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Comparison of the face part acuity chart with the child recognition chart and the light house picture chart

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COMPARISON OF THE FACE PART ACUITY CHART WITH THE CHILD RECOGNITION CHART AND THE LIGHT HOUSE PICTURE CHART

By

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A thesis submitted to the faculty of the College of Optometry Pacific University Forest Grove, Oregon for the degree Doctor of Optometry May, 1989

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Jim Franta

John Mari

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We would like to acknowledge Chris Gross and Paul Kohl for the development of the Face Part Acuity Chart and the idea for this project. We would most like to thank Sandra Landis for taking the time to advise and help us in completing this project.
ABSTRACT

The Face Part Visual Acuity Chart was developed by Dr. Chris Gross in 1986. The chart is designed to obtain more reliable acuity measurements from children one to four years in age. In this project the Face Part Chart is compared individually to two standard near point cards. The Light House Chart and the Child Recognition Chart were compared to the new chart for accuracy and testability. Although the Face Part Card showed promise, more refinements are needed before it proves to be clinically useful.
INTRODUCTION

Our sight is a very precious sense. From the moment a child is born he starts learning about the world through vision. Many people think vision operates similar to a camera, but it is much more complex. Vision is part of the total development of a young person. Through vision a person gains an understanding of the world that shapes his background, behavior and ability to negotiate physical space.

Since vision is such an important part of development, it is interesting that until the last 30-40 years there has been little emphasis on examining a young child's vision for deficiencies. It is known however that the first several years of a child's life are critical to development. Any deficiencies that a child may have can seriously alter his development.

Testing vision in older children (age 7 and up) and adults has always been easier because at these ages they can communicate and express themselves. At an early age of life however, a young child can not always recognize and communicate there is something wrong. If the problem has been present since birth the child may not even know that his visual experience is different. He may just think that is the way life is!

Over the years there has been much study into the normal visual development of a child. This has been made possible by better objective and subjective methods of testing the visual components. The study of visual development was mainly conducted by researchers. Since it has been done in the research environment, clinicians are now able to use similar procedures in the office. As a result we have been able to examine visual functioning in younger and younger children. Most authorities in this area feel that a child should receive his first eye exam at 6 months of age. By being able to test vision at such an early age, problems can be diagnosed and corrected before they interfere with the developmental process.

In any vision exam an accurate evaluation of visual acuity (eye sight) is an important first step. Visual acuity tests the ability to discriminate detail. An assessment of visual acuity will tell the examiner how well this child performs on this task as compared to other "normal" children of the same age. If an examiner finds a below normal visual acuity it starts
off a whole series of subsequent tests to establish the reason. Is it a refractive error, due to some disease process, or due to some functional disorder? Visual acuity also tells the examiner whether or not a person is capable of performing a certain task such as reading or driving a car. A repeatable assessment of visual acuity can also show whether improvement is made through refractive measures or another treatment modality such as orthoptic or medical intervention.

Testing visual acuity in the majority of adults is a relatively simple procedure because the adult patient can communicate verbally with the examiner. This patient can reliably tell the examiner whether or not he can discriminate different levels of detail. With the young child testing visual acuity becomes considerably more difficult because of the lack of verbal communication skills between the child and the examiner. It is especially important to test visual acuity in young children because it is at these early ages that many vision problems manifest themselves. Consider that if all non-traumatic strabismic's (congenital and acquired) are considered together the most frequent onset of strabismus is between the ages of 2 and 4. Commonly associated with strabismus is amblyopia, and the classical way to test for this condition is to assess visual acuity. It is disturbing to note that the age group in which amblyopia is most prevalent is also the age group that is most difficult to assess visual acuity reliably.

There are several methods used to test visual acuity. Of the many methods used, by far the most widely used procedure is the use of optotypes. The principle of the optotype were set in 1862 and suggested the use of a set of letters constructed so that each of the constituent parts of the letter and the separation between each part should subtend 1 minute of arc at the nodal point of the eye at a specified distance. From this basic principle many different styles of charts have evolved for both adults and children. The special charts developed for children are modified to bridge the verbal communication gap between adult and child.

Charts utilizing optotypes to assess visual acuity in young children fall into three groups:

1. Picture charts are made with simple pictures that are intended to be familiar to a young child. Picture tests have been described as early as 1872. When using a picture chart the child's task is to simply identify
the picture. Studies into the age at which pictures can be recognized have shown that children as young as 2 years old can perform this task and by 2.5 about 70% of the children can be tested using this method. Many of these charts are inadequate for the pictures are unfamiliar to the child. They are also complicated by a period of conditioning that is required to acquaint the child with the optotypes making the process inefficient and lengthy.

2. Orientation charts utilize a single test character presented at different orientations. The child is asked to respond to a particular orientation by pointing or holding a cut-out in the identical orientation. This chart works well with older children. The chart is troublesome for younger children (i.e. 2-5) because many have not yet developed an adequate directional sense, especially in the horizontal direction.

3. Matching charts utilize a simple optotype which must be matched by pointing to a corresponding figure on a similar card or by holding up the matching cut-out. This task appears to be less well understood than that of picture naming by children under 3 years of age but can be used on younger children than tests that require orientation.

One other visual acuity test that deserves mention is Preferential Looking. This test is based on the concept that a young child would rather look at a striped pattern than a blank target. Early in its development preferential looking was used as a research tool and was not very clinically useful. The equipment was large and burdensome and subjects had to be run through the test a number of times before a result could be reliably measured. Now the equipment is made less cumbersome and different testing techniques have been developed so that the examination time has been cut down. Preferential looking is fast becoming the method of choice in very young children. This technique can be used as early as a few months after birth to about 18 months of age. After this age however young children lose interest with this technique and reliability falters.

The age group from about 18 months to 48 months that is most difficult to assess visual acuity. Many charts have been developed for this age group but none are a panacea for the problems encountered with this age group.

The Chart this study is attempting to use was developed by Dr. Chris Gross while attending Pacific University College of Optometry. The chart
she developed was designed in an attempt to construct a new acuity test optotype which would minimize the drawbacks of the other picture chart optotypes. On her chart she designed familiar optotypes of the eye, ear, nose, and mouth. Hence it is called the Face Part Acuity Chart (FPAC). The reasoning behind using these figures is that young children see these features from their earliest days therefore these would be familiar objects to them. Many parents also teach a game of pointing to facial features as early as one year of age. It was hoped that by using these features as optotypes they would be more familiar to all children. It was also expected that pre-verbal children, handicapped children and adults, and non-english speaking children could use this chart by simply pointing to their own corresponding feature.

The Face Part Acuity Chart was developed by Dr. Gross in 1986. It has never been used on a large population and compared to any of the other commonly used picture charts. This study's goal is to test a large population of young children age 18-48 months using the Face Part Acuity Chart, Child Recognition Chart and the Lighthouse Picture Chart. Percent testable and acuity values will be reported for each chart. A standard T test will be used to evaluate if there is a significant difference between each chart. Subjective comments will also be made as to the Face Part Acuity Chart's effectiveness with this population.
METHODS

The children used in the study were selected at random from various day care centers located around the Washington County area. The age groups and the number of subjects per age group were as follows:

<table>
<thead>
<tr>
<th>AGE</th>
<th>NUMBER OF CHILDREN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 YEARS</td>
<td>7</td>
</tr>
<tr>
<td>2.0 YEARS</td>
<td>8</td>
</tr>
<tr>
<td>2.5 YEARS</td>
<td>8</td>
</tr>
<tr>
<td>3.0 YEARS</td>
<td>21</td>
</tr>
<tr>
<td>3.5 YEARS</td>
<td>16</td>
</tr>
<tr>
<td>4.0 YEARS</td>
<td>23</td>
</tr>
</tbody>
</table>

We allowed a three month cushion on each side of the age groups in order to keep the age brackets as accurate as possible to the child's actual birth date.

The near point cards used were the American Optical Child Recognition Near Point Test, the Lighthouse Low Vision Services' Near Vision Test Symbols for Children, and Dr. Chris Gross' Face Part Acuity Chart. All of the children were tested in the morning and in the familiarity of their own day-care in order to alleviate as much anxiety as possible. Each child was tested both monocularly and binocularly at 13 inches under standard near point illumination. The subjects were first asked to identify each picture in the 20/300 to 20/400 range. They were also asked to identify the four face parts used on the Face Part Acuity Chart by simply pointing to the corresponding part on their own face. They were told what a certain picture was if they couldn't identify it. We then proceeded to test each child's visual acuity to the clinically significant level of 20/30 and recorded the findings. A line was credited if over 50% of the pictures were correctly identified. We also recorded a response column in which we as clinicians assessed each child's subjective response to each of the three visual acuity cards.
RESULTS

The data received from our test population was gathered and analyzed according to the ages of each subject. We then compared the newly developed Face Parts Visual Acuity Chart individually against both the Light House Chart and the Child Recognition Chart. We statistically compared the results using the paired T-test and experimentally we were willing to accept a 5% error as the criterion to reject our null hypothesis (that the two matched acuity tests yielded the same acuity threshold). We also recorded any subjective responses given, as to the ease or confusion presented by each test.

When comparing the Face Parts Acuity Chart against the Light House Acuity Chart our "P" values were as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5  yrs.</td>
<td>.132</td>
</tr>
<tr>
<td>3.0  yrs.</td>
<td>.288</td>
</tr>
<tr>
<td>2.0  yrs.</td>
<td>.20</td>
</tr>
<tr>
<td>3.5  yrs.</td>
<td>.16</td>
</tr>
<tr>
<td>2.5  yrs.</td>
<td>.076</td>
</tr>
<tr>
<td>4.0  yrs.</td>
<td>.004</td>
</tr>
</tbody>
</table>

Holding to our experimental design we cannot reject our null hypothesis: there is no difference in the two tests except in the 4.0 year old category. When compared to the same Face Part Chart to the Child Recognition Card our "P" values were as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5  yrs.</td>
<td>.109</td>
</tr>
<tr>
<td>3.0  yrs.</td>
<td>.27</td>
</tr>
<tr>
<td>2.0  yrs.</td>
<td>.19</td>
</tr>
<tr>
<td>3.5  yrs.</td>
<td>.041</td>
</tr>
<tr>
<td>2.5  yrs.</td>
<td>.025</td>
</tr>
<tr>
<td>4.0  yrs.</td>
<td>.0048</td>
</tr>
</tbody>
</table>

Holding to the experimental design, we now only can reject the null hypothesis in 50% of the groups (2.5 yrs., 3.5 yrs., 4.0 yrs.).

The percentage of each age group that was able to conceptualize and respond to each given test was recorded. It was found that in the 1.5 year group a mere 14% of infants tested could give seemingly valid responses to the Face Part Chart. The percentage rose to 42% in the other two charts that were used. In the 2.0 year category, 62.5% response rate was recorded across the board. At the level of 2.5 years and older, 100% of the subjects were able to respond.

Objectively, it was quite evident the Face Part Acuity Chart presented the greatest challenge to the infant population. Much more time was
needed to instruct the patient as to the identity of each target. The tests were marred with identification reversals of both the nose and ear pairing and with the eye and mouth. This problem was much more evident when the acuity demands were in the 20/40 - 20/30 range.

Discussion

The newly developed Face Part Acuity Chart requires the identification of common facial features. The response may be relayed verbally or by simply pointing to the involved feature. In theory, the card would be clinically useful for acuity measures on pre-verbal or non-verbal infants as well as infants who are easily intimidated and have trouble communicating in such situations. Our experimental results show the card may need some revisions before it is truly clinically applicable.

The statistical analysis reveals a lack of evidence to totally reject the null hypothesis, (that the compared acuity tests have the same thresholds). In some cases the new card may function very adequately. In fact we witnessed some of the older test subjects (3 and 4 yr. old) performing equally well on all acuity cards presented. Although they proved the card has potential, they were not the target population that the card wanted to service.

When the card was introduced to the younger population (1.5 and 2 yr. old), we could only obtain a 14% response rate as compared with a 42.5% rate on the other cards. The main obstacle seemed to be the recognition of the test targets as actual parts of facial anatomy. Even after extensive tutoring as to their identities at the 20/400 level, the subjects would consistently confuse the nose target with the ear configuration and visa-versa. The same problem occurred with the eye target and the mouth target. The theory that young children (1.5-2.0 yr. old) know this anatomy and that it could be used to test visual acuity has merit. When each subject was instructed verbally to touch each facial part before seeing the card, most had no problems. The illustrations need to be refined before they are more easily recognizable to a child.
Data from "% RESPONSE PER AGE"
Data from "AGE GROUP VS MEAN OF M.A.R."

Age Range | LIGHTHOUSE | FACE PART | C.R.C.
--- | --- | --- | ---
0 | 1.91 | 1.59 | 1.54
0.5 | 1.53 | 1.54 | 1.54
1 | 1.96 | 1.62 | 1.96
1.5 | 1.62 | 1.5 | 1.5
2 | 2 | 1.5 | 1.5
2.5 | 1.5 | 1.5 | 1.5
3 | 1.59 | 1.54 | 1.54
3.5 | 1.92 | 1.54 | 1.54
4 | 2.24 | 1.54 | 1.54
CONCLUSION

The need for vision testing at an early age is very important. Many vision problems such as myopia, strabismus, amblyopia, and glaucoma are present at birth or develop in the first few years of life. It is important to have a battery of tests to evaluate a young child's visual skills so that prevention and remediation can take place at an early age. Because this age group is so very young, many "standard" optometric tests and equipment do not fit the needs of this group. One such test is visual acuity. There are a number of specially designed charts with special symbols used to test visual acuity in this age group. One such chart was developed by Dr. Chris Gross while at Pacific University. Dr. Gross worked on this problem and developed the Face Part Acuity Chart. This chart utilizes familiar face features as test characters to assess visual acuity. The chart theoretically should eliminate or reduce problems such as letter recognition and verbalization. The goal of this project was to evaluate the effectiveness of this chart and compare it with two other commonly used acuity charts.

The new acuity chart was tested and the results analyzed. Although the subjects demonstrated the ability to locate each face part when asked, the illustrations were too confusing to the majority of our test population. The concept of the pictures on the Face Part Acuity Chart has good potential, but without refinement of the illustrations on the chart it does not warrant clinical use.
REFERENCES


