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Effect of newborn screening programs on congenital nasolacrimal duct obstruction

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ABSTRACT

Aims: To evaluate the effect of routine ophthalmological examination in babies with congenital nasolacrimal duct obstruction (CNLDO).

Methods: One hundred patients aged 1-12 months who presented to our clinic for routine ophthalmological examinations at the request of the Turkish Ministry of Health in 2022-2024 and who were diagnosed with CNLDO were enrolled in the study. The patients' demographic and clinical characteristics, mode of delivery, gender, laterality, and type of nutrition were determined.

Results: One hundred patients with a mean age of three months were enrolled. Sixty-five percent were aged two months or less, and 35% were older than two months. Fifty percent were female, and 50% were male. Normal delivery was present in 55% of the cases and cesarean delivery in 45%. Seventy percent of the patients were breastfed, while 30% received ready-made formula. Ninety percent of the patients were born full term, 85% had no other diseases, and 65% of patients had unilateral CNLDO, and 35% bilateral.

Conclusion: The Turkish Ministry of Health recommends routine ophthalmological examination for every baby at 0-3 months of age in order to diagnose diseases such as congenital cataract, strabismus and retinoblastoma that may result in early blindness. Babies who present within the scope of the screening program are diagnosed early in case of CNLDO. Babies diagnosed early have a higher chance of recovery without surgery.

Keywords: Congenital nasolacrimal duct obstruction, early diagnosis, Ministry of Health

INTRODUCTION

Congenital nasolacrimal duct obstruction (CNLDO) is the congenital obstruction of the drainage system in the nasolacrimal duct.[1] The prevalence ranges between 5% and 20%.[2] The cause is often a membranous obstruction that develops at the distal end of the nasolacrimal duct, where it opens into the inferior meatus nasi, or at the Hasner valve.[3]

Patients present with unilateral or bilateral watering and crusting in the eyes during the first year of life. In the presence of infection, they can also present with conjunctivitis, dacryocystitis, and periorbital cellulitis.[4]

Due to the effects of recurrent infections and epiphora, these babies are also at risk of amblyopia.[5]

Researchs show that 62.8-95% of cases resolve spontaneously within the first year. Cases detected early should be supported with lacrimal sac massage for easy opening of the obstruction. CNLDO can be treated with conservative approaches such as lacrimal sac massage in the first year of life, but may require surgical intervention in later years.[6]

The first interventional method used is probing. This is reported to be 87.2% successful when applied between two weeks and 41 months of age. Silicone tube intubation is frequently employed when probing is ineffective or if patients present later than that age. The success rate of silicone tube intubation varies between 62% and 100%.[7-9]

Screening programs are applied for diseases that are commonly seen in Turkiye and that have a high success rate if treated early. Newborn screenings are basically grouped under the titles of hypothyroidism, phenylketonuria, biotinylase deficiency, and cystic fibrosis, which are checked with capillary dried blood, hearing screening, critical congenital heart disease, developmental hip dysplasia screening, and eye screening with red reflex.[10]

Hearing screening has been implemented since 2005 within the scope of the Turkish Ministry of Health National Screening Program. Hearing loss rates have been significantly reduced as a result.[11]

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The red reflex test is an essential part of the newborn examination and is used to identify numerous pathologies that may be present in the visual axis, including cataract, corneal opacity, retinoblastoma, and retinal detachment. Dark spots in the reflex, decreased red or white reflex, and asymmetry in the reflex are indications for referring the baby to an ophthalmologist.[12]

This study was performed to draw attention to the fact that babies evaluated within the scope of the screening program and with CNLDO can be identified in the early months, that follow-up and treatment can be performed more regularly by creating awareness in families, and that babies might require fewer invasive interventions as a result of screening.

METHODS

The study involved 100 patients aged 1-12 months who presented to our clinic within the scope of the Ministry of Health eye screening program between 2022 and 2024 and who were diagnosed with CNLDO. Approval for the study was obtained from the Harran University Faculty of Medicine Clinical Researches Ethics Committee (Date: 21.10.2024, Decision No: 16/7), and it was conducted in accordance with the principles of the Declaration of Helsinki.

Diagnosis of CNLDO was confirmed by performing a fluorescein disappearance test on babies with watery and crusty eyes. The patients' demographic and clinical characteristics, type of delivery and feeding methods used, age, and laterality characteristics were examined. Birth times and additional diseases were recorded. Data analysis was performed on SPSS version 20 software.

RESULTS

The mean age of the 100 babies included in the study was 2.8 months. Sixty-five babies (65%) were aged two months or younger and 35 (35%) were older than two months. Fifty (50%) were girls and 50 (50%) were boys. Fifty-five babies (55%) were born by the spontaneous vaginal delivery and 45 (45%) by cesarean section. 70% were breastfed, 15% were given formula, 15% were breastfed and formula. Ninety percent were born at term (47-40 weeks), 5% were preterm, and 5% were post-term. Comorbid conditions were observed in 15% of the study population, predominantly manifesting as cardiovascular and respiratory disorders, while 85% of patients presented without concurrent medical conditions. Finally, 65% of cases were unilateral and 35% were bilateral (Table 1).

There were no statistically significant differences between the spontaneous vaginal delivery and cesarean section (CS) groups in terms of age (p=0.635), gender distribution (p=0.653), or laterality (p=0.587), with the overall distribution of demographic and clinical characteristics being comparable between the two groups (p=0.909). These findings are presented in detail in Table 2.

There were no statistically significant differences among the breastfeeding, formula feeding, and mixed feeding groups in terms of age (p=0.412), gender distribution (p=0.107), or laterality (p=0.486), with the overall distribution of demographic and clinical characteristics being comparable across the feeding types (p=0.106). These findings are presented in detail in Table 3.

Table 1. Descriptive characteristics (%)

Category	Details
Age	2.8 months
Gender n (F/M)	50 (50%) 50 (50%)
Feeding	Breastfed; 70% Formula; 15% Breastfed and formula; 15%
Birth mechanism	SVD; 55% C/S; 45%
Comorbid conditions	15%
Laterally	Unilateral; %65 Bilateral; 35
Age of birth	<36 week; 5% 36-40 week; 90% >40 week; 5%

SVD: Spontaneous vaginal delivery, CS: Cesarean section, F/M: Female/male, p<0.05

Table 2. Comparison of the demographic and clinical characteristics of patients based on the mode of delivery

	SVD n (%)	CS n (%)	p
Number	55 (55%)	45 (45%)	0.909
Age	4.09±4.42	4.33±5.78	0.635
Gender (F/M)	30/25 (54.5/45.5)	20/25 (44.4/55.6)	0.653
Laterally			
Right	25 (45.5%)	20 (44%)	
Left	15 (27.3%)	5 (11%)	0.587
Bilateral	15 (27.3%)	20 (44%)	

SVD: Spontaneous vaginal delivery, CS: Cesarean section, F/M: Female/male

Table 3. Comparison of demographic and clinical characteristics of patients according to type of feeding

	Breastfed n (%)	Formula n (%)	Breastfed and formula n (%)	p
Number	70 (70%)	15 (15%)	15 (15%)	0.106
Age	2.78±3.48	1.33±0.57	1.33±0.57	0.412
Gender (F/M)	25 (35.7%)	10 (66.7%)	15 (100%)	0.107
	45 (64.3%)	5 (33.3%)	0 (0%)	
Laterally				
Right	25 (35.7%)	5 (33.3%)	10 (66.7%)	
Left	20 (28.6%)	0 (0%)	5 (33.3%)	0.486
Bilateral	25 (35.7%)	10 (66.7%)	0 (0%)	

F/M: Female/male

DISCUSSION

The findings of this study highlight the importance of early diagnosis and conservative treatment. By implementing routine ophthalmological examinations as part of the screening program, a significant proportion of cases can be identified and managed within the first few months of life. This early intervention can lead to higher rates of spontaneous resolution and reduce the need for more invasive surgical interventions, which has the potential to improve patient outcomes, reduce healthcare costs, and alleviate the burden on the healthcare system.

CNLDO is the most common cause of epiphora in infancy. In terms of clinical presentation, the distribution pattern of this condition demonstrates notable variability in its laterality. The condition is mostly unilateral, although bilateral occurrence has also been reported in 14-33.8% of cases.[13,14] The incidence of unilateral CNLDO was also significantly high among our own cases. Our findings regarding laterality align with established literature, though with some notable distinctions. Some studies have described CNLDO as more common in premature babies, since the nasolacrimal canal completes its development late.[15] However, premature babies constituted only 5% of our cases. This pattern challenges the usual link between prematurity and CNLDO, suggesting that other developmental factors might play a bigger role in its occurrence. The low number of premature infants with CNLDO in our study could be due to advancements in prenatal care and monitoring, though this idea needs further confirmation through larger, multi-center studies. Additionally, the fact that most cases in our cohort were term infants hints that nasolacrimal duct development might depend on more than just gestational age, such as genetic factors, environmental influences, or other developmental aspects that are not yet fully understood.

A higher incidence of CNLDO has been reported in some studies in babies born by cesarean section compared to the spontaneous vaginal delivery. Postpartum pressure differences may facilitate the rupture of Hasner's membrane. Similarly to the present study, some publications involving larger case series have observed no relationship between type of delivery and CNLDO.[16] Our findings, in line with larger case series, indicate that the mode of delivery may not play a significant role in the occurrence of CNLDO. This highlights the need for further research into the embryological and anatomical development of the nasolacrimal system.The comparable distribution of CNLDO cases between cesarean section (45%) and spontaneous vaginal delivery (55%) in our cohort (p=0.909) suggests that delivery-related pressure differences may not play as significant a role as previously hypothesized.

Our literature review revealed no previous studies examining the relationship between breastfeeding and CNLDO. In our study, we found that feeding method did not appear to influence CNLDO development, with most babies being breastfed (70%), while equal numbers were either formula-fed (15%) or received both breast milk and formula (15%) (p=0.106). The high number of breastfed infants in our study likely mirrors typical feeding choices in our community rather than suggesting any direct link to CNLDO. However, it would be valuable to study how different feeding actions, such as sucking patterns and pressure changes around the eye area during feeding, might affect the condition. While nutrition itself may not directly affect CNLDO development, breastfeeding's immune-boosting properties might help reduce related infections, though we need more research to confirm this idea.

In agreement with the literature, CNLDO was unilateral in the majority of our cases. No difference between gender distributions has also been reported.[17] The average age for CNLDO has been variously reported as 3.4 months, 17.6 months, and 1.7 years.[18-20] The average age of our patients was 2.8 months, while in a previous international study the average age was five weeks.[16] The success rate of conservative treatment when started early is quite high. When lacrimal sac massage is performed in the first nine months, success rates of up to 89.8% have been reported.[21]

Limitations

This study has several notable methodological limitations that warrant consideration. First, the relatively small sample size may limit the statistical power and generalizability of our findings. Additionally, the single-center design of this investigation may introduce institutional bias.

CONCLUSION

CNLDO can now be diagnosed earlier thanks to the screening programs implemented by the Turkish Ministry of Health. This means that patients can receive regular follow-up and treatment and can recover with conservative treatment.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Harran University Faculty of Medicine Clinical Researches Ethics Committee (Date: 21.10.2024, Decision No: 16/7).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article

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Traumatic hyphema after closed-globe injuries: accompanying findings, management and visual outcomes

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ABSTRACT

Aims: The aim of this study is to present the clinical findings and treatment approaches of patients with traumatic hyphema.

Methods: The files of patients with traumatic hyphema who were diagnosed and treated in our clinic were retrospectively reviewed as part of the study. Hyphema grading was based on the level of hyphema at the time of initial presentation

Results: A total of 25 cases of traumatic hyphema were evaluated in the study, consisting of 18 males (72%) and 7 females (28%). The average age of the patients was 44.7±24.4 years. Among the cases, 1 had stage 0 hyphema (4%), 13 had stage 1 hyphema (52%), 5 had stage 2 (20%), 5 had stage 3 (20%), and 1 had stage 4 (4%). At the time of presentation, the best-corrected visual acuity of the patients was 1.24±0.99 logMAR which increased to 0.16±0.27 logMAR at the last follow-up. The intraocular pressures were 25±13.4 at the initial visit and 13.4±9.9 at the last follow-up. Anti-glaucomatous treatment was initiated in 10 (40%) cases due to elevated intraocular pressure. An anterior chamber lavage was performed on 4 cases. The common findings accompanying hyphema included: 12% iridodialysis, 12% phacodonesis, 12%vitreous hemorrhage, 8% traumatic cataract, 8% corneal lamellar laceration and 8% commotio retinae.

Conclusion: Visual outcomes in cases of traumatic hyphema are generally favorable. Close monitoring is essential during the treatment process and in the management of complications in cases of traumatic hyphema.

Keywords: Cataract, glaucoma, hyphema, trauma

INTRODUCTION

Hyphema, the presence of blood in the anterior chamber of the eye, is often caused by blunt ocular trauma.[1] It can also result from various other conditions, including congenital anomalies, coagulopathies, and systemic diseases.[2] The pathophysiology of traumatic hyphema begins with the disruption of the blood-aqueous barrier, which results in bleeding from the ciliary body or iris.[2,3] Diagnosis is usually made through clinical examination techniques, including slit-lamp biomicroscopy, which assess the extent of the hyphema and any associated ocular injuries.[3,4] Treatment typically involves topical and/or systemic corticosteroids, cycloplegics and along with addressing underlying pathology.[1,2] Complications may include corneal blood staining, synechiae, increased intraocular pressure, and glaucomatous optic atrophy.[1-5] Rebleeding ise more likely in blacks (especially with sickle cell disease), and those who have antiplatelet therapy.[2] Timely recognition and management are crucial to prevent complications such as glaucoma and corneal blood staining.[6] Follow-up examinations should be conducted as necessary to monitor healing and potential complications.[6]

Understanding the implications of traumatic hyphema is crucial for clinicians in order to optimize treatment strategies and improve patient outcomes. In this study, cases with closed globe injuries who presented to our clinic due to blunt trauma and were diagnosed with hyphema were evaluated. The aim is to present the demographic characteristics, clinical findings, and treatment processes of all cases.

METHODS

The study was carried out with the permission of the Tokat Gaziosmanpaşa University Non-intervention Scientific Researches Ethics Committee (Date: 04.03.2025, Decision No: 25-MOBAEK091). This research was carried out from 2021 to 2024 at the Department of Ophthalmology, Faculty of Medicine, Tokat Gaziosmanpaşa University. The study adhered to the principles outlined in the Helsinki Declaration. The patients who had closed globe injury with hyphema were included in the study. The patients who had open globe injury with or without hyphema, as well as those with inadequate follow-up duration, were excluded from the study.

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The files of patients with traumatic hyphema who were diagnosed and treated in our clinic were retrospectively reviewed as part of the study. Data were collected from the patients' files, including age, gender, cause of trauma, visual acuity, findings from anterior and posterior segment examinations, intraocular pressure measurements, ultrasonic posterior segment examination findings, treatment administered, and follow-up duration.

Hyphema grading was based on the level of hyphema at the time of initial presentation.[7] Accordingly, it was classified as follows:[7]

- **Stage 0:** Presence of hyphema that is too small to be seen microscopically and does not provide a level.
- **Stage 1:** Presence of hyphema with a level up to 1/3 in the anterior chamber.
- **Stage 2:** Presence of hyphema with a level between 1/3 and 1/2 in the anterior chamber.
- **Stage 3:** Presence of hyphema with a level close to 1/2 to total in the anterior chamber.
- **Stage 4:** Presence of total hyphema.

All patients were administered topical 0.1% dexamethasone eight times a day and topical 1% cyclopentolate three times a day. Topical and systemic antiglaucoma medications were added to the treatment for patients with intraocular pressure of 22 mmHg or higher. Anterior chamber lavage was performed if there was no improvement within five days in cases of total hyphema, if intraocular pressure could not be controlled despite antiglaucoma treatment, and in the presence of corneal blood staining.

Descriptive statistics were employed to analyze the collected data, with results presented as mean±standard deviation and percentages.

RESULTS

A total of 25 cases of traumatic hyphema were evaluated in the study, consisting of 18 males (72%) and 7 females (28%). The average age of the patients was 44.7±24.4 years. Among the cases, 1 had stage 0 hyphema (4%), 13 had Stage 1 hyphema (52%), 5 had stage 2 (20%), 5 had stage 3 (20%), and 1 had stage 4 (4%).

At the time of presentation, the best-corrected visual acuity of the patients was 1.24±0.99 logMAR which increased to 0.16±0.27 logMAR at the last follow-up. The intraocular pressures were 25±13.4 at the initial visit and 13.4±9.9 at the last follow-up. Anti-glaucomatous treatment was initiated in 10 (40%) cases due to elevated intraocular pressure. An anterior chamber lavage was performed on 4 cases. In three of these cases, anterior chamber lavage was performed due to uncontrolled intraocular pressure, and this successfully brought the pressure under control. In one case, anterior chamber lavage was performed due to the risk of corneal staining with blood. In a case with stage 4 hyphema, it was known that the patient had no light perception prior to the trauma. Due to no light perception, retinal detachment, uncontrolled intraocular pressure, and the patient's pain, evisceration was performed.

The common findings accompanying hyphema included: 12% iridodialysis, 12% phacodonesis, 12%vitreous hemorrhage, 8% traumatic cataract, 8% corneal lamellar laceration and 8% commotio retinae. Table presents the findings associated with hyphema. In one case of traumatic cataract, the patient was monitored due to the presence of an early-stage cataract that did not show progression. In another case, due to the development of advanced-stage cataract, elective surgery was performed after the hyphema completely resolved. In one case with vitreous hemorrhage, vitreoretinal surgery was planned. During the surgery, it was observed that a total dialysis of the upper half of the retina, retinal pigment epithelium (RPE), and choroid occurred, reaching up to the optic disc, revealing bare sclera. This patient lost light perception due to advanced proliferative vitreoretinopathy. In the other two patients with vitreous hemorrhage, the hemorrhage resolved spontaneously. Pars plana vitrectomy was performed due to the development of a macular hole in a case following trauma, and the hole closed. In one case, the patient lost light perception following the development of optic atrophy due to uncontrolled glaucoma.

Table. Anterior and posterior segment complications accompanying traumatic hyphema

Findings accompanying hyphema	n	%
Eyelid laceration	1	4
Corneal lamellar laceration	2	8
Iridodialysis	3	12
Iris sphincter rupture	1	4
Phacodonesis	3	12
Traumatic cataract	2	8
Vitreous hemorrhage	3	12
Commotio retinae	2	8
Retinal detachment	1	4
Macular hole	1	4
Dialysis of the retina, RPE, and choroid	1	4

RPE: Retinal pigment epithelium

DISCUSSION

Traumatic hyphema is an important ocular condition characterized by the accumulation of blood in the anterior chamber of the eye, typically resulting from blunt or penetrating injuries.[2,6] It is frequently observed in both pediatric and adult populations, especially among individuals participating in contact sports or working in hazardous environments.[2,8] This condition can lead to serious complications, including increased intraocular pressure, corneal opacities, and in severe cases, permanent vision impairment.[1-6]

The average best corrected visual acuity of the cases included in our study at the time of presentation was 1.24±0.99 logMAR. This average increased to 0.16±0.27 logMAR after the treatment process. Visual improvement was observed in 22 cases, while two patients lost light perception. One patient lost light perception due to uncontrolled glaucoma. The other lost light perception due to advanced posterior segment complications. One patient who underwent evisceration already had a negative light perception before the trauma. Bursalı et al.[4] reported that the initial average visual acuity was 1.7±0.8 logMAR, and the final average visual acuity was 0.2±0.3 logMAR. Similarly, Ersöz et al.[3] also reported a significant increase in visual acuity after treatment.

Elevated intraocular pressure frequently accompanies cases of traumatic hyphema. As the level of hyphema increases, the risk of elevated intraocular pressure also rises.[2] In the literature, the incidence of increased intraocular pressure following traumatic hyphema has been reported to be around one-third of all patients.[2,3] In our study, elevated intraocular pressure was found to be 40%.

The elevation of intraocular pressure (IOP) is primarily due to several interrelated mechanisms. Initially, the presence of blood in the anterior chamber can obstruct the trabecular meshwork, which is responsible for draining aqueous humor from the eye. This obstruction leads to impaired outflow and subsequently increases IOP.[2,4] A large blood clot in the anterior chamber can cause a pupillary block, resulting in an increase in intraocular pressure.[2,4] Additionally, the trauma that causes hyphema can also induce inflammation, resulting in the release of inflammatory mediators. These mediators can contribute to increased permeability of the blood-aqueous barrier, allowing additional fluid and inflammatory cells to enter the anterior chamber. This accumulation further complicates drainage through the trabecular meshwork, exacerbating the rise in IOP.[2,4] In summary, elevated intraocular pressure in traumatic hyphema arises from a combination of mechanical obstruction of the aqueous outflow pathways and inflammatory responses, necessitating careful monitoring and management to prevent potential complications.

If intraocular pressure remains uncontrolled, surgical intervention should be considered.[2,9] In our study, anterior chamber lavage was performed in three cases (12%) where intraocular pressure could not be controlled, and this successfully brought the pressure under control. Additionally, anterior chamber lavage was performed in one case (4%) with corneal blood staining. Bursalı et al.[4] reported performing anterior chamber lavage in a total of 3 cases (6.25%), including 1 case with persistently elevated intraocular pressure despite medical treatment and 2 cases at risk for corneal staining. Similarly, Ersöz et al.[3] performed anterior chamber lavage in 3 cases (4.5%) to control intraocular pressure.

Complications in both the anterior and posterior segments are frequently associated with traumatic hyphema, often impacting visual acuity. The literature frequently cites complications such as traumatic cataract, vitreous hemorrhage, and phacodonesis accompanying traumatic hyphema.[3,4,8,10-13] In our study, the most common complications associated with hyphema were iridodialysis (12%), phacodonesis (12%), and vitreous hemorrhage (12%). One case presented with vitreous hemorrhage along with extensive retinal, RPE, and choroidal dialysis. Despite undergoing vitreoretinal surgery, this case showed a poor prognosis.

CONCLUSION

Visual outcomes in cases of traumatic hyphema are generally favorable. However, the presence of accompanying complications, particularly those affecting the posterior segment, can negatively impact on visual results. Increased intraocular pressure, which is commonly encountered, can usually be controlled with topical anti-glaucomatous treatment. Treatment protocols often include monitoring of intraocular pressure, pharmacological interventions, and, in some cases, surgical intervention. Close monitoring is essential during the treatment process and in the management of complications in cases of traumatic hyphema.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Tokat Gaziosmanpaşa University Non-intervention Scientific Researches Ethics Committee (Date: 04.03.2025, Decision No: 25-MOBAEK091).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article

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Correlations between intermittent exotropia, stereoacuity and ocular torsion

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ABSTRACT

Aims: To objectively measure anatomical ocular torsion in intermittent exotropia (IXT), correlate with the amount of exo-deviation and stereoacuity.

Methods: We enrolled 84 participants from 8 to 35 years. Revised Newcastle control scores were obtained. Deviation was measured using prism cover test. Titmus stereo test was used for stereopsis. Dominant eye was identified using a hole in the card test. Anatomical ocular torsion was obtained using Spectralis SD-OCT. Any sorts of pathological conditions affecting ocular motility were excluded.

Results: The anatomical torsion of left or right eyes or their relative difference among different IXT groups was not found statistically significant (p-value >0.05). Newcastle Control Scale score was lowest 1 (1-2) in the convergence insufficiency group, 4 (2-8) in the divergence excess group and highest 5 (3-6) in the basic group (p-value <0.000). The amount of exodeviation positively correlated with different Newcastle Control Scales scores but no correlations were found between anatomical ocular torsion and neither stereopsis, nor the amount of near and distance exo-deviations.

Conclusion: This study could not establish significant correlations between anatomical ocular torsion measured objectively with OCT and the severity of deviation or stereoacuity. The revised Newcastle Control Scale was remarkable in monitoring the progression of IXT.

Keywords: Cyclodeviation, intermittent exotropia, ocular torsion, revised newcastle control score, stereoacuity

INTRODUCTION

The anatomical cyclo-position of an eye around its visual axis is called ocular torsion.[1] According to Donder's law, the eye assumes an invariable and involuntary angle of torsion, independent of the path taken in achieving that position of gaze.[2,3] But ocular torsion also occurs due to an imbalance between the vertically acting muscles.[4] This torsional disparity between two eyes can hamper fusion and stereopsis.[5] Significant cyclovertical deviations can be found in anisometropia, uncorrected astigmatism, orbital anomalies and neuromuscular or innervational anomalies.[6] Similarly, such deviations are also in cases with intermittent exotropia (IXT), although IXT is a horizontal form of strabismus.[1] Any cyclo-disparity is likely to mask under the significant sensory component of sensory cyclofusion where motor cyclovergence need not play.[2,6] Nevertheless, it is fair to assume cyclo-disparity as an obstacle for obtaining or maintaining binocular single vision in intermittent exotropia.[1] Subjective tests like the double Maddox-Rod test, Lancaster red-green test, Bagolini test, synoptophore, etc., are widely used to assess this disparity.[6,7] However, these measurements are be constrained by sensory adaptation to fundus torsion over time, particularly if cyclotorsion appears during early childhood.[2,8,9] These incomitant deviations have large inter-observer variability as well.[6]

Direct observation of the fundus, iris photography, fundus OCT, and fundus photography have been proposed to objectively assess ocular torsion.[1,7,10] For the purpose of this study, we used Spectralis SD-OCT. Fovea and Bruch's membrane orifice centroid is automatically traced, and ocular torsion is revealed relative to the acquired image frame horizontal axis (**Figure 1**).[11-13] We used cover tests and prism

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cover tests with prescribed glasses to measure and group IXT into convergence insufficiency (CI), divergence excess (DE), and basic types. We also used the revised Newcastle home and clinical control scores to mark the presentation of IXT and stereoacuity to observe the status of binocular single vision.

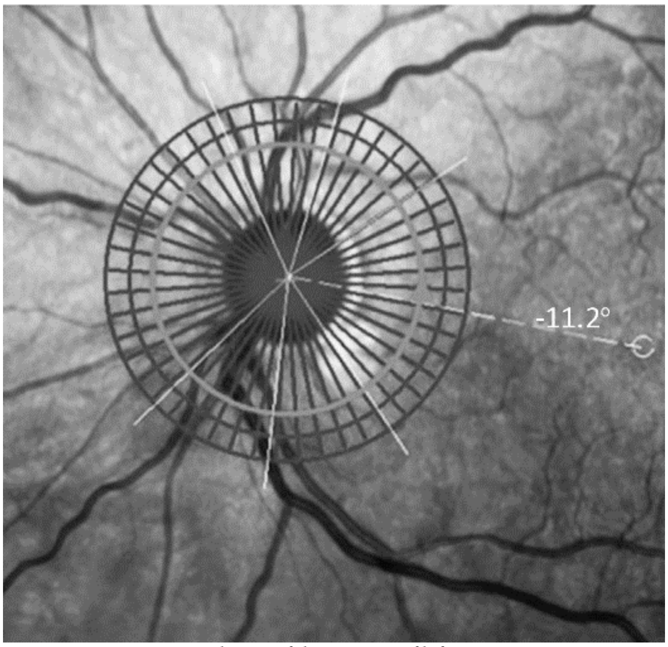

Figure 1. Automatic revelation of the amount of left eye extorsion in SDOCT
SDOCT: Spectral domain optical coherence tomography

METHODS

The study was carried out with the permission of the Institutional Review Committee, Institute of Medicine, Tribhuvan University, Kathmandu, Nepal (Date: 17.08.2022, Decision No: 147(6-11)E2, 079/080). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This observational study was conducted at B.P. Koirala Lions Centre for Ophthalmic Studies, Kathmandu, Nepal. We enrolled participants with different types of intermittent exotropia from 8 to 35 years old having visual acuity of 6/9 or better. We avoided children below 8 years of age because of poor application of orthoptic tests on them. Sample size was calculated after considering the prevalence rate of intermittent exotropia 5.16%.[14] Neurological paralytic squints, mechanical squints, myogenic squints, alphabet pattern strabismus, dissociated vertical deviations, developmental disabilities, previous history of strabismus surgery, myopia or hypermetropia >3.00 D, anisometropia >1.5 D, and astigmatism >1.5 D were all excluded from the study. Other conditions, such as nystagmus, albinism, microphthalmia, retinopathy of prematurity, congenital cataracts, etc., were also excluded. To avoid any sorts interobserver errors, all the tests were administered by the principal researcher himself.

Participants were asked about the frequency of onset of strabismus at home to determine the revised Newcastle Home Control Scale (NHCS) scores and cover tests were performed at both near (33 cm) and distance (6 meters) fixation distances to obtain the revised Newcastle Clinical Control Scale scores as Newcastle Near Control Scale (NNCS) and Newcastle Distance Control Scale (NDCS) scores (Table 1). Prism cover tests were also done at both distances to measure the amount of IXT using a prism bar. With the amount of deviation at near and distance, we segregated the participants into different groups of intermittent exotropia. The groups with greater than 8 PD of exo-deviation at near than at a distance was termed the convergence insufficiency (CI) group, while the reverse one was called divergence excess (DE) group. If greater than 8 PD of exo-deviation was present at both distances with less than 8 PD difference, it was termed the Basic group. We also enrolled less severe cases with less than 8 PD of deviation as control group. Stereoacuity was measured using the Titmus stereo test. The dominant eye was determined using a hole in the card test in conjunction with the near point of convergence test.

Table 1. Scoring of Intermittent exotropia based on Revised Newcastle Control Score[6,19]

Home control score	
0	Deviation is never seen
1	Deviation is seen <50% of time fixing at distance
2	Deviation is seen >50% of time fixing at distance
3	Deviation is seen >50% of time fixing at distance and near
Clinic control (near/distance)	
0	Immediate realignment after dissociation
1	Realignment with aid of blink or refixation
2	Remains manifest after dissociation/prolonged fixation
3	Manifest spontaneously
Total score	Home Score+Near Score+Distance Score

We used spectralis spectral domain optical coherence tomography (SDOCT) (Heidelberg Engineering GmBH, Heidelberg, Germany) for the measurement of disc to fovea angle as ocular torsion. The patient with their refractive correction was required to sit maintaining the appropriate head, chin and canthus positions. During optic nerve head-radial and circle (ONH-RC) scans, the patient first fixates on the inner central target whereby machine completes foveal scans and captures grayscale photograph. Later patient fixates on the nasal target whereby the machine completes optic disc scans. Now on earlier greyscale map, exact foveal location, center of optic disc and angle between them is traced. No mydriatics or cycloplegics were used.

We used SPSS version-26 for analysis. p-value <0.05 is considered statistically significant. We used Spearman's correlation when at least one of the variables is ordinal like stereopsis, Newcastle scores, prism cover test etc. and Pearson's correlation only when both the variables are continuous like ocular torsion. Correlation coefficient which is not significantly different from 0 indicated no correlation and if significantly different from 0 and <0.2, it is considered weakly correlated. Likewise, 0.2-0.5 is considered moderately correlated and the value of >0.5 is considered strongly correlated.

RESULTS

A total of 84 participants with age of 8 to 35 years were enrolled; 20 controls had orthophoria or below 8 PD of phoria at any distance, 27 had CI type of IXT, 16 had DE type of IXT, and 21 had the Basic type of IXT. The mean age of respective groups was 20, 19, 16 and 21 years. Only 18% of individuals had left dominant eyes. (Table 2).

Table 2. Average age, gender count, and dominant eyes count				
	Control	**CI**	**DE**	**Basic**
Age (years, mean±SD)	20±7	19±7	16±7	21±9
Male (count)	7	8	6	8
Female (count)	13	19	10	13
Right eye dominant (count)	18	23	11	17
Left eye dominant (count)	2	4	5	4

CI: Convergence insufficiency, DE: Divergence excess, SD: Standard deviation

On observing the Newcastle Control Scale Scores, each score in the control group was obtained 0 (0-0). The total median score was lowest in the CI group i.e., 1 (1-2), followed by 4 (2-8) in the DE group and it was highest i.e., 5 (3-6) in the basic group. The total score in the CI group was derived from the Newcastle Near control Scale (NNCS) score alone. To the DE group, Newcastle Home Control Scale (NHCS) score and Newcastle Distance Control Scale (NDCS) scores contributed. Meanwhile, to the basic group, all of three Newcastle Control Scale Scores contributed (Table 3). The difference in Newcastle scores of different groups was found statistically significant (0.000, Pearson's chi-squared test).

Table 3. Median and 95% Confidence Interval of Newcastle Scores					
	Control	**CI**	**DE**	**Basic**	**p-value***
NHCS Score	0 (0-0)	0 (0-0)	1.5 (1-3)	1 (0-2)	0.000
NNCS Score	0 (0-0)	1 (1-2)	0.5 (0-2)	2 (1-2)	0.000
NDCS Score	0 (0-0)	0 (0-1)	2 (1-3)	2 (1-2)	0.000
Total score	0 (0-0)	1 (1-2)	4 (2-8)	5 (3-6)	0.000

Pearson's chi-squared test, NHCS: Newcastle Home Control Scale, NNCS: Newcastle Near Control Scale, NDCS: Newcastle Distance Control Scale, CI: Convergence insufficiency, DE: Divergence excess, p-value of <0.05 indicates statistically significant finding

The median stereopsis (seconds of arc) in different groups are found as, 40 (40-40) in control group, 40 (40-80) in CI group, 45 (40-140) in DE group and 40 (40-60) in the basic group. We found no significant differences in stereopsis among these groups (p-value-0.65, Chi-square test). The mean amount of deviation of different groups at near and distance fixations is shown in Table 4. The amount of deviation fits with the nature of each group respectively (p<0.001, chi-square test).

Table 4. Mean amount of deviation of different groups at near and distance fixations				
	Control	**CI**	**DE**	**Basic IXT**
Near (PD)	-1.1±1.8	-16.4±7.7	-13.1±7.4	-19.8±7.1
Distance (PD)	0±0	-5.3±5.9	-26.9±8.6	-19.5±7.5

A negative value means exo-deviation and a positive value implies eso-deviation, CI: Convergence insufficiency, DE: Divergence excess, IXT: Intermittent exotropia, PD: Prism diopters

The anatomical ocular torsion of different IXT groups is shown in Table 5. The differences were not found statistically significant (p-value: >0.05, 1-way ANOVA). Within an individual, left eye was found more extorted by an average of 3.4±4.3 degrees than the right eye (p-value: <0.000, T test). There was no statistically significant difference in ocular torsion in terms of dominant eye (p-value: >0.05, T test).

On performing different correlations we found that, Newcastle Home Control Scale (NHCS) score correlated strongly with near prism cover test (PCT) [n (71)=.521, p=0.000] and distance PCT [n (71)=.756, p=0.000] (Figure 2). Stereopsis was moderately correlated with near PCT [n (71)=.377, p=.001] (Figure 3) and NNCS [n (71)=0.376, p=.001] (Figure 4) but not correlated with NHCS [r (71)=.155, p=0.197]. We couldn't find any correlations between ocular torsion of neither eye with any of age, Newcastle score, stereoacuity and amount of prism deviation for near as well as distance (Table 6). We also couldn't find the correlation between the torsion of two eyes [n (71)=.127, p=0.291]. Rather, we found a strong positive correlation between the amount of near and distance exo-deviation [r (71)=.725, p=0.000] (Figure 5).

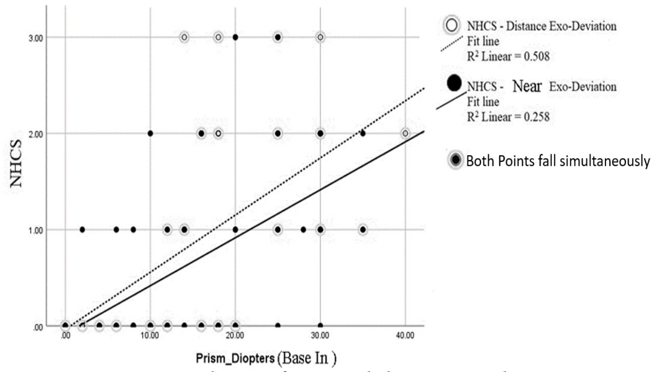

Figure 2. Positive correlation of near and distance exo-deviation in prism diopters with Newcastle Home Control Scale Score

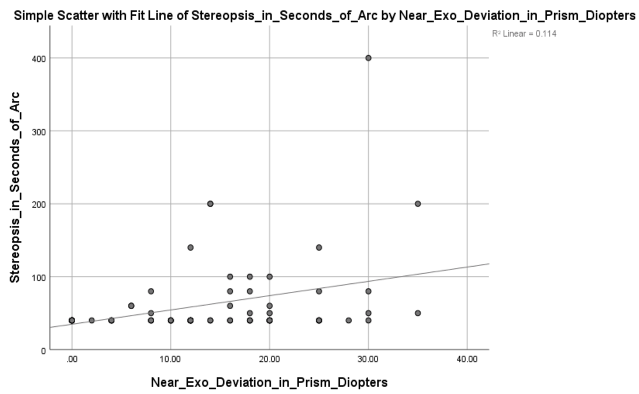

Figure 3. Positive correlation between near exo-deviation in prism diopters and stereoacuity

Table 5. Mean ocular torsion (in degrees) of left and right eyes of different groups					
	Control	**CI**	**DE**	**Basic IXT**	**p-value***
Right eye	-4.3±2.7	-4.9±2.8	-6.1±2.3	-4.7±3.2	0.6
Left eye	-7.6±2.7	-7.5±3.4	-10.8±4.0	-8.5±4.0	0.1
Average	-5.98±1.82	-6.21±2.44	-8.43±2.63	-6.64±2.49	0.1
Difference, p-value**	3.3±4.1, 0.007	2.7±3.8, 0.001	4.7±3.8, 0.01	3.8±5.2, 0.003	0.63

**The negative value indicates extortion, One-Way ANOVA test, Paired sample T test between right and left eye, CI: Convergence insufficiency, DE: Divergence excess, IXT: Intermittent exotropia, p-value of <0.05 indicates statistically significant finding

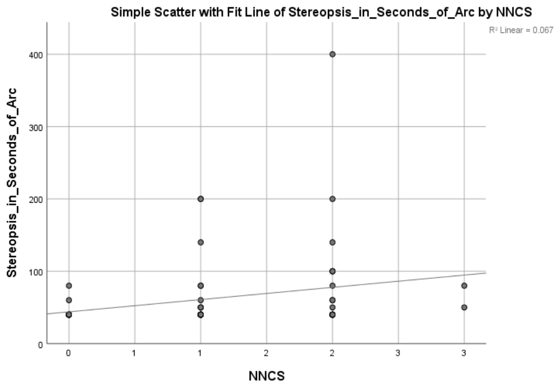

Figure 4. Positive correlation between Newcastle Near Control Scale Score and stereopsis

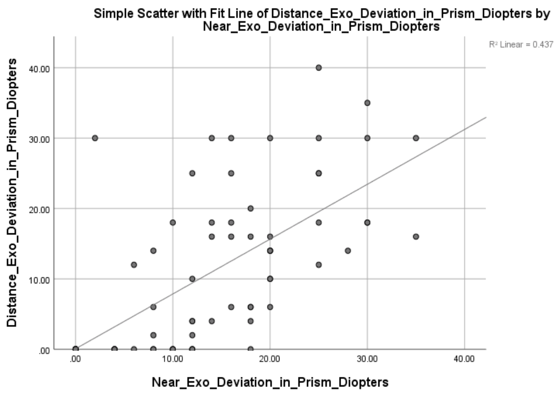

Figure 5. Positive correlation between near exo-deviation and distance exo-deviation in prism diopters

DISCUSSION

This study objectively measured ocular torsion in IXT and investigated potential correlations with the deviation severity and stereo acuity. Contrary to the initial hypothesis, the study did not reveal a significant relationship between objectively measured ocular torsion and stereoacuity or the severity of intermittent exotropia indicated by prism cover test amounts. On the other hand, stereopsis was found to correlate with the amount of near deviation. Thus, while the amount of near deviation has an influential role on stereopsis but the lack of clear correlation with anatomical ocular torsion measured with OCT method challenges the presumed impact of torsion on binocular vision perception.

Kang et al.[7] found that, the findings of ocular torsion measured using fundus photography and OCT correlated with each other. Si et al.[12] also showed the usefulness of OCT in the measurement of ocular torsion. Although the amount of ocular torsion measured is comparable to our study, the implications on binocular vision were besides the scope of these studies. On the other hand, Georgievski et al.[5] adjusted synoptophore targets to present varying degrees of torsional disparity and demonstrated that torsional disparity of 6 degrees or more significantly degrades horizontal fusional vergence and stereopsis. The test is completely sensory and has no link to anatomical torsion.

Morton et al.[8] discusses the usefulness of fundus photography in diagnosing vertical strabismus and found that fundus torsion strongly correlates with oblique muscle dysfunction. Kushner et al.[11] shared that objective and subjective torsion have different roles. Objective torsion can be useful in motility pattern caused by oblique or vertical muscle dysfunction where subjective torsion is mostly meaningless. But at other instances, the measurement of subjective torsion is to consider torsion as a part of the treatment plan. They also suggested that those who develop torsion during their childhood may not report to the subjective test. And there may or may not be correlation in between these two tests. Anatomically, torsional angle has a wide range of normal variation that doesn't hinder fusion. When vertical prisms were placed, in about 80 % of asymptomatic cases, the vertical deviation was induced for a short interval and it is considered as the manifestation of previously physiologically compensated deviation.[15,16] In contrast, when vertical prisms were placed in the symptomatic cases, they didn't develop vertical deviations indicating that there were no prior compensated deviations which would decompensate.[6,17] This bizarre nature comprising of wide normal range, compensation and decompensation, etc. indirectly indicates that anatomical torsional angle amid subjective findings is just an arbitrary value within a certain range.

Lee et al.[18] demonstrated that vertical deviation and extorsion measured with fundus photography decreases significantly after horizontal muscle surgery in patients with IXT and unilateral inferior oblique muscle overaction. Although they associated objectively measured vertical and cyclo deviations with IXT, the improvement in stereoacuity following surgery was found insignificant which stills questions the subjective implications of such deviations on IXT.

While using optical coherence tomography (OCT) for objectively assessing ocular torsion, we have a greater advantage of locating the fovea and drawing the disc margins because OCT utilizes cross sectional images to plot them in the grayscale picture of retina taken in the primary position of gaze and is automatic. However, lack of correlations between ocular torsion and the severity of exodeviation-measured with prism cover tests and Newcastle Control Scale scores or stereoacuity raises the question about the role of anatomical torsion in non-strabismic binocular vision disorders. Therefore, this study questions the possibility of interchangeably using subjective and objective methods

Table 6. Spearman's correlation coefficient between ocular torsion and stereopsis, Newcastle Scores near and distance deviation

	Age	Stereopsis	NHCS	NNCS	NDCS	Near deviation	Distance deviation
Torsion OD	.066	.058	-.024	-.157	-.081	-.054	.000
p-value	.582	.629	.846	.190	.503	.653	.998
Sample size	71	71	71	71	71	71	71
Torsion OS	.123	.049	-.173	-.026	-.094	.069	.176
p-value	.305	.687	.149	.830	.436	.568	.142
Sample size	71	71	71	71	71	71	71

NHCS: Newcastle Home Control Scale, NNCS: Newcastle Near Control Scale, NDCS: Newcastle Distance Control Scale, p-value of <0.05 indicates statistically significant finding of measuring ocular torsion and cyclodeviations as also described by Kushner et al.[11]

Limitations

Although ocular torsion measurement using OCT demonstrates higher interobserver agreement over fundus photo methods, the use of an inner target disrupts sensory fusion, and the machine used in this study lacks a mechanism to control for fusion. We also felt that the subjective ways of measuring cyclodeviations and symptom scores would further support the findings of this study.

CONCLUSION

While this study objectively measured ocular torsion in intermittent exotropia, it did not establish significant correlations between anatomical torsion and the severity of deviation or stereo acuity. It claims the futility of objective ways of measuring anatomical torsion in non-strabismic binocular vision disorders. The revised Newcastle Control Scale was found remarkable in monitoring the progression of the intermittent exotropia.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Institutional Review Committee, Institute of Medicine, Tribhuvan University, Kathmandu, Nepal (Date: 17.08.2022, Decision No: 147(6-11)E2, 079/080).

Informed Consent

Informed consent was taken from either the patients or their guardians before data collection. Anonymity was maintained. No additional risk of any type was introduced to the patients during this study.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article

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Evaluation of the efficacy of argon laser photocoagulation therapy in patients with retinal tear

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ABSTRACT

Aims: To report the clinical results of argon laser photocoagulation treatment of patients diagnosed in our clinic with retinal tears and/or holes.

Methods: Argon laser photocoagulation 0.1-0.2 sec, 200-400 µm spot size in 3-4 rows around the lesion and 250-500 millijoule power) treatment results of patients with retinal tears and/or holes who were treated and followed up in our clinic's retina unit were evaluated retrospectively.

Results: During the follow-up period (1-72 months), 61 eyes of 57 patients were treated with argon laser photocoagulation. The success rate of the treatment in retinal detachment prophylaxis was 89.5%. Visual functions improved or remained stable in 82.5% of the patients after argon laser retinopexy. No increase in intraocular pressure or laser-related side effects were observed in any patient during the follow-up period.

Conclusion: Argon laser photocoagulation is a safe and effective method for retinal tears and holes. According to our clinical experience, it can be safely applied in the prevention of retinal detachment.

Keywords: Argon laser photocoagulation, retinal holes, retinal tear, retinal detachment

INTRODUCTION

The retinal tear is a full-thickness defect of the retina that usually occurs as a result of posterior vitreous detachment and may lead to retinal detachment when left untreated.[1] It is usually observed as horseshoe, opercular, and linear.[2] Retinal tears may be diagnosed incidentally on examination or patients may present with floaters, photopsy, or visual field defects. Especially degenerative myopia, lattice degeneration, and trauma are important risk factors.[3] When retinal tear is not treated, retinal detachment develops in 30-50% of patients.[4,5]

However, retinal detachment and visual loss can be prevented with prompt treatment. Today, argon laser photocoagulation is used as a safe and effective treatment procedure. The main aim of treatment is to prevent retinal detachment and visual loss.[6]

The widely used argon laser photocoagulation was introduced by L'Esperance in 1968 and Zweng reported in 1972 that it could be used in the treatment of retinal tears and prevented the progression of tears to retinal detachment.[7-9] Argon laser photocoagulation is the main mechanism that prevents retinal detachment; the formation of strong adhesions between the retina and retinal pigment epithelium that prevent migration of subretinal fluid.[3,10] However, although argon laser photocoagulation is an accepted treatment modality for retinal tears, argon laser photocoagulation has many side effects. Some of these include angle closure, macular edema, deterioration in color vision, and visual loss.[11]

In this study, we aimed to evaluate the clinical characteristics of patients diagnosed with retinal tears and/or holes and the results of treatment with Argon laser photocoagulation in our clinic.

METHODS

The charts of the patients who applied to the retina unit of Yüzüncü Yıl University, Faculty of Medicine, Ophthalmology Department were scanned retrospectively. Patients who presented with complaints of photopsia and decreased vision and were found to have retinal tears and/or holes or were incidentally found to have retinal tears and/or holes during peripheral retinal examination were included in the

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study. The Declaration of Helsinki conducted our study after the approval of the Van Yüzüncü Yıl University Non-interventional Clinical Researches Ethics Committee (Date: 04.02.2025, Decision No: 2025/01-41).

Patients who underwent peripheral retinal examination with a binocular indirect ophthalmoscope or Goldman's three-mirror lens after a complete ophthalmological examination were included in the study. Information such as best visual acuity, surgical history, presence of comorbidities (diabetes mellitus, hypertension, retinal detachment, glaucoma, degenerative myopia, macular edema, etc.), localization of the holes, power of argon laser, need for additional laser, follow-up period, and best visual acuity after treatment was recorded. Patients with a history of trauma, a follow-up period of less than one month, and corneal edema were excluded from the study.

Detailed information about the diagnosed patients was filed, and argon laser photocoagulation (quantel medical, easyret, 577 nm) prophylaxis was performed after informed consent forms were obtained. The argon laser photocoagulation procedure was performed on the same day after diagnosis. argon laser photocoagulation was applied in 0.1-0.2 s, in 3-4 rows around the lesion with a spot size of 200-400 μm and a power of 250-500 millijoules. Patients were advised to follow up the next day.

Statistical Analysis

Data analyses were performed using statistical package for the social sciences (SPSS) software. Descriptive statistics were presented as percentages, means, and standard deviations (SD). The chi-square test (X^2) was used to compare categorical variables. The significance level was accepted as $p<0.05$.

RESULTS

The study included 61 eyes of 57 patients. The mean age of the patients was 37.82±0.83 years; 49.1% were female (n=28) and 50.9% were male (n=29). Among the patients included in our study, 66.7% (n=38) had involvement in the right eye, 33.3% (n=19) in the left eye, and 4 patients had involvement in both eyes. Of these, 94.7% (n=54) were phakic. 5.3% (n=3) were pseudophakic, and the follow-up period ranged between (mean of 36,4 month) 1 and 72 months. Regarding ocular pathologies, 43.9% (n=25) had a diagnosis of degenerative myopia and 7% (n=4) had a history of vitrectomy.

The most common hole localization was in the superior temporal and inferior temporal regions (24.6%, n=14). Systemic diseases accompanying retinal tears are shown in Table 1.

Table 1. Systemic diseases accompanying retinal tears

Hypertension	Diabetes mellitus	Diabetes mellitus and hypertension	No history of systemic disease
4	2	3	48
7%	3.5%	5.3%	84.2%

Retinal detachment developed in 10.5% (n=6) of the argon laser patients, and the patients were referred for additional lasers and surgery. There was no significant statistical correlation between the development of retinal detachment and the involved eye and hole localization. Clinical characteristics and treatment outcomes of patients with retinal tears are shown in Table 2.

Table 2. Clinical features and treatment outcomes of patients with retinal tears

Feature	Values
Total number of patients (eyes)	57 patients (61 eyes)
Mean age (SD)	37.82±0.83 years
Gender distribution	Female: 49.1% (28), male: 50.9% (29)
Follow-up period (months)	1-72 months
Location of retinal tear	Superior temporal: 24.6% (14), inferior temporal: 24.6% (14)
System diseases	Hypertension: 7% (4), diabetes mellitus: 3.5% (2), diabetes mellitus and hypertension 5.3% (3), no history of systemic disease 84.2% (48)
Degenerative myopia	43.9% (n=25)
Phacic/pseudophakic	Phacic: 94.7% (54), pseudophakic: 5.3% (3)
Treatment success rate	89.5% (retinal detachment prophylaxis)
Visual function recovery	Improvement or stability: 82.5%
Complications	Intraocular pressure elevation: none, laser related side effects: none
Number of patients with retinal detachment	10.5% (n=6)

SD: Standard deviation

Visual functions improved or remained stable in 82.5% of the patients after laser retinopexy. There were no laser-related side effects or increased intraocular pressure in any of our patients.

DISCUSSION

Retinal tears and holes are important risk factors for the development of retinal detachment. Argon laser photocoagulation has long been used in the treatment of retinal tears and holes as a treatment with proven safety and efficacy. This treatment aims to prevent the development of retinal detachment.[12] Looking at the literature, Khan et al.[12] reported that only 11.6% of 45 patients who were followed up for 6 months after argon laser retinopexy failed to achieve the desired result, and retinal detachment developed in 7.0% of the patients. This was associated with vitreous hemorrhage. Garoon et al.[13] reported that retinal detachment developed in 5.7% of the patients in the 3-year follow-up of laser retinopexy performed in 401 eyes. They explained that this result was related to vitreous hemorrhage, multiple retinal tears, and superior temporal localization. In a similar study, McElhinney et al.[14] reported that retinal detachment developed in 6% of 87 patients who underwent laser retinopexy with a follow-up of approximately 11 months, and the important reason for this was the localization of the tears and holes. Although a similar rate was found in our study, unlike our study, no statistical correlation was found between localization and retinal detachment. However, of the 6 patients who developed retinal detachment, 3 had degenerative myopia, 1 had a history of diabetes and hypertension, and the remaining 2 had inferior temporal and inferior nasal retinal tears. The presence of additional disease, degenerative myopia and inferiorly located retinal tears can be considered as important risk factors for developing retinal detachment.

Finally, in the literature, the incidence of retinal detachment was found to be 0-13.8% in patients with asymptomatic retinal holes or tears and 35-47% in symptomatic patients.

However, there is an incidence of retinal detachment in 2.1-8.8% after prophylactic treatment.[15] This shows us that early diagnosis and treatment of retinal tears are very effective in preventing the development of detachment. The development of retinal detachment in 10.5% of the patients included in our study was found to be relatively high compared to the literature. This condition was associated with a high rate of degenerative myopia (43.9%), which is an important risk factor for retinal detachment. Thus, our study emphasizes the importance of additional risk factors in the success of laser retinopexy prophylaxis.

Pollak and Oliver's study on the treatment of argon laser photocoagulation in patients with retinal tears demonstrated the success of argon laser photocoagulation in retinal tears with a risk of detachment and showed that argon laser photocoagulation was superior to cryopexy because of its easy and convenient applicability as well as the absence of any side effects.[5] Some side effects of argon laser photocoagulation in the prophylaxis of retinal tears are as follows: angle closure, macular edema, foveal involvement, color vision deterioration, and visual loss.[16] Additionally, epiretinal membrane (ERM) development, vitreous detachment, and retinal tears may be observed after prophylactic laser retinopexy.[17] Especially with the development of ERM, anatomical changes occur in the macula, which results in deterioration and loss of vision. Similarly, microcystic structures and deterioration in the ellipsoid zone after ERM surgery may also negatively affect the final visual acuity.[18] However, the incidence of these side effects is quite low.[11] In our study, prophylaxis was found to be adequate in 82.5% of the patients, and the listed side effects were not observed.

Limitations

The retrospective nature of the study and the small number of cases, short follow-up time may be considered limitations of the study.

CONCLUSION

Argon laser photocoagulation is an easy and effective treatment method that reduces the risk of retinal detachment and has a very low complication rate. According to our clinical experience, it can be safely applied in the prevention of retinal detachment.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Van Yüzüncü Yıl University Non-interventional Clinical Researches Ethics Committee (Date: 04.02.2025, Decision No: 2025/01-41).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Case Report

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Beyond the fracture: documenting a unique case of total globe dislocation in orbital trauma

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ABSTRACT

A 62-year-old woman presented to the emergency department following blunt trauma to the right orbital region caused by an impact from a cow horn. Ophthalmologic examination revealed the absence of the globe and no light perception. Computed tomography scans showed dislocation of the globe into the maxillary sinus and fracture of the upper orbital wall. A multidisciplinary surgical approach was used, during which the globe was manually repositioned into the orbit and the lower orbital wall was repaired with polyethylene mesh. Postoperative examination on the first postoperative day showed signs of early stage ocular ischemic syndrome. On long-term follow-up, ptosis and enophthalmos were observed and the absence of light perception, which was thought to be due to optic nerve damage, persisted. Anterior segment examination revealed cataract formation and diffuse iris atrophy. Eye movements were severely restricted in inferior and lateral gaze and esotropia was observed in primary position. This case highlights the rarity of severe globe dislocation as a complication and emphasizes the critical importance of early surgical intervention as timely diagnosis and immediate repositioning are essential for visual recovery in the absence of optic nerve damage.

Keywords: Orbital blow-out fracture, globe dislocation, anterior ischemic syndrome, optic nerve damage

INTRODUCTION

Traumatic orbital floor fractures are relatively common; however, the complete displacement of the globe into the maxillary sinus as a result of trauma is an exceedingly rare occurrence.[1] Although the visual prognosis for patients with globe dislocation into the paranasal sinuses is generally poor, it is imperative that the globe is repositioned as soon as possible.[1] Additionally, eyelid and orbital reconstruction should be planned during the postoperative period to mitigate the risk of further complications.

The literature describes two primary techniques for surgical repositioning of the globe. The first technique is the transmaxillary approach, while the second involves transposing the globe back into the orbital space.[2,3]

Most complications reported in the literature, as documented through PubMed, include decreased vision, blurred vision, diplopia, and enophthalmos. In this case report, we present a patient whose globe was completely dislocated into the maxilla following trauma. The patient underwent emergency surgery, during which anterior segment ischemia was observed during the follow-up period.

CASE

A 62-year-old female patient was admitted to the emergency department after sustaining a blow to the right orbital region from a cow horn. Upon examination, a 2 cm incision was noted on the upper eyelid, accompanied by a hematoma. The ophthalmological examination of the left eye was unremarkable. Due to the patient's inability to voluntarily open her eyelids, manual intervention was required; however, no globe was visible within the orbit. Furthermore, no light perception was detected following bright light stimulation applied to the orbit and maxillary region.

Computed tomography (CT) imaging was performed, revealing a significant fracture line in the right orbital floor and complete displacement of the globe into the maxillary sinus. After obtaining informed consent from the patient, surgery was planned in collaboration with the ear, nose, and throat (ENT) Department. The maxillary sinus was accessed via the transmaxillary route using the Caldwell-Luc approach. There were no signs of perforation in the globe located in the maxillary sinus, and it was manually repositioned into the orbit. Polyethylene mesh was utilized for the reconstruction of the lower orbital wall. The surgery was concluded following

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the repair of the lower wall. Postoperative CT imaging was planned. The CT imaging confirmed that the globe was in the correct position. (Figure 1, 2).

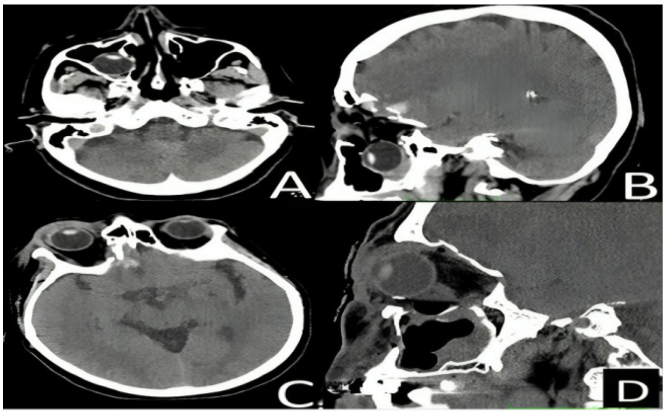

Figure 1. Preoperative and postoperative CT imaging of globe dislocation to the maxilla after trauma: A) Axial imaging shows intact globe dislocation to the maxilla as a result of orbital inferior wall fracture. B) Orbital inferior wall fracture and dislocation of the globe to the maxilla on sagittal imaging. C) In postoperative day 1 axial CT imaging, the globe was repositioned into the orbit. D) Inferior wall stability was achieved with the polyethylene mesh seen on the inferior wall in the sagittal CT examination on postoperative day 1

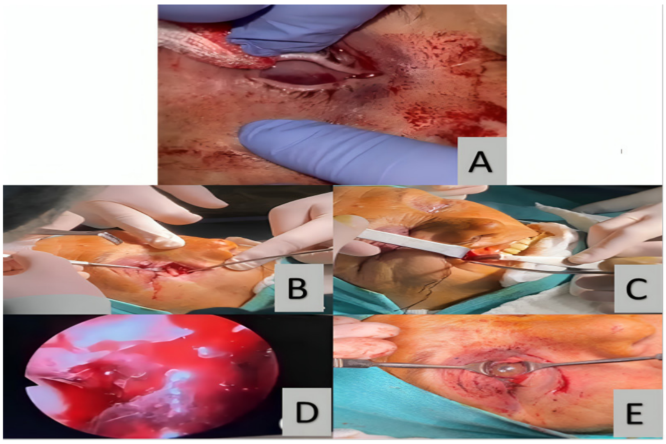

Figure 2. Empty orbit view and inferior wall repair via transmaxillary route: A) There was no evidence of the presence of a globe in the right orbit. B) Approach to the fracture line with a subciliary incision. C) Transmaxillary incision made for diagnosis and treatment. D) Visualization of the globe in the maxillary sinus with the help of an endoscope. E) Globe appearance within the orbit after globe reposition

During the postoperative day 1 examination, the patient exhibited no light perception, and eye movements were restricted in all directions. Anterior segment ischemia was suspected when conjunctival hyperemia, significant corneal edema, and flare findings in the anterior chamber were observed during the anterior segment examination. Fundus imaging could not be performed due to the severe corneal edema. B-scan ultrasonography imaging did not detect any abnormalities in the retina and other intraocular structures.

At the 6-month follow-up examination, ptosis and enophthalmos were noted, and the patient continued to have no light perception. Additionally, cataract and diffuse iris atrophy, believed to be secondary to anterior segment ischemia, were observed. Eye movements remained restricted in all directions, and esotropia was present in the primary position. The anterior segment examination revealed a clear cornea, diffuse iris atrophy, a mature cataract, and iris pigment deposits in front of the anterior capsule (Figure 3).

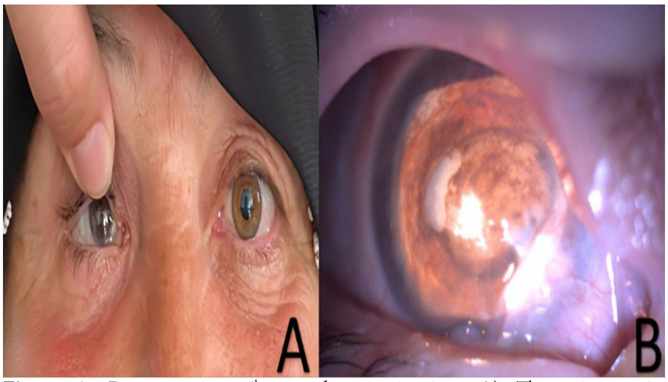

Figure 3. Postoperative 6th month examination: A) There is ptosis, enophthalmus, esotropia and limited gaze in the right eye. B) Anterior segment examination reveals diffuse iris atrophy and pigment loss in the right iris, as well as mature cataract and pigmented fibrous membrane residue covering the anterior capsule

DISCUSSION

Blunt trauma in the orbital region typically results in fractures of multiple walls. This condition can lead to complications such as enophthalmos and diplopia, as well as alterations in orbital volume.[4] As a consequence of globe dislocation, enucleation, blindness, and orbito-facial deformities may occur. These traumatic dislocations are often associated with varying degrees of optic nerve damage, which can result in partial or complete blindness in the affected eye.[4] In addition to these conditions, the rupture of vascular structures is a common mechanism contributing to vision loss.[2] Edema and tension in the surrounding tissues, resulting from the trauma, may disrupt the circulation of the retinal artery and the feeding vessels of the optic nerve and other intraorbital structures. Consequently, total globe ischemia becomes inevitable.[5]

In a study analyzing the literature on globe dislocation,[4] 19 cases between 1981 and 2020 were examined. It was observed that partial optic nerve damage was reported in 3 cases,[5] while total optic nerve damage was reported in another 3 cases.[6] In our case, the absence of light perception at the time of admission and at the 6th postoperative month, along with the lack of light reflex in the postoperative period, suggests the possibility of total optic nerve damage. The rupture of vascular structures is one of the common mechanisms contributing to vision loss.[2,5] In our case, the ocular ischemic syndrome that developed in the early postoperative period, along with the ischemic findings in the anterior segment observed later, supports this hypothesis. We found globe repositioning via the transmaxillary route to be appropriate in our case.

In our case, the globe was completely dislocated into the maxillary sinus following blunt trauma inflicted by a cow horn. Previous studies have demonstrated that animal-induced ocular injuries are often associated with a visual acuity of less than 0.1.[7] Although the anatomical integrity of the globe was restored postoperatively, the final visual acuity remained poor due to optic nerve damage and ischemia resulting from injury to the intraocular vascular structures. A comprehensive review of the literature revealed that the association between severe globe dislocation and ocular ischemic syndrome has not been previously reported, underscoring its clearly negative impact on visual prognosis.

In addition, enophthalmos, complete ptosis attributable to a defect in the levator muscle, and esotropia resulting from traumatic injury to the rectus muscles were also observed due to damage to the rectus muscles as a consequence of trauma were also observed.

CONCLUSION

In conclusion, the present case underscores the critical importance of prompt diagnostic evaluation and timely intervention in managing severe orbital trauma, particularly in instances of complete globe dislocation. Although anatomical repositioning via the transmaxillary approach was successfully accomplished, subsequent ocular ischemia and optic nerve injury resulted in sustained visual impairment. These observations highlight the need for continuous refinement of treatment protocols to optimize both functional recovery and cosmetic outcomes in similarly complex orbital injuries.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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