



Article

Comparison of Visual Acuity and Strabismus Pre- and Post-Baerveldt 350 Glaucoma Drainage Device Placement in Refractory Childhood Glaucomas

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Abstract

Objective: Assess visual acuity (VA) and strabismus changes in children after Baerveldt 350 (BV350) device placement. **Methods and Analysis:** Retrospective cohort study of children (<21 years of age) who had superotemporal BV350 placement (2011–2023) and >6-month follow-up. Ocular diagnoses, surgical details, and preoperative and final follow-up exam findings were collected. In bilateral cases, first eye implanted was included in analysis. **Results:** Ninety-seven patients underwent BV350 surgery with median age of 6.7 (interquartile (IQR) 3.1, 11.2) years and with a median of 4.2 (IQR 1.8, 6.8) years of follow-up. Most common glaucomas were secondary to non-acquired ocular anomaly ($n = 31$) or primary congenital glaucoma ($n = 21$). There was no difference in preoperative and final VA ($p = 0.6583$). Twenty-seven (28%) and twenty-five (26%) patients were orthophoric preoperatively and at final follow-up, respectively. Orthophoria at final follow-up was associated with preoperative (odds ratio (OR) 1.8 [1.2, 2.9]) and final VA (OR 1.5 [1.1, 2.3]). At final follow-up, 13 patients (13%) and 19 patients (20%) showed worsened or improved horizontal deviation (>10 prism diopter (PD) change), respectively. No patients reported postoperative diplopia. Only four patients, all with esotropia, underwent subsequent strabismus surgery. **Conclusions:** Children who underwent BV350 placement did not have significant change in VA, and a high percentage of patients had strabismus prior to (72%) and following (74%) glaucoma surgery. Orthophoria was associated with better VA. The majority of patients did not show worsening of strabismus postoperatively, and none reported diplopia.



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1. Introduction

Glaucoma drainage devices (GDDs) are commonly used in children with advanced or secondary forms of glaucoma [1–3]. While valved GDDs like Ahmed implants have an immediate pressure-lowering effect, they can be associated with an early hypertensive phase, encapsulation, and ultimately failure [4–7]. Non-valved GDDs such as Baerveldt implants have a greater risk of postoperative hypotony; however, studies in children and adults have shown better long-term success rates compared to valved devices [5,8,9].

Both Ahmed and Baerveldt devices can cause ocular motility disturbances [10,11]. In adults, there are varying rates of diplopia after GDD placement, although this symptom is less often seen in children due to suppression or poor vision [10–13]. Few studies have focused on changes in strabismus specifically after implantation of the larger Baerveldt 350 device (BV350) in the pediatric population [14–16]. The goal of this study was to evaluate visual acuity (VA) and strabismus changes associated with BV350 placement in children with refractory glaucoma. In the current study, we present a large cohort of children who underwent BV350 surgery in the superotemporal quadrant and assess changes in visual acuity and strabismus pre- and post-implantation.

2. Materials and Methods

A retrospective case series identified patients (<21 years old) who underwent superotemporal placement of a BV350 GDD by one surgeon (BLB) at the University of Michigan or the Ann & Robert H. Lurie Children's Hospital of Chicago between 2011 and 2023. Patients had at least 6 months of postoperative follow-up and pre- and postoperative strabismus exam findings. This study was approved as exempt from need for informed consent due to its retrospective nature by the Institutional Review Boards of University of Michigan (HUM00230468, approval date 24 April 2023) and the Ann & Robert H. Lurie Children's Hospital of Chicago (IRB 2021-4146, approval date 26 October 2020). This study adhered to the tenets of the Declaration of Helsinki. Data collection was de-identified and Health Insurance Portability and Accountability Act (HIPAA)-compliant. Patients were not involved in the design of the study or the analysis of data.

Data collected included gender, self-reported race and ethnicity, age at time of BV350 placement, ophthalmic and systemic diagnoses, and details of all previous strabismus and glaucoma surgeries. Prior glaucoma surgeries included goniotomy, trabeculotomy, trabeculectomy (with or without antifibrotics), Ahmed GDD placement, transcleral cycloablation, and endoscopic cycloablation. Childhood glaucomas were diagnosed and classified based on the World Glaucoma Association consensus [17]. Preoperative findings were obtained from the examination immediately prior to GDD implantation. Optotype VA testing (Allen, LEA symbols, or Snellen) were obtained when possible, but fix and follow, count fingers, hand motions, and light perception were noted if VA was worse than the largest optotype or poor cooperation of the patient. Optotype VA was converted to LogMAR VA. Non-optotype VA recorded as count fingers or hand motion was approximated as 2.0 LogMAR, light perception as 3.0 LogMAR, and no light perception as 4.0 LogMAR. Strabismus measurements were performed by an orthoptist or physician. Horizontal and vertical strabismus type and deviation in prism diopters (PD) were obtained at 20 feet with correction in primary position. Strabismus was measured by cover–uncover and alternate cover testing when there was adequate fixation for at least a 20/400 target in both eyes. In patients with poor fixation of one or both eyes, strabismus was measured by the Krimsky or Modified Krimsky test. Intraocular pressure (IOP) was measured by Goldmann applanation in the clinic whenever possible. In patients too young or uncooperative for Goldmann applanation, iCare (Revenue, Vantaa, Finland) was used in the clinic. Tonopen (Reichert, Depew, NY, USA) or iCare was used in the operating room immediately after anesthesia induction.

All patients required BV350 (Abbott Medical Optics, Santa Ana, CA, USA) due to elevated IOP and either risk or evidence of glaucomatous progression. The BV350 implant was placed in the superotemporal quadrant. The surgical technique for BV350 implantation (complete implantation and staged implantation) was previously described [18]. In eyes with an axial length smaller than 22.0 mm, the posterior edge of the plate was trimmed to allow for placement at least 6 mm posterior to the limbus with at least 3 mm space

between the plate and the optic nerve. In some patients, BV350 implantation was staged with placement of the plate during one surgery and then placement of the intraocular tube portion in a second surgery. Staged procedures were typically performed when either (1) angle surgery was performed concurrently in the same eye such that there may have been the possibility of not needing the 2nd stage if IOP control was achieved, or (2) if intraocular glaucoma surgery was performed on the contralateral eye in order to avoid same-day bilateral intraocular surgeries. There was not an age or glaucoma type criteria for the staged approach. Stage 2 placement was performed at least 3 weeks after stage 1 placement to allow for adequate capsule formation and when elevated IOP necessitated intraocular tube placement. All patients included in the study who underwent stage 1 placement had subsequent stage 2 placement for full BV350 functionality. The time of follow-up was calculated based on the time of stage 2 placement.

BV350 implantation was often combined with other procedures including removal of a superotemporal Ahmed GDD, pars plana vitrectomy, or lateral rectus recession. When Baerveldt placement was combined with angle surgery, the plate was placed superotemporally, and then either goniotomy or trabeculotomy (previously described in [19,20]) was performed prior to intraocular implantation of the tube. Similarly, lensectomy with or without intraocular lens and posterior capsulectomy were performed between plate and intraocular tube placement. Keratoprosthesis and penetrating keratoplasty were performed in combination with both BV350 placement and pars plana vitrectomy, with plate placement first followed by vitrectomy, keratoplasty, and then implantation of the intraocular tube. Cycloablation and Ahmed revision with removal of the capsule were both performed after completion of the BV350 placement. For scleral buckle removal, surgery was performed through a complete peritomy instead of a limbal-based approach. The buckle was removed prior to placement of the BV350 plate.

While one hundred and thirty-three eyes were reviewed, only one eye per patient was included in the statistical analysis. The first eye which underwent BV350 implantation was included in bilateral cases. GraphPad Prism 10 (GraphPad, La Jolla, CA, USA) and SPSS 29 (IBM, Armonk, NY, USA) were used for statistical analyses. Normality was tested using D'Agostino and Pearson tests, and only preoperative and postoperative IOP was found to follow a normal distribution. Additional statistical analyses included paired *t*-test (for normal distributions) and Wilcoxon matched pairs signed *t*-test for pre- versus postoperative comparison, Mann–Whitney U test for group comparison, ANOVA, and univariate logistic and linear regression analysis. Reported *p*-values were two-tailed. *p*-values less than 0.05 were considered statistically significant.

3. Results

Ninety-seven patients who met inclusion criteria underwent BV350 GDD placement, at a median age of 6.7 years (interquartile range (IQR) 3.1, 11.2), and had follow-up at a median of 4.2 years (IQR 1.8, 6.8). The majority of patients were female, white, and non-Hispanic (Table 1). The most common diagnosis was primary congenital glaucoma ($n = 21$ (18%), Table 1). Thirty-one (32%) and fourteen (14%) patients had secondary forms of glaucoma due to non-acquired ocular anomaly or systemic disease, respectively (Table 2). Thirteen patients (13%) had glaucoma following cataract surgery and fifteen (15%) had acquired forms of glaucoma. Thirty-three (34%) patients had a history of developmental delay. Sixty-two patients (64%) had bilateral glaucoma, although only thirty-six patients required BV350 placement in both eyes. In bilateral cases, the first eye that was implanted with BV350 was included in the analysis.

Table 1. Demographics.

	Patients (<i>n</i> = 97)
Gender	Male: 40
	Female 57
Race	White: 69
	Black: 21
	Asian: 7
Ethnicity	Non-Hispanic: 87
	Hispanic: 10
Age at surgery (years)	7.7 ± 5.6
	Median 6.7
	IQR 3.1, 11.2
	Range 0.2–20.5
Follow-up (years)	4.5 ± 3.0
	Median 4.2
	IQR 1.8, 6.8
	Range 0.5–10.9

Table 2. Types of glaucoma.

Type of Glaucoma	Number of Patients	Patients with Bilateral Glaucoma	Patients Requiring Bilateral BV350
Primary	24		
Primary congenital	21	18	9
Juvenile open angle	3	3	3
Secondary			
Non-acquired ocular Anomaly	31		
Aniridia	3	3	3
Anterior megalophthalmos	1	1	1
Anterior segment dysgenesis	3	2	1
Axenfeld–Rieger syndrome	8	8	2
Congenital ectropion uvea	1	1	1
Microphthalmia	6	4	2
Microspherophakia	1	1	1
Peters anomaly	5	3	1
Non-acquired systemic disease	14		
Hurler syndrome	1	1	1
Juvenile xanthogranuloma	1	0	0
Kabuki syndrome	1	0	0
Isolated port wine birthmark	1	0	0
Rubinstein Taybi	1	1	1
Stickler syndrome	3	1	1
Sturge Weber syndrome	6	3	2
Following cataract surgery	13	5	3
Acquired	15		
Angle closure	2	0	0
Neovascular	1	0	0
Retinopathy of prematurity	2	2	1
Traumatic	4	0	0
Uveitic	6	5	4

Seventy-three (75%) patients had a history of previous intraocular (glaucoma or non-glaucoma) surgery with a median of two (IQR 1, 4) surgeries per eye (Supplemental Table S1). Fifty-nine (61%) patients had prior glaucoma surgery and thirty-five (36%) had non-glaucoma intraocular surgery. Five (5%) patients had a history of strabismus surgery (Supplemental Table S1). Sixty-one (63%) BV350 surgeries were combined with other proce-

dures, most commonly pars plana vitrectomy ($n = 25$), angle surgery ($n = 13$), or removal of superotemporal Ahmed ($n = 13$). Eight patients had concurrent lateral rectus recession for exotropia, two of which had previously undergone lateral rectus resection for esotropia.

VA was worse in the operative eye compared to the non-operative eye (Table 3) preoperatively ($p < 0.01$) and at final follow-up ($p < 0.01$). There was no difference in preoperative and final VA in either the operative or the non-operative eye. For 37 (38%) patients, the operative eye was the preferred eye or there was no preference due to equal VA. None of the patients switched eye preference following BV350 placement. There was a greater difference in VA between the operative and non-operative eye at final follow-up compared to preoperatively ($p < 0.01$). The preoperative IOP (28.0 ± 9.3) was significantly higher than the final IOP (14.2 ± 5.2 , $p < 0.0001$).

Table 3. Visual acuity (VA).

	Preoperative	Final Follow-Up	Preoperative Versus Postoperative p -Value *
Operative Eye	1.50 $\pm$ 1.10 Median 1.22 IQR 0.48, 3.00 Range 0.00–3.00	1.33 $\pm$ 1.14 Median 1.05 IQR 0.33, 2.00 Range 0.00–4.00	$p = 0.69$
Non-Operative Eye	1.13 $\pm$ 1.31 Median 0.50 IQR 0.00, 2.00 Range 0.00–4.00	1.00 $\pm$ 1.31 Median 0.30 IQR 0.00, 1.76 Range 0.00–4.00	$p = 0.19$
Operative versus Non-Operative Eye VA p -value **	$p < 0.01$	$p < 0.01$	
Preferred Eye	Ipsilateral: 30 (31%) Contralateral 60 (62%) Equal VA 7 (7%)	Ipsilateral: 30 (31%) Contralateral 60 (62%) Equal VA 7 (7%)	
Difference in Interocular VA	0.87 $\pm$ 0.89 Median 0.80 IQR 0.10, 1.11 Range 0.00–3.00	1.04 $\pm$ 0.99 Median 0.90 IQR 0.10, 2.00 Range 0.00–3.90	$p < 0.01$

Abbreviations: VA, visual acuity; IQR, interquartile range. * Wilcoxon matched pairs signed t -test for paired comparison of operative and non-operative eyes; $p < 0.05$ considered statistically significant. ** Wilcoxon matched pairs signed t -test for paired comparison of preoperative and final follow-up values; $p < 0.05$ considered statistically significant.

Following BV350 implantation, only four patients had strabismus surgery, all for esotropia (Supplemental Table S1). Three patients without history of prior strabismus surgery underwent bilateral medial rectus recessions (two patients) or ipsilateral medial rectus recession and lateral rectus resection (one patient). One patient who underwent lateral rectus recession and medial rectus resection at the time of BV350 implantation had medial rectus recession for consecutive esotropia.

Almost half of the patients had an exodeviation (Supplemental Table S2) preoperatively ($n = 46$, 47%) and at final follow-up ($n = 47$, 48%), with the majority having constant exotropia. Twenty-seven (28%) and twenty-five (26%) patients were orthophoric preoperatively and at final follow-up, respectively. Twenty-one (22%) and twenty-two (23%) patients had esodeviations, with nineteen showing constant esotropia preoperatively and at final follow-up. Three patients had variable horizontal strabismus. Four patients had vertical strabismus preoperatively, which increased to seven at final follow-up.

Patients with orthophoria preoperatively or at final follow-up had better VA in the operative eye compared to patients with eso- and exodeviations ($p < 0.01$, $p < 0.01$, Figure 1, Supplemental Table S3). There was no difference in preoperative or final VA between pa-

tients with eso- versus exodeviations ($p = 0.78$, $p = 0.83$). In addition, orthophoric alignment preoperatively and at final follow-up was associated with better VA in the operative eye (Table 4). There was no difference between the average esodeviation and exodeviation (in prism diopters (PD)) preoperatively ($p = 0.98$) or at final follow-up ($p = 0.64$). However, the amount of horizontal deviation (in PD), whether eso- or exodeviation, was weakly but statistically associated with operative eye VA preoperatively (Figure 2A, $r^2 = 0.21$) and at final follow-up (Figure 2B, $r^2 = 0.16$). No patient complained of diplopia either preoperatively or at final follow-up. There was also no significant difference in age at time of BV350 surgery between patients with orthophoria, eso-, and exo-deviations ($p = 0.11$).

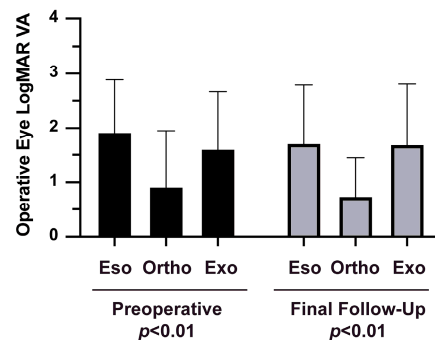


Figure 1. Operative eye VA and strabismus.

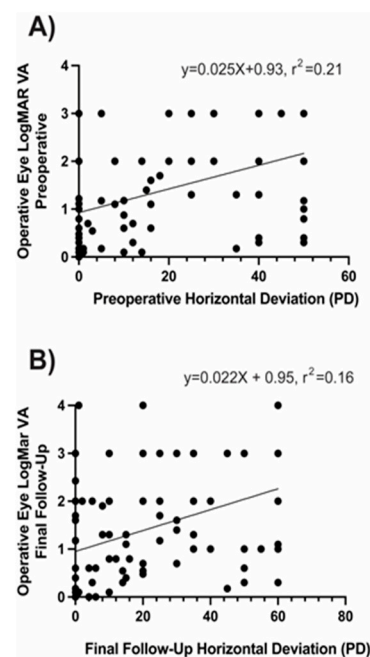


Figure 2. Linear regression of horizontal deviation and operative eye VA. **(A)** Linear regression of preoperative horizontal deviation in prism diopters (PD) with operative eye LogMAR VA showed a significant non-zero relationship ($p < 0.01$, $y = 0.025X + 0.93$) with $r^2 = 0.21$. **(B)** Further, linear regression also showed a significant non-zero relationship ($p < 0.01$, $y = 0.022X + 0.95$ with $r^2 = 0.16$) between final horizontal deviation and operative eye LogMAR VA.

LogMAR VA in the operative eye was significantly better in patients with orthophoria (ortho) preoperatively ($p < 0.01$) and postoperatively ($p < 0.01$) compared to patients with esodeviations (Eso) or exodeviations (Exo).

Table 4. Orthophoric alignment associations with VA.

	Preoperative Orthophoric Alignment	Final Follow-Up Orthophoric Alignment
Preoperative Operative Eye VA	OR 2.2 [1.4, 3.7]	OR 1.8 [1.2, 2.9]
Preoperative Difference in Interocular VA	OR 2.1 [1.2, 4.4]	OR 1.2 [0.8, 2.1]
Final Follow-Up VA	OR 3.1 [1.8, 6.2]	OR 1.5 [1.1, 2.3]
Final Follow-Up Difference in Interocular VA	OR 2.1 [1.2, 4.0]	OR 1.5 [0.9, 2.5]

Abbreviations: visual acuity, VA; odds ratio, OR.

At final follow-up, 13 patients (13%) had a horizontal deviation (eso or exo) that was more than 10 PD larger than preoperative deviation, while 19 patients (20%) showed improved horizontal deviation of at least 10 PD (Supplemental Table S4). There was no significant difference in age ($p = 0.81$) or distribution of types of glaucoma ($p = 0.11$) between patients who showed worse results versus patients with improved strabismus. Two of the patients with worse strabismus had concurrent lateral rectus recession for exotropia at time of BV350 placement, but at final follow-up the exotropia was greater than preoperatively. Following BV350 placement, one patient underwent bilateral medial rectus recession for esotropia but developed consecutive exotropia of greater horizontal deviation than the original esotropia. Two patients with improved strabismus had combined lateral rectus recession for exotropia with BV350 placement and showed improvement of the exotropia. One patient, who underwent lateral rectus recession and medial rectus resection at the time of BV350 placement, developed consecutive esotropia and underwent subsequent medial rectus recession with improvement of overall horizontal deviation. There was no difference in preoperative ($p = 0.58$) or final follow-up ($p = 0.84$) VA between patients who had worse versus improved strabismus (Supplemental Table S4).

4. Discussion

In the United States (US), GDDs have largely supplanted trabeculectomy in children needing angle bypass surgery for IOP control. Although GDDs have less life-long risk of infection and by and large have a more predictable postoperative course compared to trabeculectomy, GDDs more commonly induce strabismus [10,13,21]. In adults, strabismus is often accompanied by diplopia, which is associated with lower quality of life and may require extraocular muscle surgery [11,22]. However, fewer studies have evaluated strabismus prior to and after GDD implantation in children. Since GDDs are most commonly implanted in the superotemporal quadrant, postoperative strabismus in adults is predominantly demonstrated in exotropias and hypertropias of the operated eye [10,23,24]. This is usually accompanied by some amount of incomitance due to restriction of the lateral and/or superior rectus muscles, likely due to scarring behind and around the implant plate [12,23]. Strabismus surgery to alleviate the diplopia is challenging due to scarring between the muscle, the capsule surrounding the plate, and the underlying sclera [25]. Further, the lateral and superior recti typically need to be recessed; however, the implant, if placed below the muscles, may block the ideal location for muscle reattachment. In addition, surgery can disrupt the capsule surrounding the GDD plate, which may initially cause hypotony but then ultimately lead to a greater wound healing response, resulting in encapsulation and tube failure. Techniques such as not suturing the plate to the sclera and placing the plate above the muscles have been used to try to decrease disruption of extraocular muscle motility [24,26]. Nevertheless, the unsutured plate technique did not decrease diplopia [24]. Additionally, placement of the plate above the muscles can allow

for easier muscle recession, but the capsule can still adhere to the underlying muscle, and there is increased risk of anterior shifting of the plate.

While diplopia has been reported in 5–65% of adult patients after GDD placement, this symptom is not frequently seen or endorsed in the pediatric population [10–15]. This is likely due to multiple reasons. Children, especially under the age of 8 years old, rarely complain of diplopia due to suppression of the deviating eye. In addition, children, especially those younger than 5 years old, may not be able to effectively communicate symptoms of double vision. Nevertheless, none of the patients in our cohort who were 8 years or older complained of postoperative diplopia. This may be due to poor vision in one or both of the eyes. Vision in the operative eye was generally poorer compared to the fellow non-operative eye, and 70 of the 97 (72%) patients preoperatively had strabismus on their exam, with 59 patients having tropic deviations, suggesting poor or absence of fusion. Interestingly, of the 27 patients who were orthophoric preoperatively, 4 patients showed tropic deviations, all of which were esotropias at final follow-up. These four patients had a history of early-onset glaucoma (3 PCG, 1 microspherophakia) and poor vision at final follow-up.

Our study was unique in that it involved the largest cohort of pediatric patients and only included those who underwent BV350 surgery in the superotemporal quadrant in order to decrease variation from other types of GDD and implant location. In contrast to other pediatric studies, the vast majority of our patients (87%) did not show worsening of strabismus after BV350 implantation. Not surprisingly, VA in the operative eye was associated with orthophoria preoperatively and at final follow-up. Although our study did not include extraocular motility information due to its retrospective nature, ours did find that the amount of preoperative and final horizontal deviation was associated with VA. Nevertheless, VA was not significantly different between the patients who showed worsening horizontal alignment versus those with improved horizontal deviation. This suggests that VA, which showed a wide range from 20/20 to light perception, did not confound an improvement or worsening of overall horizontal alignment. Further, the VA in the operative eye was significantly worse than the VA in the non-operative eye, but it is important to realize that amblyopia in addition to glaucoma influences VA in children. Sixty-three percent of the patients in our cohort underwent unilateral BV350 placement. However, 64% of the children in our study had bilateral glaucoma, and the eye included in the study may not be the worse-seeing eye as surgery was dictated by the need for IOP control. In fact, in 31% of patients, the operative eye was the preferred eye. Our cohort has a number of differences compared to other pediatric studies on strabismus after GDD placement [14–16]. In Schotthoefer et al.'s study, 62 patients with a history of "congenital glaucoma" or "aphakic glaucoma" underwent GDD surgery with the majority having Ahmed FP7 or S2 placement ($n = 43$), while only 12 patients underwent a BV350 implantation [14]. This study was published prior to the recategorization of childhood glaucomas by the World Glaucoma Congress, so there may be heterogeneity within the "congenital glaucoma" group. The age at time of surgery was younger than our cohort, and, as a result, there were a number of patients who did not have preoperative vision data. Nonetheless, there was a decrease in the number of patients with orthophoria following GDD placement, with many showing limitation of extraocular motility. In Leahy et al.'s study, the majority of patients (21 of 30) also underwent Ahmed placement, with only 30% (9 of 30) having a BV350 implanted for a wide variety of types of pediatric glaucomas [16]. The average age of patients was more similar to our cohort as well as the high percentage of patients with vision less than LogMAR 1.00. Postoperatively, almost 50% of patients had a horizontal and/or vertical deviation, and 33% had extraocular motility deficits, although it is unknown how much of a change this was, as only 11 (37%) patients had available

preoperative strabismus information. In Talsania et al.'s study, 81 patients underwent various types of GDD surgery, including the smaller Baerveldt 250 implant (47%), Ahmed FP7 or S2 (37%) or the BV350 (16%), in different locations (superotemporally, inferonasally, and inferotemporally) [15]. While the average age at time of surgery was similar to our cohort, the percentage of patients with preoperative strabismus was lower (47%), and the visual acuity of the operative eye was better than our cohort. This may account for the higher percentage of new or worsened postoperative strabismus (31%) compared to our cohort (13%). It is important to note that these three studies used different types of GDDs. Studies in adults have shown that Ahmed devices may have greater risk of extraocular motility defects due to their higher profiles, especially compared to the smaller Baerveldt 250 device [11,22]. While Talsania et al. did not show an association between the type of GDD and risk of new or worse postoperative strabismus, the number of patients, especially in the BV350 group ($n = 13$), was limited.

As with all retrospective studies, there are limitations that must be recognized. There is no control group, as well as no heterogeneity within the cohort with regard to the type of glaucoma and length of follow-up. In addition, many of the patients had concurrent surgeries with the BV350 placement including strabismus surgery, which could certainly influence postoperative visual acuity and alignment results. Pars plana vitrectomy and angle surgery together constituted the majority of concurrent surgeries, and neither of these surgeries would be expected to significantly alter postoperative strabismus. Further, we did not include extraocular motility information, namely limitations or restrictions, and only included strabismus measurements in primary position. As a result, the effects of BV350 placement specifically on alignment was confounded by these factors. Nonetheless, the strengths of our study include the number of included children, the uniformity of type and location of GDD, and that all surgeries were performed by a single surgeon.

5. Conclusions

In summary, we present preoperative and postoperative VA and strabismus data on one of the largest cohorts of pediatric patients who underwent superotemporal BV350 GDD placement. While diplopia after GDD is an important consideration in adults, pediatric glaucoma patients often have preoperative strabismus and amblyopia. At least in our cohort, the majority of patients did not show worsening of strabismus after BV350 surgery, and VA remained stable.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/jcto4010004/s1>. Table S1: Surgical history, Table S2: Strabismus distribution, Table S3: VA and strabismus deviation, Table S4: Worse versus improved strabismus.

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Informed Consent Statement: Due to the retrospective nature and IRB approval as exempt, informed consent was not required.

Data Availability Statement: Dataset available on request from the authors. The data cannot be uploaded to a public registry due to it containing HIPAA information. Further, given the rarity of these diseases and the relatively small number of patients, even without HIPAA information, the data could be considered identifiable for specific patients.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

BV350	Baerveldt 350 glaucoma drainage device
GDD	Glaucoma drainage device
HIPAA	Health insurance portability and accountability act
IOP	Intraocular pressure
IQR	Interquartile region
OR	Odds ratio
PD	Prism diopter
VA	Visual acuity

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