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Monocular Diplopia in Astigmatism and Traumatic Iridodialysis Patient: A Case Report

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ABSTRACT

Monocular diplopia is the perception of double (or many) pictures while seeing with just one eye, and it reflects an ocular rather than a brain origin. Only 11% patients identified as monocular diplopia. Cataracts, corneal surface abnormalities (such as keratoconus or astigmatism), and, in rare cases, occipital cortex lesions can all cause monocular diplopia. We report a case of monocular diplopia patient caused by either astigmatism or traumatic iridodialysis. A 43-year-old man complained of double vision, nausea, and vomiting while utilizing two eyes or when patient's occluded left eye was opened. In left eye, the patient had astigmatism and traumatic iridodialysis. Patient's left eye was occluded following penetrating injury in January 2022 and had iris repositioning and corneoscleral suturing. On examination, the left eye showed conjunctival hyperemia, temporal mild subconjunctival hemorrhage, corneoscleral suture at 3 o'clock, corneal conjunctivalization and traumatic iridodialysis. The other tests were normal. Monocular diplopia was detected in the patient. Diplopia is one of the symptoms indicating the iris has to be repaired, particularly after trauma. The reconstruction will help patients by reducing diplopia, photophobia, and glare while preserving visual acuity. As iris restoration remains a subject of innovation in ophthalmology, several studies were necessary to optimize the method and identify widespread side effects.Ocular problems are the most prevalent etiology for monocular diplopia, including astigmatism and traumatic iridodialysis. Careful examination to determine the etiology is important since treating underlying cause remains the mainstay treatment for monocular diplopia.

Keywords: *astigmatism, iridodialysis, monocular diplopia, case report*

1. INTRODUCTION

In both regular and emergency care settings, diplopia is a frequent occurrence that requires medical attention. According to one research, diplopia is responsible for around 805,000 trips to ambulatory settings and 50,000 visits to emergency rooms per year in the United States. According to the findings of one research, only 16% of those who underwent diplopia did so for potentially life-threatening reasons, despite the fact that we are always concerned about these potential origins of the problem. In addition, patients with monocular diplopia are identified with the condition 11% less often than those with binocular diplopia (1–5).

Monocular diplopia is the perception of double (or many) pictures while seeing with just one sick eye or both eyes. To establish an early diagnosis of monocular diplopia, place an occluder over the afflicted eye and another eye. If monocular diplopia disappears when just one sick eye is covered, that's a unilateral monocular diplopia. Monocular diplopia can result from cataract changes in the lens, corneal irregularities (like keratoconus or astigmatism), and, in very rare cases, lesions in the occipital cortex (referred to as "cortical polyopia"), typically associated with homonymous visual field defects. It may also occur due to a combination of these factors. If using a pinhole doesn't resolve the diplopia, it suggests that the cause may be related to the macula (1,6).

Monocular diplopia is often diagnosed and treated by ophthalmologists, although it may also be a symptom of a variety of neurological conditions. According to a newly published research, monocular diplopia is produced by the ophthalmic manifestation of high intracranial pressure. Moreover, medical personnel often mistake monocular diplopia for a functional condition when it is not. In terms of therapeutic therapy, diplopia patients have few alternatives. Patients with monocular diplopia need treatment for both their refractive issues and the likelihood of acquiring cataracts. Additionally, patients must be evaluated for the potential of cataract surgery. In order to determine the cause of monocular diplopia, it is required to conduct a comprehensive eye exam and a thorough inspection (7).

This case report discussed a 43-years-old patient diagnosed with monocular diplopia due to astigmatism and traumatic iridodialysis. Since ocular problems are the most prevalent cause of monocular diplopia, further diagnostic testing and/or treatment will be necessary to reveal the etiology thus alleviate the complaints.

2. CASE ILLUSTRATION

A 43-years-old man complained of double vision in the outpatient clinic. Patient experienced double vision, nausea, and vomiting while using two eyes or when patient's occluded left eye was opened. In January 2022, patient's left eye was being occluded after experienced penetrating injury, iris reposition and corneoscleral suturing. Postoperative examination in left eye revealed iridodialysis, two holes in the iris. Patient also had post-surgery astigmatism in left eye.

On examination, right eye visual acuity was 0.0 LogMAR. Patient's left eye visual acuity was 1.4 LogMAR with correction S+1.50 C-7.50 A70 became 0.0 LogMAR. Before we examine visual acuity for this patient, autorefractor keratometer used for guide BCVA test (Table 1).

Table 1. Result of autorefractor keratometer

VD = 13. 5			
<R>	SPH	CYL	AX
	0.00	+0.25	155
	0.00	+0.25	157
	0.00	+0.25	156
	0.00	+0.25	157
<R>	mm	D	AX
R1	7.72	43.75	
R2	7.72	43.75	
AVE	7.72	43.75	
CYL		0.00	

<L>	SPH	CYL	AX
	+2.75	-8.25	63
	+2.50	-8.00	63
	+2.50	-8.00	64
	+2.50	-8.00	64
	+2.75	-8.00	64
	+2.50	-8.00	64
	+2.50	-8.00	64
<L>	mm	D	AX
R1	8.30	40.75	64
R2	6.91	49.00	154
AVE	7.61	45.00	
CYL		+8.25	154
PD = 63			

In patient's left eye examination was found conjunctival hyperemia, corneoscleral suture on 3 o'clock position and corneal conjunctivalization. In anterior chamber, iridodialysis was found on 3 and 4 o'clock position (Figure 1). Right eye examination was within normal limits.

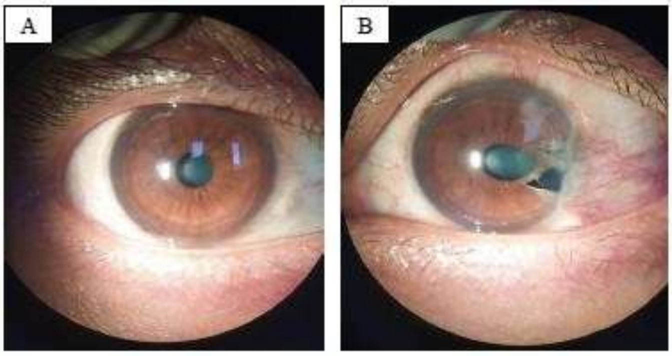

Figure 1. Slit lamp examination A) Right eye was normal. B) Conjunctival hyperemia, corneoscleral suture on 3 o'clock position and corneal conjunctivalization were observed in left eye.

The fundus photography examination of the patient revealed normal fundus images for both eyes (Figure 2). The specular microscope examination was also normal. The cell density was 2.885 cells/mm2 for right eye and 2.946 cells/mm2 for left eye. Hexagonal cells were 69 % for both eyes. Corneal thickness was 505 µm for right eye and 491 for left eye (Table 2).

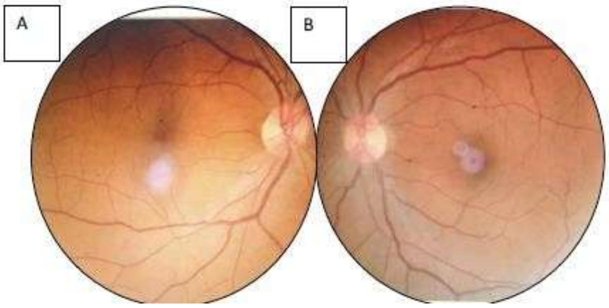

Figure 2. Fundus photographic - A) Right eye was normal fundus, B) Left eye was normal fundus

Table 2. Specular microscopy findings for both eyes

		Right Eye	Left Eye
Number of Cells (NUM)	Cells	240	223
Cell Density (CD)	Cells/mm^2	2885	2946
Average Area	µm^2	332	322
Standard Deviation (SD)	µm^2	85	86
Coefficient of Variation (CV)	%	26	27
Max Area (MAX)	µm^2	951	979
Min Area (MIN)	µm^2	129	125
Hexagonal Cells (HEX)	%	69	69
Corneal Thickness (CT)	µm	505	491

The corneal topography test revealed a normal pattern for the right axial curvature and a prolate asymmetric bow-tie pattern for the left axial curvature, both of which were indicative of regular asymmetric astigmatism. The central corneal astigmatism was detected in both eyes, with 0.34 for the right eye and 8.54 for the left eye (Figure 3).

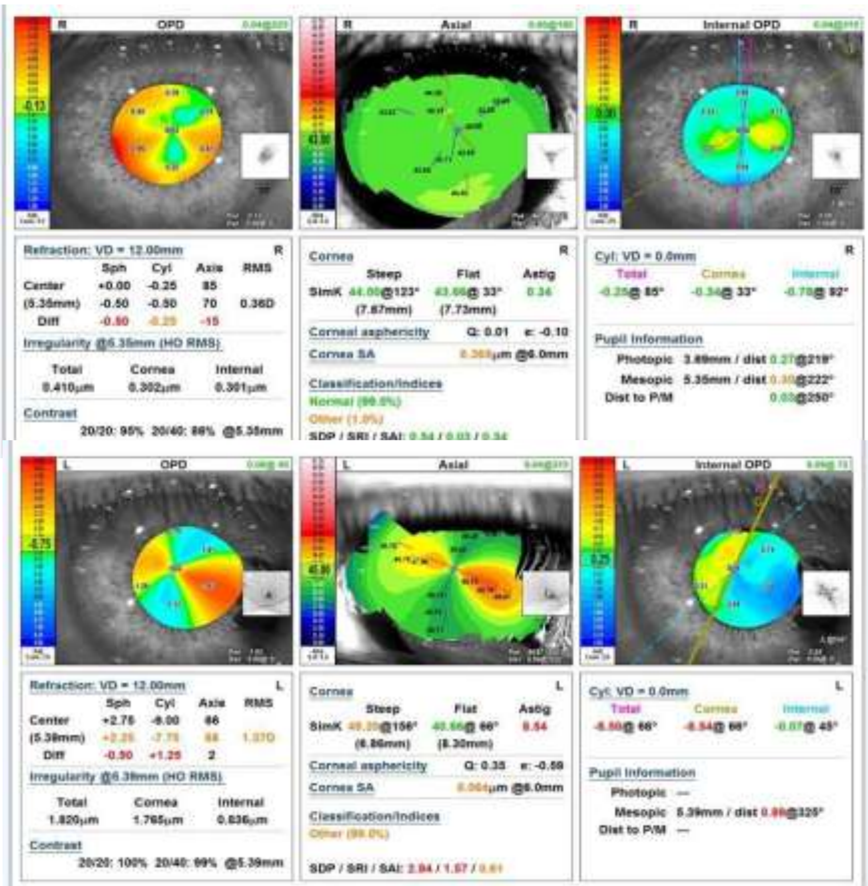

Figure 3. Corneal topography findings for both eyes

The patient underwent iris repair and corneoscleral suture removal fifteen days after initial presentation. During the surgery, it was observed that the iris was thinner and more prone to tearing, with iris atrophy present. The procedure was done by first creating a main port in the anterior chamber at around 1 o'clock using a keratome, and a side port at 6 o'clock using a slit knife. Ophthalmic viscosurgical devices (OVD) was then inserted behind the iris to release any synechia and to push the iris toward the incisions. The iris was then stitched using the McCannel technique with 10.0 polypropylene thread, with three stitches applied initially, followed by creating a port at 2 o'clock and stitching the iris once more. Then, irrigation and aspiration is performed, followed by stitching of the main port around 1 o'clock. Corneal hydration and insertion of cefuroxime was also done, along with the insertion of an air bubble. Peritomy of the corneal conjunctivalization from 2 to 5 o'clock is performed using a crescent. Six sutures of the corneoscleral junction was removed, followed by cutting of the conjunctivalization within 1 mm margin. Finally, a subconjunctival injection of dexamethasone-gentamycin is administered to reduce the risk of post-operative infection. The outcome of the surgery revealed successful closure of the iridodialysis in affected eye and removal of the 6 corneoscleral sutures (Figure 4).

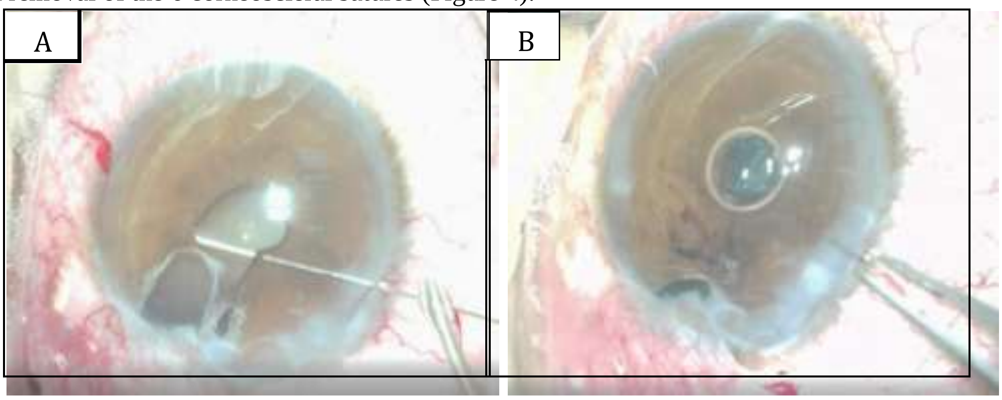

Figure 4. Iris repositioning procedure A) The base of the iris is anchored to the base of the scleral tunnel. B) The shape of the pupil is restored after stitching, and the area of defect becomes smaller.

Post operatively, the patient was given topical prednisone 6 times a day along with oral methylprednisolone to reduce the degree of inflammation and tapered of gradually after 2 weeks. Topical antibiotic levofloxacin four times a day was also given prevent further infection, and the patient received a 1% solution of Atropine to widen the pupil and alleviate tension around the suture site (Figure 5).

One week after the surgery, the patient reported occasional pain in the eye but reduced complaints of double vision. The patient's visual acuity in the affected eye was found to be 1.3 LogMAR, which was improved to 0.4 LogMAR with pinhole correction. The patient was scheduled to receive glasses prescription two weeks following the removal of the corneoscleral sutures. The left pupil appeared non-circular, measuring 5 mm in diameter under the effect of homatropine. The patient was advised to facilitate adaptation of the left eye by removing the eye patch and seeing with both eyes for approximately one hour each day.

During the three-week follow-up, the patient experienced worsening dizziness, particularly when opening the eye patch. Consequently, the patient was advised to wear glasses. In the natural vision, the patient's left eye had a visual acuity of 0.7 LogMAR, which improved to 0.0 LogMAR with cylindric lens (S+1.00 C-3.50 A90), though the patient experienced glare. Upon examination of both eyes, the patient achieved positive binocular balance and negative diplopia with a left lens of smaller cylindrical power (S+0.75 C-2.75 A90). The patient was instructed to wear the prescribed glasses and to report any discomfort experienced during the one-month evaluation period.

Following a one-month glasses evaluation, the patient reported occasional dizziness when viewing with both eyes, describing the vision as wavering. Despite attempts at binocular adaptation, the symptoms persisted. The prescription was adjusted to S+0.50 C-1.50 A100, resulting in a corrected visual acuity of 0.1 LogMAR in the left eye. This prescription provided the patient with the most comfortable binocular vision state.

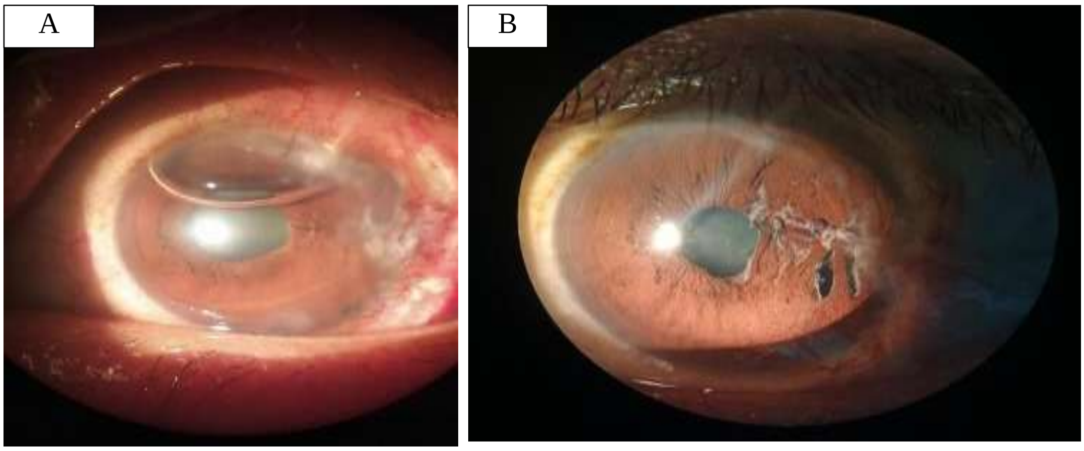

Figure 5. Slit lamp examination A) left eye one day post-surgery, conjunctival hyperemia can be observed, pupil is irregular, with notable opacity around the limbus. Air bubble is present. B) left eye on follow up two-years after surgery. Pupil is slightly irregular, iris not radial. Corneoscleral suture at 3 o'clock is epithelized.

During the six-month follow-up, the patient reported a significant reduction in dizziness and double vision; however, a new complaint arose regarding redness and discomfort in the left eye. Schirmer and Fluorescein tests were conducted, revealing Schirmer values of 5 mm/5 mm and TBUT values of 8 s/6 s. The patient was diagnosed with dry eye and was prescribed hyaluronate eyedrops along with artificial tears. These symptoms persisted until the one-year follow-up with no improvement reported, and the patient mentioned using artificial tears an average of 6-7 times per day. At 2-years evaluation, the patient complaint of recurring dizziness especially when focusing on an object. This prompted a reevaluation of the patient's glasses, resulting in an adjustment of the glasses to S+0.75 C-1.75 A120 lens for the left eye, with visual acuity of 0.1 LogMAR reached. From anterior segment examination, eyelids show no edema and minimal spasms, no conjunctival or pericorneal hyperemia, and there is no reaction on the conjunctival palpebral papillae. The cornea appears clear, with no Descemet folds observed. Anterior chamber depth and inflammation markers are within normal limits. The iris is irregular in the left eye, with iridodialysis which has been sutured at 3 o'clock in the left eye, no synechia is observed. The right pupil is round and left pupil shows slight deformity in shape, with a diameter of 3 mm and 4 mm in the right and left eye respectively. The right lens is clear and left lens has minimal opacity. Visual acuity was 5/5 for the right eye, and best corrected visual acuity of 0.1 LogMAR was reached on the left eye with S+0.75 C-1.75 A120 lens. The prescribed glasses currently provided the patient with the most comfortable binocular state. The patient was advised to consider prosthetic iris contact lenses, but opted to continue wearing glasses instead.

3. DISCUSSION

We described a case of monocular diplopia had been caused by traumatic iridodialysis or astigmatism, which both of these options are not inconceivable. Monocular diplopia can be attributed to the eye itself if no underlying neurological, ophthalmological, or psychological conditions are present. When using just one eye to view an object, monocular diplopia can cause the perception of double or multiple images (2). This condition may result from various causes, including refractive errors, corneal disorders (like irregular astigmatism), iris lesions, cataracts, or macular diseases. Approximately 11 percent of people report experiencing monocular diplopia due to these factors (6).

Refractive error (whether it has been corrected or the correction is out of date), corneal abnormalities (including dry eye), cataracts, and macular degeneration are the most common causes (2). Frequently, cataracts and refractive irregularities, also known as astigmatism, are responsible for the development of monocular diplopia (8). Because intraocular pathology is the most prevalent cause, a thorough assessment by an ophthalmologist is required. Almost rare do lesions in the primary and secondary visual cortex generate unilateral or bilateral monocular diplopia or polyopia (more than two pictures). When cataracts are the primary cause of diplopia, visual acuity loss and haziness may also be present. This is due to cataracts clouding the eye's lens. In rare cases, metamorphopsia may be linked to macular conditions, as assessed through an Amsler grid test. Other causes of monocular diplopia include dry eye syndrome, ill-fitting contact lenses, an irregular corneal surface, keratoconus, iris abnormalities (such as iridodialysis, polycoria, and extensive iridotomies), and vitreous opacities. The pinhole test can help differentiate between monocular diplopia caused by optical issues and other forms of the condition. The optical causes can then be corrected using artificial tears, glasses, contact lenses, or surgery to fix refractive faults or cataracts; surgery to repair refractive errors or cataracts is also a possibility (8).

Double vision (diplopia) can stem from various sources, ranging from harmless etiologies, such as cataracts, to severe causes like posterior communicating artery aneurysm. To enable a thorough evaluation of diplopia as a presenting symptom, a clinical symptom-based algorithm can be utilized to enable general practitioners and other clinicians to correctly identify the underlying cause of diplopia. The Edinburgh Diagnostic Diplopia Algorithm was developed for this purpose (Figure 6). The first step of this algorithm require clinician receiving patients with main complaints of double vision to clarify whether the symptom is truly diplopia or perceived diplopia due to blurred vision or visual loss. If the patient has true diplopia then clinician is required to distinguish between monocular and binocular diplopia based on whether the symptom persist when each eye is covered separately. Patients with monocular diplopia should be further evaluated with a pinhole, if the diplopia persist it is most likely due to cortical abnormality and require urgent referral. However, if symptoms improved with pinhole then it is most likely due to abnormalities in the refractory media of the orbit, most commonly due to cataracts. Patients with binocular diplopia should be questioned whether the image is separated horizontally or vertically. Horizontally split image suggests abnormalities in ocular movement, which can be caused by abducens nerve (CN VI) palsy or internuclear ophthalmoplegia. Vertically split image might be caused by cranial nerve palsy (CN III or IV) or from thyroid orbitopathy causing restrictive myopathy of the inferior rectus. This algorithm also emphasized the urgency of referrals in some causes of diplopia, particularly those related to neurological dysfunction (9).

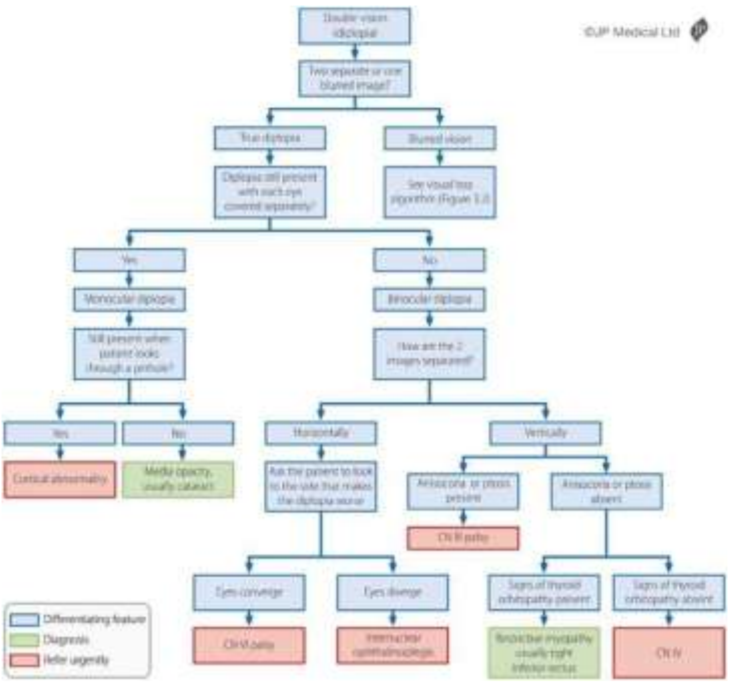

Figure 6. The Edinburgh Diagnostic Diplopia

A study by Butler et al. studied the accuracy of this algorithm. In total, the algorithm-guided diagnosis accurately identified the underlying cause of diplopia in 82% (37 out of 45) of the patients. The algorithm accurately diagnosed all six patients with isolated CN III palsies and identified those with dual pathology involving CN III. Urgent evaluation is crucial for patients with acute CN III palsies, as this may signal a life-threatening posterior-communicating artery aneurysm. Overall, the results indicate the algorithm's effectiveness in detecting serious conditions like cranial nerve palsies and internuclear ophthalmoplegia, while maintaining specificity for minor issues like cataracts to ensure all urgent cases receive proper attention. For inexperienced clinicians, the algorithm serves as a helpful prompt, guiding them on when and what aspects of history and examination to focus on when evaluating diplopia patients, such as distinguishing between monocular and binocular diplopia and determining its orientation (10).

Approximately 11.5 to 25.1 percent of diplopia patients may continue be affected by monocular diplopia; therefore, it should be thoroughly evaluated in neurology clinical practice. Monocular diplopia, while less prevalent than binocular diplopia, can nonetheless cause double vision in certain individuals. Neurological causes of monocular diplopia include malignancies, such as pituitary tumors, which can compress macular nerve fibers, and midbrain strokes that affect eyelid posture and the interaction between the tear film and the corneal surface (7,11). Despite the fact that these disorders typically entail the superimposition of several pictures and the existence of bilateral characteristics (cerebral polyopia), monocular diplopia can be caused by abnormalities of the visual cortex, cerebellum, or vestibular nuclei (for example, stroke, epilepsy, occipital migraine). Epilepsy medications like carbamazepine, lacosamide, lamotrigine, zonisamide, and phenytoin have been associated to an increased prevalence of diplopia, which can masquerade as monocular vision. Moreover, monocular diplopia is commonly misinterpreted as a functional impairment (7,11).

Patients with eye injuries who undergo traumatic iridodialysis may develop a condition known as monocular diplopia. Iridodialysis is a condition that involves removing the iris from its scleral spur connection. The most prevalent causes of monocular diplopia are uncorrected refractive errors, corneal abnormalities (such as dry eye), cataracts, and macular diseases. Obtaining a full history of the patient's diplopia may aid in determining a diagnosis even before the patient is checked (12).

This is the case for the great majority of various conditions. The beginning of diplopia cannot be foreseen due to the fact that it is a binary condition. An individual can either possess or not possess the state. As a result, questioning about the time period during which the diplopia first appeared will be ineffective in determining its underlying cause. If a "shadow," "ghost," "haze," or clear "double image" continues to be perceived even when the unused eye is closed, it strongly indicates an ocular cause. This can be easily confirmed by covering the patient’s seeing eye with a pinhole occluder (or a similar device) and asking whether the double vision persists or disappears (12).

Physiologic diplopia is a normal occurrence caused by the misalignment of the ocular axes when focusing on an object. While it is not the same as monocular vision, doctors should recognize this phenomenon. It is a typical visual experience that happens when looking at a specific object (8). This impression is the result of misaligned ocular axis. For instance, if you hold the camera close to the subject's face while focusing on the subject's face, the backdrop will appear "doubled." A similar effect can be obtained by focusing on a distant topic while retaining an object in the camera's field of view that is reasonably close. When patients are reviewed following the finding of this event, they can be reassured that it is a completely normal occurrence, and that extra testing are not required because they are unnecessary (2).

On patient examination, we found right eye visual acuity was 0.0 logMAR for this patient. The patient’s left eye visual acuity was 1.4 LogMAR with correction S+1.50 C-7.50 A70 became 0.0 logMAR and complaint of diplopia was getting better with pinhole. We can conclude that monocular diplopia caused by ocular problem. From the result of specular microscopy, we get information that central corneal endothelium was normal.

The treatment for diplopia must be customized according to the disorder's underlying cause. Treatment of the underlying pathology is always the most prudent course of action and should be undertaken whenever possible. Depending on the underlying cause of the disease being treated, the therapy technique can be classed as either surgical or non-surgical. Diplopia, which is associated with a high morbidity rate due to disorientation and confusion, is frequently treated with medications that ease the condition's symptoms. In such cases, the goal is to reconstruct a single binocular image in both patient’s eyes (8).

Since the cause of our patient is either astigmatism, traumatic iridodialysis, or even both, it is appropriate to address both cause. In our case, it is also reasonable to consider an eye patch, glasses with lenses, tape that is partially opaque, or contact lenses with an opaque core. In order to treat diplopia, it is often essential to temporarily cover one eye until the problem corrects (8).

To decrease astigmatism in the left eye, we would like to remove the corneoscleral suture at 3 o'clock. Recent study indicates that suture removal may reduce astigmatism and improve eye acuity (13). After suture removal, astigmatism was decreased to less than 0.5D, according to the study. Following the removal of selected sutures, 74% of 50 eyes had residual astigmatism of less than 3D. Early suture removal may decrease suture-induced astigmatism by decreasing compression. Chronic astigmatism is nonetheless evident because to the severity of damage, scarring, and corneal topographic alteration (13).

Even if the eye has recovered after the sutures were removed, there are still risks to consider. Complications of corneoscleral suture removal including cataract, vascularised scar formation, and infection (13,14). The origin of cataract production is unknown, and patients should have cataract therapy. Posttraumatic vascularised scars are caused by anterior synechiae and iris imprisonment (14). Scars, however, may be prevented with careful attention. To prevent iris entrapment, suturing should be gentle, and hyaluronic acid (healon) should be utilized to restore the anterior chamber. With meticulous debridement and postoperative care, it is possible to prevent infection (15).

Additionally, we want to do iris repair or traumatic iris reconstruction. Diplopia is one of the symptoms indicating the iris has to be repaired, particularly after trauma (16). As the iris has several functions, including controlling the size and breadth of the pupil and reducing aberrations from the lens and cornea by restricting the amount of light entering the pupil, iris restoration may alleviate diplopia symptoms, especially in the case of iris damage caused by trauma (16). According to the research, the reconstruction will help patients by reducing diplopia, photophobia, and glare while preserving visual acuity (16–18). As iris restoration remains a subject of innovation in ophthalmology, several studies were necessary to optimize the method and identify widespread side effects. However, a surgical eye infection, bleeding, and inflammation must be considered.

The human iris comprises the anterior stromal part and the posterior double-layered pigmented epithelium, with the iris dilator and sphincter pupillae muscles situated between them. Healing in iris defects is confined to areas adjacent to sutures, leading to scarring characterized by infiltration of fibroblasts, plasma cells, and macrophages with limited collagen deposition. The long-term strength of the iris defect is determined by the presence of a suture, emphasizing its crucial role in the healing process and overall structural integrity (19).

Planing for this patient will be conducted surgical reconstruction of the iris with closed-chamber iris repair technique from McCannel (Figure 5). In patients with phakic eyes, care must be taken to avoid damaging the anterior lens capsule, which could lead to a traumatic cataract. An ophthalmic viscoelastic device (OVD) should be placed between the posterior iris and anterior lens capsule to protect during the procedure. Limbal paracentesis allows a long suture needle to pass beneath the proximal edge of the iris, through the distal edge, and out through the cornea. After cutting off the needle, the distal end of the suture is retrieved through the paracentesis site using a microhook. The suture ends are then tied to secure the iris edges and repair the defect (20).

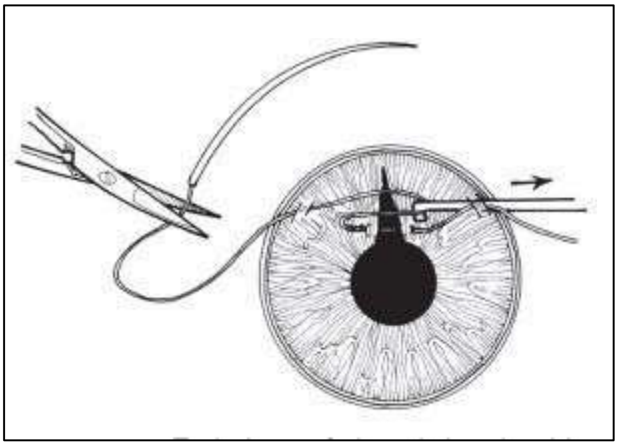

Figure 7. McCannel technique of close-chamber iris repair (20).

Several techniques can be used to repair iridodialysis, including both open and closed chamber iridoplasty. Open chamber methods involve accessing the iridodialysis site through a self-sealing incision near the limbus, such as a phacoemulsification incision, or via a scleral tunnel incision. The open chamber approach for iridodialysis repair was first introduced by Paton, though it is no longer commonly used. In contrast, closed-chamber techniques involve using a needle to enter the anterior chamber, with various described methods. Prior to surgery, miotic agents are given to constrict the pupil, which helps to elongate and expand the iris surface area (21,22).

The McCannel technique uses two double-armed sutures to anchor the peripheral iris to the scleral wall about 1 mm behind the limbus. The procedure starts with one needle entering the anterior chamber through the lower limbus, passing through the iris base, exiting at the anterior chamber angle, and penetrating the sclera. A second needle is inserted through the same incision, piercing the iris base near the first needle. The sutures are then tied over the sclera and buried. This method involves less manipulation than other iridodialysis repair techniques, but a potential complication is suture erosion through the eye's superficial layers (17,23).

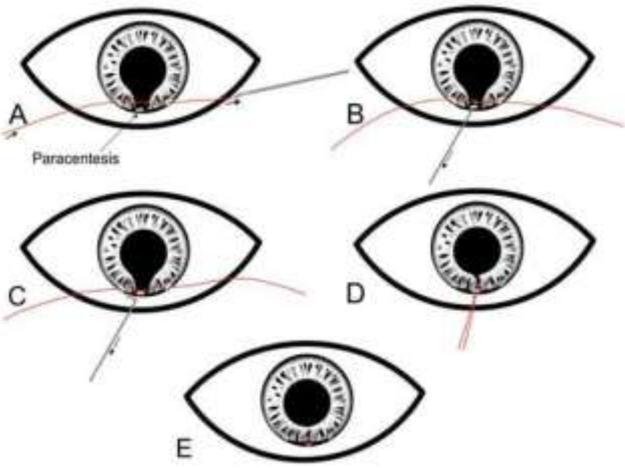

Figure 8. Step-by-step diagrammatic representation of the McCannel technique for repairing an iris defect. (A) Two limbal paracenteses are made 90 degrees away from the iris defect. A long needle with a 10/0 polypropylene suture is passed through one paracentesis, through the edges of the iris defect, and then through the other paracentesis. (B) A Sinskey hook is introduced through a limbal paracentesis at the site of the iris defect. (C) The Sinskey hook is used to bring both ends of the suture out of the anterior chamber. (D) The suture is securely tied with a knot outside the eye. (E) After the knot is secured, it is slipped into the anterior chamber and positioned over the iris to complete the repair (23).

The Cobbler's Technique for repairing iridodialysis helps to restore iris integrity while minimizing disruption to surrounding structures. A partial-thickness scleral tunnel is created, positioned parallel to and 1.5 mm behind the limbus, along the extent of the iridodialysis.A limbal paracentesis is made opposite the scleral tunnel. A 26-gauge needle is used to thread a 10/0 polypropylene suture, which is passed through the paracentesis, capturing the iris root, and then exits through the scleral groove. The loose end of the suture is pulled through, and the needle is reinserted into the anterior chamber to capture the iris root again. By pulling the suture, a loop is created, and the loose end is passed through this loop to secure it. This looping process is repeated multiple times, forming several loops over the scleral bed, which are tied off to stabilize and repair the iris (24).

Open chamber techniques, such as Paton's incarceration technique and the curved needle method, may carry a higher risk of postoperative infection in patients. In contrast, closed chamber techniques, including the McCannel technique, Cobbler's Technique, stroke and dock technique, and double-armed suture technique, have been shown to be safer and less invasive (25,26).

In this case, the patient underwent closed-chamber iris repair with McCannel technique due to the relatively large defect (2–3 clock hours). The patient achieved best-corrected visual acuity (BCVA) of 0.1 logMAR in the operated eye. A study by Lin et al. reviewed the outcomes of iris repair surgery in 51 patients. Group A underwent iris repair using the reversed scleral tunnel technique, while Group B received the double-armed suture technique. The results showed that both groups experienced improvement in mean best-corrected visual acuity (BCVA) at the final follow-up compared to preoperative levels. In Group A, the mean logMAR BCVA improved from 1.37 ± 0.60 to 0.47 ± 0.27 ($p < 0.05$), while in Group B, it improved from 1.32 ± 0.67 to 0.51 ± 0.41 ($p < 0.05$). Additionally, a final BCVA of ≥ 0.48 logMAR (20/60) was achieved in 13 eyes (48.1%) in Group A and 13 eyes (54.2%) in Group B (27).

Functional complaints such as glare and monocular diplopia are common consequences of iridodialysis, caused by the polycoria of a pseudopupil formed due to the condition. These symptoms are often most troublesome when the iridodialysis is situated in the nasal, temporal, or inferior quadrants (28). Since the introduction of the first iris-lens plane implant, significant progress has been made in prosthetic iris devices, offering a variety of options tailored to individual patients' ocular anatomy and preferences. These include designs such as iris-lens diaphragm devices, endocapsular capsular tension ring-based devices, and customizable artificial irises, which are suitable for iris defects larger than 3 clock hours. These devices differ in their fixation methods, placement locations, sizes, materials, and costs, enabling surgeons to choose the most appropriate option based on factors like the severity of the iris defect, the condition of the intraocular lens, and the integrity of the capsular bag. In addition to their functional aspects, cosmetic considerations, such as post-operative appearance and symmetry with the contralateral eye, are also important, highlighting the need for thorough evaluation of both anatomical and cosmetic factors to ensure the best possible outcomes for each patient (23).

The main advantage of iris-lens diaphragm devices is their ability to address both large iris defects and phakia with a single implant, which improves visual acuity and significantly reduces glare (by 75–100%), as noted in previous studies. However, these devices have several drawbacks. Due to their large size and rigid material, they require a substantial corneal incision, typically between 8 and 11 mm, for insertion, which can lead to significant induced astigmatism. Additionally, their size makes them difficult to rotate and maneuver within the anterior chamber, increasing the risk of iatrogenic intraoperative damage to surrounding structures. This can result in complications such as further iris damage, uveitis-glaucoma-hyphaema syndrome, and corneal decompensation (29,30).

Non-surgical methods for traumatic iris reconstruction provide effective alternatives to surgical procedures and include options like contact lenses and tattooing. Soft and rigid gas permeable contact lenses, particularly those with larger diameters, can be highly effective in managing conditions like traumatic iridodialysis, aniridia, and partial iris tissue loss. These lenses can be designed with a central clear pupillary zone and an opaque peripheral margin, and they can be customized to adjust the pupillary diameter to help reduce glare and photophobia, potentially enhancing both visual function and cosmetic appearance. The success of contact lenses may also depend on factors such as gas permeability (31,32).

Some researchers have explored the use of toric intraocular lenses (IOLs) during iris reconstructive surgery in patients who also have astigmatism (33,34). Since the introduction of the first foldable 1-piece toric intraocular lens (IOL) in 1994, there have been significant advancements in toric IOL technology, including improvements in materials, design, and surgical techniques. Most studies on toric IOLs have focused on patients with at least 1.00 to 1.50 diopters (D) of corneal astigmatism, with those having regular bowtie astigmatism being ideal candidates for implantation. In contrast, irregular astigmatism is generally considered a relative contraindication. Preoperative corneal topography, using techniques like Placido-disk videokeratoscopy or Scheimpflug imaging, is recommended to assess for irregular astigmatism. While toric IOLs are primarily effective in correcting regular astigmatism, they have also demonstrated effectiveness in patients with irregular corneal astigmatism, including those with conditions such as keratoconus, pellucid marginal degeneration, or postkeratoplasty eyes. However, toric IOL implantation is not recommended for patients with potential capsular bag instability, such as those with pseudoexfoliation syndrome or trauma-induced zonulysis, as zonular weakness may result in IOL rotation or decentration (35,36).

4. CONCLUSIONS

In conclusion, it is crucial to determine the obvious cause of monocular diplopia and then use the most effective treatment for the disease. This case study discusses a treatment in which the left eye was briefly covered to relieve monocular diplopia resulting from astigmatism or traumatic iridodialysis. Although a thorough examination is necessary for diagnosis, monocular diplopia is mostly treated by addressing the underlying reason. A differential diagnosis of diplopia may be ruled out with a comprehensive ocular and neuro-ophthalmic examination, allowing for the avoidance of superfluous diagnostic procedures. The article will increase ophthalmologists' grasp of monocular diplopia, which may lead to a better understanding of the condition's epidemiology and physiopathology in the future.

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