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A thesis Presented to the

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INTRODUCTION

In today's eye care professions, much of the time that is spent doing an exam is devoted to first, detecting pathology, second, determining refractive error, and third, finding if there are any muscle imbalances. Relatively little if any time is spent determining whether unequal ocular images exist for the two eyes. This image imbalance is commonly known as aniseikonia.

Adelbert Ames Jr. Defined aniseikonia as "that condition of the binocular visual apparatus in which a relative difference exists in the size and/or shape of the ocular images."[1] Ames, considered the father of aniseikonia, founded the Dartmouth Eye Institute, which was instrumental in the development of aniseikonic testing techniques. His studies promoted much interest in the field of aniseikonia during the 1930's and 40's. Since that time the literature on aniseikonia has diminished. Articles found today usually deal with the induced aniseikonia associated with monocular aphakia. Today's practitioner is aware of image size differences brought about by large anisometropic conditions, but the actual testing for the aniseikonia has usually not been performed. For this reason optical instrument companies no longer manufacture aniseikonia testing devices.

A major controversy exists concerning the maximum amount of aniseikonia that can be tolerated by patients without producing symptoms. These symptoms include asthenopia, headaches, photophobia, reading difficulties, nausea, nervousness, motility difficulty, general fatigue, vertigo, and space perception problems.[2] Ogle reports that to main-

tain ocular alignment in the presence of aniseikonia an image size difference of no more than five percent can be allowed.[3] Other authorities state that lesser amount of aniseikonia, around one and a half percent, can produce symptoms and be disturbing to the patient.[4] The subjective complaints of aniseikonia in the general population are not significant enough to warrant routine testing, however this may not be the case within the epileptic population. Dr. Ray S. Martin, O.D., a practitioner with special interest in ideopathic epilepsy, has suggested that there may be a special need for testing aniseikonia in the epileptic population.

Epilepsy refers to a number of disorders of the nervous system centered in the brain. An intermittent imbalance in the electrical activity of the brain occurs with epilepsy. Manifestations of this uncontrolled activity include seizures, convulsions or other muscle spasms, loss of consciousness from a few seconds to several minutes, and abnormal social behavior. There is no known etiology as to why brain cells discharge abnormally and cause the symptoms of epilepsy called seizures. The three most common forms of epileptic seizures are petit mal, grand mal, and psychomotor. Petit mal usually occurs with children from four to ten years of age, but may continue into adulthood with increasing severity. It is characterized by short periods of blinking or staring of only a few seconds duration. With grand mal seizures a person suffers convulsions lasting from one to twenty minutes, but usually less than five minutes. Psychomotor seizures have a pattern of rapid onset of mental confusion accompanied by a cessation of the person's current activity. These seizures are primarily a disorder of adults and older children.

Research to find a cause or cure for epilepsy is common and has shown much advancement. Some research has linked epileptic seizures with such visual input as flashing lights, or visual display terminals.[5] Further investigation into other visual causes of epilepsy is needed. Presently, there have been no investigations published relating the topics of aniseikonia and epilepsy. This research project will test the hypothesis that there is a greater proportion of individuals suffering from aniseikonic stress in the epileptic population than in the non-epileptic population.

METHODS

A system for subject referral was established with a local seizure treatment center so as to provide a source of epileptic patients for the project. Potential subjects were given a flyer offering a complete eye examination with all fees waived and a phone number to call to make an appointment.

Upon arriving for the appointment, the patients were asked to read and sign an informed consent form. This form mentioned that aniseikonia was specifically being tested along with other basic optometric tests. Aniseikonia was explained to the subjects, but because of the complexity of the tests and the sheer numbers of different tests performed, it was felt that the patients would not be able to influence the outcome of the testing even if they knew what was being tested.

Before the aniseikonia testing began, a complete case history was taken which included questions about what type of seizures the patient usually had, how often they had their seizures, when did they first begin, and what type of medication they took to control them. After the case

history was taken, a complete vision exam was given which included testing for:

1. visual acuities
2. proper eye movements
3. external/internal ocular health
4. refractive error
5. intra-ocular pressure
6. visual field defects
7. stereopsis (depth perception)

Each subject was required to detect the sixth level of the Randot stereopsis Test. Stereopsis was necessary to show adequate performance on the American Optical Space Eikonometer, the instrument used for aniseikonia testing.

Before the subjects were actually tested on the Space Eikonometer, they were allowed to view some sample settings while looking into the instrument, in order to get a feel of how the testing would be done. This is in accordance with the instruction manual.[6] If the subject could describe the precise image location correctly, the testing began. The amount of aniseikonia in a particular case is measured by introducing known magnifications by means of the adjustable magnification units and declination unit until the target elements appear normal to the patient. For every subject, ranges were established for each of the three quantities measured by the instrument. These quantities are:

1. The percent horizontal (X90) magnification correction for the two eyes.
2. The percent vertical (X180) magnification correction for the two eyes.

3. The declination (delta) error in degrees, that is, the difference between the small rotary displacements of vertical lines in space for each eye. A declination error exists only when there are meridional magnifications of one or both images in an oblique meridian.

Ranges were found by going from undetectable to detectable settings on the instrument. The midpoint of these ranges were used as the subject's magnification and declination errors. A subject was diagnosed as having aniseikonia if any of the midpoint errors were too great to be compensated for by the subjects range of undetectability.

RESULTS

Ten subjects from the Epilepsy Center of Oregon were given a vision examination. Eight of the ten subjects had sufficient stereopsis for aniseikonia testing, and five out of the eight tested had epilepsy of unknown origin (ideopathic). Data obtained from the Space Eikonometer is listed in Table A. For each subject tested, the figures listed in the table include the percent magnification correction for the two eyes in the horizontal(H) and vertical (V) meridians, and the declination error(D) in an oblique meridian.

TABLE A

Subjects	H	V	D
MH*	0 ± 1.0	1.5 ± 1.0 L	0 ± 0.25
RJ*	1.0 ± 0.5 L	1.5 ± 0.5 L	0.25 ± 0.5 +
RP*	3.0 ± 0.5 L	3.0 ± 1.0 L	0.5 ± 0.25 +
CR*	0 ± 0.5	1.75 ± 0.5 R	0.25 ± 0.25 -
DR*	0 ± 0.75	0 ± 0.75	0 ± 0.75
GB	0.25 ± 0.5 L	0.75 ± 0.62 L	0 ± 0.20
VH	0.72 ± 0.37 R	0 ± 0.75	0 ± 0.00
KG	0.12 ± 0.37 L	0.5 ± 0.75 L	0.1 ± 0.3 -

*Subjects with ideopathic epilepsy

CASE REPORTS AND DISCUSSION

The original intent of this project was to use the data in a statistical analysis to find out if a greater proportion of individuals in the epileptic population have aniseikonia, than in the general population. Since the patient sample was too small to make statistical projections of the epileptic population, a case report format and discussion follows.

Subject #1: M.H. was a 24 year old white female reporting decreased visual acuity at distance, and light sensitivity. She had one grand mal seizure two years ago, and takes dilantin medication to control her ideopathic epilepsy. She felt that her distance vision became blurry and her light sensitivity increased after starting therapy on

dilantin. Her distance refraction was: -0.50D -0.50D X145 OD, and -0.75D -0.25D X 035 OS, diagnosed as myopia and oblique astigmatism. Results from aniseikonia testing show a one and a half percent magnification in the vertical meridian was needed in front of the left eye to equalize ocular image size. After her tolerance range was taken into account, an uncompensated aniseikonia value of a half of one percent was present.

Subject #2: R.J. was a 35 year old white female who reported no ocular problems. She has several petit mal seizures a year of unexplainable origin. She takes dilantin for medication therapy. No distance perscription was given, but a near Rx was prescribed for reading: +0.50D -0.25D X 085 OD, and +0.75 D sphere OS. Results from aniseikonia testing showed a need for a half of one percent magnification (OS) in the horizontal meridian, and a one percent magnification (OS) in the vertical meridian, after tolerance ranges were taken into account.

Subject #3: R.P. was a 25 year old white male with subjective complaints of blurred vision at near, and eye aches after reading for an hour. He had two grand mal seizures and two petit mal. His first seizure was a grand mal in 1977, and his last was a petit mal, one and a half years age. He has a drug allergy to dilantin, so phenobarbital was taken for drug therapy to control ideopathic epilepsy. A bifocal spectacle prescription for full time wear was given: +2.75D -1.75D X 010 OD, and +0.25D sphere OS, plus +1.00D add OU. He had hyperopia OU, with-the-rule astigmatism OD, and the greatest amount of anisometropia of all the subjects in the project. Results from aniseikonia testing show an uncorrected magnification of two and a half percent

(OS) in the horizontal meridian, a two percent magnification (OS) in the vertical meridian, and a positive declination of 0.25 degrees after tolerance ranges were taken into account.

Subject #4: C.R. was a 51 year old white male with no statement of ocular problems. He had only one grand mal seizure in 1965, and takes dilantin and Mebaral to control his ideopathic epilepsy. He was given a spectacle prescription for reading only: +1.75D -0.25D X 005 OD, and +2.00D sphere OS. Results from aniseikonia testing show an uncorrected magnification of 1.25 percent (OD) in the vertical meridian after tolerance ranges were taken into account.

Subject #5: G.B. was a 24 year old white female who had complaints of headaches associated with near work. She has been having petit and grand mal seizures since she was hit by a car a few years ago and sustained injury to her head and neck. She currently takes dilantin which controls her seizures. No visual problems were found that could explain her headaches and therefore no spectacle prescription or therapy was given. Results from aniseikonia testing showed a need for 0.13 percent magnification OS in the vertical meridian, after tolerance ranges were taken into account.

Subject #7: V.H. was a 35 year old white female who's only visual complaint was photophobia. She has been suffering from psychomotor seizures since she was a child. She believes these seizures may be the result of her bout with hydrocephalus when very young. She takes dilantin and tranxene to control her seizures. No spectacle prescription was needed. Although she was not classified as an ideopathic epileptic, aniseikonia testing was performed anyhow. The results showed no aniseikonia errors that could not be compensated for with her tolerance ranges.

Subject #8: G.K. was a 30 year old white male who complained of slight visual blur at distance. His first seizure occurred in 1975. Since then, he has had approximately two grand mal seizures a year. He has been diagnosed as having a vascular abnormality within his frontal lobe. This may be the cause of the seizures. He currently is taking dilantin. He was given a spectacle prescription of fulltime wear: -1.00D -1.00D X 176 OD, and -1.00D -1.50D X 009 OS. He was found to have no aniseikonia error that was not compensated for by his tolerance ranges.

Subject #9: J.H. was a 30 year old white female who had no subjective visual complaints. She has had approximately one grand mal seizure a year since they started in 1975. There is no apparent cause for her seizures and she currently takes Tegretol and Phenobarbital to control them. She was found to have an alternating exotropia with the left eye being dominant. She was not aware of this problem which has most likely been present since she was very young. Although she had a high anisometropia, there was only a one line difference in the visual acuities between the two eyes. She was referred to specialty clinic for a strabismus workup. Because she was non-binocular, aniseikonia testing was not performed.

Subject #10: D.T. was a 36 year old white male who complained of loss of vision in his right eye since a car wreck in 1966. He has complex/partial seizures which are controlled by dilantin and tegretol.

He was found to have a macular dysfunction in his right eye which prevented normal binocular vision. The aniseikonia testing was not performed due to this lack of binocularity. A spectacle prescription for near and far was given: -0.75D -0.50D X 105 OD, and -0.75D -0.75 D X 106 OS, plus a +1.50D add OU.

CONCLUSION

Although the findings of this study were valid, the sample size of this project was too small to make any inferences regarding the epileptic population. The compiled data shows four out of the five subjects with ideopathic epilepsy had measurable amounts of aniseikonia, however, none of these four had symptoms that warranted its correction. Also among these four subjects, only one had a large enough amount of aniseikonia (greater than one and a half percent)[4] to be significant as reported in the literature. Also, the same subject had the largest amount of anisometropia among the ideopathic epileptic subjects tested.

In summary, it should be noted that although the sample size was small, to find four out of the ten subjects having measurable aniseikonia leads one to question if chance alone was responsible for these findings. Further investigation using a larger population size is needed in this area so as to allow statistical analysis. If the results of such an investigation showed a higher prevalence of aniseikonia among the ideopathic epileptic population, an additional study

testing the use of lens therapy to control or reduce epileptic seizures in aniseikonic subjects would be of significant value. It would provide much insight into a possible cause, and perhaps a simple cure for this unexplained form of epilepsy.

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