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Characteristics of Children Evaluated at a Pediatric Low Vision Clinic: 1981–2003

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Abstract: The records of 1,661 children and adolescents who received 3,188 clinical low vision evaluations from a single examiner at low vision clinics sponsored by the Iowa Braille School over a 22-year period were surveyed to determine the characteristics of this population. The factors that were reviewed included age, sex, ocular condition, best-corrected vision at far and near, habitual working distance, and recommended optical devices.

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Only a few studies have investigated the causes of childhood visual impairment (that is, blindness or low vision) (DeCarlo & Nowakowski, 1999; Ingelse & Steele, 2001; Kelley, Sanspree, & Davidson, 2000;

Wilkinson & Stewart, 1993, 1996). DeCarlo & Nowakowski (1999) noted that "these studies are difficult to perform, except in schools for those who are visual impaired" (p. 651). Ingelse and Steele (2001) noted, "our results can only be fairly compared with students in other residential schools for the visually impaired. These results would not be 'generalized' to the visually impaired adolescent population at large" (p. 766). In addition, as Wilkinson, Stewart, and Trantham (2000) indicated, few reports have discussed the evaluation and low vision management of children and youths (hereafter "students") with visual impairments. Because of this limited information, characteristics, needs, and intervention strategies for this population have not been well understood.

This article presents an overview of the population, from birth to age 21, in the Midwestern United States that had a visual impairment or had visual complaints or concerns that required specialized evaluation techniques that are used more frequently in a low vision clinic than during routine ophthalmic evaluations. The Low Vision Services program sponsored by the Iowa Braille School has now been in existence for 22 years. Over that time, 1,781 students have been evaluated during 3,316 visits. Of these students, 1,661 were evaluated at 3,188 clinical low vision evaluations by a single examiner, making this the largest population of students ever reported.

The Iowa Braille School's low vision clinics serve any child or youth in Iowa from birth to age 21 who has been identified as having a visual impairment. There are no restrictions based on age or additional disabling conditions.

Methods

Participants

This population profile is based on a review of the clinical records generated from clinical low vision evaluations of 1,661 students, from birth to age 21, who had a total of 3,188 clinical low vision evaluations, by a single examiner (an optometrist specializing in low vision) at the Iowa Braille School's low vision clinic from the fall of 1981 through the spring of 2003. Of the students who were evaluated 732 (44%) were females and 929 (56%) were males. Of the 3,188 evaluations, 25.8% were for children from birth to age 4, 27.4% were for children aged 5–8, 22.4% were for children aged 9–12, 16.9% were for youths aged 13–16, and 7.5% were for youths aged 17–21.

Procedures

Each student who is evaluated at an Iowa Braille School low vision clinic has a report generated following each evaluation visit. These reports were used to develop a database of information on each student's visit or visits. The database was then used as the basis for the data presented in this article.

Results

Types of ocular conditions

Table 1 shows the frequency of the wide variety of ocular conditions found within the clinic population, as well as a number of other clinic populations in the United States, New Zealand, and Australia. The most frequent ocular conditions causing vision loss among the students who were evaluated were almost equally divided among several conditions that are commonly presented at birth or shortly thereafter: nystagmus, optic atrophy, optic nerve hypoplasia, retinopathy of prematurity, albinism, and aphakia. In addition, cortical visual impairment, other types of brain injury or brain malformation, and a myriad of syndromes (see Box 1) that have vision loss as one of their components were commonly encountered. Less commonly noted, but still noted on a regular basis, were aniridia, retinal/optic nerve colobomas, Leber's congenital amaurosis, cataracts, glaucoma, malignant myopia, Stargardt disease, and retinitis pigmentosa.

Of the students who were evaluated, 85 (5.12%) were found to have no functional loss of visual acuity or visual field at the time of their evaluations. These students were referred for low vision evaluations because of concerns about their visual functioning and how their visual functioning may have been affecting their learning. Some of these students had reduced vision while wearing a patch for amblyopia therapy, while others were labeled not testable by their primary eye care providers because of the presence of additional disabilities.

Visual acuities

Distance visual acuities were normally measured using the ETDRS chart at 1, 2, or 4 meters (approximately 3, 6 1/2, and 13 feet); the Feinbloom test chart at 5 or 10 feet; or the LEA symbol flash card test at 5 or 10 feet. Teller Acuity testing was used for 17.36% of the evaluations for children who could not respond to a more conventional acuity test. In addition, there were 19 evaluations (0.6% of the total visits) where the student was found not to be responsive to any of the aforementioned distance acuity testing techniques. During these evaluations, common objects were used at various distances to determine an approximate functional acuity measurement. Finally, 4.14% of the evaluations found the students to be not testable in a way that a distance acuity measurement could be established at that visit. Distance acuities ranged from 20/20 to no light perception (NLP) with an acuity distribution as presented in Table 2.

Near vision testing was reported with metric notation using the Lighthouse near vision acuity test card or the LEA symbol near vision acuity test card. The students were allowed to bring the materials to their preferred working distance for their near visual acuity test. They used whatever spectacles, contact lens–spectacle combination, or spectacle-mounted low vision device that was determined to be most appropriate for their needs. The best-corrected near visual acuities ranged from .5M to 16M (1M print is approximately equivalent to standard newsprint), with acuities distributed as in Table 2.

Optical devices

Optical prescriptions were recommended for many of the students with visual impairments who were evaluated. These prescriptions can be grouped as follows: best refractive correction (single vision and multifocal), contact lenses, absorptive filters, telescopic corrections (handheld and spectacle mounted), reading and microscopic spectacles, closed-circuit televisions, hand and stand magnifiers, and other video magnification devices. The distribution of low vision devices that were recommended is shown in Table 3.

Discussion

In reviewing the etiologies of the various ocular conditions that cause visual impairments in the pediatric population noted in Table 1, we noted that a more heterogeneous distribution of conditions was found in the Iowa population than in the other populations. The likely explanation for this finding is that the Iowa Braille School's low vision clinics population is a nonprescreened group of predominantly noninstitutionalized students. Thus, this population likely represents a more accurate assessment of the distribution of ocular conditions that cause vision loss in the pediatric population.

It is of interest to note that 75.6% of the evaluations were for students aged 12 or younger. This proportion demonstrates the importance of providing clinical low vision evaluations early in a child's life. The information provided by a clinical low vision evaluation is helpful to both the child's parents and the educational team as they work together to develop appropriate strategies and to acquire the necessary tools to allow the child to function at his or her highest potential. When low vision services are begun early in a child's life, the child's needs can be more carefully monitored over time. Careful monitoring will help to minimize concerns that may develop about the child's academic performance in relation to the visual loss. In addition, visual functioning, as it relates to vocational planning, can be monitored as the child matures.

A relatively small number of students (5.12%) were referred for a clinical low vision evaluation because there were concerns about their visual abilities and because they had been found to be difficult to test or untestable during routine ophthalmic assessments. The low vision team in Iowa has believed that when parents or the educational team express concerns about a student's visual functioning as it relates to educational planning, it is appropriate for the student to be evaluated at a low vision clinic, even if he or she is found not to have a visual deficit following the evaluation. Even when a student is found not to need ongoing low vision services, the information gained from the clinical low vision evaluation is helpful to the educational team.

Visual acuity testing has changed during the past 22 years. Initially, the Lighthouse symbols (apple, house, and umbrella) were used for children who were too young to respond to the Feinbloom (number) chart. The first change in visual acuity testing occurred in the mid-1980s, when the ETDRS charts began to be used more frequently than the Feinbloom chart. Following this change, LEA symbols (apple, house, circle, and square) replaced the Lighthouse symbols for younger children. In the early 1990s, an increasing number of preverbal and nonverbal children were referred for assessment. To assess these children's visual acuities, preferential viewing assessment using Teller acuity cards became the norm for this population.

Only 11.3% of the evaluations found students with light perception or less visual acuity, and 61% had a visual acuity of 20/200 or better. What is more important from an educational standpoint, 80.7% of the evaluations found the students could read print 1.5M or smaller, and 64.8% could read print smaller then 1M (newsprint). This is an important finding for educational planning because 1.25M print is equivalent to 12-point type, which is found in magazines and textbooks through the 12th grade.

Table 4 shows that 79.35% of the students had a habitual near-point working distance of 6 inches (15.25 cm) or less. This is an important finding, since teachers and parents often want a child with a visual impairment to have a “normal” working distance. Parents and teachers should be made aware that children naturally use linear magnification (that is, they bring materials closer) to see best. This normal adaptation should not be discouraged.

During 1,119 of the 3,188 low vision evaluations, 1,534 devices were prescribed. At these visits, 765 students received one device, 293 students received two devices, and 61 students received three devices (unduplicated count from one clinical visit to the next). Of the students who received devices, 36% required an optical correction (spectacles or contact lenses) for optimum visual performance. This finding illustrates the importance of a careful refraction for all students who are visually impaired, on a regular basis, to find uncorrected or undercorrected refractive errors. Optical devices that are designed more or less exclusively for the enhancement of near vision were prescribed approximately twice as often (46.0% versus 23.4%) as devices that are used primarily for the enhancement of distance vision because optimal near-vision performance is critical for success in school.

As noted previously, 75.6% of the evaluations were for students aged 12 or younger. At these younger ages, many students' accommodative abilities are good enough for them to be able to read regular-size print accurately and comfortably at the closer working distances that they naturally adapt without the use of additional devices. Because students' accommodative abilities decrease with age, at the same time that print size decreases and reading demands increase, students typically need a reading correction for optimal near-point visual performance some time after age 10. At the same time, greater independence, particularly with travel and in school, requires a greater use of distance magnification devices. The students who did not receive low vision devices fell into several categories: those who did not require spectacles or devices at that time, those who already had the appropriate spectacles and devices, and those who would not benefit from devices because their vision was too poor or they were unable to use any device effectively.

Iowa Braille School's Low Vision Services model

The wealth of data pertaining to the characteristics of students with low vision that has been gathered over the past 22 years of clinical low vision evaluations has provided the source that has directed the evolution of the low vision services model used by the Iowa Braille School's low vision clinics. The intent of the current model is to provide a variety of components that may occur during an evaluation at a low vision clinic, with the objective of addressing the particular low vision needs of the students, their families, and their educational teams.

Components

Measurements of distance and near visual acuity and/or general visual functioning level.

For young children or nonverbal children who are not able to respond to a traditional test of acuity measurement, other methods are used to obtain a general indication of the level of visual functioning or even a distance acuity equivalent. This information is helpful in giving a prognosis for expected levels of visual functioning as the child matures.

Information to assist parents and teachers to gain a better understanding of the student's visual condition and visual functioning, that is, "how" he or she sees.

Often the diagnosis and even the visual acuity are known prior to the low vision evaluation. But the parents and teachers may not know what that level of vision means for the student from a functional standpoint.

Assessment to determine if there is a refractive error and whether the refractive error is significant enough to indicate a need for corrective lenses.

Refractive errors are not uncommon in a variety of ocular conditions that are found in students. In assessing a refractive error, it is important to know whether correcting it will improve a student's visual performance at distance or at near. It is also important to know if correcting the refractive error to improve visual performance for certain visual activities, such as distance vision tasks, may make the vision worse for other tasks. This can be the situation for a student with a high degree of myopia, who may be told to wear his or her spectacles during reading activities when, in fact, her or his reading vision may be significantly enhanced by removing the spectacles. In most cases, there should be a functional improvement in performance for either a distance vision or near vision task for spectacles to be recommended.

Provision of information that is useful in determining the most appropriate learning media and literacy media.

For many students, a great deal of the clinical examination is devoted to assessing their ability to see print and evaluating how that ability may be improved. Near vision is measured in terms of print size and the visual working distance from the page. Low vision devices for near tasks are demonstrated and recommended if they are found to benefit the student's visual functioning. If needed, a follow-up visit will be scheduled for the selection and use of the devices or for determining the appropriate print size, most appropriate learning medium, or other adaptations. With this information, the inappropriate use of materials, such as large print, can be avoided. During the 1990–91 school year, the Iowa State Department of Education Vision Consultant decided to attempt to provide a low vision evaluation to every student in Iowa who was receiving large-print materials in school. Table 5 shows how, as a result of this multiyear effort, the use of large-print materials has radically decreased in Iowa (see Table 5).

Provision of information useful in the process of determining whether vision is likely to be a major factor that influences educational programming when there are concerns about other developmental areas.

The low vision clinic evaluation often provides information to the educational team that helps them determine whether a student's academic problems are due to a visual impairment or whether the student's visual functioning does not significantly affect performance in areas, such as reading or writing. Our experience in Iowa has been that at times, vision can be blamed for a variety of problems, including reading difficulties, poor math skills, and behavioral problems. The clinical low vision evaluation provides the educational team with valuable information that helps them sort out which of these problems are vision related and which are related to other difficulties that require specific, nonvisual remediation. It is important to realize that learning difficulties can occur simultaneously with a visual impairment.

Assessment to determine whether low vision devices, technology equipment, or other adaptations and accommodations are likely to enhance the student's level of functioning and to assist the educational team with helping the student to try recommended devices, equipment, or strategies and to acquire devices or equipment when appropriate.

This assessment allows the low vision team to make an accurate determination of which devices will best meet the needs of the student, as opposed to allowing the student to choose a device in a hit-or-miss fashion without any determination of what the most appropriate device or devices would be.

Provision of a reevaluation, as needed, to determine if visual functioning is improving, remaining stable, or otherwise changing; what these changes may indicate in terms of programming needs; or whether the need for devices or other accommodations has changed.

A particular visual diagnosis will usually indicate a prognosis for whether the eye condition will remain stable. It is important that visual functioning be closely monitored over time as one indicator of the student's visual status because as a result of the growth and maturation process, a student's need for specific devices or optical power will change over time. These needs should be carefully monitored to ensure that the student is being provided with the devices necessary for optimum functioning. It is important that students return for follow-up visits to the low vision clinic as recommended. Educational programming decisions need to be based on information that is as current and accurate as possible.

Assessment of vision in terms of acquiring a learner's permit or a driver's license.

Many students want to learn if they can qualify visually to be able to drive. The low vision clinician will counsel a student with regard to the procedures he or she would need to follow for his or her particular situation and can provide the required written documentation, when appropriate.

Provision of information for other related services, such as orientation and mobility services.

A certified orientation and mobility specialist (COMS) is part of the low vision clinic team and may do screening assessments at the clinic or arrange for follow-up visits at a later date. In addition, the COMS may conduct a follow-up assessment with distance visual devices (such as handheld monocular telescopes) or with light filters, as recommended by the low vision clinician.

Conclusion

The findings presented in this article demonstrate the heterogeneous nature of etiologies of congenital and acquired visual impairments in students, as well as the variability in their visual functioning and low vision rehabilitative needs. Although the prevalence of visual impairments in children and youths in the United States has been estimated as 1–2% (Kelley et al., 2000), the needs of this population are significant because of how the impairments affect educational performance and vocational planning. With greater information on the visual abilities of students who are visually impaired, programming can be developed that will help them develop their full potential, educationally, vocationally, and socially.

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