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Monocular Surgery Approach in V pattern Esotropia: A Rare Case Report

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ABSTRACT

Esotropia, characterized by an inward misalignment of the eyes, presents in various forms, including incomitant deviations such as V-pattern esotropia, which is distinguished by notable differences in gaze direction. V-pattern esotropia is relatively uncommon within the general population. V-pattern esotropia poses a distinct surgical challenge because it is linked to dysfunction of the oblique muscles. Correcting such deviations in individuals with horizontal strabismus can be complex, as both vertical and horizontal misalignments need to be addressed. Usually, surgical approach is to weaken the overactive superior or inferior oblique muscles, depending on the pattern. This case report details the clinical management of a patient diagnosed with V-pattern esotropia. The patient experienced diplopia and blurriness in the right eye for one year, with a history of esotropia that began three years prior. Additionally, he reported occasional visual disturbances and had a family history of strabismus. Initial examination revealed reduced visual acuity in the right eye and suppression of this eye during the Worth Four Dot Test. Further evaluation demonstrated a 15-degree esotropia on Hirschberg testing, accompanied by significant deviations in gaze direction. The Krimsky test indicated V- pattern deviations from the primary gaze position. Surgical intervention consisted of horizontal muscle surgery on the right eye, incorporating the "MALE" (medial to apex lateral to empty) procedure, aimed at restoring the eye to its correct anatomical alignment. Following the surgery, the patient's vision improved, enabling him to read textbooks with ease for his college studies.

Keywords: *esotropia, v pattern, monocular surgery, case report*

1. INTRODUCTION

Esotropia, a condition in which one eye is misaligned, turning inward towards the nose, is named after the Greek words "eso," which means "within," and "tropia," which means "turn." This misalignment can be present from birth or develop later in life, and it can be intermittent or constant. The pattern of misalignment can change, with the degree of deviation varying depending on the direction of gaze. Esotropia is divided into concomitant and incomitant types, and depending on the individual case, it may affect only one eye at a time or alternate between the eyes [1].

Incomitant deviations, frequently denoted by letter patterns like A or V, might be the result of horizontal eye misalignments. A noticeable difference in the angle of deviation when the eyes are looking up or down distinguishes these patterns. Even when there isn't a dominant angle of departure, certain alphabet patterns might occasionally exist [2].

Hashemi et al.'s meta-analysis estimates the prevalence of esotropia at 0.77% [3]. Although adult-specific data is not provided, the incidence of adult-onset strabismus, including esotropia, is 54.1 per 1000 person-years, with no gender differences and an increase with age [4]. V- pattern esotropia occurs in approximately 11.5% of 122 patients, suggesting its relative rarity in the general population, though prevalence can vary by population [2]. Strabismus, affecting 2-5% of people, disrupts binocular vision and depth perception. Misaligned eyes can cause double vision or confusion, potentially leading to amblyopia. Pattern strabismus is surgically challenging due to complex deviations and muscle imbalances, requiring precise adjustments and correction of torsion and muscle dysfunction [5].

We report a monocular surgical approach for treating V-pattern esotropia, where the eye returns to its normal anatomical position following the procedure.

2. PATIENT AND OBSERVATION

Patient Information: A 27-year-old male patient visited the outpatient clinic, reporting double vision and blurriness in his right eye for the past year. The double vision occurred when both eyes were open, with the blurriness more prominent in the right eye. The patient noticed an inward deviation of the right eye, or esotropia, beginning in 2020. He also experienced occasional visual disturbances, such as white circular lights in the right eye, especially when viewing distant objects. He denied any pain or discomfort. His maternal aunt had a history of strabismus. The patient had no eye injuries. He had worn glasses since age 18 but was unsure of the prescription. As a university student, he frequently used computers and gadgets for academic work.

Clinical Findings: The ophthalmologic examination revealed that the right eye had a visual acuity of 6/20, which improved to 5/5 with correction of S-2.25 C-1.50 A0. The left eye had a visual acuity of 6/15, which also improved to 5/5 with correction of S-1.00 C-0.75 A178. Intraocular pressure (IOP) was measured at 17 mmHg in the right eye and 18 mmHg in the left eye. Color vision testing with Ishihara plates showed a score of 20/38 in the right eye and 38/38 in the left. Ocular motility was normal in both eyes with no pain, and the confrontation test was within normal limits. The anterior segment of both eyes showed 3 mm, rounded, isochoric pupils with normal light reflexes. Posterior segment examination revealed excyclotorsion in both eyes. (Figure 1).

The patient exhibits normal ocular motility in all directions without any pain, indicating a full range of eye movements. However, suppression is observed in the right eye during the Worth Four Dot Test (WFDT). The Hirschberg test shows a 15-degree esotropia, reflecting inward eye deviation. Additionally, the patient has an asymmetric palpebral fissure height, with the right eye measuring 8 mm and the left eye 10 mm, causing the right eye to appear slightly hypertropic.

Notably, the Krimsky test results show notable deviations from the primary gaze, with orthophoria in upward gaze, a 35 PD base-out deviation in primary gaze, and a 40 PD base-out deviation in downward gaze (Figure 2). These results indicate significant ocular misalignment, especially in downward gaze. The Stereofly test reveals stereopsis greater than 800 seconds of arc, suggesting poor depth perception. Likewise, the TNO stereoscopic vision test shows stereopsis greater than 480 seconds of arc, reinforcing the presence of strong binocular vision.

Diagnostic assessment: The blood test results indicated an increased hemostasis function (APTT 67.5 s), which led us to refer the patient to the internal medicine department. A follow-up hemostasis test was scheduled for two weeks later. During the evaluation, concerns about the potential risk of postoperative bleeding were raised. After two weeks, the hemostasis function was found to be within normal range (APTT 31.7 s). From radiology examination, we found no evident abnormalities or pathologies observed.

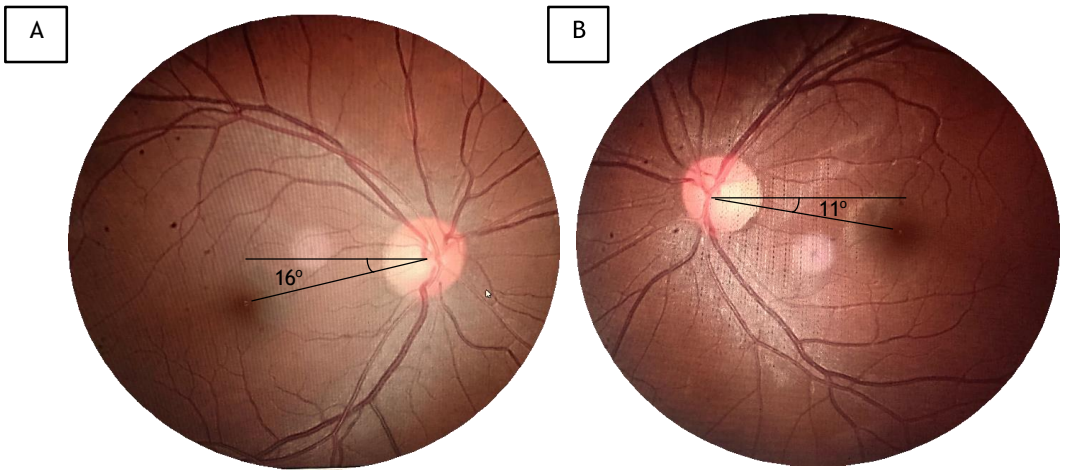

Figure 1. Fundoscopic examination. (A) Right eye funduscopic examination revealed a normal optic nerve head margin and color, with 16-degree excyclotorsion. (B) Left eye fundoscopic examination revealed a normal optic nerve head margin and color, with 11- degree excyclotorsion

Diagnosis: V Pattern Esotropia

Therapeutic interventions: Since there is a greater than 25 PD discrepancy between upgaze and downgaze, horizontal muscle surgery and the "MALE" procedure with complete tendon width were the preferred forms of therapy for this patient. The patient underwent a surgery involving recess of the medial rectus muscle by 7.0 mm, followed by transposition of the medial rectus muscle to the inferior position and transposition of the lateral rectus muscle to the superior position using the full tendon width without any lacteral rectus resection. The patient planned to follow up after one and three months due to

the wound healing evaluation.

Follow-up and outcome of interventions: Significant improvement was observed on the first day following surgery, with continued progress noted a week later. At that point, the conjunctival hyperemia had diminished, and the patient reported reduced double vision at distance. The result was orthophoria in the primary, upgaze, and downgaze positions, and amazingly, he felt joyful as he could easily read his textbooks clearly during lectures (Figure 3). Three months after the procedure, both double vision and ocular motility had further improved. His vision felt double, and there was a sense of torsion when looking at distant objects without glasses. With corrective eyewear, he achieved 5/5 vision in both eyes, fully resolving the double vision. The Stereofly test indicated stereopsis of over 400 seconds of arc, showing improved depth perception. Additionally, the TNO stereoscopic vision test showed stereopsis greater than 480 seconds of arc, though the Worth Four Dot test still indicated suppression in the right eye.

Patient Perspective: "I experienced difficulty in seeing clearly, especially while reading textbooks during college, due to double vision, which required me to read very close-up.

Thankfully, after the surgery, my double vision gradually reduced, and now I can comfortably read textbooks during my studies. I am grateful to all the doctors and nurses who took care of me during my illness."

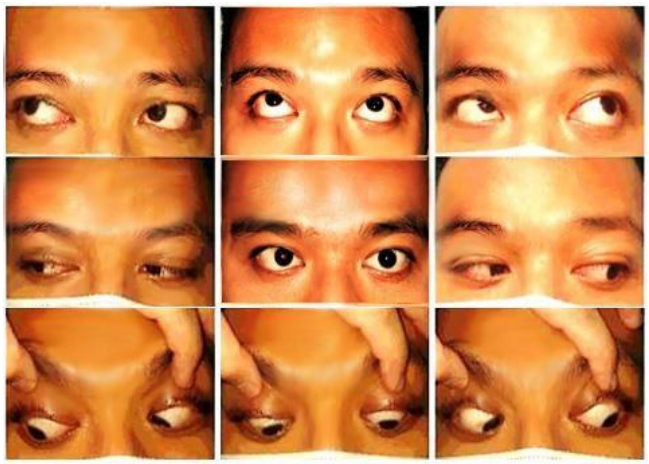

Figure 2. Preoperative photograph of patient who had V pattern esotropia. Patient's ocular motility needs whole tendon width vertical transposition achieves a collapse of 40 PD between upgaze and downgaze.

3. DISCUSSION

Esotropia is a type of strabismus, or eye misalignment, characterized by an inward deviation of one eye. It can be congenital, meaning present at birth, or acquired later in life. Esotropia is a form of strabismus, which is an eye movement disorder characterized by one or both eyes turning inward towards the nose. This condition can come and go or be present all the time, and it may be more noticeable when focusing on close or far objects. Esotropia can occur at any age, with different forms and causes [6].

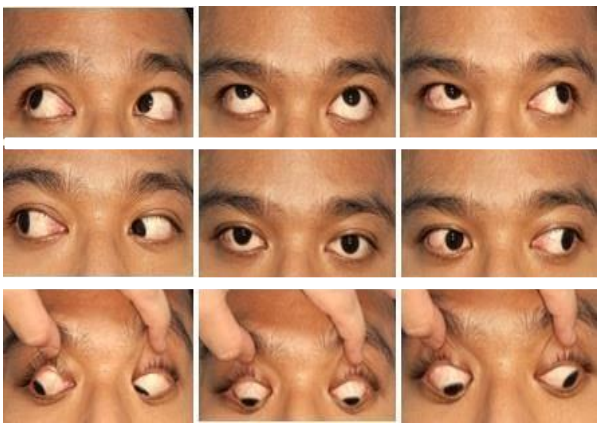

Figure 3. Patient's ocular motility three months follow up after surgical treatment showed improvement

Significant differences in ocular alignment across various gaze directions, particularly the pronounced misalignment in downward gaze, support the diagnosis of V-pattern strabismus. In our patient, the Krimsky test showed a 35 PD base-out (BO) deviation in primary gaze and a 40 PD BO deviation in downward gaze, highlighting the misalignment between upward and downward gaze. This is consistent with the V-pattern, where the deviation between the superior and inferior rectus muscles exceeds 15 prism diopters [7]. Dysfunction of the oblique muscles, like the inferior oblique, likely contributes to this misalignment, especially in downward gaze, as seen in V-pattern esotropia where oblique muscles play a key role in eye movement.

Presence of excyclotorsion in our case, supports the idea that ocular torsion plays a role in the development of A or V pattern strabismus. Rotation causes the superior rectus muscle to shift temporally and the inferior rectus muscle nasally, which can contribute to the formation of a V pattern. Inward deviation of the right eye (esotropia) is linked to oblique muscle dysfunction, especially the overaction of the superior oblique muscle, commonly associated with ocular torsion. Connection suggests that the observed excyclotorsion is influencing the patient's strabismus, as the torsion-induced muscle displacement can worsen misalignment, fostering the development of pattern strabismus like the V pattern. [2].

The ocular motility tests revealed normal eye movements but identified alignment issues, including right eye suppression, 15-degree esotropia, and significant deviations in primary and downward gaze. These findings point to a complex ocular alignment problem, likely strabismus, involving misalignment of the visual axes. In cases of esotropia, the eyes turn inward, potentially leading to uncrossed diplopia, where two separate images of the same object are seen [8].

Horizontal misalignments in ocular positioning can present as incomitant deviations, commonly known as alphabet patterns. These patterns are characterized by variations in the angle of deviation between different gaze positions, particularly evident in A and V configurations. The A pattern features a greater angle of deviation in downward gaze compared to primary or upward gaze, while the V pattern exhibits a larger angle of deviation in upward gaze. These distinct configurations are indicative of the complex interplay between extraocular muscles and their function in different gaze directions [9].

In this case, there is no evidence of oblique muscle overactivity or patterns suggestive of oblique dysfunction or dissociated vertical deviation (DVD), so vertical transposition of the horizontal muscles was performed. This procedure involves shifting the muscles by half to a full tendon width. The medial rectus muscles are moved toward the "apex" of the pattern (downward in a V-pattern), while the lateral rectus muscles are repositioned toward the open end (upward in a V-pattern). A helpful mnemonic for this procedure is “MALE”: medial rectus to the apex, lateral rectus to the open space. The 7.0 mm medial rectus resection was calculated to be sufficient for correcting the patient's esotropia, and lateral rectus resection was avoided due to concerns about overcorrection. Given that the right eye exhibited more significant strabismus, we opted to perform surgery on only one eye to reduce the risk of complications. However, due to the presence of a V-pattern with a 40 prism diopter difference in upgaze and downgaze, we decided to proceed with the transposition using the MALE procedure. Vertical transposition is particularly useful in cases of horizontal strabismus (esotropia or exotropia), allowing for concurrent recessing or resecting of muscles. It is important to move similar muscles together, such as both medial rectus or both lateral rectus, to avoid inducing torsion in patients with two functional foveae. Shifting half of the tendon width (infra- or supraplacement) leads to a collapse of 15 prism diopters (PD), while shifting the entire tendon width results in a collapse of 25 PD [11]. Since this patient has a collapse pattern of 40 PD, full tendon width was necessary. The surgery involved transposing the medial rectus muscle inferiorly and the lateral rectus muscle superiorly, utilizing the full tendon width for correction. This procedure was done on one eye, as the fellow eye has good vision, reducing postoperative risks.

Pattern strabismus can be treated with a monocular recession/resection procedure that involves vertical transposition. Sharma and colleagues studied torsional changes before and after surgery, finding new intorsion in three patients and worsening intorsion in five out of eight cases. Despite this, the pattern collapsed successfully. The patient’s recovery aligns with this research, demonstrating that vertical muscle transposition effectively treats V-pattern esotropia and improves depth perception, eye alignment, and vision clarity [7].

4. CONCLUSION

pattern esotropia is an uncommon ailment. This complicated illness is impacted by a number of factors, such as neurological problems, refractive defects, and inheritance. The procedure included using the entire tendon width to transposition the medial rectus muscle to the inferior position and the lateral rectus muscle to the superior position, as well as recessioning the medial rectus muscle. This surgical strategy successfully treated the patient's condition and yielded positive results.

Competing interests

The authors declare no competing interest.

Authors’ contributions

Patient management: RP, DHP. Data collection: DHP, RP Manuscript drafting: DHP, RP. Manuscript revision: DHP, RP, RL, LK. All authors approved final version of the manuscript.

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