n = 571) and the TECNIS® ZCB80 (n = 476) IOLs; 5.5% of AcrySof® IOL eyes and 16% of eyes implanted with the TECNIS® lens had at least 1 risk factor for ACCS (P<.0001). Mean postoperative follow-up for these groups was 4.2 months and 5.7 months, respectively. The incidence of ACCS, defined as a capsular opening area less than 10 mm², was significantly greater in the SN60WF group (8 eyes, 1.4%) than in the TECNIS® group (1 eye, 0.21%; P=.045).

Underlying mechanisms
Various mechanisms have been proposed to explain the lower propensity for ACO and capsulorhexis phimosis with a TECNIS® IOL compared with the AcrySof® lens. One idea is that the 360° square edge of the TECNIS® IOL serves as a barrier to LEC migration between the anterior capsule and IOL than the interrupted square edge on the AcrySof® lens. A difference in IOL optic surface configuration has also been suggested to be a factor by influencing LEC migration or reducing contact between the optic and the anterior capsule. Compositional differences in the hydrophobic acrylic materials of both lenses may also be involved.

Personal experience
Six years ago at Mercy Eye Center, a decision was made to switch from using AcrySof® lenses to TECNIS® IOLs. The change was driven by surgeons’ frustrations with glistenings in the AcrySof® acrylic material, disappointing outcomes with the early generation of the AcrySof® multifocal IOL, and a cost difference favoring the TECNIS® portfolio. Reduced development of ACO and capsulorhexis phimosis may be another benefit of the switch to TECNIS® IOLs. Although the studies on this topic have only evaluated the aspheric monofocal TECNIS® IOL, all members of the TECNIS® portfolio share the same material and design features that have been suggested as potential factors in limiting these complications.

Over the past 6 years, I and my colleagues have been very satisfied with the performance and clinical outcomes we are achieving with the entire family of TECNIS® IOLs. We are considering further studies to identify significant clinical differences in ACCS, such as a retrospective study comparing rates of laser anterior capsulotomy before and after the change in IOL technologies, or ideally a prospective study to document ACC.

Conclusion
ACCS can have visually significant consequences and compromise outcomes of refractive cataract surgery. Surgical strategies for limiting this complication have been described and include use of an appropriately sized capsulorhexis and thorough cleanup of LECs. Evidence showing a decreased occurrence of ACO and ACC with the TECNIS® IOL compared with an AcrySof® IOL might be something else for cataract surgeons to consider.

REFERENCES

TECNIS® Monofocal 1-Piece IOL
Rx Only
PRECAUTIONS: Do not resterilize the lens. Most sterilizers are not equipped to sterilize the soft acrylic material without producing undesirable side effects. Do not soak or rinse the intraocular lens with any solution other than sterile balanced salt solution or sterile normal saline. Do not store the lens in direct sunlight or at a temperature greater than 113°F (45°C). Do not autoclave the balanced salt solution or sterile normal saline. Do not store the lens in direct sunlight or at a temperature greater than 113°F (45°C). Do not autoclave the balanced salt solution or sterile normal saline. Do not store the lens in direct sunlight or at a temperature greater than 113°F (45°C). Do not autoclave the balanced salt solution or sterile normal saline. Do not store the lens in direct sunlight or at a temperature greater than 113°F (45°C). Do not autoclave the balanced salt solution or sterile normal saline.

WARNINGS: Physicians considering lens implantation should weigh the potential risk/benefit ratio for any conditions described in the TECNIS® 1-Piece IOL Directions for Use that could increase complications or impact patient outcomes. These conditions include recurrent severe anterior or posterior segment inflammation or uveitis; patients in whom the intraocular lens may affect the ability to observe, diagnose, or treat posterior segment diseases; surgical difficulties at the time of cataract extraction, which may increase the potential for complications (e.g., persistent bleeding, significant iris damage, uncontrolled positive pressure or significant vitreous prolapse or loss); a compromised eye due to previous trauma or developmental defects in which appropriate support of the IOL is not possible; circumstances that would result in damage to the endothelium during implantation; suspected microbial infection; or patients in whom neither the posterior capsule nor the zonules are intact enough to provide support for the IOL. Children under the age of 2 years are not suitable candidates for intraocular lenses. The TECNIS® 1-Piece IOL should not be placed in the ciliary sulcus. ADVERSE EVENTS: In 3.3% of patients, reported adverse events of cataract surgery with the 1-Piece IOL included macular edema. Other reported reactions occurring in less than 1% of patients were secondary surgical intervention (pars plana vitrectomy with membrane peel) and lens exchange (due to torn lens haptic).

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