



## Video

## Successful prism treatment for cyclic esotropia: A case report

Noriko Nishikawa<sup>\*</sup>, Yuriya Kawaguchi, Rui Fushitsu, Yumi Kuroda, Taiji Nagaoka

Department of Ophthalmology, Asahikawa Medical University, Asahikawa, Japan

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## ABSTRACT

**Purpose:** To report a case of cyclic esotropia successfully treated with prismatic correction.

**Observations:** A 9-year-old girl presented with intermittent esotropia and diplopia occurring over the previous 4 months. The patient had 30 prism diopters (PD) of esotropia at both distance and near. Ocular motility testing, other ophthalmic examinations, and brain magnetic resonance imaging revealed no abnormalities. At the third visit, the patient had 6 PD of intermittent esotropia without diplopia, and the eye position diary demonstrated esotropia every other day, which led to a diagnosis of cyclic esotropia with a 48-h cycle. The cyclic pattern persisted for 9 months following the initial visit. However, during a subsequent regular visit, the patient reported a newfound ability to self-adjust from "esotropic" days to "straight" days by tightly closing the eyes immediately after waking up in the morning, particularly when wishing to avoid strabismus. To address the condition, we affixed a Fresnel membrane prism on the glasses to compensate for the latent deviation on a "straight" day. During the subsequent 18 months, the esotropia completely resolved, and the patient was followed up with gradual decreases in prism power.

**Conclusions and Importance:** Correcting latent deviation using a prism lens is a simple approach without potential side effects. The present findings suggest that this approach is a viable treatment option for cyclic esotropia during its early and periodic stages.

## 1. Introduction

Cyclic esotropia is a rare disorder in which esotropia and esophoria appear in a 48-h cycle and sometimes with other cycles.<sup>1</sup> Treatment for cyclic esotropia usually involves surgical interventions to correct the deviation that presents on the "esotropic" day, resulting in optimal alignment without overcorrection on the previous 'straight' days.<sup>2,3</sup> Other treatment methods have been documented, including refractive correction,<sup>1</sup> botulinum toxin injection,<sup>4,5</sup> and, in rare cases, the use of prism glasses.<sup>6–8</sup> However, due to the rarity of this disease, non-surgical treatments have not been widely adopted.

In this report, we present an unusual case of cyclic esotropia in a 9-year-old girl who was able to self-correct the ocular misalignment on "esotropic" days. In addition, the patient was successfully treated with a prism lens based on the latent angle observed on "straight" days. We also review and discuss comparisons with other reported cases.

## 2. Case report

A 9-year-old girl presented with intermittent esotropia with diplopia

occurring over the previous 4 months. The patient reported experiencing double vision at home, particularly while playing video games. The patient was otherwise healthy with no significant medical history. Best-corrected visual acuity was measured at 20/16 in both eyes, and cycloplegic refractions with 1% cyclopentolate revealed  $+0.90-1.82 \times 170^\circ$  in the right eye and  $+0.97-1.86 \times 2^\circ$  in the left eye. A simultaneous prism cover test revealed esotropia of 25 prism diopters (PD) at distance and 30 PD at near, whereas an alternate prism cover test showed 30 PD at both distance and near. The ocular motility test, anterior segment and fundus examinations, and magnetic resonance imaging of the brain and orbit revealed no abnormalities. The patient had no family history of strabismus. Notably, the patient's mother noticed that the eye position varied on a daily basis. We prescribed fully corrected glasses and asked the mother to record the positions of the eyes daily. At the third visit, the angle of deviation was intermittent esotropia of 6 PD at both distance and near, with no accompanying diplopia, and stereoacuity was assessed as 40 seconds of arc with the Stereo Fly test (Stereo Optical Co., Inc, Chicago, IL, USA). The diary of the eye position demonstrated esotropia every other day. Thus, a diagnosis of cyclic esotropia with a 48-h cycle was determined.

<sup>\*</sup> Corresponding author. Department of Ophthalmology, Asahikawa Medical University, 2-1-1-1 Midorigaoka Higashi, Asahikawa, Hokkaido, 078-8510, Japan.  
E-mail address: [nnori@asahikawa-med.ac.jp](mailto:nnori@asahikawa-med.ac.jp) (N. Nishikawa).



**Fig. 1.** Clinical photographs of an "esotropic" day with 35 PD esotropia (top) and a "straight" day with esophoria.

The cyclic pattern remained unchanged for 9 months after the initial visit (Fig. 1); however, during the subsequent regular checkup, a change occurred in which the cycle was altered to the "straight" day even though the scheduled date was the "esotropic" day. Since the patient wanted to avoid strabismus on the day cousins visited for the New Year holiday, the patient closed both eyes tightly and succeeded in correcting the eye position. Between subsequent visits, the patient could reposition on days when avoiding esotropia was desired, although notably, this could only be achieved immediately after wake-up.

Although the patient and family requested surgery, we decided to try the methods that correct the latent angle on "straight" days with a Fresnel prism lens, as recommended in a previous report.<sup>6</sup> We affixed a 6PD base-out Fresnel membrane to the left eye of her glasses on a "straight" day. At the visit after the prism correction, the patient reported no diplopia for 2 weeks. For the subsequent 18 months, there were no occurrences of an "esotropic" day with the prism glasses worn daily. During repeated alternating cover tests to detect latent deviation, the patient exhibited an esophoria of 12 PD without the use of prism glasses. The patient continued to wear the prismatic glasses with gradual reductions in prism power.

### 3. Discussion

Common characteristics of cyclic esotropia include an onset age of 3–4 years, an esotropia angle of 30–40 PD, a mild V-pattern, mild

hyperopia, and a high accommodative convergence/accommodation ratio.<sup>1,9</sup> Cyclic esotropia occurs in primary and secondary forms.<sup>3,8–10</sup> The general course of this condition often leads to a gradual disruption of the cycle pattern and progression to constant strabismus, requiring surgical intervention.<sup>1,2</sup>

In this case, the age of onset was older than typically characterized, hyperopia and a high AC/A ratio were not observed, and no trigger for the onset was present. We attempted to treat this patient with reference to the report by Voide et al.,<sup>6</sup> who successfully used prism treatment in a 6-year-old girl with cyclic esotropia that occurred during occlusion therapy for anisometropic amblyopia. Our patient also had a successful treatment course in which the cyclic esotropia persisted for almost a year and disappeared immediately after wearing a 6 PD lens to reduce the latent deviation of the "straight" day. More recently, Furr et al.<sup>7</sup> reported a case in which cyclic esotropia that had developed as early as 2 years of age disappeared with correction of the deviation on the "straight" day with a prism; however, accommodative esotropia persisted thereafter. Another report<sup>8</sup> described a 3-year-old boy with consecutive cyclic esotropia after intermittent exotropia surgery, which was corrected using a Fresnel prism lens for the angle on "esotropic" days only, which prolonged the cycle and eliminated cyclic esotropia. Four cases,<sup>6–8</sup> including ours, are summarized in Table 1. In all those cases, the prism treatment was initiated at periodic stages, and they had a moderate to large esotropia angle equal to distance and near on the "esotropic" day with good stereoacuity. Furthermore, in the three cases where the deviation was corrected on "straight" days, the cycle disappeared immediately. No similarities were found regarding onset age, presence or absence of a trigger event, refraction, or time from onset to prism treatment.

Concerning the mechanism for the cycle disappearance by correcting the latent deviation on the "straight" days, Voide et al.<sup>6</sup> speculated that this phenomenon arises from the relief of compensatory efforts needed to maintain esophoria. Consistently, our patient also had an eso-deviation on the "straight" days, which would have required divergence efforts. Notably, some cases have been reported to be cured with hyperopic correction alone<sup>1</sup> or with botulinum toxin treatment, which only has a temporary effect.<sup>4</sup> These results suggest that the cyclic pattern might be eliminated by correcting the burden of maintaining binocular vision. In addition, a notable feature of this treatment is its correction of small angles on "straight" days rather than "esotropic" days, resulting in less difficulty in vision with the Fresnel prism lens.

It is interesting to note that the patient was able to reposition the eyes on the "esotropic" days by closing the eyes tightly. The exact mechanism

**Table 1**  
Summary of reported cases of cyclic esotropia successfully treated with prism treatment.

Characteristics/Authors	Voide et al.	Furr et al.	Rekrutiak et al.	Present case
Reported year	2015	2023	1989	Pending 2024
Age of onset (years)	6	2	3	9
Sex	Female	Female	Male	Female
Onset trigger	Occlusion therapy	Episode with sand in both eyes	Strabismus surgery for exotropia	None
Refraction (D)	RE: +3.75 LE: +2.0	RE: +2.0 LE: +2.0	BE: no refractive error	RE: +0.90–1.82 × 170° LE: +0.97–1.86 × 2°
Angle of esotropia on "esotropic" days				
Distance (PD)	40	30	25	30
Near (PD)	40	30	25	30
Corrected target angle	6 PD for distance deviation on "straight" days	5 PD for distance deviation on "straight" days	25 PD for deviation on "esotropic" days	6 PD for "straight" days
Period from onset to prism treatment	1 month	6 weeks	4 months	1 year
Period of time until the cycle of esotropia disappears	Immediately	Immediately	Approximately 4 months	Immediately
Other characteristics	Anisometropic amblyopia in the right eye	Residual elements of accommodative esotropia	Secondary to exotropia surgery	Change the "esotropic" day to "straight" day by oneself
Stereoacuity (arcsec)	60	50	60	40

RE: right eye; LE: left eye; BE: both eyes; D: diopters; PD: prism diopters.

of this episode is a matter of speculation, although it may be related to the finding that blinking often allows strabismus to return to the phoria position in cases of intermittent exotropia. Furthermore, the fact that the patient could only do this immediately after waking up in the morning may be an important clue in understanding the pathophysiology of cyclic strabismus, which has been suggested to be related to circadian rhythms.<sup>11,12</sup>

#### 4. Conclusions

In conclusion, we described a rare case of cyclic esotropia that was successfully treated with a prism lens, along with other reported cases. This method is simple and has no potential side effects; therefore, it can be recommended as a first-line treatment when the cycle persists.

Patient Consent to Publication.

The patient's legal guardian provided verbal consent for the publication of the case.

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#### CRediT authorship contribution statement

**Noriko Nishikawa:** Writing – original draft, Visualization, Investigation, Data curation, Conceptualization. **Yuriya Kawaguchi:** Writing – review & editing, Conceptualization. **Rui Fushitsu:** Conceptualization, Writing – review & editing. **Yumi Kuroda:** Conceptualization, Writing – review & editing. **Taiji Nagaoka:** Supervision, Writing – review & editing.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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#### References

1. Helveston EM. Cyclic strabismus. *Am Orthopt J.* 1973;23(1):48–51. <https://doi.org/10.1080/0065955X.1973.11982322>.
2. Çelik S, Inal A, Ocak OB, Aygıt ED, Akar S, Gökyiğit B. Cyclic strabismus: what measured angle of strabismus should guide surgery? *Strabismus.* 2019;27(4): 205–210. <https://doi.org/10.1080/09273972.2019.1692041>.
3. Souza-Dias C, Kushner BJ, Rebouças de Carvalho LE. Long-term follow-up of cyclic esotropia. *J Binocul Vis Ocul Motil.* 2018;68(4):148–153. <https://doi.org/10.1080/2576117X.2018.1529451>.
4. Jones A, Jain S. Botulinum toxin: a novel treatment for pediatric cyclic esotropia. *J AAPOS.* 2014;18(6):614–615. <https://doi.org/10.1016/j.jaapos.2014.07.155>.
5. Akyuz Unsal AI, Özkan SB, Ziyilan S. Role of botulinum toxin type A in cyclic esotropia: a long-term follow-up. *J Pediatr Ophthalmol Strabismus.* 2019;56(6): 360–364. <https://doi.org/10.3928/01913913-20190909-01>.
6. Voide N, Pisset C, Klainguti G, Kaeser PF. Nonsurgical treatment of cyclic esotropia. *J AAPOS.* 2015;19(2):196–198. <https://doi.org/10.1016/j.jaapos.2014.11.008>.
7. Furr BA, Archer SM. Resolution of cyclic esotropia with 5-year follow-up after brief Fresnel prism treatment. *J AAPOS.* 2023. <https://doi.org/10.1016/j.jaapos.2023.09.010>. Published online November 19.
8. Rekrutiak DM, Gilmour GR. Consecutive cyclic esotropia. *Am Orthopt J.* 1989;39(1): 86–88. <https://doi.org/10.1080/0065955x.1989.11981939>.
9. Wang X, Chen B, Liu L. Cyclic esotropia with development of a high accommodative convergence to accommodation ratio after surgery for intermittent exotropia. *Int Ophthalmol.* 2017;37(4):1069–1072. <https://doi.org/10.1007/s10792-016-0354-9>.
10. Pehere NK, Kommineni UB, Kekunnaya R. Consecutive cyclic esotropia – a case report. *Indian J Ophthalmol.* 2019;67(2):280–282. [https://doi.org/10.4103/ijo.IJO\\_1018\\_18](https://doi.org/10.4103/ijo.IJO_1018_18).
11. Metz HS, Bigelow C. Change in the cycle of circadian strabismus. *Am J Ophthalmol.* 1995;120(1):124–125. [https://doi.org/10.1016/s0002-9394\(14\)73775-4](https://doi.org/10.1016/s0002-9394(14)73775-4).
12. Metz HS. Light and the circadian clock. *J AAPOS.* 2003;7(4):229–230. [https://doi.org/10.1016/s1091-8531\(03\)00119-8](https://doi.org/10.1016/s1091-8531(03)00119-8).