

## VISION SCREENING FOR CHILDREN

Vision disorders are the fourth most common type of disability in the United States, and the most prevalent disability for American children (National Eye Institute 2004). Though most vision problems are not extreme and can be corrected easily, only 14 percent of children receive comprehensive vision exams before five years of age (Optos 2005). Problems with vision in childhood can lead to difficulty in the classroom because approximately 50 percent of students with learning difficulties have vision disorders (Optos 2005). Catching and correcting these disorders through regular school vision screening often leads to improvement in the classroom.

### Overview of Vision Disorders

Vision disorders can be divided into two basic groups, refractive errors and non-refractive errors:

- Refractive Errors- Eye disorders that result from the eye not focusing accurately on light, which results in blurred vision.
- Non-Refractive Errors- Eye problems that are caused by diseases in the eye.

While refractive errors are seen in almost 20 percent of children, non-refractive errors are much less common and more serious.

Some common refractive errors include (Children's Hospital Boston 2005):

- Myopia or nearsightedness
- Hyperopia or farsightedness
- Astigmatism- a disorder in which the cornea of the eye is abnormally curved resulting in decreased vision

- Amblyopia or lazy eye- a disorder that occurs when decreased vision in one eye leads to an overcompensation by the strong eye
- Strabismus or crossed-eyes

### Unique Problems for Vision Impaired Children

Before the issues regarding the necessity of screening children for vision problems can be discussed, the unique difficulties encountered when screening children must be addressed. Many vision tests assume the patients to be tested have a certain basic level of knowledge, such as being able to read the alphabet. For example, the common E Chart test is not applicable to children of preschool age or younger because they have not usually learned to read. Several manufacturers of vision testing supplies have tackled this obstacle by making charts and flash cards with familiar symbols, such as a house, an animal, or shapes, but even this test must be first screened for validity by asking the child to name or match the objects at a close distance to ensure quality of the results. Most card manufacturers do not recommend their cards to be used until the child is two and a half to three years of age.

Age can also present a problem in testing for vision impairment not because of the level of knowledge required to take the test, but because of the level of patience and maturity needed to complete a test. Young children often have a hard time sitting still during an eye exam or eye screening making completing a test difficult (American Family Physician 2004). Another

problem faced by families of children with impaired vision is the difficulty parents encounter in even assessing that there is a vision problem to begin with. Many parents do not know that their child has a vision problem for a long time because vision problems do not hurt, and children have no way of knowing how well they should see (National Eye Institute 2005).

### **The Vision in Preschoolers Study (VIP Study)**

Little empirical research has been conducted regarding vision screening for children. The VIP study is by far the most comprehensive experiment, studying thousands of randomly selected preschoolers enrolled in the Head Start program from various geographic regions within the United States.

The VIP study consists of three unique phases:

- Phase I- A two year period during which 11 different screening tests were administered by licensed eye care professionals (optometrists and ophthalmologists) and compared for performance.
- Phase II- The four most accurate screening tests were administered to over 1,000 head start preschoolers (most of whom had been identified as prone to vision problems by phase I) by both pediatric nurses and lay screeners.
- Phase III- The last phase is still underway but will be an extension of phase II.

Results of the VIP study, while still developing, are promising with regard to the possibility that lay screeners and school nurses can administer vision tests accurately. This study suggests that the “gold standard” for vision screening which is the costly and time consuming method that includes optometrists administering tests to children on a regular basis, may not be necessary because simpler and less expensive tools and test givers could be used. Using the four most precise instruments, school nurses correctly identified up to 68 percent of children with vision disorders and lay screeners correctly identified up to 62 percent of these children. Additionally, both nurses and lay screeners correctly identified over 80 percent of children

with severe eye conditions. These correctly identified percentages increase even more when controlled for the type of instrument used when administering the test. Two of the four tools established as most accurate (the Retinomax Autorefractor and the SureSight Vision Screener) were just as effective when used by nurse screeners and lay screeners in phase II as when used by licensed eye care professionals in phase I (The Vision in Preschoolers Study Group 2005).

### **Examining Specific Tools for Vision Testing**

Four of the eleven tools used in Phase I of the VIP study were identified as the most accurate. These four tools are:

- Retinomax Autorefractor- Automated refractors, or autorefractors are used to measure the patients refractive error and evaluate them for contact lenses or glasses. These tools work by measuring how light is changed and focused on an object when entering a person’s eye. These handheld and compact units measure the patient’s refractive error by letting them rest their chin on the machine while they look directly at the image inside (such as a tree or a house). The machine then measures when the image is blurry and clear to them by measuring the amount of light entering the eye (Wikipedia 2005). Autorefractors (as opposed to the traditional subjective refraction tests where patients tell the doctor which view is clearer) are especially good for nonverbal patients such as children because they are quick, painless, and do not require any patient feedback (Gole GA, Schluter PJ, Hall J, Colville D, 2003). These units are made by a variety of companies and can cost anywhere from \$7,000 to \$20,000 (Norath 2001).
- SureSight Vision Screener- The SureSight Vision Screener is very similar to the Retinomax Autorefractor. The SureSight Vision Screener is not an autorefractor, but is a screening autorefractor and is usually used by school nurses rather than licensed eye care professionals. It is similar to an autorefractor in function but only assesses whether or not the patient has a refractive

error, not whether they will need a prescription and what that prescription should be. The SureSight Vision Screener costs \$4,650 (Miami Medical 2005, Welchallyn 2005).

- Linear Lea Symbols VA Test- Lea tests are a unique variety of tests including symbols and letters invented by a Finnish ophthalmologist. These tests are unique because the symbols used transform into rings or balls when the patient can no longer see them clearly. This is especially helpful for children who have failed several vision screenings because since they always see a symbol, self-esteem is not a factor interfering with the validity of the test. These tests come in a variety of forms including flash cards, books, and traditional eye charts. It is important to note however, that vision measured with a single symbol may not be as accurate as when measured by a chart or line test so this must be taken into account when using this type of test (Visual Acuity Tests 2005, Precision Vision, 2003).
- Stereo Smile II- Stereo tests are used to measure three dimensional viewing and depth perception. Problems in these areas of vision are important because they are associated with eye disorders such as amblyopia, suppression, and strabismus. The pediatric tests include things such as 3D viewing glasses and charts with symbols for the patient to match. Prices for these types of vision testing tools vary but are usually in the \$1,000 range (Medical Mail Order 2005).

In addition to these four tools tested in the VIP study, another method of screening, called photoscreening is becoming popular. Photoscreening relies on a light beam being directed into the patient's eye and a photograph, or digital image, being taken of the pupil. This method is preferable according to some because it would allow young children to be tested easily and quickly, and with further research, it may be an option to replace the traditional eye examination (Health Newsfeed 2005). Photoscreening may be especially useful as a preliminary line of defense in examining young

children who are at high risk for eye problems such as premature infants, children with developmental delays, or children whose family has a history of eye problems (American Academy of Pediatrics 2002).

### **Current Vision Screening Requirements and Recommendations**

The Texas Department of State Health Services (DSHS) mandates that children must be screened when they turn four by September 1<sup>st</sup> of their first year of preschool or kindergarten, and alternating years after that beginning with 1<sup>st</sup> grade. The tests approved for state mandated vision testing are the Snellen Alphabet Test, the Sloan Letter Chart, the Snellen Tumbling "E" Chart, and the HOTV Crowded Test Set. All these tests require a preschool reading ability at a minimum and only measure for visual acuity problems such as myopia (Texas Department of State Health Services 2005). The limitations of these tests present a problem when compared to the current vision screening recommendations from licensed eye care professionals, as detailed below, regarding their lack of applicability to young children, and their inability to address more serious eye problems.

Current vision screening recommendations from the American Academy of Pediatrics and the American Academy of Ophthalmology are dependent on the age and ability of the child being tested, but test administration should begin in infancy with the patient's well infant and well child visits, and should continue on a regular basis until the child is mature enough for a formal examination. Before vision testing, physicians should elicit an adequate history of visual difficulties from the child's parents. Questions regarding the child's vision habits (holding objects unusually close), eye appearance (whether or not the eyes appear straight or crossed when focusing), and relevant family histories should be asked. During these tests the most sophisticated procedure possible for the child to respond to should be used. For infants and children from birth to two years of age, recommendations suggest that their vision test should include an examination of (American Academy of Pediatrics):

- Eyelids and orbits- Evaluating the eyes for symmetry and function, including the ability to open both eyes.
- External examination- An evaluation of specific areas of the eye such as the cornea and iris, using a penlight to check for abnormality.
- Motility, eye muscle balance, and pupils- Consists of having the child focus on a toy or penlight and follow it to make sure the cornea reflects light symmetrically.
- Red reflex- Screens for abnormalities in the back of the eye by using an ophthalmoscope focused on the pupil. The red reflex reflected should be symmetrical and without dark or light spots.

Children older than two should be screened using the previous measures in addition to the following tests (American Academy of Pediatrics):

- Vision testing- Vision testing becomes possible around 2 or three years of age. Tests using picture cards and symbols such as the Snellen Letters, Tumbling E, or HOTV tests should be administered to check for refractive errors such as myopia.
- Ophthalmoscopy- This test usually is administered only to children four and older who are willing to fixate on a toy while the ophthalmoscope evaluates the retinal vasculature and optic nerve for abnormality.

### Vision Screening Mandates for the Future

The importance of vision screening for children and adults has long been neglected. More advanced tests, adaptable to younger children, and a greatly increased frequency of children being tested should be included in future vision mandates. Regarding this goal, the National Eye Institute reported in 2000 that for the first time, vision objectives have been included in the national disease prevention initiative, Healthy People 2010 (National Eye Institute 2004). The Healthy People 2010 objective is to “improve the visual and hearing health of the nation through prevention, early detection, treatment, and rehabilitation” (National Eye Institute 2004). This initiative cites that vision loss is associated with loss of independence,

unemployment, and decreased quality of life. In addition to improving vision health in the general public, specific objectives of the Healthy People 2010 initiative regarding young people include increasing the proportion of preschool children who receive vision screenings, and reducing blindness and other visual impairments in children age 17 and under. In addition to merely issuing a mandate for vision improvement, the U.S. could look to other first world countries for vision health goals such as the United Kingdom where vision problems are under control because vision screenings by optometrists are free to all children under age 16 (Vision Testing and Screening in Young Children 2005). While this may be a difficult goal, more comprehensive healthcare coverage for pediatric vision testing, as well as further research on promising new tests such as photoscreening, would greatly improve the vision health, and overall health, in the United States.

### References

- American Academy of Pediatrics. (2002). Use of Photoscreening for Children’s Vision Screening. *Pediatrics*, 109.
- American Family Physician. (2004). *AAP Issues Guidelines for Vision Screening in Infants, Children, and Young Adults*. [Online]. Available: [http://www.findarticles.com/p/articles/mi\\_m3225/is\\_n1\\_v55/ai\\_19051888/print](http://www.findarticles.com/p/articles/mi_m3225/is_n1_v55/ai_19051888/print)
- Children’s Hospital Boston. (2005). *Vision Problems*. [Online]. Available: <http://www.childrenshospital.org/az/Site1486/mainpageS1486P0.html>
- Eye Examination and Vision Screening in Infants, Children, and Young Adults. (1996). *Pediatrics*, 98.
- Gole G.A., Schluter, P.J., Hall J., Colville D. (2003). *Comparison of the Retinomax Autorefractor with Hand-Held Retinoscopy of 1-year-old Infants*. [Online]. Available: <http://www.ncbi.nlm.nih.gov/entrez/query.fc>

[gi?cmd=Retrieve&db=PubMed&list\\_uids=12](http://www.ncbi.nlm.nih.gov/pubmed/16122222)

Health News Feed. (2005). *Traditional Vision Screening Best*. [Online]. Available: [http://www.hopkinsmedicine.org/hnf/hnf\\_5008.htm](http://www.hopkinsmedicine.org/hnf/hnf_5008.htm)

Medical Mail Order. (2005). *Vision Testers*. [Online]. Available: <http://www.medicalmailorder.com/visiontesters.html>

Miami Medical. (2005). *Welch Allyn SureSight Vision Screener*. [Online]. Available: [http://www.miami-med.com/Welch\\_Allyn\\_SureSight.htm](http://www.miami-med.com/Welch_Allyn_SureSight.htm)

National Eye Institute. (2004). *Healthy People 2010, the National Health Blueprint, Includes Vision Objectives for the First Time*. [Online]. Available: <http://www.nei.nih.gov/news/pressreleases/060100.asp>

National Eye Institute. (2005). *Trained Screeners Can Identify Preschoolers with Vision Disorders*.

National Eye Institute. (2004). *Vision in Preschoolers Study*. [Online]. Available: <http://www.nei.nih.gov/neitrials/static/study85.asp>

Norath, David J. (2001). *An Examining Eye on Autorefractors*. [Online]. Available: <http://visioncareproducts.com/03/auto.html>

Optos. (2005). *Protect Your Vision*. [Online]. Available:

<http://www.optos.com/forpatients/protectyourvision/childrenseyehealth/considerthesefacts>

Precision Vision. (2003). *The Lea Test System Overview*. [Online]. Available: [http://www.fatf.com/download/PV\\_CAT\\_NO\\_PRICE.PDF](http://www.fatf.com/download/PV_CAT_NO_PRICE.PDF)

Texas Department of State Health Services. (2005). *Vision and Hearing Screening*. [Online]. Available: <http://www.dshs.state.tx.us/vhs/require.shtm>

The Vision in Preschoolers Study Group. (2005). *Preschool Vision Screening Tests Administered by Nurse Screeners Compared with Lay Screeners in the Vision in Preschoolers Study*.

Vision Testing and Screening in Young Children - Patient UK. (2005). *Vision Screening*. [Online]. Available: <http://www.patient.co.uk/printer.asp?doc=40024572>

Visual Acuity Tests. (2005). *Visual Acuity Tests*. [Online]. Available: <http://www.lea-test.fi/en/vistests/pediatric/vactests/vatests.html>

WelchAllyn. (2005). *SureSight Vision Screener Ranks at the Top of National Study*. [Online]. Available: <http://www.welchallyn.com/medical/news/press/view.asp?ID-317>

Wikipedia. (2005). *Automated Refractor*. [Online]. Available: <http://en.wikipedia.org/wiki/Autorefractor>