Real-World Effectiveness of a Binocular Dual-Mechanism Therapy in Severe Amblyopia: Analysis from the PUPiL Registry

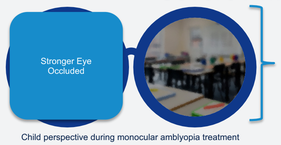
Cleveland Clinic
Cole Eye Institute

Alexandra Williamson[1], Alyssa A. Godfrey[2,3], Eric D. Gaier[4], Fatema Ghasia[1], Euna Koo[5], Courtney Kraus[6], Whitney Stuard Sambhariya[6], Shelley Hancock[7], Maanasa Indaram[2]

[1] Cleveland Clinic, Cleveland, Ohio, United States [2]Ophthalmology, University of California San Francisco, San Francisco, California, United States [3]Drexel University College of Medicine, Philadelphia, Pennsylvania, United States [4]Ophthalmology, Boston Children's Hospital, Boston, Massachusetts, United States [5]Ophthalmology, Stanford University, Stanford, California, United States [6]Ophthalmology, Johns Hopkins University, Baltimore, Maryland, United States [7]Luminopia Inc, Cambridge, Massachusetts, United States

Background

Traditional Monocular Amblyopia Treatments and Severe Amblyopia



Child perspective during monocular amblyopia treatment

Poor to no visual function for duration of treatment
Legal blindness: ≤20/200

Binocular, Dual-Mechanism Therapy (Luminopia[1])

FDA-Cleared, evaluated in Phase 1, 2, 3 clinical trials[2,3]

Dichoptic masking complimentary across both eyes to encourage binocular vision

Contrast reduction to the fellow eye to reduce amblyopic eye suppression

Purpose

To test the hypothesis that Luminopia therapy improves visual acuity in severe amblyopia, and **to explore** key predictors of treatment response.

Methods

- PUPiL Registry[4] patients selected for analysis:
  - Amblyopic eye BCVA of ≤ 20/100 at time of Luminopia prescription, "baseline"
- Outcomes Evaluated:
  - Primary: Mean Change from Baseline to last registry observation from 11/1/23 -3/4/25, and treatment usage metrics
  - Linear regression to evaluate predictors on BCVA change, group comparisons performed using ANOVA/ANCOVA
  - Sub-analysis of patients with BCVA <20/200 at baseline

Results: Demographics†

Registry Patients with ≥ 20/100 at Baseline		N=59
Gender	Female, n (%)	21 (36)
	Male, n (%)	38 (64)
Age Category	4 - 7 years, n (%)	33 (56)
	8 - 12 years, n (%)	20 (34)
Amblyopia Type	Anisometropic, n (%)	23 (39)
	Mixed, n (%)	13 (22)
	Strabismic, n (%)	12 (20)
	Deprivation, n (%)	11 (19)
Previous Treatment	Yes, n (%)	50 (85)
	Mean Duration of Previous Treatment(s), months (±SD)	31±25
	No, n (%)	9 (15)
Treatment Prescribed at Baseline	Luminopia only*, n (%)	49 (83)
	Luminopia + Patching, n (%)	6 (10)
	Luminopia + Patching + Atropine, n (%)	4 (7)
Amblyopia Severity	20/100 – 20/200, n (%)	50 (85)
	>20/200, n (%)	9 (15)

†Based on clinical data in patients' medical records

Results: Primary Outcomes

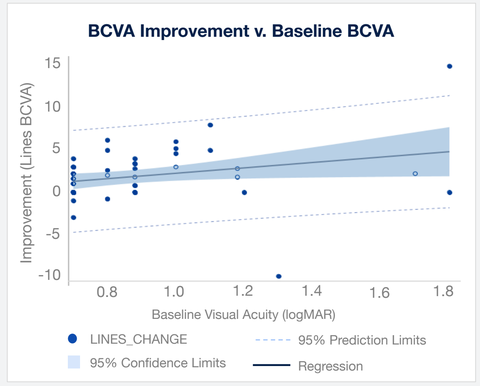
Mean improvement:
1.8 lines BCVA
95% CI: 1.0, 2.6

Average treatment hours:
163 hours
95% CI: 129, 197

Average time on treatment:
11.8 months
95% CI: 10.2, 13.4

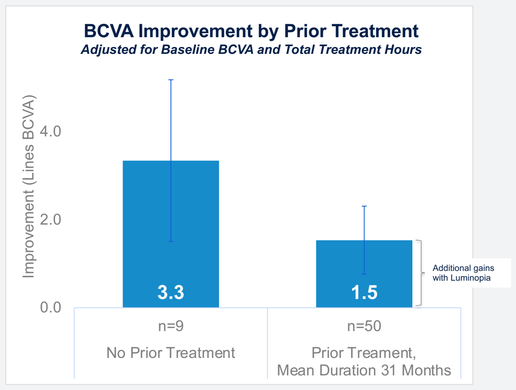
Results: Linear Regression

Patients with worse BCVA at baseline gained more lines BCVA during treatment



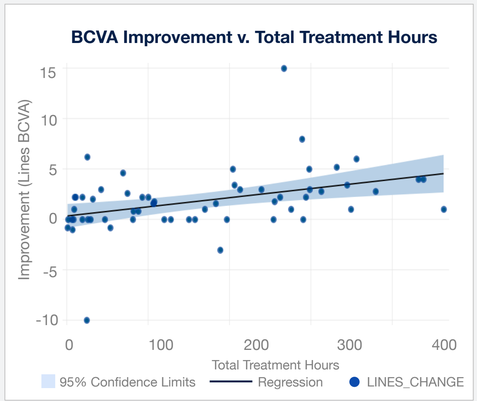
Baseline BCVA: F-value: 4.56, p=0.0370

Treatment naive patients had more gains than those with prior amblyopia treatment



Prior Treatment: F-value: 3.29, p=0.0752

Significant relationship between hours of treatment completed and BCVA improvement



Total Treatment Hours: F-value: 10.20, p=0.0023

Non-Significant Predictors

- Age (F-value: 0.00, p=0.9441)
- Concurrent Treatments (F-value: 1.2, p=0.2787)
- Amblyopia Type (F-value: 0.30, p=0.8270)

Limitations

- Real world data has inherent variability
  - No standardized method of BCVA collection
  - No pre-determined follow-up schedule
- No control group
- Patient with <12 weeks not included in the PUPiL Registry
- Safety data collected from follow-up notes as proactively reported by patient/caregiver

Results: Amblyopia <20/200

Beyond inclusion criteria of prospective clinical trials with Luminopia to date.

Mean improvement:
2.8 ± 6.7 lines BCVA

Average treatment hours:
177 ± 136 hours

Average time on treatment:
15.7 ± 5.6 months

Conclusion

Among these Registry Patients:

- Results support the primary hypothesis, demonstrating a statistically significant improvement in real-world visual acuity
- Patients with worse BCVA, more Luminopia treatment hours, and no prior amblyopia treatment gained more lines BCVA
- Improvement was seen regardless of age, concurrent treatment, and amblyopia type
- Very severe amblyopia (<20/200) showed substantial gains
- No serious events were reported in follow-up data

BCVA: Best Corrected Visual Acuity, Amblyopic Eye

Sources

1. Luminopia LBL-0001 Rev. E, April 2025. Luminopia is indicated for improvement in visual acuity in patients age 4 to <13 associated with anisometropia and/or mild strabismus
2. Xiao S, Gaier ED, Wu HC, et al. Digital therapeutic improves visual acuity and encourages high adherence in amblyopic children in open-label pilot study. J AAPOS. 2021;25(2):87.e1-87.e6. doi:10.1016/j.jaapos.2020.11.022
3. Xiao, S., Angjeli, E., Wu, H. C., Gaier, E. D., Gomez, S., Travers, D. A., Binenbaum, G., Langer, R., Hunter, D. G., Repka, M. X., & Luminopia Pivotal Trial Group (2022). Randomized Controlled Trial of a Dichoptic Digital Therapeutic for Amblyopia. Ophthalmology, 129(1), 77–85. https://doi.org/10.1016/j.ophtha.2021.09.001.
4. NCT06429280. Enrollment Criteria include undergoing at least 12 weeks of Luminopia treatment and diagnosis of amblyopia.

Real world patient using Luminopia

Disclosures

- Alyssa A. Godfrey: Luminopia (Travel Grant)
- Maanasa Indaram: Luminopia (Travel Grant); Glaukos: (Consultant/Contractor)
- Eric D. Gaier: Luminopia: (Personal Financial Interest, Patent)
- Shelley Hancock: Luminopia: (Employment, Personal Financial Interest)