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ORIGINAL RESEARCH

Comparing Park Table - Augmented and Standard Surgical Doses in Acute Acquired Comitant Esotropia: A Retrospective Analysis

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Purpose: Acquired comitant esotropia (ACE) is a rare condition characterized by the sudden onset of inward eye deviation. In non-recovered cases, surgery was performed. The standard surgical dose typically leads to undercorrection, and multimodal approaches were used to enhance outcomes. The current study aimed to explore the clinical course and identify factors influencing surgical success in patients with ACE at a tertiary hospital.

Patients and Methods: This retrospective study reviewed the electronic medical records of 99 patients diagnosed with ACE at Phramongkutklao Hospital between 2014 and 2024. Data collected included patient demographics, underlying etiologies, clinical presentations, treatment approaches, and surgical outcomes. Surgical cases were categorized based on the use of either the standard Park surgical dosage or an augmented dose, defined as an additional 0.5 mm beyond the standard amount. Factors associated with successful surgical outcomes were also evaluated through statistical analysis.

Results: The mean age at diagnosis was 28.97 ± 19.67 years, with a slight predominance of men. ACE was classified as types I (Swan type), II (Burian–Franceschetti), and III (Bielschowsky) in 8.08% (8/99), 46.46% (46/99), and 45.45% (45/99), respectively. All cases were idiopathic, with neuroimaging abnormalities detected in 4.04% (4/99) of patients. Surgical intervention was required in 79.8% (79/99) of cases. One year postoperatively, 75% (54/72) of patients demonstrated substantial improvement in ocular alignment. Based on subgroup analysis, the success rate was 91.18% in the augmented group and 60.53% in the non-augmented group. Logistic regression analysis indicated that an augmented surgical dose was significantly associated with favorable surgical outcomes (adjusted odds ratio: 5.50; 95% confidence interval [95% CI], 1.32–22.89).

Conclusion: This study demonstrates a high surgical success rate in patients with ACE, supporting the potential use of augmented surgical doses. Further research is warranted to identify additional prognostic factors and refine treatment strategies for optimal ACE management.

Plain Language Summary: Acquired comitant esotropia (ACE) is a rare eye condition in which one or both eyes suddenly turn inward, often causing double vision. When conservative treatments like glasses or prisms fail, surgery is usually required. However, the standard surgical approach can sometimes result in undercorrection, prompting the use of adjusted, or "augmented", surgical doses to improve outcomes.

In this study, we reviewed the records of 99 patients treated for ACE at a tertiary hospital in Thailand between 2014 and 2024. Most patients eventually required surgery, and those who received an augmented surgical dose—an extra 0.5 mm beyond the standard measurement—had significantly better results. One year after surgery, about 75% of patients showed marked improvement in eye alignment. Statistical analysis revealed that using an augmented dose increased the likelihood of surgical success by more than five times.

These findings support the use of augmented surgical dosing in ACE and suggest that tailoring the surgical dose may lead to better outcomes. More studies are needed to further refine surgical techniques and identify other factors that influence success.

Keywords: acquired comitant esotropia, clinical course, etiology, incidence, surgical outcomes, tertiary hospital

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Introduction

Acquired comitant esotropia (ACE) is a rare form of strabismus characterized by the acute onset of esodeviation, typically in older children or adults, and presents notable diagnostic and therapeutic challenges due to its varied etiologies and clinical presentations.[1] Although ACE accounts for only 0.3% of childhood strabismus cases,[2,3] recent studies report a rising incidence, potentially linked to increased digital screen exposure during the COVID-19 pandemic.[4–8] Etiologies range from functional and structural abnormalities to idiopathic origins. In rare cases, ACE may be associated with intracranial pathology, complicating diagnosis and management.

Although nonsurgical options such as prism glasses and botulinum toxin have been used, surgical correction remains the mainstay for most patients, with reported success rates ranging from 70% to 96.15%.[9–18] Standard surgical doses, however, may lead to undercorrection, prompting the development of alternative approaches such as prism adaptation[9,11,17,18] and augmented surgical dosing protocols.[19–21] Nevertheless, no consensus exists on the optimal surgical approach for ACE, and limited evidence guides surgical dose selection.

Despite these global developments, data on ACE in the Thai population are lacking. In our clinical experience, standard surgical doses often resulted in undercorrection. Inspired by recent literature advocating dose augmentation,[19–21] we adopted a modified approach by increasing the standard dose by 0.5 mm. This study retrospectively compares the surgical outcomes of standard versus augmented dosing in ACE, aiming to fill the knowledge gap in Thailand and support optimized surgical planning.

Materials and Methods

We retrospectively reviewed medical records for all patients diagnosed with ACE at our tertiary hospital from October 1, 2014, to January 31, 2024. Patients were determined through diagnostic coding (International Statistical Classification of Diseases and Related Health Problems, 10th revision, code H500) and electronic health record searches using relevant keywords related to acquired esotropia.

Participants

Inclusion criteria were patients of all ages with documented clinical and ophthalmologic assessments consistent with ACE, full ocular duction, and at least one year of follow-up. Exclusion criteria were participants with incomplete recorded data, incomplete follow-up, a positive thyroid function test or acetylcholine receptor antibody, or previous strabismus surgery. Figure 1 illustrates a participant flowchart.

Because of the retrospective design and rarity of acute ACE, a formal sample size calculation and power analysis were not performed. All eligible cases over the 10-year study period were included to ensure a comprehensive data capture.

Data collected from medical records included patient demographics (age at presentation and sex), onset duration of ACE, presenting symptoms, ocular examination results (degree of esotropia and visual acuity), diagnostic investigations (refraction, ocular motility assessments, and neuroimaging if indicated), treatment modalities (optical correction, prism glasses, and occlusion therapy), and details of surgical interventions (surgical technique, preoperative and postoperative ocular alignment measurements, and complications).

Disease Definition

ACE presents as a sudden inward deviation of one or both eyes in individuals without prior strabismus, typically with comitant misalignment and diplopia. Burian and Miller[22] classify ACE into three types: Type I (Swan), caused by fusion interruption; Type II (Franceschetti), an idiopathic, large-angle esotropia often associated with hyperopia and stress; and Type III (Bielschowsky), characterized by moderate myopia and large-distance esotropia.

The measurement was based on the largest angle, either at distance or near, measured with spectacle correction.

Surgical success was defined as achieving ocular alignment within 10 prism diopters of the primary position, as assessed by the alternating prism cover test, with no clinical diplopia. The standard surgical dose was determined based on the Parks table.[23] An augmented surgical dose was applied by increasing the standard dose by 0.5 mm per procedure, regardless of whether the surgery involved recession or resection. Postoperative ocular alignment was categorized into three types:

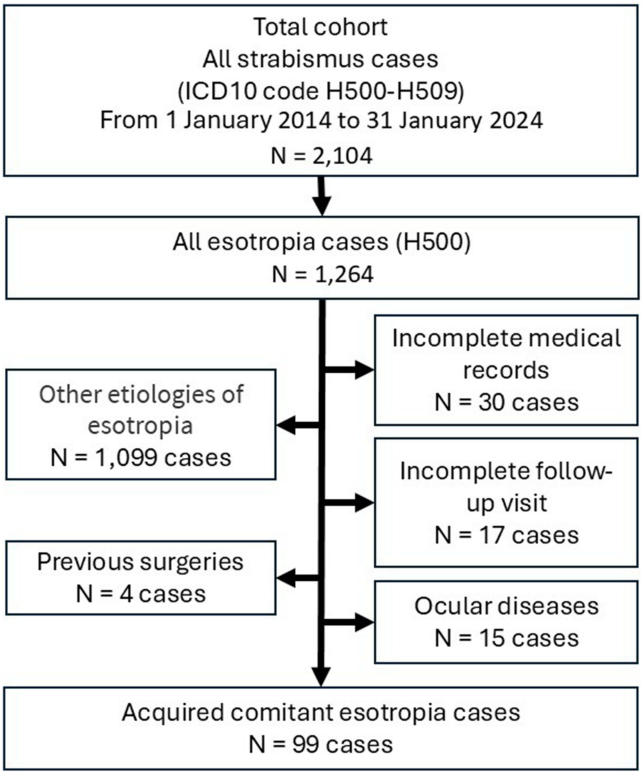

Figure 1 Flowchart of participants' recruitment.
Abbreviations: ICD, international classification of disease; N, number of participants.

orthotropia, defined as ocular alignment within 5 prism diopters of orthotropia; residual esotropia, defined as an esotropia with an angle of ≥5 prism diopters; and consecutive exotropia, defined as an exotropia with an angle of ≥5 prism diopters.

Statistical Analysis

Descriptive statistics were utilized to summarize demographic characteristics, etiologies, clinical presentations, and treatment outcomes. Continuous variables were presented as means ± standard deviations (SD), whereas categorical variables were expressed as frequencies and percentages. Surgical outcomes were evaluated based on postoperative ocular alignment measurements at each follow-up time point. The Mann–Whitney *U*-test was used to compare ordinal or continuous variables between two independent groups, whereas Fisher's exact test was applied to assess associations between categorical variables in small samples or those with low expected frequencies.

Logistic regression was used to identify independent factors associated with successful surgery in ACE. Multivariate logistic regression was adjusted for factors that affected the good surgical outcomes, including augmented surgical dose, mean age, mean duration, and preoperative angle. A p-value of <0.05 was considered statistically significant. Stata 14 (StataCorp LLC, USA) was used for analysis.

Ethics Approval

The Institutional Review Board of the Royal Thai Army Medical Department approved this study, under approval number S016h/67_Exp. The informed consent requirement was waived due to the retrospective study design. The study adheres to the Declaration of Helsinki.

Results

A total of 2104 strabismus cases were found during the study period. Of 1264 initial cases diagnosed with convergent comitant esotropia, 741 were excluded due to specific underlying causes, previous surgery, incomplete data, or insufficient

follow-up. Ultimately, 99 patients diagnosed with ACE met the inclusion criteria and were included in the study cohort. The mean age at presentation was 28.97 ± 19.67 years, with a slight predominance of men (man: woman = 52:47). The age range at the onset of ACE varied from 3 to 84 years, indicating a wide spectrum of affected individuals in adult and older pediatric populations. The mean follow-up period was 18.25 ± 5.43 months. Table 1 shows demographic data.

This study revealed a 7.83% (99/1264) incidence of ACE in overall esotropia cases and a 4.71% (99/2104) incidence in overall strabismus cases.

The distribution of ACE types indicates a predominance of idiopathic cases potentially associated with stress or hyperopia (Franceschetti type, 46.46%), followed by myopia-related esotropia (Bielschowsky-type, 45.45%), and a smaller proportion of cases potentially related to disruptions in fusion (Swan type, 8.08%) while no specific underlying cause was determined. Additionally, 4.04% (4/99) of cases presented with abnormal neuroimaging findings (Table 2).

The mean onset duration was 3.01 ± 3.94 years. All participants presented with binocular diplopia. The mean refraction was 2.90 ± 4.56 diopters. A total of 4.04% (4/99) of cases spontaneously recovered. However, 79.8% (79/99) of patients exhibited persistent or progressive esotropia requiring surgical intervention.

Table 1 Demographics of the Overall ACE Case

Variable	Category	Surgery (n, %)	No surgery (n, %)	*p*
Sex	Man	42 (52.5%)	10 (52.6%)	1
	Woman	38 (47.5%)	9 (47.4%)	
Type of ACE	1	7 (8.8%)	1 (5.3%)	0.082
	2	41 (51.2%)	5 (26.3%)	
	3	32 (40.0%)	13 (68.4%)	
Refraction	Mean ± SD	−1.43 ± 2.93	−3.71 ± 5.59	0.037
	Median (IQR)	−0.50 (−2.81–1.00)	−2.62 (−5.31–0.25)	
Age at presentation	Mean ± SD	24.55 ± 16.83	47.58 ± 20.26	<0.001
	Median (IQR)	24.00 (9.75–36.00)	44.00 (35.50–66.00)	
Onset duration (Year)	Mean ± SD	3.01 ± 3.94	3.09 ± 7.26	0.027
	Median (IQR)	2.00 (1.00–3.00)	1.00 (1.00–1.00)	
Strabismus angle	Mean ± SD	34.66 ± 12.70	15.63 ± 10.10	<0.001
	Median (IQR)	32.50 (25.00–45.00)	14.00 (10.00–18.00)	

Notes: Data are presented as the mean ± SD, median (interquartile range), or n (%) of patients.
Abbreviations: ACE, acquired comitant esotropia; SD, standard deviation.

Table 2 Abnormal Neuroimaging Findings in Four Cases

	Age	Sex	Findings
Case 1	7	Male	Hypodensity lesion in the left frontal lobe of 0.4 cm from old intracranial bleeding
Case 2	39	Female	Carvernoma 1.4 × 1.3 × 1.1 cm^3 at the medial left frontal lobe
Case 3	57	Female	Well circumscribed mass extra–axial involves right cavernous sinus, petrous apex, right side of temporal cerebri (suspected meningioma)
Case 4	65	Male	Outpouching lesion of left supraclinoid ICA of 0.14 cm, indicating a saccular aneurysm

Notes: Neuroimaging modality: All cases evaluated with MRI (1.5T or 3T) with contrast enhancement, except Case 1 which received both CT and MRI due to acute presentation. Clinical correlation: None of these findings were considered the direct cause of ACE, but represented incidental discoveries during diagnostic workup. Follow-up: Case 4 was referred for neurosurgical consultation due to aneurysm; others monitored conservatively.

A total of 14.14% (14/99) of ACE cases received nonsurgical treatment. Six cases received prism glasses to treat double vision. The mean esotropic angle in this group was 15.63 ± 10.10 prism diopters.

Surgical procedures included unilateral medial rectus (UMR) recession (5.06%, 4/79), bilateral medial rectus (BMR) recession (82.28%, 65/79), and unilateral medial rectus muscle recession and lateral rectus resection (12.66%, 10/79), according to preoperative measurements and surgeon discretion. The preoperative data is presented in Table 3, and the postoperative data is shown in Table 4.

The overall success rate was highest one week after surgery at 75.95% (60/79), declining to 75% (54/72) one year after surgery. In subgroup analysis, the success rate was 91.18% in the augmented group and 60.53% in the non-augmented group one year postoperatively.

The mean preoperative angle was 34.66 ± 12.70 prism diopters in the success group, which improved to 3.68 ± 5.37 diopters one year postoperatively.

Across surgical techniques, augmented dosing was associated with larger preoperative deviation angles and higher dose-response values than standard dosing. In BMR recession, the mean preoperative angle in the augmented group was 37.33 ± 13.29 prism diopters (PD), compared to 31.61 ± 9.91 PD in the non-augmented group. The corresponding dose-

Table 3 Preoperative Data in ACE Cases Received Surgery

Variable	Category	Success (%)	Nonsuccess (%)	*p*
Age at presentation	Mean ± SD	22.00 ± 15.81	32.05 ± 18.33	0.027
	Median (IQR)	20.00 (8.75–31.25)	34.00 (19.00–41.50)	
Refraction	Mean ± SD	−1.33 ± 2.82	−1.83 ± 3.36	0.561
	Median (IQR)	−0.12 (–3.19–1.00)	−1.00 (−2.38–0.25)	
Onset duration (Year)	Mean ± SD	2.84 ± 4.18	3.50 ± 3.17	0.106
	Median (IQR)	2.00 (1.00–3.00)	2.00 (2.00–3.75)	
Type	1	6 (10)	1 (5.3)	0.702
	2	31 (51.7)	9 (47.4)	
	3	23 (38.3)	9 (47.4)	
Sex	Man	34 (56.7)	8 (42.1)	0.301
	Woman	26 (43.3)	11 (57.9)	
Preoperative angle	Mean ± SD	35.98 ± 12.61	31.47 ± 12.26	0.197
	Median (IQR)	35.00 (30.00–45.00)	30.00 (20.00–40.00)	
Surgical approach	Bilateral MR recession (augmented)	23 (92%)	2 (8%)	0.01
	Bilateral MR recession (standard)	21 (63.6%)	12 (36.4%)	
	Recess–resect procedure (augmented)	7 (87.5%)	1 (12.5%)	
	Recess–resect procedure (standard)	1 (50%)	1 (50%)	
	Unilateral MR recession (augmented)	1 (100%)	0 (0%)	
	Unilateral MR recession (standard)	1 (33.3%)	2 (66.7%)	
Augmented	Yes	31 (57.4)	3 (16.7)	0.003
	No	23 (42.6)	15 (83.3)	

Notes: Data are presented as the mean ± SD, median (interquartile range), or n (%) of patients.
Abbreviations: ACE, acquired comitant esotropia; SD, standard deviation; IQR, interquartile range; MR, medial rectus.

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Table 4 Postoperative Outcomes in Surgically Treated ACE Cases

Variable	Category	1 Week	1 Month	6 Months	1 Year	p-value
Success Group		(n = 60)	(n = 60)	(n = 60)	(n = 54)	
- Alignment	Orthotropia	44 (73.3%)	48 (80.0%)	49 (81.7%)	44 (81.5%)	<0.001
	Esotropia	14 (23.3%)	12 (20.0%)	11 (18.3%)	10 (18.5%)	
	Exotropia	2 (3.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
- Deviation Angle	Mean ± SD	1.52 ± 2.79	0.98 ± 2.16	0.72 ± 1.64	0.80 ± 1.91	<0.001
	Median (IQR)	0.00 (0.00–2.50)	0.00 (0.00–0.00)	0.00 (0.00–0.00)	0.00 (0.00–0.00)	
Nonsuccess Group		(n = 19)	(n = 19)	(n = 19)	(n = 18)	
- Alignment	Orthotropia	1 (5.3%)	0 (0.0%)	2 (10.5%)	0 (0.0%)	<0.001
	Esotropia	18 (94.7%)	19 (100.0%)	17 (89.5%)	18 (100.0%)	
	Exotropia	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
- Deviation Angle	Mean ± SD	10.58 ± 7.11	11.68 ± 4.99	10.53 ± 5.07	12.00 ± 2.75	<0.001
	Median (IQR)	10.00 (5.00–14.50)	10.00 (8.00–15.00)	10.00 (8.00–12.00)	12.00 (10.00–14.00)	

Notes: p-values compare outcomes between Success and Nonsuccess groups at each timepoint.
Abbreviations: ACE, acquired comitant esotropia; IQR, interquartile range.

response was 5.48 ± 1.14 PD/mm in the augmented group versus 4.39 ± 0.77 PD/mm in the non-augmented group. For unilateral medial rectus recession with lateral rectus resection, the augmented group showed a higher mean preoperative angle (46.67 ± 12.58 PD) than the non-augmented group (37.86 ± 13.18 PD). The dose-response in the augmented recess-resect group was 7.00 ± 1.32 PD/mm for resection and 6.67 ± 2.08 PD/mm for recession, while the non-augmented group had lower values of 5.79 ± 1.93 PD/mm and 5.43 ± 0.79 PD/mm, respectively. In UMR recession alone, the augmented group had a higher preoperative angle (55 PD) compared to the non-augmented group (16.67 ± 3.06 PD), with corresponding dose-responses of 6.5 PD/mm and 5.50 ± 0.87 PD/mm, respectively.

Multivariate analysis indicated that an augmented surgical dose was significantly associated with favorable surgical outcomes at 1 year postoperatively ($p < 0.05$). After adjusting for confounders—including augmented surgical dose, age, onset duration, and preoperative angle—patients who received an augmented dose had an adjusted odds ratio of 5.50 (95% CI, 1.32–22.89) for surgical success (Table 5).

Table 5 Logistic Regression Analysis of Factors Influencing Successful Surgical Outcomes in ACE

Factor	Coefficient	Std. Error	z-value	p-value	Adjusted OR	95% CI
Constant	1.73	1.27	1.36	0.174	5.64	0.47–68.34
Augmented surgery	1.70	0.73	2.34	0.019	5.50	1.32–22.89
Age (years)	−0.04	0.02	−1.77	0.077	0.96	0.92–1.00
Preoperative Angle	−0.01	0.03	−0.21	0.834	0.99	0.94–1.05
Duration (years)	−0.00	0.08	−0.02	0.988	1.00	0.85–1.17

Notes: Significant predictors marked with (p < 0.05); All continuous variables (age, preoperative angle, duration) are measured in years or prism diopters.
Abbreviations: ACE, acquired comitant esotropia; OR, odds ratio; CI, confidence interval; Std. error, standard error; adjusted OR, adjusted for covariates in the model.

No surgical complications were recorded during the follow-up period. The reoperation rate in this study was 12.66% (10/79). The second operation involved unilateral or bilateral lateral rectus resection, based on the amount of residual esotropia.

Discussion

This study found an incidence rate of ACE at 4.71%, notably higher than the 0.3% reported in earlier studies.[2,3] Several factors may explain this discrepancy. First, our study was conducted at a tertiary care hospital, which typically handles more complex cases, including ACE, leading to an increased incidence compared with general population studies. Second, the rise in screen time in the digital age potentially contributed to a higher incidence of ACE, as prolonged near-work activities can increase accommodative demand and disrupt ocular alignment.[4–7] Additionally, advances in diagnostic capabilities and heightened clinician awareness have facilitated earlier and more frequent detection of ACE. Finally, variations in study design, population demographics, and diagnostic criteria across studies could account for the observed differences in incidence rates. These factors highlight the need for standardized, large-scale epidemiological studies to accurately determine the true incidence of ACE and its contributing factors.

Regarding ACE subtypes, type II (Burian–Franceschetti) was the most prevalent, observed in 46.46% (46/99) of cases, followed closely by type III (Bielschowsky) at 45.45% (45/99). Type I (Swan type) was the least common, accounting for 8.08% (8/99) of cases. These findings are consistent with previous studies, such as that by Lekskul et al,[21] which reported proportions of 16.7%, 30%, and 36.67% for the Swan, Burian–Franceschetti, and Bielschowsky types, respectively.

While earlier research primarily linked ACE to early childhood onset,[24,25] our findings indicate a significantly later mean age of onset (28.97 ± 19.67 years). This is particularly relevant for Bielschowsky-type ACE, which is predominantly observed in adults with prolonged, uncorrected myopia and excessive near-work activities. The pathophysiology of this subtype involves an imbalance in convergence–divergence tone, leading to increased MR muscle forces—a mechanism that aligns with our observations. Additionally, our findings suggest a higher prevalence of ACE among Asian adults and older children, potentially influenced by environmental and cultural factors that promote prolonged near-work activities.[7]

Abnormal neuroimaging findings were seen in 4.04% (4/99) of cases, though none were directly linked to ACE pathogenesis. These findings, however, highlight the continued importance of neuroimaging in ACE evaluation. Previous studies have identified serious underlying causes, such as brain tumors and congenital anomalies, supporting routine imaging to rule out occult neurological pathology.[26]

Furthermore, 79.8% (79/99) of patients with ACE required surgical intervention, underscoring the limited efficacy of conservative management in most cases. This high surgical rate may reflect the role of our institution as a tertiary referral center, which typically handles more complex and severe cases. Many patients referred to tertiary centers require surgery after failing to respond to conservative treatments, which likely accounts for the increased proportion of surgical cases. Additionally, non-recovery cases—especially in adults with sudden onset diplopia—may suffer significant psychosocial distress and reduced quality of life, reinforcing the need for timely surgical correction.

The overall surgical success rate for ACE in our cohort was 75% (54/72), aligning with previous studies that report success rates ranging from 70% to 96.15%.[9,11–19,21] Various surgical techniques were used, including UMR recession, BMR recession, unilateral recess-resect, and three-muscle procedures. A key contributor to the high success rate was the applied surgical dose, which improved outcomes. However, no consensus exists regarding the optimal standard or augmented surgical dose for ACE treatment.

Multivariate logistic regression analysis in our study confirmed that increased surgical dose was significantly associated with improved outcomes in patients with ACE. This aligns with previous literature supporting augmented dosing to address the high risk of undercorrection seen with standard protocols. Zhou et al[27] reported favorable results with augmented unilateral recess–resect procedures, especially in patients with deviations over 30 PD, and provided dose-response data recommending increased resection amounts. Similarly, Yu et al[28] demonstrated superior long-term ocular alignment with augmented doses compared to botulinum toxin type A injections. Additional studies suggest increasing surgical dose improves success rates even without formal comparison groups.[20,21]

Our findings further support this approach. Among patients undergoing BMR recession, the augmented group showed a higher dose-response (5.48 ± 1.14 PD/mm) than the non-augmented group (4.39 ± 0.77 PD/mm), along with a higher preoperative deviation. In unilateral recess-resect procedures, the augmented group also had superior dose-responses (7.00 ± 1.32 PD/mm for resection and 6.67 ± 2.08 PD/mm for recession) compared to the non-augmented group (5.79 ± 1.93 PD/mm and 5.43 ± 0.79 PD/mm, respectively). For UMR recession alone, the augmented group showed a higher dose-response (6.5 PD/mm) than the non-augmented group (5.50 ± 0.87 PD/mm). These results align with previously reported dose-responses—5.11 PD/mm for medial rectus recession and 2.51 PD/mm for lateral rectus resection in deviations <30 PD—indicating additional correction is needed for deviations >30 PD.[27] This consistency supports adjusting surgical dosing by deviation magnitude.

Innovations in target angle determination—such as prism adaptation, base-out recovery, occlusion testing, and the Maddox rod method—aim to improve surgical precision and reduce recurrence. However, these often require patient cooperation or specialized tools. Additionally, the risk of overcorrection with augmented dosing highlights the need for careful, individualized surgical planning.[11,29,30]

Despite growing international evidence, data on ACE and augmented dosing remain scarce in Thailand. This retrospective study offers locally relevant insights, demonstrating a significant link between increased surgical dose and better outcomes, with dose-response trends consistent with global standards. The findings underscore the need for individualized planning that considers patient factors such as age, deviation angle, and clinical subtype. A patient-centered, deviation-based approach—guided by clinical presentation and regional data—can enhance surgical success and support evidence-based decision-making in the Thai context.

Limitations

First, its retrospective design may introduce selection bias, because only patients with complete medical records and follow-up data were included. Second, the single-center setting may limit the generalizability of the results to other populations or healthcare settings. Third, the lack of long-term follow-up restricts our ability to comprehensively evaluate the durability of surgical success and long-term visual outcomes in some cases. Fourth, sensory outcomes, such as stereoacuity and binocular vision, were not assessed, limiting evaluation of functional success. Fifth, differences in strabismic angles between distance and near fixation were not analyzed; future studies should examine their relevance to surgical planning. Lastly, screen time and near-work activities were not monitored, warranting further investigation into their possible association.

Future Directions

Future research should focus on prospective, multicenter studies to confirm and expand upon our findings. Larger sample sizes and diverse populations will improve the generalizability and robustness of data. Long-term follow-up studies are crucial to understanding the enduring effects of surgical intervention and to identifying predictors of sustained success. Moreover, investigating advanced diagnostic tools and individualized treatment approaches could improve ACE treatment.

Conclusion

Surgical intervention remains highly effective for managing ACE, with a high rate of successful ocular alignment. This study demonstrates that augmented surgical dosing is significantly linked to improved outcomes, with an adjusted odds ratio showing more than a fivefold increase in success odds. These findings provide strong evidence supporting enhanced dosing in ACE treatment. Further prospective studies are needed to optimize surgical strategies and identify other factors influencing success.

Abbreviations

ACE, Acquired comitant esotropia; BMR, Bilateral medial rectus; SD, Standard deviations; UMR, Unilateral medial rectus.

Data Sharing Statement

All data analyzed in this study are included in this published article.

Ethics Approval and Consent to Participate

The Institutional Review Board of the Royal Thai Army Medical Department reviewed and approved the study protocol (approval number S016h/67_Exp). Written informed consent for publication was waived by The Institutional Review Board of the Royal Thai Army Medical Department because of the retrospective nature of the study. Participant data were kept anonymous and confidential.

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Disclosure

The author reports no competing interests in this work.

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