New England College of Optometry NECO

Cycloplegic Cover Test Measurements in the Pediatric Population

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BACKGROUND

- Most pediatric ophthalmologists and optometrists rely on cover test (CT) measurements taken before dilation because the cycloplegic effects of dilation are expected to considerably affect ocular alignment.
- Rivera et al. (2017) reported that strabismus measurements in adults were not significantly affected by tropicamide 1% and phenylephrine 2.5%¹. They postulated that their findings would not apply to the pediatric population.

METHODS

Cover Test
COver rest
Distance
Near
Distance
Near

RESULTS (CONTINUED)

• Near cover test measurements changed significantly after cycloplegia (Table 4, Figures 3 & 4).

Change at Near (Habitual Rx)	Change at Near (Manifest/ Cycloplegic Rx)
$6.11^{\Delta}(95\% \text{ CI } 4.24 - 7.98^{\Delta})$	$5.00^{\Delta}(95\% \text{ CI } 3.42 - 6.58^{\Delta})$

Table 4: Average change in alignment at near

DISCUSSION

- Clinical Considerations Distance CT Unchanged in 94%
- Only 2/36 (6%) of subjects changed 5^{Δ} or more at distance after cycloplegia.
- The maximum change was 8^{Δ} , which was seen in one patient.
- Distance CT change after cycloplegia was not clinically significant and did not alter the surgical or clinical plans in 34/36 (94%) of patients.

• No publications to date demonstrate the impact of cycloplegia on ocular alignment in children.

PURPOSE

• The aim of our study was to determine if alignment measurements significantly change after cycloplegic dilation in pediatric patients.

HYPOTHESES

Primary

- Ocular alignment measured by cover testing will significantly change after cycloplegia.
- The difference between pre- and post-cycloplegia measurements will be greater in subjects with a high AC/A ratio.

Secondary

- The direction of manifest strabismus will be altered by cycloplegia, with children becoming more esotropic.
- Pre-cycloplegia near measurement, with the addition of minus 3.00 lenses, and post-cycloplegia near measurement

Near with -3.00

Near with +3.00

Table 1: Cover test measurements pre-cycloplegia



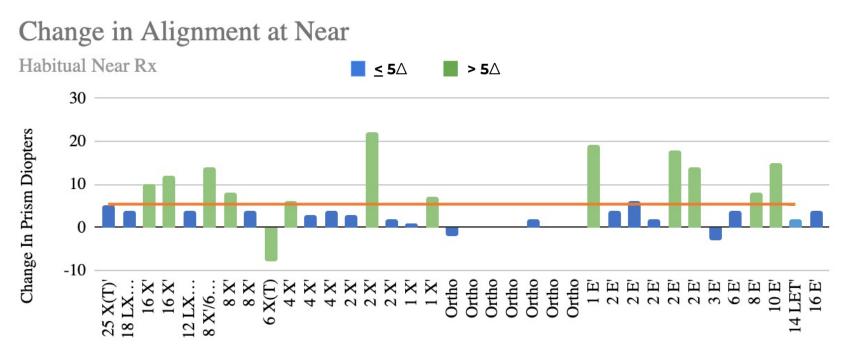
Post-Cycloplegia Measurements		
Wearing	Cover Test	
Habitual Rx	Distance	
	Near	
Cycloplegic Rx	Distance	
	Near	
	Distance with -3.00	
	Near with +3.00	

Table 2: Cover test measurements post-cycloplegia



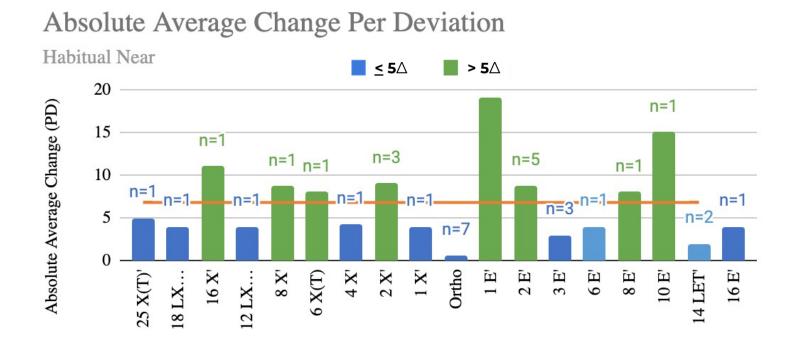
Habitual Distance Rx

• 36 patients aged 5-17 years (mean age = 11 years) were



Pre-Cycloplegia Alignment

Figure 3: Change in alignment at near per subject



Pre-Cycloplegia Alignment

Figure 4: Average change in alignment at near per deviation

• Subjects within Morgan's Norms pre-cycloplegia did not

• Morgan's Norms are defined as CT measurements

within $0-3^{\Delta}$ of exophoria at distance and $0-6^{\Delta}$ of

(Table 5).

significantly change at distance or near post-cycloplegia

Greater Accommodative Amplitude in Children

- Children have greater accommodative amplitudes than adults so their accommodative systems may try to overcome near blur by applying extra effort to accommodate. Per the accommodative triad, this will cause them to adopt a more esophoric or esotropic posture at near, as seen in 14/36 (39%) of patients in our study.
- Subjects are not expected to have blur at distance postcycloplegia if they are wearing their cycloplegic refraction.¹⁶
- Minimal change in distance alignment was seen after cycloplegia in our study.

Morgan's Norms

- Subjects within Morgan's Norms did not significantly change at near post-cycloplegia.
- This is likely due to a more stable binocular system and appropriate AC/A ratio expected in patients within Morgan's Norms.¹⁵

Study Limitations

- Our conclusions are limited by a small sample size of 36 subjects.
- Only six subjects (16.7%) had strabismus pre-cycloplegia, so our data may not be generalizable to all strabismic populations.
- There was variable wait time between the instillation of cyclopentolate and post-dilated measurements, but within clinically expected timeframes. • The pupillary distance for each child was not individually measured, thus affecting accuracy of the AC/A ratio calculation.

will correlate (due to increased accommodative effort).

METHODS

- This study was approved by the Institutional Review Board of Tufts Medical Center and adhered to the tenets of the Declaration of Helsinki.
- This study was conducted from 2018-21 in the Pediatric Eye Clinic at Tufts Children's Hospital, Boston, MA.

Inclusion Criteria:

• Patients with hyperopia greater than +4.00 D, myopia greater than -1.00 D, and/or astigmatism greater than 2.00 D must have reported compliance with glasses wear for over 75% of waking hours.

Exclusion Criteria:

- Patients with eccentric viewing, dissociated vertical deviation (DVD), BCVA worse than 20/50 in either eye at distance or near, and/or developmental limitations that precluded a reliable CT measurement.
- A comprehensive eye examination was performed.

enrolled in the study.

• The results of paired t-tests revealed alignment at **distance** did not significantly change after cycloplegia (p=1.00) (Table 3, Figures 1 & 2).

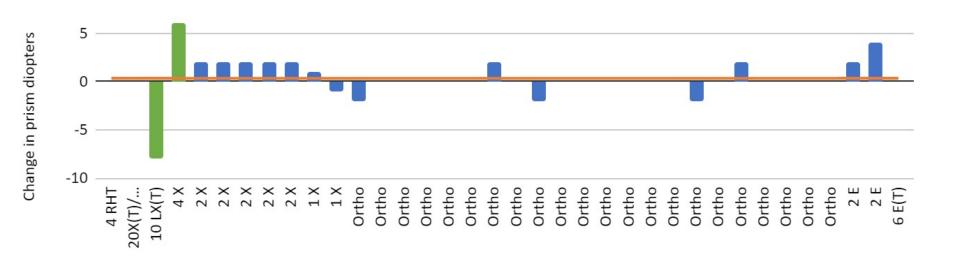
Change at Distance (Habitual Rx)	Change at Distance (Manifest/ Cycloplegic Rx)
$1.17^{\Delta}(95\% \text{ CI } 0.77 - 1.75^{\Delta})$	$1.40^{\Delta}(95\% \text{ CI } 0.73 - 2.03^{\Delta})$
	1.10 () 570 CI 0.75 2.05)

Table 3: Average change in alignment at distance

exophoria at near. ¹⁴			
	Change at Distance	Change at Near	
Subjects Within Morgan's Norms	$0.73^{\Delta}(95\% \text{ CI } 0.4 - 1.06^{\Delta})$	3.75 ^Δ (95% CI 1.14 – 6.36 ^Δ)	
Subjects Outside of Morgan's Norms	$3.33^{\Delta}(95\% \text{ CI } 0.94 - 5.72^{\Delta})$	$7.47^{\Delta}(95\% \text{ CI } 5.13 - 9.81^{\Delta})$	

 Table 5: Average change in alignment for Morgan's Norms

Change in Alignment at Distance **≤ 5**∆ **≥ 5**∆



Pre-Cyclo Alignment

Figure 1: Change in alignment at distance per subject

- Eso-deviated subjects (n=12) changed an average of 8.25^{Δ} $(3.70 - 12.80^{\Delta})$ after cycloplegia, while exo-deviated subjects (n=17) changed an average of 6.88^{Δ} (4.45 – 9.31[∆]).
- There was a weak negative correlation between AC/A ratio and change in cover test measurements after cycloplegia (r = -0.08).

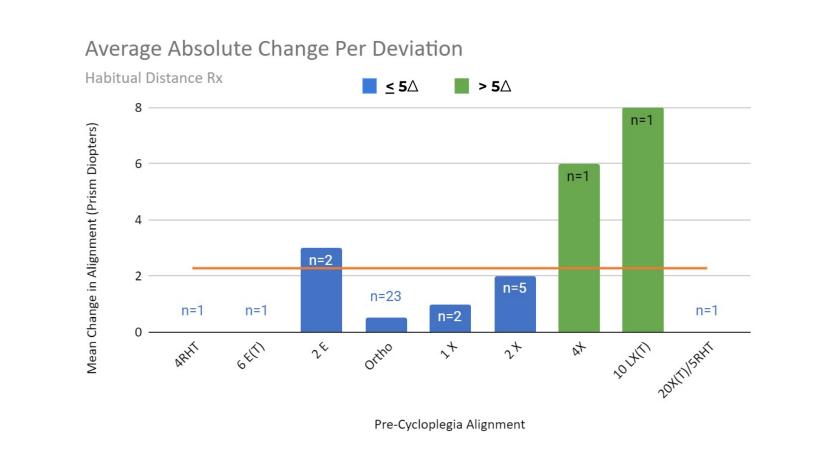
CONCLUSIONS

- 1. Distance cover test measurements do not significantly change after cycloplegia in pediatric patients.
- 2. In children without significant strabismus (Morgan's Norms), amblyopia, or change in stereoacuity, it may be reasonable to cycloplege pediatric patients prior to alternate cover testing.
- 3. Cycloplegia changed near cover test measurements more than 10^{Δ} in 8/36 (22%), therefore near measurements are not reliable indices of strabismus change after cycloplegia.

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- Alternating prism CT measurements were obtained by a study investigator before cycloplegia (Table 1). • Subjects were fixating on a 20/150 letter at distance (6m) and a 20/30 number at near (33 cm).
- Subjects were given proparacaine, and then dilated with a "TPC" combination drop containing:
- Tropicamide 1%
- Phenylephrine 2.5%
- Cyclopentolate 1%
- After 30-60 minutes, a masked examiner repeated the CT measurements (Table 2).



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Figure 2: Average change in alignment at distance per deviation
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- If you have any questions, please email: RebeccaArmagno@gmail.com
- There was a positive correlation between the precycloplegia near measurement in -3.00 lenses and the post-cycloplegia near measurement (r=0.78).
- There was a moderate correlation between the precycloplegia near measurement and the post-cycloplegia near measurement in +3.00 lenses (r=0.64).
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