Article ▸ # The Impact of Short-Term Prism Correction in Convergence Insufficiency on Reading Rate and Accuracy

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ABSTRACT

Background: The purpose of this study was to determine if short-term use of base- in prism would result in improved reading rate during oral and silent reading in school-aged children with symptomatic convergence insufficiency (CI).

Methods: Fifteen school-aged children, ages 9 to 15, with symptomatic CI orally read grade-equivalent passages for 5 minutes under 3 conditions: habitual correction, base-in prism, and size lenses, as well as a story silently for about 7 minutes with both base-in prism and size lenses. The reading rate in corrected words per minute (CWPM) was calculated for each minute of the five minutes of oral reading. The words per minute (WPM) was calculated for the silent reading. A symptoms survey was given to each subject, asking them to compare both BI prism and size lenses to habitual correction during silent reading.

Results: The mean CWPM for the oral reading with the habitual correction was 119 (SD=33.13), with base-in prism was 129 (SD=34.20), and with the size lens was 128 (SD=38.00). A repeated measures ANOVA indicated that the reading rate for habitual correction was significantly slower from the base-in prism and size lens conditions, but that prism and size lenses were not different from each other.

The mean WPM for the silent read for the base-in prism was 127 (SD=52.3), and with the size lenses was 139 (SD=55.5). A repeated measures ANOVA found no difference between the two conditions. The mean symptom survey score for base-in prism was 7.33 (SD=13.85) and for size lenses was 5.07 (SD=18.81). A paired t-test found no significant difference between perceived symptoms experienced under both conditions.

Conclusions: Our data suggests that with short-term use of prisms, there was no improvement with reading rate and accuracy when compared to size lenses. In addition, in the prism and size lens conditions children reported improvements in visual comfort and performance.

Keywords: base-in prism, binocular vision, Convergence Insufficiency, reading

Introduction

Convergence Insufficiency (CI) is a common binocular vision disorder that occurs in approximately 5-15% of school aged children.[1-4] Children with symptomatic CI have more symptoms when reading and doing close work (headaches, double vision, slow reading, and loss of place) when compared to children with normal binocular vision.[5,6] In addition, parents of children with CI have reported a significantly greater level of adverse academic behaviors and worry about school performance when compared to children with normal binocular vision.[7]

One approach to treating CI is the use of base-in (BI) prism to help reduce the severity of symptoms and possibly improve reading rate. Dusek et al.[8] evaluated both computerized home vision therapy (HTS) and the prescribing of 8^{Δ} base-in reading spectacles for the treatment of CI for students with reported reading difficulties. Participants referred to his practice received a general binocular assessment. A diagnosis of CI was given based on a NPC greater than 6 cm, exophoria greater at near than distance, low AC/A ratio, low binocular accommodative facility and a reduced vergence facility. Participants were then allowed to choose between completing computerized HTS or receiving a prescription for 8^{Δ} base-in reading spectacles. Those who declined treatment were subsequently used as a control group. All participants returned four weeks later for a second assessment, where their reading speed and number of errors were noted using the Salzburg Reading Test, and their accommodation and NPC were re-measured.

Based on the pre- and post-treatment data, it was found that children who had used the prism spectacles showed the most improvement in reading speed between the three groups, taking 21.49 seconds less to complete the reading task and the greatest reduction in mean reading error score by 2.80.

Another treatment study by Stavis et al.[9]focused on the use of base-in prisms to alleviate visual discomfort while reading experienced by school-aged children. Subjects, between the ages

Table 1. Inclusion Criteria

Between ages 9-15.
IQ greater than 80 by the Kaufman Brief Intelligence Test (KBIT) matrices test.
Word decoding score of > 80 on the WIAT or WRAT tests of reading
Visual Acuity of 20/25 or better with no significant under corrected refractive error.
Exophoria ≥ 4Δ at near than at far.
CI Symptom Survey score ≥ 16.
Failed Sheard's criteria at near or have a blur/break point < 15Δ.
Accommodation amplitude of > 8D.

Table 2. Exclusion Criteria

Disability interfering with testing or treatment.
Use of systemic medication that affects accommodation or convergence.
CI previously treated with home- or office-based vergence/ accommodative therapy.
Constant strabismus.
History of strabismus surgery.
Vertical heterophoria greater than 1 Δ.
Systemic diseases known to affect accommodation, vergence and ocular motility such as: multiple sclerosis, Graves thyroid disease, myasthenia gravis, diabetes, Parkinson's disease
Manifest or latent nystagmus.
Developmental disability, mental retardation, attention deficit hyperactivity disorder (ADHD), or learning disability diagnosis in children that in the investigator's opinion would interfere with testing.
Uncorrected refractive error greater than 1.00 D for myopia, astigmatism and anisometropia.
Uncorrected hyperopia of 1.5 D or greater.

8-18, were recruited from the practice of the primary author. Selection criteria were a report of discomfort while reading and an exodeviation greater at near than at distance. Both amplitude of convergence and NPC were excluded as specific criteria for inclusion in the study. The participants were asked to read a paragraph orally from the McGraw Hill Spectrum Reader, first without any correction and then a second time with 2 or 3 diopters of base-in prism in front of each eye (4 to 6 prism total). If the child read more fluently with the prism correction they were asked to wear the correction for two weeks and return for a reading assessment. Children with an exodeviation of under 15 were typically given 4 BI prism overall and those with an exophoric deviation between 15 to 20 prism diopters were given 6 BI prism overall. After two weeks subjects read passages with base-in prism or their distance refractive correction. If minimal refractive correction was present the subjects wore plano lenses in the no prism condition. The GORT-3 scaled scores (mean =10 and SD =3) showed that mean oral reading speed improved from a scaled score of 8.79 to 9.97, reading accuracy score improved from 8.76 to 10.91, and reading comprehension from a score of 9.21 to 11.48. Participants also reported subjective improvement in asthenopic symptoms while wearing the base-in prisms.

Few studies have examined the potential for a placebo effect with lenses and have investigated the short-term impact of prism correction on reading. O'Leary and Evans[10] examined the difference in reading rates while subjects were wearing prism spectacles and a second time while wearing size lenses with no refractive power but that created similar magnification effects. Size lenses have no vertex power to alter the refractive error of the eye, and thus shift the entering rays of light so that the image is ultimately enlarged.[11] A control group of 40 normal adults showed similar reading rates with and without the size lens. They concluded that the use of a size lens was an adequate placebo control lens. The study then examined the effectiveness of prism correction based on Mallet Unit testing compared to size lenses for differences in reading rate. The study used adult subjects with a mean age of 43. In the group with exophoria only the subjects receiving 2.5 to 3.0 prism diopters of base in prism showed a statistically significant increase in reading rate. The improvement was small with mean increase in reading rate of 3.2 percent on the Wilkins Rate of Reading Test. However, the authors did not report a baseline reading rate prior to wearing the prism correction or size lens.

This study investigated the short-term impact of prism on reading rate in school-aged children with CI. Unlike past studies, we plan to execute an ecologically based reading task designed to simulate typical classroom activity for 5th and 6th graders as defined by Ritty et al.[12] The extended reading task allows us to investigate possible fatigue effects of CI on reading. In addition, we asked children to compare each type of lens to their habitual correction. The results of the study may help determine those children with CI who would benefit from a prism correction.

Materials and Methods

Subjects

Children ages 9 to 15 with symptomatic CI were recruited from the teaching clinic at the University Eye Center at the Southern California College of Optometry. The specified age range was chosen to capture school-aged children who were old enough to have attained basic reading fluency skills. Students and Doctors at the teaching clinic were informed about the study. Written consent was obtained from the parent/ guardian and assent was obtained from the child. The study was approved by the Institutional Review Board at Marshall B. Ketchum University.

The diagnosis of CI was based on the presence of greater exophoria at near than distance (> 4D) and either failing Sheard's criteria or having reduced positive fusional vergence (blur or break < 15 D).[13] A cover test was performed at distance and at 40cm to measure the phoria, and positive and negative fusional vergence ranges were measured at 40cm using a prism bar and the mean of 3 responses for positive fusional convergence was used. A near point of convergence (NPC) was also performed using an Astron Rule with an accommodative target using the mean of 3 responses but was not part of the diagnostic criteria.

Table 3. Grade levels for passages used for short oral and long silent reading

Grade level	Baseline passage	Oral Passage 1	Oral Passage 2	Silent Passage 1	Silent Passage 2
3	2.7	3.3	3.3	3.5	3.5
4	4.3	4.4	4.4	4.5	4.5
5	4.35	4.5	4.5	5.9	5.9
6	5.2	5.5	5.5	6.9	6.6
7	6.3	7.5	7.4	7.8	7.6
8	6.3	8.4	8.4	7.8	7.6

In addition, all children had an accommodative amplitude of 8 D or greater as measured by the push up test.

Participants who met the criteria for a diagnosis of CI were screened for cognitive ability with Kaufman Brief Intelligence Test (KBIT-II matrices > 80)[14] as well as an exam to screen for reading disabilities. The child needed to receive a standard score of > 80 on the Wechsler Individual Achievement Test-II (WIAT-II) or the Wide Range Achievement Test-4 (WRAT-4)[15,16] (see Table 1 for criteria). These criteria were chosen based on a standard deviation from the mean of approximately 1.5 as indicative of significant impairment.[14-16] These tests were chosen to exclude subjects who have a specific reading disability that would cause them significant difficulty in decoding individual words, potentially biasing the reading rate and accuracy data, or whose cognitive ability resulted in an impairment of reading comprehension. For eligible subjects the WIAT-II or WRAT-IV Reading Test grade equivalent score was derived and the child would then read passages at this reading level. Tables 1 and 2 have a detailed description of the inclusion and exclusion criteria.

The study used a within subject design where all subjects orally read passages with his or her habitual prescription, a size lens and a base in prism. For silent reading, subjects read with prism and size lenses but not habitual correction. The oral reading with the habitual prescription was done at the baseline visit following the K-BIT and reading tests. The prism lens correction and size lens condition were administered in a separate visit, which took approximately one hour. The child started with oral reading first with each lens and then completed the silent reading stories. The order of administration of the two conditions was randomized, with eight subjects wearing prism first and seven subjects wearing size lenses first.

Based on previous research studies a minimum of 4PD was used for all cases.[8-10] In order to determine the prism correction we showed the subject the 4 PD correction and they compared this to habitual correction. If the subject noted improvement with the prism correction then comparisons were made between 4 PD base in lens and lenses of increasing power in 2 prism diopter increments. To control for patient perception of the magnification effects from the BI prism lenses, subjects wore 2% size lenses over their habitual Rx during the trials without prism.[10] To ensure the study was masked, one individual prepared the lenses and another conducted the reading trials to eliminate examiner bias. The reading trials were videotaped for later analysis and the individual analyzing the video was masked to whether the child was wearing prism or size lenses.

Table 4. Subjective Symptoms Survey
In comparing the glasses worn to how your eyes normally feel:

1. Did your eyes feel tired while reading?
2. Did your eyes feel uncomfortable while reading?
3. Did you experience a headache while reading?
4. Did you feel sleepy when reading?
5. Did you lose concentration when reading?
6. Did you have trouble remembering what you have read?
7. Did you have double vision when reading?
8. Did you see the words move jump, swim, or appear to float on the page when reading?
9. Did you feel as though you read more slowly?
10. Did your eyes hurt when reading?
11. Did your eyes feel sore when reading?
12. Did you feel a “pulling” feeling around your eyes when reading?
13. Did you notice the words blurring or coming in and out of focus when reading?
14. Did you lose your place while reading?
15. Did you have to re-read the same line of words?

A 7-point Likert scale used to score patient’s symptoms						
A lot worse	Some-what worse	A little worse	The same	A little better	Some-what better	A lot better

Participants read different printed passages chosen from the easyCBM website, completing each task while wearing habitual correction, the size lenses and while wearing the prism correction for their CI in the oral reading condition. For silent reading children did not read the passage with habitual correction. All passages were checked for grade equivalency with the Flesch-Kincaid Reading Ease test. Passages for oral reading were combined to have equivalent reading levels and passages were also chosen for silent reading to be at similar grade levels (Table 3). Text consisted of 12-point, single-spaced Times New Roman font based on a review of 5th and 6th grade level reading books. According to Bailey & Lovie, this font size corresponds to a visual acuity of 20/80 at 40 cm.[17]

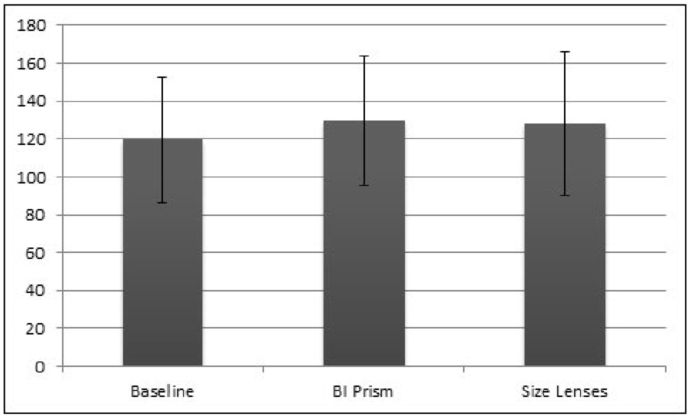

Figure 1. *The mean and SD corrected words per minute (CWPM) for short oral reading under baseline, size lenses and BI prism conditions.*

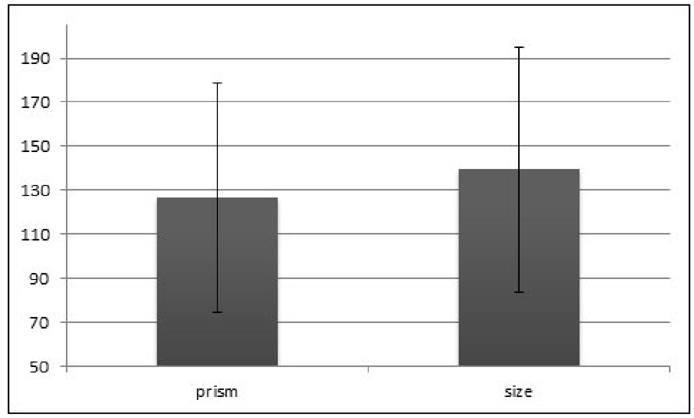

Figure 3. *The mean and SD of words per minute read during long silent reading for both BI prism and size lenses.*

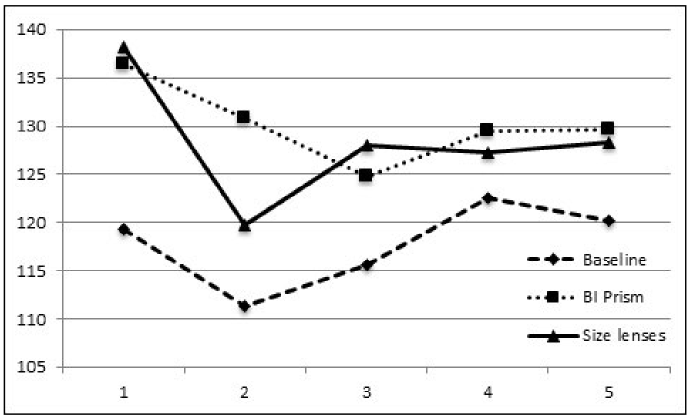

Figure 2. *The mean oral reading rate in CWPM for each of the five blocks of time for baseline, prism and size lens conditions.*

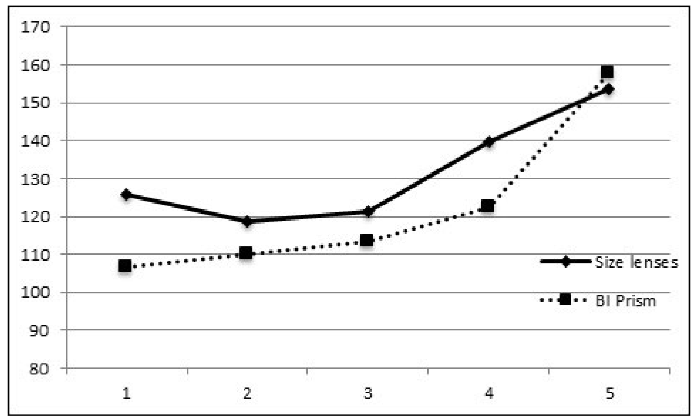

Figure 4. *Silent reading rate in WPM for both size lenses and prism across each reading block of 200 words.*

The first task was five-minutes of oral reading where correct words per minute were used to calculate the reading rate. In the second task, participants were asked to read silently for up to fifteen minutes. The length chosen for the extended task was based on work done by Ritty, et al.[12] which showed that students are asked to sustain near work for approximately seventeen minutes at a time in the classroom. At the end of each silent reading passage the child answered ten comprehension questions and completed a questionnaire to determine any changes in symptoms and errors experienced by the child during the extended reading tasks based on the CISS (Table 4). We chose a scaling system that allowed the patients to make a judgment as to whether symptoms and performance with the lenses were better or worse than their habitual prescription.[18]

Answers were scored based on a 7-point Likert scale as listed in Table 4. An answer choice of "The same" was used as a value of zero, and all answer choices to the left assigned negative values (-1 for a little worse, -2 for somewhat worse, and -3 for a lot worse) while all answer choices to the right were assigned positive values. Scores could range from -45 to 45.

For the oral reading task, reading rate and accuracy were analyzed based on video recording of the patient reading. Reading rate was calculated by the correct number of words per minute (CWPM) and analyzed for the five-minute oral reading with mean times at sixty second intervals to account for fatigue effects. The CWPM was defined by subtracting substitutions, mispronunciations, hesitations (3 seconds) and transpositions from the total words read. To insure consistency, two graders assessed 3 records and then results were correlated. Inter-rater reliability was found to be higher than 0.9.

For silent reading, we calculated the reading rate by dividing the passage into equal parts of approximately 200 words on index cards. After finishing reading the card, the child moved to the next card and from the video recording we got an approximate measure of reading rate. This was analyzed over time to account for any fatigue effects. We also assessed the number correct on the 10 comprehension questions for each passage. The time taken to read the passages varied due to different reading rates among subjects.

Data Analysis

For oral reading, we evaluated the reading rate and accuracy over time divided into five 60 second intervals for each lens condition, using a repeated measures ANOVA. We assessed for effects due to lens condition and time on reading rate and accuracy. In addition, any interaction between lens condition and time was calculated.

For silent reading, we compared the reading rate over time for each lens condition, as well as the number correct

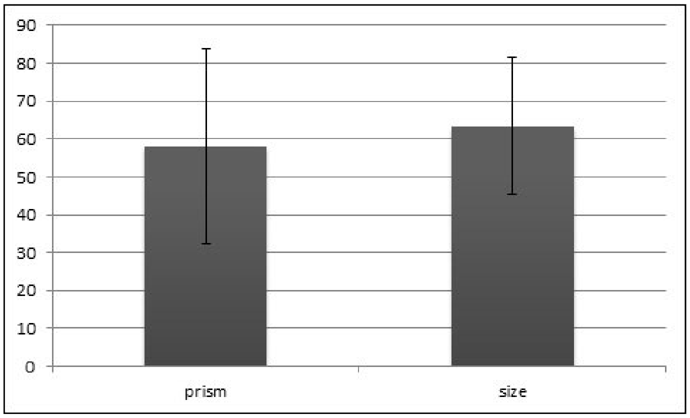

Figure 5. *The mean percent correct and SD of comprehension questions during the long silent reading for prism and size lens conditions.*

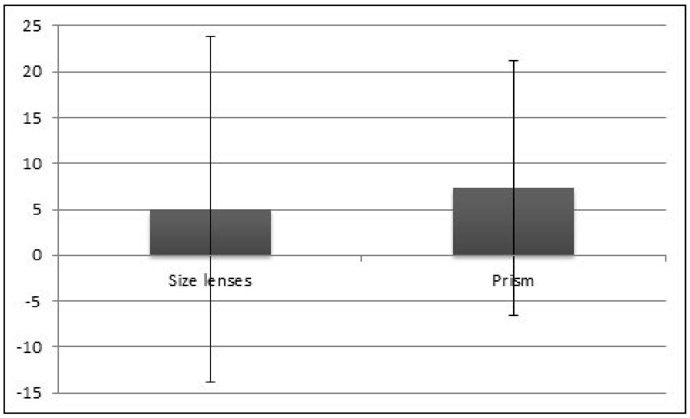

Figure 6. *Mean and SD for symptom survey scores for both size lenses and BI prism.*

on the comprehension questions. For reading rate over time a repeated measures ANOVA was calculated. A series of ten comprehension questions were administered for each silent reading condition, and a paired t-test was calculated. The symptoms questionnaire for both conditions was analyzed using a paired t-test.

Oral reading rate was chosen as the primary measure for calculating sample size due to the fact that there is reasonable data on the typical variation of reading rate in the target population. With a sample size of 12 in this within-subject design, we would be able to detect a 12 WPM change in performance between the two lens conditions, with 80% power ($p < 0.05$). Given that the average reading rate of our group was 116 WPM, a change of 12 WPM would be a 9% change in reading rate which would be considered clinically meaningful. Our sample use of fifteen was sufficient to detect a meaningful change in reading.

Results

Subjects

Fifteen subjects with CI were recruited for the study, seven of which were female and eight male. The mean age was 11.62 years old, with a mean reading grade level of 5th grade. Participants had a mean distance phoria of 2 exophoria, and a near phoria of 13 exophoria. The mean positive fusional

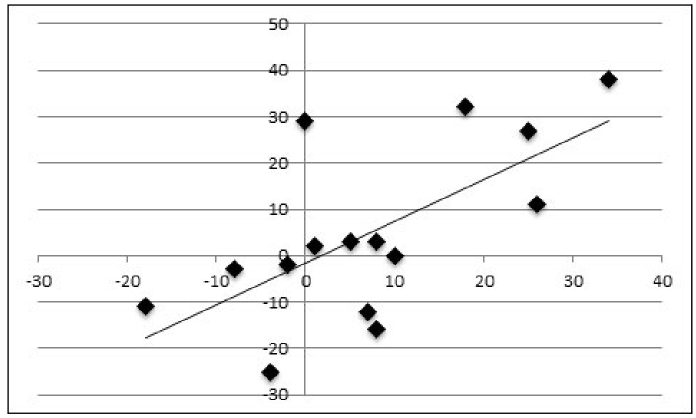

Figure 7. *Symptom Survey score for prism (x-axis) and size lenses (y-axis).*

vergence break at near was found to be 12.8 prism diopters, and the mean NPC break point was 12.2 centimeters. The mean CISS score was 25.27.

Short Oral Reading

The mean CWPM with habitual correction was 119 (SD=33.13), with base-in prism it was 129 (SD=34.20), and with size lenses it was 128 (SD=38.00) (Figure 1). The repeated measures ANOVA evaluating lens condition and time found significant main effects for lens condition ($p < .0001$) and time ($p = .004$). There was also an interaction between lens condition and time ($p=.03$). A post-hoc Tukey Pairwise comparison showed that the reading rate for habitual correction was significantly slower from the base-in prism and size lens conditions ($p<0.05$). However, the two lens conditions were not different from each other. The ANOVA also found a significant interaction between condition and time (Figure 2). A post-hoc Tukey Pairwise comparison at each time block showed significant differences at time blocks 1 and 2. At time block 1, baseline was significantly slower than the prism and size lens condition. At time block 2, baseline was significantly slower than prism but not the size lens condition.

Long Silent Reading

The mean WPM for base-in prism was 127 (SD=52.3) and with size lenses it was 139 (SD=55.5) (Figure 3). A repeated measures ANOVA evaluating lens condition and time found no main effect for condition ($p = 0.097$) but did find a significant main effect for time ($p < .0001$). There was no interaction between condition and time ($p=0.74$). Post hoc analysis using a Dunnett Multiple Comparisons with block 1 as a control, found that blocks 2, 3 and 4 were all statistically similar to block 1. However, block 5, or the last block was significantly faster than block 1 (Figure 4).

In analyzing the 10 comprehension questions answered by each subject under both conditions, subjects scored 58% correct (SD=26%) with the prism condition and 63% correct (SD=18%) with the size lenses (Figure 5). A paired T-test found no significant difference between comprehension scores between prism and size lenses (p = 0.452). A possible order effect was also analyzed using a paired T- test, which revealed no order effect between the conditions on comprehension level (p = 0.574).

Symptoms Survey

The mean survey score for base-in prism was 7.33 (SD=13.85) and for size lenses it was 5.07 (SD=18.81) (Figure 6). The range of scores for the prism condition was -18 to 34 and for the size lens condition was -25 to 38. A paired t-test found no significant difference between the two conditions (p=0.54). Finally, we correlated the prism and size lens patient symptoms reported and found an r value of 0.67 which would be considered a moderate correlation (Figure 7).[19]

Discussion

When comparing reading rate and perceived symptoms, there were no statistical differences between size lenses or base-in prism for either silent or oral reading. However, for oral reading, both size lenses and prism were statistically different from habitual correction alone. There were time effects noted for both oral and silent reading. For oral reading, subjects read the fastest in the first minute and minutes 3 through 5 were all similar in terms of reading speed, suggesting a leveling-off effect. For silent reading, subjects read at a steady pace for the first 3 blocks of time, and then read the fastest in the 5th, or last block of reading in both the prism and size lens conditions.

Our results do not agree with the O'Leary and Evans[10] study who did find a difference between the prism and size lens condition in subjects with exo deviations as measured by the Mallet Unit. However, the difference was only found for higher prism powers and the improvement in reading rate was small (3.2%). O'Leary and Evans investigated patients with a broad range of exo deviations and did not focus exclusively on subjects with CI. It is therefore difficult to make direct comparisons between our study and theirs due to differences in binocular vision conditions in the subject pool and method for prescribing the prism power. O'Leary and Evans also used a much wider age range of subjects, with a mean age of 43. Using a wide range of age in the study allowed for a number of confounding factors, such as different cognition levels and awareness of symptoms, as well as factors associated with emerging presbyopia. Finally, rather than having subjects read a typical story, O'Leary and Evans utilized the Wilkins Rate of Reading Test (WRRT), which uses a randomized sequence of common words and therefore may not represent reading typical text that we used in our study.

Comparing our results directly with Dusek et al.[8] and Stavis et al.[9] is difficult because they had subjects wear prism for a longer duration than we did. However, our findings are in agreement that children who are provided base-in prism read faster than they do without prismatic correction in place. Dusek et al. recorded the time taken to read a grade appropriate passage and found an improvement from 108.49 to 87 seconds after wearing an 8PD base-in prism for four weeks. This was a 19.8% decrease in time taken to read a passage, which was larger than the oral reading rate improvement for our study, which showed a change of 7.81% for the five minutes of reading with the prism correction. However, in the first minute of oral reading we found a 12.55% improvement in reading rate which is closer to the report by Dusek et al. In addition, the Dusek et al. study did not use a control condition and the examiner was not masked to the child's condition. It is more difficult to compare directly to the Stavis et al. study, which used the GORT-3 test that only provides a scaled score of reading fluency and not a reading rate. Stavis et al compared reading with refractive correction or plano lenses and prism following wearing the prism for at least 2 weeks. The prism condition did show significant improvements in reading rate and accuracy. However, the subject may not have been truly masked to the prism condition due to the image changes between wearing habitual correction and a prism lens. Based on our results we cannot rule out that wearing prisms for longer term may still have a possible impact on reading that cannot be attributed to a practice or placebo effect. Dusek et al. had subjects wear the prism for 1 month and Stavis et al. showed that there is an improvement with use of prism after wearing them for 2 weeks.

Possible fatigue during reading is a symptom that children with CI report more frequently than children with normal binocular vision.[5,6] However, the fatigue effect has not been studied in a formal way during reading. This study did look at reading rate over time and offers some indirect evidence about fatigue. Our results showed that there was little to no fatigue effect evident during the first five-minute oral reading task. In the habitual, size, and prism lens conditions the reading rate at 3, 4, or 5 minutes was quite similar across the three conditions. However, during the long silent reading task, block four was faster than the previous three blocks and the final block was significantly faster than the previous four blocks. The blocks consisted of 200 words and at a mean reading rate of 126.68 wpm the fourth block occurred after an average of 4.74 minutes of reading and the final block after an average 6.32 minutes of reading. We also have to remember that the silent reading occurred after ten minutes of oral reading. This implies that fatigue starts to set in around fifteen minutes of near work. This increase in reading rate suggests that subjects were growing tired and chose to skim the material much faster at the end of the session. This is further supported by the subject's performance on the comprehension questions, which were lower than anticipated across both conditions. In both conditions our subjects scored below 70 percent comprehension which is usually the cut-off value for understanding text at an instructional reading level.[20,21] Both silent reading conditions show a similar reading rate pattern with children reading faster in the last two blocks of time, suggesting that CI subjects may need an extended period of time away from near work to recover from the fatigue.

Our findings provide an interesting insight when compared to work done by Ritty et al.[12] that describes the typical school day experience for 4th and 5th grade students. They found that children spend about 4.75 hours/day on academically related subject work, with 2.50 hours of this time involving near work or reading. It was found that students were on average spending 16.6 minutes on sustained near work, which is just past the cutoff of fifteen minutes for a fatigue effect found in our study. Considering that this period of sustained reading occurs approximately 10 times for any given school day, the results are that children with CI in our study are likely experiencing fatigue in the classroom. However, we did not have a control group of children with normal binocular vision to use as a comparison and therefore cannot rule out that most children would show fatigue with our extended reading task.

We found an increase in oral reading rate from habitual correction with both the prism and size lens treatments. This could be due to a practice effect that could occur when the child returned for the second visit to read the passages with the lenses on. Although we cannot rule out this possibility, the test retest reliability of the easy CBM passages is quite high (>.90)[22] and we created passages that were equivalent as measured by the Flesch-Kincaid Reading ease measure (Table 3). In fact, the baseline passage was always at an easier level than the stories used for the two lens conditions. The high reliability and using equivalent passages would suggest that the improvement was not due to a practice effect. In addition, the greatest difference was found in the first minute of oral reading with no significant differences found after three minutes, suggesting there was no practice effect. Another possible explanation is that there was a placebo effect. The children may have responded to the idea that the glasses they were wearing were supposed to help them read better, and they therefore improved under both test conditions. Scheiman et al.[23] who found that both placebo lenses and BI prism correction showed significant improvement in CISS scores after 6 weeks of wear-time. We too found that subjects reported improved symptoms of comfort and performance while wearing prism and size lenses.

Our results showed that children tended to read fastest during the first minute of an oral reading task with the lenses in place and then slowed down after that. The practitioner may get a false sense that the lens is helping with reading rate if testing occurs for only one minute and is compared to habitual correction. Our results suggest that five minutes of reading would be more representative of the child's actual reading rate with lenses in place.

The improvement in subject reported symptoms of comfort and performance and oral reading during the first minute have implications when practitioners are trial framing prism correction for CI. The practitioner is likely to get a positive subjective response to lenses and faster oral reading during the initial minute of reading. Both responses were typical in our study and may not indicate a long-term benefit of lenses. However, we cannot make a direct conclusion about the long-term efficacy of prism correction from our data.

Clinically, our results imply that prism correction for patients with CI may not be as effective in short-term use when compared to longer term use. While there may still be a long-term improvement with use of prism, this remains unclear based on current literature.

Conclusion

Our study focused on short-term outcome measures and found that there was no difference between size lens and BI prism in terms of impact on reading rate, comprehension or perceived symptoms. However, oral reading was faster with prism and size lenses compared to habitual correction and patient report of symptoms of comfort and performance also showed a positive response. These results suggest that there may be a placebo effect when a child is wearing lenses. This has implications for doctors utilizing trial frames in practice, as they may not predict future performance. Finally, our study indicated that fatigue may begin after fifteen minutes of reading in our children diagnosed with CI.

Acknowledgements

This study was conducted in partial fulfillment of a Master in Vision Science at the Southern California College of Optometry at Marshall B. Ketchum University. Portions of this data were presented at the American Academy of Optometry Meeting in 2015 and the College of Optometrists in Vision Development Meeting in 2016.

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Greenawalt Chung A, Borsting E. The Impact of Short-Term Prism Correction in Convergence Insufficiency on Reading Rate and Accuracy. Optom Vis Perf 2018;6(1):11-8.

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