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Visual profile of Romanian children and adults

Kathy Hendrickson

Pacific University

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Visual profile of Romanian children and adults

Abstract
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Degree Type
Thesis

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VISUAL PROFILE OF ROMANIAN CHILDREN AND ADULTS

BY

KATHY HENDRICKSON

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
For the degree of
Doctor of Optometry
May 22, 1999

Advisor:

Dr. Willard Bleything
THE VISUAL PROFILE OF ROMANIAN CHILDREN AND ADULTS ASSESSED THROUGH VISION SCREENINGS

May 22, 1999

Principal investigator:

Kathy Hendrickson

Faculty Advisor:

Willard Bleything O.D., M.S.
Biography

I am from Strathcona, Minnesota. I received a Bachelor of Science degree in Natural Science from the University of North Dakota in 1995. I have been involved in Amigos Eyecare, College of Optometrists in Vision Development, and the AOA Contact Lens Club while in optometry school. After I graduate, I hope to return to the Midwest to practice.

Acknowledgements

I would like to thank everyone who helped me organize and execute this thesis.

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Abstract

Epidemiological information was collected on 690 children and 190 adults on a recent eye care mission to Romania. Prevalence of refractive errors, binocularity and ocular health problems was recorded and evaluated. The data from the children population showed that 45% were emmetropic, 27% were myopic, and 28% were hyperopic. For the adults, 41% were emmetropic, 16% were myopic, and 41% were hyperopic. When compared to other nations, the average refractive error of the Romanian children was more myopic, and for the adults it was slightly more hyperopic. With-the-rule astigmatism had the highest occurrence when compared to other axis orientations, yet the overall occurrence of astigmatism was less than that found in other nations for both children and adults. The prevalence of strabismus and ocular disease was also shown to be less in the Romanian children in relation to other nations.

Key words: vision screening, Romanian children, baseline data
Introduction

Many studies have looked at the prevalence of refractive and ocular health conditions in children and adults of different nationalities, but there is no current research available for Romanian children or adults. Extensive studies have been performed on children in Finland.\textsuperscript{1,2,3,4,5} These studies show a higher frequency of myopia, increasing myopia with age, and that females were more likely to need glasses than males. Another study looked at the refractive status of children in Denmark.\textsuperscript{6} This study also showed the children to be shifting toward myopia. Sperduto found that 23-24\% of children in the United States were myopic.\textsuperscript{7} A study by Scheiman looked at the prevalence of vision and ocular disease conditions in a clinical pediatric population in the United States.\textsuperscript{8} Scheiman found that the most common conditions in children are refractive anomalies, binocular vision problems, and accommodative disorders. Studies have also been done in an adult Caucasian population by Hyams.\textsuperscript{9} It was found that in the adult population 18.4\% were myopic, 57.1\% were emmetropic, and 24.5\% were hyperopic. Another study done in Framingham, Massachusetts looked at visual acuity and refraction in an adult clinical population.\textsuperscript{10} This study showed that 83.7\% of the population had visual acuity of 20/20 or 20/25, and 59\% had spherical equivalent refractions of 0.0 to +2.0.

A problem with past prevalence studies is that they often show limited information on binocularity and ocular health of children. An additional problem is that many of these previous studies used a small number of subjects and were often retrospective in nature. This study addresses these issues by looking at
binocularity and ocular health along with refractive status in a large group of Romanian children and adults.

A study was done in Orinda, California that provided baseline data for future screenings. The Orinda study developed the Modified Clinical Technique (MCT) which isolated four main areas necessary for a screening: visual acuities, refractive status, eye coordination, and organic. This Modified Clinical Technique referred the greatest number of correct-referrals (99%) and the fewest over-referrals (4%). The MCT technique served as a model for the screening. The goal of this study was to provide a visual profile of Romanian children and adults.

Methods

Subjects selected were 690 Romanian children ages 2-18 and 190 adults ages 19-77. The children were from orphanages and schools. Most of the adults were caretakers and teachers at the orphanages and schools in rural Sibiu. A temporary clinic was set up in Boita, Agnita, Turnu Rosu, and Talmaciu to screen refractive status, binocularity, and ocular health. Thirteen optometry students and 2 optometrists performed the screenings assisted by local residents who helped with translation. Patients were seen on a first come, first serve basis. The exam was divided into five stations. At the first station, translators registered each subject and a case history was performed. At the second station, visual acuity was tested at far using the picture and Snellen charts. Findings were recorded in Snellen fraction form. Unilateral and alternating cover tests were performed at a 20-foot distance with the patient fixating at a 20/40 Snellen letter. A phoria or tropia was measured at this time. At the third station, the refractive
status was found using a Retinomax autorefractor. Patients with low visual acuity and poor autorefractor results were retested with a lens bar and a retinoscope. Station four consisted of a series of near tests. Visual acuity at near was taken using a Snellen or picture chart. Findings were recorded in Snellen fraction form. Motility and near point of convergence were done at a 40-centimeter distance using colored beads on a wand. A randot stereoacuity card was used to test binocularity. At station five, an ophthalmoscope was used to check ocular health and pupils. The anterior segment evaluation included examining the lids, cornea, conjunctiva, and iris. The posterior segment evaluation included the C/D ratio, foveal light reflex, optic disc margins, and color. Pupils were assessed for diameter, direct and consensual responses, and an afferent pupillary defect. After the subject had finished all of the testing, a supervising optometrist looked at the findings and referred patients who met the referral criteria (Table 1). Station six was the glasses dispensary. Various service clubs provided the recycled spectacles prior to departure for the trip. They were sorted, cleaned, verified, and catalogued according to lens power and gender style by members of Amigos Eye Care, a student outreach group. If it was determined that the subject needed glasses, one of the clinicians would try to find a pair of glasses that matched the subject's prescription.

The data collected were entered into Filemaker Pro 2.1 database and frequency tables derived. The data were then exported into Excel and descriptive statistics computed. Because this study involved a pediatric population, not all of the tests could be administered to all of the subjects.
Table 1. Referral criteria used during the screening. Criteria is based on the format used at Pacific University College of Optometry.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Procedure</th>
<th>Criteria for Referral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance Visual Acuity</td>
<td>Snellen or Picture Chart</td>
<td>20/30 or poorer, either eye</td>
</tr>
<tr>
<td>Near Visual Acuity</td>
<td>Snellen Chart</td>
<td>20/30 or poorer, either eye</td>
</tr>
<tr>
<td>Refractive Error</td>
<td>Autorefractor or Retinoscopy</td>
<td></td>
</tr>
<tr>
<td>Hyperopia</td>
<td></td>
<td>+1.50 or greater</td>
</tr>
<tr>
<td>Myopia</td>
<td></td>
<td>-0.75 or greater with acuity loss</td>
</tr>
<tr>
<td>Astigmatism</td>
<td></td>
<td>1.00D or more</td>
</tr>
<tr>
<td>Anisometropia</td>
<td></td>
<td>1.00D or more</td>
</tr>
<tr>
<td>Eye Posture (Distance)</td>
<td>Cover Test</td>
<td></td>
</tr>
<tr>
<td>Tropia</td>
<td></td>
<td>Any tropia</td>
</tr>
<tr>
<td>Esophoria</td>
<td></td>
<td>5&quot; or more</td>
</tr>
<tr>
<td>Exophoria</td>
<td></td>
<td>10&quot; or more</td>
</tr>
<tr>
<td>Hyperphoria</td>
<td></td>
<td>2&quot; or more</td>
</tr>
<tr>
<td>Ocular Health</td>
<td>Direct Ophthalmoscopy and External observation</td>
<td>Any verified pathology or medical anomaly of eye and/or adnexa</td>
</tr>
<tr>
<td>Ocular Motilities</td>
<td>Bead Skills</td>
<td>Any anomalies</td>
</tr>
<tr>
<td>Saccadics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pursuits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraocular Muscles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convergence</td>
<td></td>
<td>Break 10 cm / recovery 18 cm</td>
</tr>
<tr>
<td>Stereoacuity</td>
<td>Lang Stereo Card</td>
<td>No stereo acuity</td>
</tr>
</tbody>
</table>

Results

Distance Acuity

Children: Acuities ranged from 20/10 to no light perception (Figure 1). The majority of the children ranged from 20/13 to 20/50. For the right eye, 65% of the children got 20/20 or better. For the left eye, 68% of the children got 20/20 or better.
Figure 1. Visual acuity results for the right eye, left eye, and both eyes at distance for children.
Adults: Acuities ranged from 20/10 to 20/4000 with the majority ranging from 20/13 to 20/50 (Figure 2). For the right eye, 59% of the adults got 20/20 or better. For the left eye, 60% of the adults got 20/20 or better.

**Refractive Data**

Children: Refractive data were collected from 506 subjects (Figures 3 and 4). Patients were divided into gender with 245 girls and 261 boys. Sphere power was defined by using autorefraction findings. Emmetropia was defined as −0.25 to +0.50. The mean right eye sphere power was +0.15D for the girls and +0.20D for the boys. The mean left eye sphere power was +0.30D for the girls and +0.41D for the boys. For both the boys and girls, the majority of refractive errors fell between −2.75 to +2.75. Forty-five percent of the girls and boys were considered emmetropic. Of the children, 27% of the girls and 28% of the boys were myopic, 29% of the girls and 27% of the boys were hyperopic.

Adults: Refractive data were collected from 116 adults (Figures 5 and 6). Patients were divided into gender with 76 females and 40 males. The mean right eye sphere power was +0.74D for the females and +0.45D for the males. The mean left sphere power for the females was +0.52D and +0.70D for the males. For both the females and males, the majority of refractive errors fell between −2.00 to +2.00. Forty percent of the females and 43% of the males were considered emmetropic. Of the subjects, 18% of the females 13% of the males were myopic, and 41% of the females, and 43% of the males were hyperopic.
Figure 2. Visual acuity results for the right eye, left eye, and both eyes at distance for adults.
Figure 3. Spherical values from the autorefractor for children.

Figure 4. Spherical values from the autorefractor for children.
Figure 5. Spherical values from the autorefractor for adults.

Figure 6. Spherical values from the autorefractor for adults.
Astigmatism

Children: For the right and left eye 18% of the girls and 13% of the boys had astigmatism greater than or equal to 1D. The dioptric range of astigmatism was from $-0.25$ to $-4.50$D (Figures 7 and 8). For the right eye, 47% of the girls and 47% of the boys had a with-the-rule astigmatism (axis between 1-30 or 150-180 degrees). For the left eye, 58% of the girls and 54% of the boys had a with-the-rule astigmatism. For the right eye 34% of the girls and 37% of the boys had an against-the-rule astigmatism (axis between 60-120 degrees). For the left eye 29% of the girls and 32% of the boys had an against-the-rule astigmatism. For the right eye 19% of the girls and 16% of the boys had an oblique astigmatism (axis between 31-59 or 121-149 degrees). For the left eye, 12% of the girls and 14% of the boys had an oblique astigmatism. The frequency of with-the-rule, against-the-rule, and oblique astigmatism can be seen in figures 9 and 10.

Adult: For the right eye 19% of the females and 25% of the males had astigmatism greater than or equal to 1D. For the left eye, 19% of the females and 18% of the males had astigmatism greater than or equal to 1D. The dioptric range of astigmatism was $-0.25$ to $-4.25$D (Figures 11 and 12). For the right eye, 53% of the females and 43% of the males had a with-the-rule astigmatism (axis between 1-30 or 150-180 degrees). For the left eye, 49% of the females and 42% of the males had a with-the-rule astigmatism. For the right eye 31% of the females and 43% of the males had an against-the-rule astigmatism (axis between 60-120 degrees). For the left eye, 39% of the females and 36% of the males had an against-the-rule astigmatism. For the right eye 16% of the females
Figure 7. Cylindrical values from the autorefractor for children.

Distribution of OD Cylinder Powers

Figure 8. Cylindrical values from the autorefractor for children.

Distribution of OS Cylinder Powers
Figure 9. Cylindrical axis findings from the autorefractor for children.

Distribution of OD Axis

Figure 10. Cylindrical axis findings from the autorefractor for children.

Distribution of OS Axis
Figure 11. Cylindrical values from the autorefractor for adults.

Distribution of OD Cylinder Powers

Figure 12. Cylindrical values from the autorefractor for adults.

Distribution of OS Cylinder Powers
and 14% of the males had an oblique astigmatism (axis between 31-59 or 121-149 degrees). For the left eye, 11% of the females and 21% of the males had an oblique astigmatism. The frequency of with-the-rule, against-the-rule, and oblique astigmatism can be seen in figures 13 and 14.

Near Point of Convergence

Children: The near point of convergence breaks for the children ranged from 0 to 70 centimeters. The majority of students, 86% fell between 0 and 6 centimeters. Figure 15 shows the frequency of the NPC in the children.

Adults: The near point of convergence breaks for the adults ranged from 0 to 30 centimeters. The majority of adults, 76% fell between 0 and 6 centimeters. Figure 16 shows the frequency of the NPC in the adults.

Ocular Health

Children: Of all the children tested only 1.3% had any ocular health problems (Table 2).

Adults: Of the adults tested, 9.2% had ocular health problems (Table 3).

Table 2. Results of ocular health assessment in children.

<table>
<thead>
<tr>
<th>Ocular Health Problem</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataracts</td>
<td>0.29%</td>
</tr>
<tr>
<td>Corneal scar</td>
<td>0.14%</td>
</tr>
<tr>
<td>Episcleritis</td>
<td>0.14%</td>
</tr>
<tr>
<td>Foreign body</td>
<td>0.43%</td>
</tr>
<tr>
<td>Hordeolum</td>
<td>0.14%</td>
</tr>
<tr>
<td>Impetigo</td>
<td>0.14%</td>
</tr>
<tr>
<td>Pigment in the retina</td>
<td>0.14%</td>
</tr>
</tbody>
</table>
Figure 13. Cylindrical axis findings from the autorefractor for adults.

Figure 14. Cylindrical axis findings from the autorefractor for adults.
Figure 15. Near point of convergence (NPC) results in children. Only break results are listed.

![Near Point of Convergence](image1)

Figure 16. Near point of convergence (NPC) results in adults. Only break results are listed.

![Near Point of Convergence](image2)
Table 3. Results of ocular health assessment in adults.

<table>
<thead>
<tr>
<th>Ocular Health Problem</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARMD</td>
<td>1.60%</td>
</tr>
<tr>
<td>Bilateral PVD</td>
<td>0.53%</td>
</tr>
<tr>
<td>Cataracts</td>
<td>2.10%</td>
</tr>
<tr>
<td>Corneal opacity</td>
<td>1.00%</td>
</tr>
<tr>
<td>Diabetic Retinopathy</td>
<td>0.53%</td>
</tr>
<tr>
<td>Failed cataract surgery</td>
<td>0.53%</td>
</tr>
<tr>
<td>Irregular pupil</td>
<td>0.53%</td>
</tr>
<tr>
<td>Macula changes</td>
<td>0.53%</td>
</tr>
<tr>
<td>Macula scarring</td>
<td>1.00%</td>
</tr>
<tr>
<td>Neuritis as a child (macula abnormal)</td>
<td>0.53%</td>
</tr>
<tr>
<td>Pinguecula</td>
<td>0.53%</td>
</tr>
<tr>
<td>Pterygium</td>
<td>0.53%</td>
</tr>
<tr>
<td>Retinal hole</td>
<td>0.53%</td>
</tr>
</tbody>
</table>

Motility

Children: Four percent of the children did not pass the motility tests. The failure was due to restriction or nystagmus.

Adults: Of the adults tested, 1.6% did not pass the motility tests. This failure was due to muscle restriction.

Phorias and Tropias at Distance

Children: Sixty-six percent were orthophoric, 13% were esophoric, 16% were exophoric, 0.4% were hyperphoric, 4.4% were esotropic, 1.6% were exotropic, 0.4% were hypertropic, and 1 patient had a dissociated vertical deviation (Figure 17).

Adults: Seventy-two percent were orthophoric, 8.8% were esophoric, 14% were exophoric, 0.6% were hyperphoric, 2.5% were esotropic, 1.2% were exotropic, and 1.2% were hypertropic (Figure 19).
Figure 17. Results of the cover test at distance in children.

Distance Cover Test

- O = orthophoric
- EP = esophoric
- XP = exophoric
- HP = hyperphoric
- ET = esotropic
- XT = exotropic
- HT = hypertropic
- DVD = dissociated

Figure 18. Results of the cover test at near in children.

Near Cover Test

- O = orthophoric
- EP = esophoric
- XP = exophoric
- HP = hyperphoric
- ET = esotropic
- XT = exotropic
- HT = hypertropic
- DVD = dissociated

vertical deviation
Figure 19. Results of the cover test at distance in adults.

Distance Cover Test

Eye Posture: O=orthophoric, EP=esophoric, XP=exophoric, HP=hyperphoric, ET=esotropic, XT=exotropic, HT=hypertropic

Figure 20. Results of the cover test at near in adults.

Near Cover Test

Eye Posture: O=orthophoric, EP=esophoric, XP=exophoric, HP=hyperphoric, ET=esotropic, XT=exotropic, HT=hypertropic
Phorias and Tropias at Near

**Children:** Thirty percent were orthophoric, 10% were esophoric, 54% were exophoric, .31% were hyperphoric, 5.3% were esotropic, 2.1% were exotropic, .31% were hypertropic, and 1 patient had a dissociated vertical deviation (Figure 18).

**Adults:** Thirty-three percent were orthophoric, 4% were esophoric, 57% were exophoric, .5% were hyperphoric, 3% were esotropic, 1.6% were exotropic (Figure 19).

**Stereopsis**

**Children:** On stereopsis testing, 8% of children could not appreciate stereopsis. The majority of the students (80%) could achieve 200 arcseconds or better (Figure 21).

**Adults:** On stereopsis testing, 6.7% of adults could not appreciate stereopsis. The majority of adults, 84% could get 200 arcseconds or better (Figure 22).

**Dispensing**

**Children:** A total of 129 pairs of glasses were dispensed. Eighty-six percent were plus lenses and 14% dispensed were minus lenses. Twenty percent of the children screened needed a prescription. Within the parameters of the recycled glasses taken on the trip, we were able to provide 98.4% of the lens prescription needs.

**Adults:** A total of 103 pairs of glasses were dispensed to the adults. Eighty-six percent were plus lenses and 14% were minus lenses. Fifty-nine percent of the
Figure 21. Results of stereocuinity testing in children.

Figure 22. Results of stereocuinity testing in adults.
adults screened needed a prescription. We were able to provide a lens for 95.3% of the subjects.

Discussion

Children: This population showed that 30% of the children had visual acuities of less than 20/25. This is considerably greater than studies done by Laatikainen who found 10.0-13.4% of Finnish children have reduced acuity. Both of Laatikainen studies and this study used a Snellen chart to assess visual acuity. The study also showed a higher prevalence of myopia (26.5-27.9%) than other populations. Myopia rates for similar age groups in other countries were lower: 17.6% United States, 24.5% Finland. This apparent increase in myopia may be due to the autorefractor overminusing the children or the children accommodating through the autorefractor. Other possibilities that may cause an increase in myopia are genetic factors, environmental stresses, or diet. In comparing the children to the adults, the children show a higher percentage of myopia. This may point to environmental stresses or diet contributing to the increase of myopia. Of the Romanian patients, 15.6% exhibited astigmatism, while there were 22.4% of patients with astigmatism in the United States, and 1.7% in Finland. The Romanian children also showed a 1.3% prevalence of ocular disease problems. This is lower than other studies. The children also showed a lower incidence of strabismus (4.4-5.3% esotropia, and 1.6-2.1% exotropia) than United States children did. Scheiman found that 6.6% of United States children were esotropic, and 4.7% were exotropic. This difference may be attributed to the fact the Scheiman looked at a clinical population and this
study is a general population. Another study shows that only 4.6% of Finnish children were strabismic. This Romanian population showed that a number of children had no stereopsis (8%) was greater than the Finnish children who had no stereopsis (4.4%). This may be misleading because Laatikainen used the Titmus test to assess stereoacuity and this study used the Lang Stereo Card.

Adults: In this population, visual acuity of 20/30 or better was significantly lower (67-69%) than a United States population (81.4%). This population also showed an increased amount of hyperopia (40.7-42.5%). In comparison, Hyams found that 24.5% of Caucasian patients were hyperopic. Twenty percent of the Romanian patients showed astigmatism equal to or greater than 1 diopter. A Finnish study showed that 56.2% of that population had astigmatism.

Conclusions
Fortunately, we were able to treat most patients' refractive anomalies and had glasses that were fairly adequate for their needs. If we were unable to supply glasses, one of two things could happen. For the patients who could afford to buy glasses in the community they were given a written prescription. If the patient could not afford glasses, the prescription was given to a missionary who would have it filled. There were a few patients that we were unable to treat. We referred these patients to ophthalmologists for strabismus evaluations, cataract assessments, and foreign body removals. In the community there are opticians and ophthalmologists, but most of the people we saw could not afford to see these clinicians. Fortunately, Northwest Medical Teams was planning to send a group of ophthalmologists into this community shortly after we left.
### Summary Chart

<table>
<thead>
<tr>
<th></th>
<th>Children</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients needing prescription</td>
<td>20.0%</td>
<td>59.0%</td>
</tr>
<tr>
<td>Supplied prescription</td>
<td>98.4%</td>
<td>95.3%</td>
</tr>
<tr>
<td>Referred to optician to fill prescription</td>
<td>1.30%</td>
<td>3.70%</td>
</tr>
<tr>
<td>Referred to missionary to fill prescription</td>
<td>0.28%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Referred to ophthalmologist</td>
<td>4.2% of children and adults</td>
<td></td>
</tr>
</tbody>
</table>
References


