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THE EFFECT OF PRETENDED ASTHMA ON FUNCTIONAL PERFORMANCE INDICATORS

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ABSTRACT

We examined the field of view (FOZ) and visual quality of femtosecond laser-assisted laser in situ keratomileusis and small-incision lenticule extraction for high myopia correction. Different emmetropic eyes were subjected to 28 astigmatic blur situations simulated by the lens induced approach. Additionally, All 24 spherical defocus values were replicated on the same pair of eyes for statistical purposes. Measurements of VA were taken and then plotted against the logMAR value of the modulus of the dioptric power vector. The decline in VA due to astigmatic defocus was significantly affected by both the alphabet and the astigmatic axis. Interactions between the astigmatic axis and the alphabet in VA degradation showed shifts of 0.10 log MAR or less. Curve- and line-heavy alphabets (like Tamil and Arabic) showed more noticeable interactions.

Keywords: Visual acuity, Astigmatism, Spherical defocus, Accommodation, state Axis

INTRODUCTION

The negative effects of astigmatism on several metrics of visual function, such as visual acuity, are examined elsewhere in this thesis. In an interesting finding, found that the effects of simulated astigmatism on visual acuity depended on the layout of the letter chart, with the greatest impact shown in more intricate layouts with more crowding. Reading and cognitive test performance are all examples of activities that require the integration of vision and cognition and are negatively affected by uncorrected astigmatism. Reading Chinese characters is difficult because of the wide variety of complex structures, diversity of categories, and similarity between characters. Although learning to read Chinese characters is likely to be more challenging than learning to read any other language, few research have actually quantified the elements that influence near visual acuity when employing Chinese characters. Given that many people throughout the world read Chinese and that astigmatism is relatively common among Chinese people, this is a crucial information gap in the existing literature. Visualizing a normal eye as perfectly round, like a basketball, can help you grasp what it's like to have astigmatism. The shape of an eye affected by astigmatism is more like an American football than a circle. The most common forms of astigmatism are horizontal **astigmatism**, and **vertical astigmatism.** The abnormal shape of the eye causes blurred near and far vision in both types of astigmatism.

LITERATURE REVIEW

ClaraBenedi-Garcia (2019) Twenty-eight subjects of varied ages and refractive profiles were examined to determine the effect of induced astigmatism on subjective optimal focus and visual acuity. Astigmatism was artificially created for measuring purposes, and high-order aberrations were corrected using an Adaptive Optics system built for the task. Once astigmatism was induced, the optimum focus shifted from the negative values seen in emmetropic pre-presbyopes to the positive values seen in presbyopes with astigmatism. After correcting for high-order aberrations, the ratio of visual acuity for those with and without astigmatism ranged from 0.74 to 0.85 to 0.98, and from 0.68 to 0.73 to 0.86 for pre-presbyopia emmetropes, presbyopia emmetropes, and presbyopia astigmats. Potential connections between these findings and the long-term success of astigmatic and presbyopic corrections are discussed.

Antzaka (2017) It has been shown in recent research that training with Action Video Game-AVGs can help children with dyslexia improve not only some aspects of attention but also their reading fluency. In order to better understand the similarities between AVG playing and reading, we decided to test the hypothesis that avid AVG players had a greater Visual Attention (VA) span, a visual attention component linked to both reading development and dyslexia. Thirty-six adults who spoke French were randomly assigned to one of two groups: AVG gamers or non-gamers, comparable in age, education, and literacy rates. Participants took a demanding reading exam as well as a behavioural task to measure VA span. The performance of AVG players increased in both areas, suggesting a link between them. These results provide support to the theory that the VA span is a key mediator of the effect of AVG play on reading comprehension. Further supporting VA span's importance to adult readers is the correlation between it and decoding pseudo-words. By integrating VA span training with the unique qualities of AVGs, researchers may one day create a new generation of remedial software.

Chiara Banfi (2017) There is evidence from certain studies to imply that difficulties with visual-spatial attention contribute to the development of dyslexia. For instance, poor visual attention shifting in spatial cueing paradigms has been associated to issues in graphemic parsing in sub lexical reading. A large group of third and fourth graders with a range of reading and spelling abilities were assessed using an external cueing paradigm to measure their visuo-spatial attention. Children with reading and spelling difficulties were shown to have a cueing deficit when individual differences in reaction times were accounted for using z-transformation. Contrarily, poor readers who did not have spelling problems had a cueing effect identical to that of controls, with a clear right-over-left advantage. The cueing impact was large, but the position effect was not present among the isolated bad spellers. We identified a diminished cueing effect not only among kids with bad orthographic spelling, but also among kids who were poor nonword readers, suggesting deficiencies in sub lexical processing (indicating deficits in lexical processing). As a result, the earlier assertions linking nonword reading to a specific trait could not be verified. Results from a parent questionnaire on attention deficit hyperactivity disorder (ADHD) showed no significant change in the analysis, suggesting that cueing abnormalities are not due to broader attentional restrictions. It was shown that 31%-48% of people with reading and/or spelling disabilities, as well as 32% of those in the control group, had problems with spatial cueing. These findings point to a possible causal relationship between visuo-spatial attention and aspects of written language processing, however the nature of this relationship is still up for debate.

Sylviane Valdois (2019) New readers sometimes struggle with decoding letter strings. Visual similarity, information loss with eccentricity, and interference from surrounding

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letters all have a role in how easily we are able to identify individual letters. Letter recognition, on the other hand, benefits from focused attention on the visuals. Here, We tested the hypothesis that pre-literacy performance on visual attention span tasks may predict post-literacy performance on reading fluency tests. Tests of verbal and nonverbal IQ, visual attention span, phonological awareness, letter-name recognition, early literacy, and verbal short-term memory were administered to 124 children from normally developing households in kindergarten. Reading assessments using irregular words, pseudo-words, and text reading were administered to first graders as a culminating activity. When controlling for factors such as age, non-verbal IQ, phonological skills, letter name awareness, and early literacy abilities, the VA span of kindergarteners was shown to be a significant predictor of reading fluency for text, irregular words, and pseudowords one year later. Path analyses conducted at the end of first grade revealed a bigger effect for pseudo-word reading than for irregular word or text reading, suggesting a distinct contribution of VA span to the various reading abilities. These results provide credence to the theory that visual attention resources acquired before to reading are associated with improved reading fluency, independent of reading subskills and reading environment, and with a particular benefit to pseudo-word reading. We provide a novel conceptual model of visual attention's role in learning to read, arguing that many of the model's key assumptions are already borne out by the data.

Amy L Sheppard (2018) The widespread adoption of digital technologies in recent years has led to widespread reliance on them in all walks of life. Rising rates of what's called "computer vision syndrome," or digital eye strain, is estimated to be 50% or more. DES includes a wide variety of symptoms related to the eyes and eyesight. There are two primary types of symptoms: internal ones associated with strain on the eyes' ability to focus, known as accommodating or binocular vision, and external ones associated with dry eye. While most cases of computer-related illness are mild and short-lived, frequent and persistent symptoms can be debilitating for professional computer users and have a measurable financial impact. Multiple surveys are available for identifying and measuring DES, and objective evaluations of measures including crucial flicker-fusion frequency, blink rate and completeness, accommodative function, and pupil features can also be utilized as markers of visual tiredness. Sometimes it's hard to see the connections between objective and subjective metrics. There are a variety of approaches to treating DES, including correcting for refractive error and/or presbyopia, treating dry eye, taking frequent breaks from screen time, and assessing vergence and accommodative issues. Blue light-filtering glasses have been investigated for their potential use in the treatment of DES by multiple authors recently, with conflicting findings. Given the widespread use of DES and digital devices, it is crucial that eye care professionals have access to high-quality evidence upon which to base their recommendations and methods of treatment.

METHODS

Trial lenses in a trial frame were used to generate refractions in fewer eyes, as in earlier studies6,19,20. In this example, the study included four young adults who reported no history of ocular disease or disorder. Subjects provided informed consent and approval was granted by the University of Valencia's Ethics Commission in accordance with the principles outlined in the Declaration of Helsinki. The left eye was covered throughout testing to eliminate any possible convergence effects. All participants had VAs of 20/40 or better after compensation. The push-up technique was used to test accommodation amplitude using a single eye. The Grand Seiko WAM-5500 open-field autorefractor was used to evaluate objective refraction and pupil size in the same controlled illumination conditions. Table 1 presents a compilation of these findings. This experiment did not involve any artificial manipulation of pupil size or accommodation in an effort to better understand VA under natural conditions in the human eye.

Table 1. Subject details.

Subject	Age (year)	Subjective refraction	Accommodation amplitude (*D*)	Pupil size (mm)
S1	26	−0.50/−0.50 × 180°	8.0	4.7 ± 0.2
S2	32	−2.00/0.00	6.5	4.50 ± 0.10
S3	28	−0.50/0.00	7.5	5.30 ± 0.14
S4	25	0.00/−0.50 × 90°	8.0	5.5 ± 0.2

As the sum of the distance refraction and the induced refractive error, trial case lenses were positioned in front of the eye for all measurements. By doing so, we were able to transform the standard script notation for each induced refraction from sphere S, cylinder power C, and axis to power vector coordinates and calculate the norm of the power vector, or blur intensity B, with the help of the following equations:

$$M = S + \frac{C}{2}$$

$$J_0 = -\frac{C}{2}\cos 2\alpha$$

$$J_{45} = -\frac{C}{2}\sin 2\alpha$$

$$B = \sqrt{M^2 + J_0^2 + J_{45}^2} = \sqrt{S^2 + SC + C^2/2}$$

The blur strengths of the lenses used to produce each kind of astigmatism on the test individuals are shown in Table 2. There are two types of compound hyperopic astigmatism that we have discussed (CHA). CHA1 was the first of its kind to keep the less hyperopic focus line at a constant distance from the retina. In the second, we manipulated the position of the Sturm interval by changing the power of the sphere while keeping the power of the cylinder fixed. We checked the 0 degree, 45 degree, and 90 degree axes for every possible power combination. To further assure precision, eight values of myopic defocus (MD) with positive spheres and sixteen values of hyperopic defocus (HD) with negative spheres were also simulated.

Sphere (S) and cylinder (C) values used to model the defocus caused by various types of astigmatism. For every set of lenses, there is a corresponding power vector whose modulus is denoted by the letter B. For starters, the cylinder sign distinguishes between simple hyperopic and simple myopic astigmatism (SHA and SMA, respectively).

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Compound hyperopic stigmatism types (CHA1) and (CHA2). (d) For cases of mixed astigmatism, Jackson Cross-cylinders with varying strengths are employed (MA).

Table 2. SHA/SMA

SHA/SMA		CHA1			CHA2			MA		
C	B	S	C	B	S	C	B	S	C	B
−0.75/+0.75	0.53	−0.50	−1.00	1.11	−0.50	−1.00	1.11	+0.25	−0.50	0.25
−1.50/+175	1.06	−0.50	−1.50	1.45	−0.75	−1.00	1.35	+0.50	−1.00	0.50
−2.25/+2.25	1.59	−0.50	−2.00	1.80	−1.00	−1.00	1.58	+0.75	−1.50	0.75
−3.00/+3.00	2.13	−0.50	−2.50	2.15	−1.25	−1.00	1.82	+1.00	−2.00	1.00
−3.50/+3.50	2.48	−0.50	−3.00	2.50	−1.50	−1.00	2.06	+1.25	−2.50	1.25
								+1.50	−3.00	1.50
								+1.75	−3.50	1.75
								+2.00	−4.00	2.00
(a)		(b)			(c)			(d)		

By adjusting the lens's rear vertex distance to 12 mm and measuring the resulting defocus values over 4.0 diopters, the lens's effective power was calculated.

Since of the large number of measurements recorded with each eye, the IVAC test was employed to evaluate VA because it gives reproducible and trustworthy findings while avoiding learning effects. The Snellen letters option of the test was used for the measurements; these letters have 100% contrast and a graduated size range from small to large. Distance of 5 metres and a calibrated 125cd/m2 CRT monitor were used to present the test. We measured under controlled lighting conditions in a specially designed dark room with a constant background light of 65010 lux. Subjects were asked to read optotypes from left to right across each line for different values of induced astigmatism, and their visual acuity (VA) was calculated if they correctly recognised more than half of the smallest optotypes. The power and axis parameters were switched around between each measuring session. In order to reduce tiredness, sessions lasted no longer than 45 minutes, and there was only a brief pause in between assessments. There was some time in between meetings. Every blur condition was measured three times, and the average of those readings was used for the final study. SPSS 19.0 for Windows was used for the statistical analysis. Shapiro-Wilk tests for normality and equality of variance were conducted on the data, and both were significant ($p>0.05$) (F-test). The correlation coefficient (R2) and slope (b) between B and VA were calculated for each case of astigmatism assessed.

RESULTS

The visual acuity (VA) scores for each of the four refractive situations are shown in Table 3. Using the provided alphabetic chart, we see that VA varied for the in-focus condition. Subjects had the best VA when compared to other charts while using the Roman chart. In comparison to the VA produced with the Arabic and Chinese charts, the VA recorded with the Tamil chart was the weakest of the four charts, with a difference of roughly one log MAR line.

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Table 3 Visual acuity scores for the different alphabet charts and refractive conditions

Alphabet	Visual acuity [logMAR] (mean ± SD; 95% confidence interval)			
	In-focus	WTR-astigmatism (2 DC)	Oblique astigmatism (2 DC)	ATR-astigmatism (2 DC)
Arabic	−0.04 ± 0.07 [−0.07, 0.01]	+0.24 ± 0.13 [0.19, 0.30]	+0.44 ± 0.10 [0.40, 0.48]	+0.30 ± 0.11 [0.25, 0.34]
Chinese	−0.02 ± 0.09 [−0.06, 0.01]	+0.22 ± 0.11 [0.17, 0.26]	+0.41 ± 0.12 [0.36, 0.46]	+0.34 ± 0.09 [0.30, 0.38]
Roman	−0.08 ± 0.07 [−0.11, −0.05]	+0.11 ± 0.12 [0.06, 0.16]	+0.20 ± 0.10 [0.16, 0.25]	+0.13 ± 0.09 [0.09, 0.16]
Tamil	+0.10 ± 0.13 [−0.05, 0.15]	+0.36 ± 0.15 [0.30, 0.42]	+0.46 ± 0.11 [0.43, 0.53]	+0.44 ± 0.14 [0.39, 0.50]

VA dependence upon axis of astigmatism

Every letter of the alphabet is represented in Figure 1 by the VA drop caused by one of three astigmatic circumstances. We discovered that the VA loss due to the three astigmatic circumstances differed throughout the alphabet charts using a two-factor repeated-measures ANOVA (F (3,72)=12.1, p0.001). The average VA decline achieved using the Roman chart was the lowest when compared to the other two VA charts. Charts in Arabic (-0.36), Chinese (-0.35), and Tamil (-0.36) were shown to degrade similarly in VA. (P>>0.05 for all pairwise tests.) Results from a post hoc repeated-measures ANOVA with a one-factor for each refractive condition showed that the Roman charts had the least severe decline in visual acuity compared to the other three VA charts for both oblique and ATR astigmatism. Figure 2 provides a graphic illustration of these contrasts.

For WTR astigmatism, only the Arabic alphabet exhibited a decline that was significantly different from the Roman alphabet's decline. F (2,48)= 37.6, p 0.001 indicates that VA performance differed across subjects based on the direction of the astigmatic axis. Under WTR, oblique, and ATR conditions, the average VA degradation was -0.23 log MAR, -0.38, and -0.31 log MAR, respectively. WTR astigmatism had milder effects than ATR and oblique astigmatism, but oblique astigmatism was more severe than ATR. Using a post hoc repeated-measures ANOVA with a one-factor for each alphabet, we observed that the astigmatic axis had a statistically significant impact on all four letter sets. Even if the degree to which this is true varies by axis and alphabet, it is clear that WTR astigmatism is the least damaging condition and oblique astigmatism is the most degrading condition across all four alphabets. When contrasting two sets of data.

Similar to how variations across astigmatic axis are reflected in the percentage of patients with clinically significant changes in VA between orientations, Variations in VA degradation across astigmatic axes may be seen throughout the four charts due to significant interactions between the alphabet and astigmatic axis (Table 5). For two alphabet charts, the estimated interaction magnitude was less than one log MAR line, which is the difference in VA degradation between the two astigmatic axis. The VA measured with the Arabic and Chinese charts are more sensitive to a shift in the astigmatic axis, from WTR to oblique, than the VA measured with the Roman chart. Similarly, whether the axis was WTR or ATR mattered more in the Chinese chart than it did in the Roman version. Arabic VA rose after the chart's axis was shifted from ATR to oblique, in contrast to Tamil's chart.

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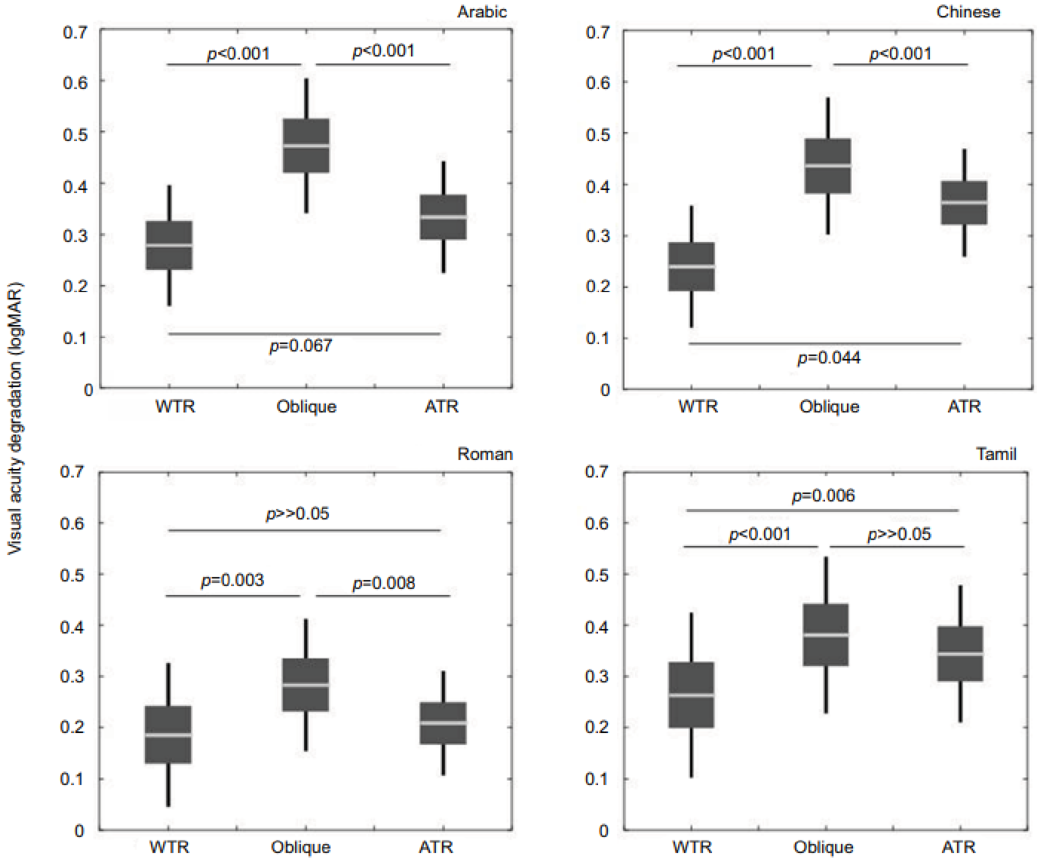

Figure 1 VA degradation induced by the astigmatic conditions for each alphabet.

Deterioration values in VA are the average of the intra-individual decreases in VA compared to the best VA after adjustment. A light grey line represents the mean, a grey box represents the 95% confidence interval for the mean, and the bars represent the standard deviation.

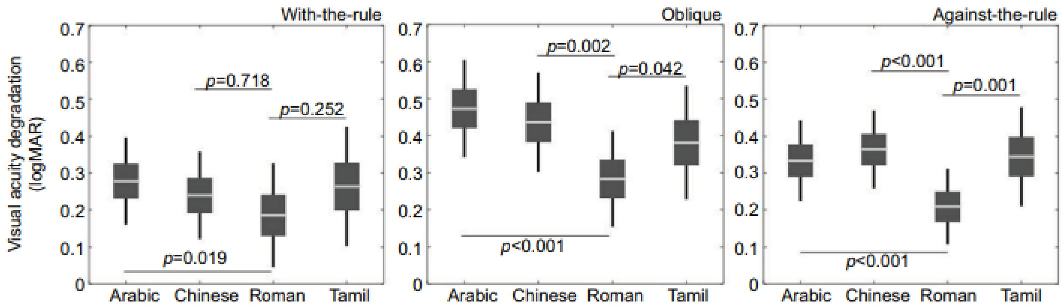

Figure 2 VA degradation induced by the astigmatic conditions for each astigmatic condition.

The mean, the bright spot, is surrounded by a grey box representing a 95% confidence range. The mean is represented by the grey line in the centre, and the standard deviation by the vertical bars. The findings of pairwise comparisons between the Arabic, Chinese, and Tamil alphabets have been omitted for the sake of brevity. (all p>0.200).

Table 4 VA differences of 0.10 log MAR or less across the two astigmatic conditions, and the proportion of subjects with VA differences of 0.10 log MAR or less overall

Alphabet	WTR vs oblique			WTR vs ATR			Oblique vs ATR		
	WTR better	Oblique better	< ±0.10 logMAR	WTR better	ATR better	< ±0.10 logMAR	Oblique better	ATR better	< ±0.10 logMAR
Arabic	68%	4%	28%	32%	16%	52%	0%	56%	44%
Chinese	80%	0%	20%	60%	4%	36%	8%	32%	60%
Roman	52%	4%	44%	32%	28%	40%	0%	40%	60%
Tamil	60%	8%	32%	48%	8%	44%	16%	36%	48%

Table 5 Alphabetic-axis interaction strength (log MAR)

Type of interaction	Magnitude of interactions (logMAR), mean [95% confidence interval]		
	WTR vs oblique	WTR vs ATR	ATR vs oblique
Arabic vs Chinese	±0.00 [−0.05, +0.05] p>0.500	−0.07 [−0.12, −0.02] p=0.180	−0.07 [−0.13, ±0.00] p>0.500
Arabic vs Roman	+0.10 [+0.03, +0.17] p=0.270	+0.03 [−0.04, +0.10] p>0.500	−0.07 [−0.13, ±0.00] p>0.500
Arabic vs Tamil	+0.08 [±0.00, +0.14] p>0.500	−0.03 [−0.08, +0.03] p>0.500	−0.10 [−0.16, −0.04] p=0.036*
Chinese vs Roman	+0.10 [+0.05, +0.15] p=0.036*	+0.10 [+0.03, +0.17] p=0.09	±0.00 [−0.07, 0.07] p>0.500
Chinese vs Tamil	+0.08 [+0.02, +0.14] p=0.234	+0.04 [−0.01, +0.10] p>0.500	−0.04 [−0.11, 0.04] p>0.500
Roman vs Tamil	−0.02 [−0.07, +0.03] p>0.500	−0.06 [−0.12, +0.01] p>0.500	−0.04 [−0.10, 0.02] p>0.500

CONCLUSIONS

Each kind of astigmatism and accommodative demand has a different connection between VA and blur strength. VA is enhanced by accommodation in either direction of the visual axis when one of the focus lines is located on the retina. Interactions between alphabet and kind of astigmatism explain the variation in the effect of meridional blur on letter discrimination. These findings have ramifications for how VA is assessed in populations who use different typographic techniques, as well as the influence of astigmatic axis on visual performance. When the identical POZ was planned for extreme myopia, SMILE produced a larger FOZ and greater decentration than FS-LASIK. Both SMILE and FS-LASIK produced similar objective and subjective visual symptoms.

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