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Long-term outcomes for pediatric patients having transscleral fixation of the capsular bag with intraocular lens for ectopia lentis

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Abstract

PURPOSE—To report the long-term outcomes of transscleral fixation of capsular tension rings (CTR) with intraocular lens (IOL) placement in pediatric patients with ectopia lentis.

SETTING—John A. Moran Eye Center, University of Utah, Salt Lake City, Utah, USA.

DESIGN—Retrospective case series.

METHODS—Pediatric patients requiring lens extraction with transscleral capsular bag fixation with a CTR and IOL for ectopia lentis between January 2006 and January 2016 were analyzed.

RESULTS—Thirty-seven patients (67 eyes) who had transscleral fixation of the capsular bag using a CTR fixated with 9-0 or 10-0 polypropylene (Prolene), 8-0 polytetrafluoroethylene (Gore-Tex), or 9-0 nylon were identified. The mean age at time of surgery was 7.25 years (2 to 18 years) and the mean follow-up was 35.3 months (0.25 to 120 months). The proportion of eyes showing improvement in corrected distance visual acuity (CDVA) postoperatively was 78.5%, which demonstrated significance with a 95% confidence interval. In the immediate postoperative period, 1 eye developed a hyphema and 1 eye required IOL repositioning. Long-term complications included posterior capsule opacification in 35 eyes (52%) and uveitis–glaucoma–hyphema syndrome in 1 eye (1.5%). Three eyes (4.4 %) required IOL repositioning for spontaneous delayed IOL dislocation, 2 sutured with 8-0 polytetrafluoroethylene at postoperative month 8 and postoperative year 3 and 1 sutured with 9-0 polypropylene at postoperative year 7.

CONCLUSION—Transscleral fixation of the capsular bag using a CTR improved CDVA and provided IOL stability in pediatric patients with ectopia lentis.

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Congenital ectopia lentis is a significant clinical problem in the pediatric population. It can be idiopathic or occur in the context of systemic disease as in homocystinuria, Weill-Marchesani syndrome, sulfite oxidase deficiency, molybdenum cofactor deficiency, hyperlysinemia, Ehlers-Danlos syndrome, or Marfan syndrome, the latter being the most common etiology. Although some cases of ectopia lentis are thought to be caused by a zonulopathy, the precise mechanism for lens dislocation varies by etiology and is not fully understood.

Irrespective of etiology, ectopia lentis in the pediatric population can result in permanent vision loss because of anisometropic amblyopia. If appropriate, refractive correction is not possible with conservative management and surgical intervention is indicated. There is, however, limited data on long-term surgical outcomes and no consensus on the best surgical management for young patients with dislocated lenses. Surgical advances have improved patient outcomes in recent years with the inclusion of various techniques including pars plana vitrectomy (PPV) with lensectomy,^{1,2} sulcus fixation of intraocular lenses (IOLs),³ iris-sutured IOLs,⁴ iris-claw IOLs,⁵ scleral-sutured capsular tension rings (CTRs) with IOL placement,^{2,6} sutureless sulcus IOL placements,⁷ and anterior chamber IOL (AC IOL) placements.⁸ Data on the efficacy and long-term sequela of these interventions is limited and therefore the optimal surgical management is unclear.

Legler et al.^B first introduced the CTR in 1993 for use in cases of zonulopathy. The device was modified by Cionni and Osher in 1998⁹ with the addition of an eyelet to be positioned anterior to the lens capsule, allowing for scleral fixation with preservation of the capsular bag. This design was further modified to provide segmental zonular support in the form of the Ahmed capsular tension segment (CTS).^C Initial studies demonstrate that transscleral fixation of these devices is an efficacious surgical intervention in pediatric patients with ectopia lentis. However, long-term outcomes in this population are not known.^{2,6,10,11} Herein, we present data from the largest published cohort of pediatric ectopia lentis patients surgically managed with transscleral sutured capsular tension devices (CTDs), for whom long-term data is available.

PATIENTS AND METHODS

Study Population

A retrospective observational case series of pediatric patients having lens extraction for ectopia lentis between January 2006 and January 2016 at 1 academic center was performed. Institutional Review Board approval was obtained for retrospective chart reviews. Patients met inclusion criteria if they were aged 18 years or younger at the time of surgery. Patients were excluded from the study if they had surgery for traumatic crystalline lens dislocation. Patients were initially selected using Current Procedural Terminology codes 66982 through 66986 (identifying cataract surgery and/or IOL placement) and these charts were then reviewed for preoperative diagnosis of ectopia lentis. All patients with atraumatic ectopia lentis were included for further analysis.

Surgical Methods

The surgeries were performed under general anesthesia by the same surgeon. For patients who required surgery in both eyes, this was most commonly completed on the same day or 2 weeks apart. Techniques were similar to those described by Vasavada et al.² in 2008 and the technique described by Cionni and Osher⁹ in 1998 for scleral fixation of modified capsular tension rings (CTRs) in adults with zonular fiber loss. Intraoperative pupil dilation was achieved with intracameral preservative-free lidocaine 1.0% with epinephrine injected through a clear corneal paracentesis. An ophthalmic viscosurgical device (OVD) was injected over the area of zonular dialysis to tamponade the vitreous face and maintain space in the anterior chamber. A 2-plane clear corneal incision was made temporally and a continuous curvilinear capsulorhexis was completed with Utrata forceps. In cases with severe zonular fiber weakness, iris retractors, Mackool hooks or capsular tension hooks (Microsurgical Technology) were used to stabilize the capsular bag. Lens material was aspirated either using the bimanual anterior vitrector or irrigation/aspiration handpiece under a low aspiration flow rate, low vacuum, and using a low bottle height. Transscleral fixation was achieved using two 25-gauge sclerotomies, 2.0 mm posterior to the limbus separated by 4.0 mm at the site of maximum zonular fiber weakness. These sclerotomies were completed after a conjunctival peritomy was performed. A 9-0 polypropylene (Prolene) or 10-0 polypropylene on a CTC needle (Ethicon) or 8-0 polytetrafluoroethylene (Gore-Tex, Gore Medical) with the needle removed was then threaded through the fixation eyelet of the modified CTR. The choice of suture was determined by current “best practice” evidence at the time of each procedure. When using polypropylene sutures, each needle and the CTD were passed through the main incision into the eye, and each needle was exited through the ciliary sulcus and scleral wall at the sclerotomy sites. When a polytetrafluoroethylene suture was used, the needle was removed from the suture, it was threaded through the eyelet and the entire suture and CTD complex were introduced into the anterior chamber through the main incision. The polytetrafluoroethylene sutures were then externalized using a Condon snare instrument through each sclerotomy site. The modified CTR or CTS was positioned so that the fixation eyelet was at the area of maximum zonular fiber weakness. The surgeon selected the CTR design intraoperatively based on the extent of zonular fiber weakness. As a general rule, if zonular fiber loss or weakness was up to 200 degrees, a single eyelet CTR was implanted. A double eyelet CTR was implanted if zonular fiber loss was more than 200 degrees. After the CTR was positioned and the fixation eyelets were confirmed to be anterior to the capsule, the sutures were tightened and tied to center the capsular bag. The suture was rotated so the knot was buried in the sclerotomy site. The IOL was then inserted into the capsular bag using OVD and the pupil constricted by intracameral administration of a parasympathomimetic, acetylcholine chloride (Miochol-E). The conjunctival peritomy was closed. Several different types of the IOLs were used (Table S1, available at <http://jcrsjournal.org>). An anterior vitrectomy was performed if necessary, although the posterior capsule was left intact. The IOL target was selected per established guidelines as published by Wilson and Trivedi.^A

Outcome Measures

The following data were retrospectively collected upon chart review: patient age at time of surgery, preoperative diagnosis, race, axial length, intraoperative complications, suture type,

IOL type and strength, type of capsular support device(s), preoperative refraction, preoperative vision, postoperative complication, corrected distance visual acuity (CDVA) 2 months postoperatively through 10 years postoperatively, and refractive outcome 2 months postoperatively through 10 years postoperatively. The presence of preoperative and postoperative strabismus, amblyopia, and glaucoma were noted as well as whether additional surgery was necessary.

Statistical Analysis

The mean, standard deviation, median, interquartile range, and range (minimum to maximum) were presented for numeric variables; frequency and percent were presented for categorical variables; data of variables of interest were summarized by eye and by suture type, respectively. Data of variables of interest collected longitudinally were summarized at each timepoint. Basic bootstrap was applied to construct the 95% confidence interval (CI) of proportion of eyes specified by variable of interest, based on 500 bootstrap replicates, including records with missing values.

To assess the possible difference in numeric outcome variable of interest between 2 groups, the Wilcoxon rank-sum test was applied after Shapiro-Wilk test provided evidence of non-normality; to assess the possible association between 2 categorical variables, the Fisher exact test was used when cells had an expected frequency of 5 or less. The assumptions were made that all missing values were random and in the overall sample, all eyes that had operations were independent observations. All analyses were 2-tailed and the statistical significance was set as a *P* value less than 0.05. Statistical analyses were performed using SAS software (version 9.4, SAS Institute, Inc.). Most analyses were performed using all eyes, given the small sample size and relative difficulty in recruiting this specific population. However, to ensure that the results were not confounded by a relative increase in patient-specific effects, postoperative vision using a randomized eye approach was also analyzed.

RESULTS

There were 599 patients under the age of 18 years who had surgery for crystalline lens extraction between January 2006 and January 2016 at the John A. Moran Eye Center, University of Utah and Primary Children's Hospital. From this cohort, 58 patients (90 eyes) were identified with the preoperative diagnosis of ectopia lentis. Thirteen of these eyes demonstrated a secondary ectopia lentis caused by trauma and were excluded. Of the remaining 45 patients (77 eyes) having planned lens extraction with scleral fixation of a CTR, 1 patient (1 eye) had a CTR placed without scleral fixation and 7 patients (9 eyes) had scleral or iris fixation of an IOL because of intraoperative complications (Table 1). These patients were excluded from further analysis. The study analyzed the remaining cohort of 37 patients (67 eyes) having scleral fixation of a capsular support device or devices. The mean follow-up for the patients was 35.3 months (range 0.25 to 120 months). The final cohort of patients had transscleral fixation of the capsular bag with use of either a CTR with CTS or a single or double eyelet Cionni modified CTR fixated with 9-0 polypropylene, 10-0 polypropylene, 8-0 polytetrafluoroethylene and in 1 case, 9-0 nylon. In this cohort, 27 of the patients who required bilateral surgery had same day surgery on both eyes, 1 patient had a 1-

month interval between eyes, and the remainder of the patients had unilateral surgery. The preoperative characteristics for each eye did not differ significantly between groups, and the mean age at time of surgery was 7.2 years (range 2 to 18 years). Most patients (30 [81.0%]) were white, consistent with the demographic of Utah and the surrounding catchment area. In 24 patients [43 eyes [64.2%]] the etiology of primary ectopia lentis was Marfan syndrome. One patient (2 eyes [3.0%]) had ectopia lentis secondary to homocystinuria and 1 patient (2 eyes [3.0%]), secondary to spherophakia. One patient demonstrated a primary ectopia lentis secondary to unknown “mixed connective tissue disorder” and in the remaining 10 patients (18 eyes [26.5%]) had idiopathic ectopia lentis.

In 56 eyes (83.6%), 8-0 polytetrafluoroethylene was used for scleral fixation, 9-0 polypropylene was used in 8 eyes (12.0%), 10-0 polypropylene was used in 1 eye (1.5%), and 9-0 nylon was used in 1 eye (1.5%). One eye did not have documentation of the type of suture used. Fifty-three eyes (79.0%) had transscleral IOL fixation with use of a modified CTR, 5 eyes (7.4%) with a CTR and CTS, 1 eye (1.5%) with a CTR and 2 CTS, 3 eyes (4.5%) with a single CTS, and 5 eyes (7.5%) with a modified CTR and a CTS. The CDVA improved postoperatively in most eyes and was statistically significant with a 95% CI considering all study eyes (Table 2, Figure 1). There remained a statistically significant improvement in postoperative CDVA when considering 1 randomized eye per patient as well (Table 2). Furthermore, during the postoperative period, 48 eyes (71.6%) had a CDVA of 20/50 or better (Figure 2). This correlated with a decrease in overall refractive error postoperatively over the 10-year follow-up (Figure 3). These results did not differ significantly for children operated during an amblyogenic age range versus those who were not (data not shown). There was an overall trend toward myopia in the patients who were followed for 10 years after surgery (Figure 3).

All complications were recorded in the medical record for patients in this cohort. In the immediate postoperative period, 1 eye developed a hyphema (postoperative day 1) and 1 eye (8-0 polytetrafluoroethylene) had IOL repositioning at postoperative month 3. Long-term complications included posterior capsule opacity in 35 eyes (52.2%) and uveitis–glaucoma–hyphema (UGH) syndrome in 1 eye (1.5%); no other patients developed glaucoma (Table S2, available at <http://jcrsjournal.org>). Two eyes (3.0%) required IOL repositioning for spontaneous delayed IOL dislocation at postoperative month 8 and postoperative year 3; both were originally sutured with 8-0 polytetrafluoroethylene. One eye (1.5%), originally sutured with 9-0 polypropylene, required IOL exchange for a spontaneous delayed dislocation resulting in UGH syndrome at postoperative year 7. One eye had IOL repositioning at postoperative year 1 after blunt trauma to the eye. There were no statistically significant associations between suture type or CTD type and each complication ($P > .05$ in all instances, Fisher exact test) (Tables 3 and 4).

Posterior capsule opacification (PCO) was the most frequently reported complication, occurring in 35 eyes (52.0%). The mean age at which PCO was diagnosed postoperatively was 6.6 years, with a mean time to opacification of 2 years after surgery (range postoperative month 3 through postoperative year 8). The mean age at time of surgery for patients who did not develop PCO was 7.1 years in the right eye surgery group and 7.5 years in the left eye surgery group. There was no statistically significant difference observed in

distribution (mean/median) in age between PCO presence and absence in either the right or left eye groups ($P > .2$ in both instances, Wilcoxon rank-sum test). Among patients who received 8-0 polytetrafluoroethylene or 9-0 polypropylene and had Marfan syndrome and received a modified CTR, there was no statistically significant association between suture type and complication of PCO ($P > .05$ in all instances, Fisher exact test) (Table S3, available at <http://jcrsjournal.org>). This group was analyzed because it contained the largest sample size while minimizing other potentially confounding variables.

DISCUSSION

Ectopia lentis is a significant and potentially blinding condition in the pediatric population. Although some cases can be successfully managed with conservative measures, there is no consensus as to which surgical intervention is most safe and efficacious over time. This is because of the paucity of data regarding long-term outcomes in pediatric patients having surgical intervention for visually significant ectopia lentis. Our study provides long-term outcome data for the largest cohort of pediatric patients having lens extraction in the setting of ectopia lentis using a transscleral sutured CTD.

Previously published work reports smaller sample sizes or shorter follow-ups. Overall, our data support this work suggesting that transscleral fixation is a safe and effective surgical procedure for pediatric patients with ectopia lentis. Specifically, we found there was a statistically significant improvement in postoperative CDVA versus preoperative CDVA. This remained present with long-term follow-up in those patients for whom we had long-term data. Furthermore, the range of refractive error was similar to that seen with traditional IOL placement in the pediatric population.¹² Importantly, we demonstrate a trend toward myopia with time, consistent with continued eye growth. Although further study is warranted, this suggests no significant harm to emmetropization and ocular maturation as a result of this surgical procedure.

It is important to note that 7 patients who were initially considered for transscleral CTR suturing were unable to receive this procedure and ultimately required alternate IOL placement; this determination was made intraoperatively by the surgeon. The reasons for this varied from initial compromise of the capsular bag, extensive degree of zonulopathy, and small size of capsular bag prohibiting CTR placement. Therefore, the reported technique shows good patient outcomes, although it is not uniformly appropriate, and patient-specific factors, some of which can only be assessed intraoperatively, should be taken into consideration.

Visual acuity improved overall in all but 14 eyes. In 7 eyes (5 patients), visual acuity measured at follow-up did not change from preoperative vision. It is possible that the lack of improved postoperative vision in these children was attributable to amblyopia secondary to their ectopia lentis, although this is not clear from our retrospective chart review. In 7 eyes (5 patients), the measured CDVA at any postoperative timepoint worsened. In 4 of these eyes, PCO was visually significant and a neodymium:YAG (Nd:YAG) capsulotomy was performed, although these patients were then lost to follow-up before documentation of

subsequent visual acuity. The remaining 3 eyes were not seen after the second postoperative month.

There were few complications either in the short-term or long-term follow-up periods. These included 1 hyphema and 1 case of UGH syndrome in the immediate postoperative follow-up interval of 3 months. We found 4 cases (6%) of spontaneous IOL dislocations, 1 in the immediate 3-month postoperative period and the remaining in the longer-term follow-up interval. Of the 4 eyes with spontaneous dislocation of the scleral-fixated CTD, 1 was seen in patients with sutures of 9-0 polypropylene (12%) and 3 with sutures of 8-0 polytetrafluoroethylene (5.4%). These rates of IOL dislocation are lower than previously reported by other groups when 10-0 polypropylene was used; Buckley¹³ reported an overall rate of 12% in a cohort of 33 eyes with scleral fixation of the IOL with a median follow up of 5 years. Another study by Cionni et al.,¹⁰ using scleral-fixated CTR, found a suture breakage rate of 10% in a cohort of 90 eyes with either 9-0 or 10-0 polypropylene use. In the Cionni et al. study,¹⁰ all IOL dislocations occurred in cases with 10-0 polypropylene use with a mean follow-up of 14.6 months.

Although the majority of IOL dislocations were seen with use of 8-0 polytetrafluoroethylene sutures, we found no statistically significant association of IOL dislocation with suture type in our cohort. This is likely because 8-0 polytetrafluoroethylene sutures were used for the majority of patients, thus proportionately these patients did not demonstrate a higher rate of IOL dislocation.

The most common postoperative complication seen in our series was PCO with 35 eyes (52%) developing visually significant PCO. This rate is similar to the rate in previous reports using the same technique of scleral fixation of a CTD. Vasavada et al.² reported PCO formation in 19 of 35 eyes (54.3%) and in a cohort of 19 eyes, 11 eyes (57.9%) developed PCO in the study by Kim et al.⁶ Of the patients who developed PCO in our study, 9 eyes (13.4%) had PPV and membranectomy and 25 (37.3%) eyes had in-office Nd:YAG capsulotomy. There was a trend toward significance ($P = .0627$) when considering the suture type as a variable for PCO development. There were more patients reported to have PCO in the polytetrafluoroethylene suture group, which was not explained by age at the time of surgery. One hypothesis might be that the 8-0 polytetrafluoroethylene suture induces more inflammation, either relative to the suture size or material, and that this creates an environment that facilitates PCO formation. Alternatively, this might represent a type 1 error. The rationale for this finding is unclear and requires further evaluation with a larger sample size.

There were no cases of retinal detachment (RD) or postoperative glaucoma in our cohort. Concern for these complications has historically been an argument against surgical intervention. Certainly, early reports of surgical intervention for congenital ectopia lentis demonstrated high rates of RD, as high as 23% in 1 reported group.¹⁴ As discussed by Kopel et al.,¹⁵ more recent rates of RD in cases of lensectomy/PPV for ectopia lentis are much improved with a reported incidence of 2 in 342 eyes. Use of transscleral CTRs reported here and by others collectively demonstrate only 1 case of RD in 249 eyes (0.004%).^{2,6,10,11} The

primary limitation of this statistic is variable time to follow-up and overall lack of long-term follow-up in all cohorts.

The risk for glaucoma in the setting of scleral IOL fixation is also debated in the literature.^{16,17} Studies done in the pediatric population with scleral fixation of an IOL have not demonstrated increased rates of glaucoma. Buckley¹³ found 2 patients in a cohort of 33 eyes with ocular hypertension. Another study by Bardorf et al.³ using scleral IOL fixation in a cohort of 43 eyes found 2 patients (4.7%) with transient ocular hypertension but no cases of glaucoma or sustained ocular hypertension. We did not find an increased risk for glaucoma at any follow-up interval in our patient population.

The decreased observation of RD or postoperative glaucoma might correlate with the precise technique we report for transscleral fixation or perhaps the lack of PPV, as has been suggested in the literature.^{16,17}

Our study was not designed to directly compare methods of transscleral IOL fixation or the contribution of PPV relative to this outcome measure. However, because our data show no evidence of postoperative glaucoma or RD using the reported approach, our data might suggest that transscleral fixation of the capsular bag is an appropriate technique to mitigate these risks relative to surgical intervention. Certainly, further study is required to clarify this point.

In summary, transscleral fixation of a CTD sutured with 8-0 polytetrafluoroethylene or 9-0 polypropylene and IOL placement in the bag offers improved vision and IOL stability in pediatric patients with ectopia lentis. Although not all patients in our cohort had long-term data, those who did, demonstrated good long-term results. When surgical intervention is indicated, our data support use of the described technique as an alternative to aphakia, AC IOL placement, or direct IOL scleral fixation. It is important to note that this technique might not be appropriate in all cases. In our cohort, the surgeon was at times unable to carry out the preoperative plan because of capsular bag compromise or inability to place the necessary surgical devices: out of 77 planned cases with a CTR, 9 (11.7%) required alternative IOL placement because of intraoperative complications or findings. Last, primary posterior capsulotomy might not be well tolerated in this patient population given the tension on the capsular bag in the presence of a CTR. Therefore, as noted in our cohort, leaving the posterior capsule in these young patients often leads to visually significant PCO.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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WHAT WAS KNOWN

- Scleral-fixated capsular tension support devices are an effective and safe short-term procedure for pediatric patients with ectopia lentis.

WHAT THIS PAPER ADDS

- In the largest cohort of pediatric patients with long-term follow-up, IOL placement with scleral fixation of the capsular bag with a CTD improved CDVA and provided IOL stability.

Figure 1.

Percent of eyes with improved CDVA and 95% CI (bootstrap resampling, 500 replicates, including records with missing values) by time (CDVA = corrected distance visual acuity; CI = confidence interval; Postoperative = the best vision result between all postoperative visits).

Figure 2.

Percent of eyes with CDVA of 20/50 or better and 95% CI (bootstrap resampling, 500 replicates, including records with missing values) by time. (CDVA = corrected distance visual acuity; CI = confidence interval; Postoperative = best vision result between all postoperative visits).

Figure 3.
Distribution of refraction type (hyperopia/myopia/emmetropic [normal]) by time.

Table 1

Details of patients unable to have scleral fixation of a CTD.

Age (y)	Eye	Diagnosis	Procedure	Intraoperative Complication	IOL
7	Right	Idiopathic	Cataract extraction IOL, iris fixation	Radial tear during capsulorhexis creation	3-piece +16.5 D *
6	Left	Marfan syndrome	Cataract extraction IOL, scleral fixation	Capsule did not remain intact during capsulorhexis	1-piece +13.0 D [†]
16	Right	Marfan syndrome	Cataract extraction IOL, iris fixation	Phacodonesis, extensive zonulopathy	3-piece +17.5 D *
14	Right	Marfan syndrome	Cataract extraction IOL, modified CTR, iris fixation	Unable to place complete modified CTR in bag after	3-piece +25.5 D *
2	Left	Idiopathic	Cataract extraction IOL, scleral fixation	scleral fixation, lens fixated to iris and modified CTR left in sulcus	1-piece +22.5D [†]
5	Right	Marfan syndrome	Cataract extraction IOL, iris fixation	Posterior capsule tear during I/A of lens	3-piece +22.0 D *
5	Left	Marfan syndrome	Cataract extraction IOL, iris fixation	Unable to place entire CTR in capsular bag	3-piece +23.5 D *
6	Right	Marfan syndrome	Cataract extraction IOL, scleral fixation	Unable to place entire CTR in capsular bag	1-piece +21.5 D [†]
6	Left	Marfan syndrome	Cataract extraction IOL, scleral fixation	Capsular bag too small	1-piece +23.0D [†]

CTD = capsular tension device; CTR = capsular tension ring; I/A = irrigation/aspiration; IOL= intraocular lens

* MA60AC (Alcon Laboratories, Inc.)

[†] CZ70BD (Alcon Laboratories, Inc.)

Table 2

Best postoperative vision.

Best Result *	All Eyes (N = 67)		1 Eye Per Patient (N = 37)	
	N (%)	95% CI of Proportion [†]	N (%)	95% CI [†]
CDVA improved				
Yes	51 (78.5)	(67.7, 87.5)	30 (83.3)	(70.3, 94.6)
No	14 (21.5)	—	6 (16.7)	—

CDVA = corrected distance visual acuity; CI = confidence interval

* Best vision between all postoperative visits

[†]“Yes” observations using basic bootstrap calculations based on 500 bootstrap replicates, including records with missing values

Table 3

Complications by suture type.

Complication*	Suture Type				P Value [‡]
	10-0 Polypropylene	9-0 Nylon	8-0 Polytetrafluoroethylene	9-0 Polypropylene	
PCO, n (%)					
No	1 (100)	1 (100)	28 (50)	1 (12.5)	.0627
Yes	0 (0)	0 (0)	28 (50)	7 (87.5)	
UGH syndrome, n (%)					
No	1 (100)	1 (100)	55 (98.2)	8 (100)	1.00
Yes	0 (0)	0 (0)	1 (1.8)	0 (0)	
IOL dislocation, n (%)					
No	1 (100)	1 (100)	53 (94.6)	7 (87.5)	.4219
Yes	0 (0)	0 (0)	3 (5.4)	1 (12.5)	

IOL = intraocular lens; PCO = posterior capsule opacification; UGH = uveitis–glaucoma–hyphema

* n = number of eyes in specified group; all analyses were based on available data

[‡]Significant probability was associated with Fisher exact test of the null hypothesis that there was no association between suture type (8-0 polytetrafluoroethylene/9-0 polypropylene) and each complication; the assumption was made that in the overall sample, all operated eyes were independent observations

Table 4

Complications by CTD type.

Complication*	CTD Type					P Value [‡]
	CTR, CTS	CTR, CTS (× 2)	CTS	Modified CTR	Modified CTR, CTS	
PCO, n (%)						
No	4 (80.0)	1 (100)	1 (33.3)	21 (39.6)	4(80.0)	.0627
Yes	1 (20.0)	0 (0)	2 (66.7)	32 (60.4)	1(20.0)	
UGH syndrome, n (%)						
No	5 (100)	1 (100)	3 (98.2)	52 (98.1)	5(100)	1.0
Yes	0 (0)	0 (0)	0 (1.8)	1 (1.9)	0(0)	
IOL dislocation, n (%)						
No	5 (100)	1 (100)	2 (66.7)	51 (96.2)	4(80.0)	.1451
Yes	0 (0)	0 (0)	1 (33.3)	2 (3.8)	1(20.0)	

CTD = capsular tension device; CTR = capsular tension ring; CTS = capsular tension segment; IOL = intraocular lens; PCO = posterior capsule opacification; UGH = uveitis–glaucoma–hyphema

* n = number of eyes in specified group; all analyses were based on available data

[‡] Significant probability was associated with Fisher exact test of the null hypothesis that there was no association between CTD type and each complication; the assumption was made that in the overall sample, all operated eyes were independent observations