



Effect of Extensive Near Work on Binocular and Accommodative Systems

Kashifa Ansari, B.S. • Aitana E. Marquez, B.S. • Morley J. Struss, B.S. • Megan S. Allen, O.D. F.A.A.O
Kelsey Fitzgerald, O.D. • Erica Tritsch, O.D • Kasey Lenhart, O.D

3241 South Michigan Avenue, Chicago, Illinois 60616

INTRODUCTION

In a world where the dependence on technology is constantly increasing, the demand on the near visual system is also increased simultaneously. The purpose of this study is to investigate how increased near work, especially digital near work, required in a graduate program, affects the near visual system over time. This study looks at changes in the near visual system of optometry students from year one to year three of their rigorous graduate school education.

METHODS

Subjects of this study were eligible volunteers from the Illinois College of Optometry (ICO), Classes 2021-2023, who had all provided informed consent. Students at ICO were given a comprehensive eye exam at the beginning of their first year, which included a measurement of eye posture through cover test, accommodation through negative relative accommodative (NRA), positive relative accommodation (PRA), and minus lens amplitude (MLA) testing, and compensating vergences through Risley Prism (RP). To measure changes to the near visual system, these tests were performed again, best corrected and in phoropter at a working distance of 40 cm, on the same students during their third year. Additionally, each subject was required to complete an online survey which included questions on time spent and symptoms when performing extended near work. Data was analyzed using a paired samples t-test with a significance level of $p < 0.05$ (IBM SPSS v27).

RESULTS

Forty-nine subjects were analyzed, and notable statistically significant p-values include those for cover test, PRA, and blur or break for base out (BO) RP vergences, which are 0.038, 0.004, and 0.038 respectively. Each of these values showed an overall increase when comparing first and third year student data. All mean values for eye posture, vergences, and PRA all fell within, or were better than, clinical norms.

Survey analysis from the Class of 2023, which included twenty-three subjects, revealed that 95.65% of subjects reported symptoms after starting optometry school including asthenopia, headaches, diplopia, and blurry vision, listed in order of most to least common. 95.65% of subjects reported using digital devices as a primary study tool with screen time of 6-16 hours/week. 56.52% of subjects reported spending 20-40 hours/week studying and 39.13% of subjects spent 41-75 hours/week studying. 95.65% of subjects reported increased screen time per week since the beginning of the COVID-19 pandemic.

FIGURE 1
Symptoms Reported by Third Year Optometry Students

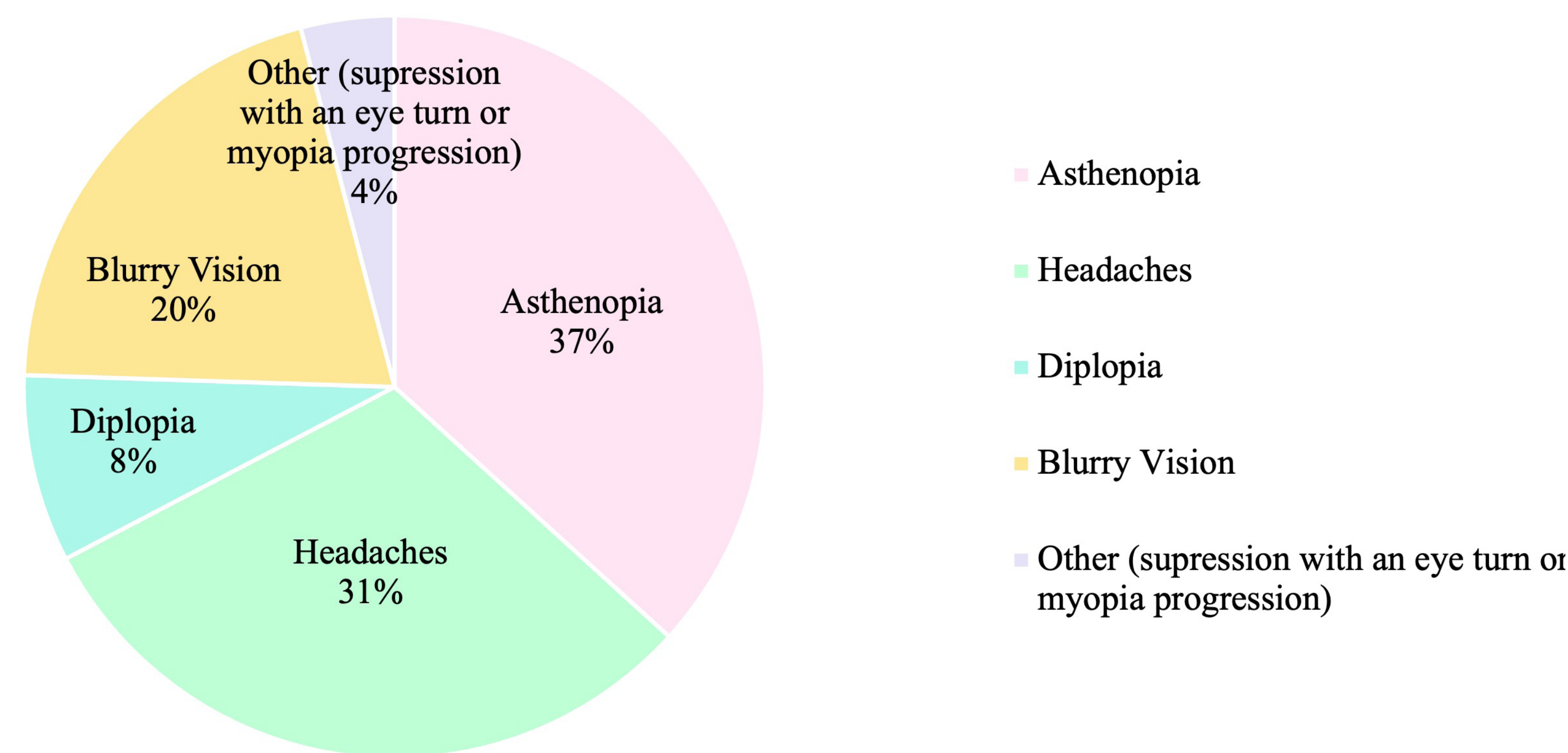


FIGURE 2
Survey

- Did you have time off between your undergraduate studies and optometry school? If so, how long?
- If coming straight from undergrad, what was your primary method of studying (computer, tablet, paper, etc.)? If you took time off, please answer "N/A".
- How many hours on average did you study per week in undergrad (including lecture time)?
- What is your primary method of studying in optometry school (computer, tablet, paper, etc.)?
- How many hours on average do you study per week in optometry school (including lecture time)?
- On average, what is your amount of screen time per day including school, work, social media, television, etc.?
- If your electronic device records your screen time per week, what is it? If it does not, please answer "N/A".
- Do you feel like your eyes have changed since starting optometry school? If so, what symptoms have you started experiencing?
 - No, my eyes haven't changed since starting optometry school
 - Eyestrain
 - Diplopia
 - Headaches
 - Blurry vision
 - Other: (please list)

FIGURE 3
Paired Sample T-Test Results

Technique Name	Year	Mean ± Standard Error	N	T-value	Significance (2-tailed)
Cover Test	1st Year	-2.53 ± 0.563	49	2.14	0.038
	3rd Year	-3.55 ± 0.609			
Negative Relative Accommodation	1st Year	2.4388 ± 0.5856	49	-0.247	0.806
	3rd Year	2.4592 ± 0.07043			
Positive Relative Accommodation	1st Year	2.2806 ± 0.09798	49	-3.019	0.004
	3rd Year	2.8878 ± 0.19358			
Minus Lens Amplitude (OD)	1st Year	8.7772 ± 0.45499	46	1.922	0.061
	3rd Year				
Age Adjusted	Age Adjusted	7.791666666666666 ± 0.267023086	46		
	1st Year	8.7609 ± 0.46359	46	0.988	0.328
Minus Lens Amplitude (OS)	3rd Year				
	Age Adjusted	8.26449275362319 ± 0.287887343	46		
Negative Fusional Vergence	1st Year	16.92 ± 0.913	49	0.508	0.614
	3rd year	16.29 ± 1.076			
Positive Fusional Vergence	1st Year	21.35 ± 1.254	48	-2.139	0.038
	3rd year	25.19 ± 1.522			

DISCUSSION

In 2021, Dr. Mohan et al. measured the visual impact of increased online class time in children during the COVID-19 pandemic, by having participants complete a Convergence Insufficiency Symptom Survey (CISS) and through measurement of binocular vergence and accommodative parameters. The study found a statistically significant difference in mean near exophoria, negative fusional vergence, negative relative accommodation, and accommodative amplitude between children who spent more than 4 hours and those that spent less than 4 hours on online classes.

Dr. Iribarren et al. conducted a study in 2001, measuring accommodative facility and asthenopia symptoms in students and office workers that spend an average of 9 ± 3.4 hours performing near work. Subjects reported symptoms of asthenopia which positively correlated with time spent performing near work. Additionally, results indicated a statistically significant negative correlation between extended near work and blurred vision, when compared to accommodative facility.

CONCLUSION

A statistically significant increase in exophoric posture in third year students may be due to the increased accommodative demand and fatigue from extended near work, and likely contributed to symptoms of binocular vision (BV) fatigue and strain. A statistically significant increase in blur and break values of BO vergences and PRA values are likely due to knowledge and awareness of BV related eye movements, through didactic education in BV and easy access to the vision therapy clinic at Illinois Eye Institute, which is something the average sample size of non-optometry school graduate school students would not have knowledge or ready access to.

REFERENCES

Available upon request.

CONTACT: Megan S. Allen, O.D. F.A.A.O
MSAllen@ico.edu • www.ico.edu