Analysis of the Results and Vision Screening Protocol Used at the 2001 Special Olympics Michigan State Summer Games

Karisa Ritter, B.S., 4th Year Intern

Daniel Wrubel, O.D., Professor

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Michigan College of Optometry,
Ferris State University, Big Rapids, MI

Abstract

Background:
Special Olympics is an international organization dedicated to empowering individuals with mental retardation through participation in organized sports. Since 1989, the Opening Eyes program has been providing vision screenings to athletes participating in the games. This population is particularly at risk for various visual and ocular problems.

Methods:
In 2001 at the Michigan State Summer Games, a comprehensive vision screening was given to over 700 athletes. The results of this screening were analyzed to identify the prevalence of certain visual and ocular anomalies in this group.

Results:
Seven hundred one athletes, ranging in age from 8 to 67 years, were evaluated. Two hundred sixty-four pairs of eyewear were dispensed including 167 prescription pairs. Of these, 77.8% of the lenses were toric (astigmatic). Almost 100 plano protective eyeglasses were dispensed and almost 200 Rx spectacles were prescribed. Other ocular problems included overt strabismus, lid pathology and optic nerve anomalies. Twenty-seven athletes were referred for further care.

Conclusions:
The results agree with the higher prevalence of refractive errors, including astigmatism. However, our results found less pathology than indicated by other studies, less overt strabismus and that more athletes had regular eye exams than found in previous studies. The Opening Eyes program is becoming more involved every year. The methods currently used for screening protocol are adequate and provide a relatively easy way to give thorough screenings with this special population.

Introduction

Since 1968, the Special Olympics have been dedicated to empowering individuals with mental retardation to become physically fit, productive and respected members of society through sports training and competition. Today, over one million people in more than 150 countries are served with year-round training and competition.[1] Started in 1989, by the Sports Vision Section of the American Optometric Association (AOA), Opening Eyes has provided screenings and education to Special Olympics athletes, as well as educated parents and coaches about eye care and the vision care needs of persons with mental retardation. Through research, they have also increased the knowledge of the visual and eye health needs of this special population. Initially, screenings and referrals were provided. However, the program has developed to include refractions and fabrication of prescription glasses. Recently Special Olympics has formally partnered with Lions Club International Foundation to expand the effort's scope. In Michigan, Opening Eyes has been present at the state summer games since June of 2000. With the strong efforts of Phil Irion, O.D. and multiple volunteers, the endeavor has been a continuing success.

To participate in Special Olympics, athletes must be at least eight years old and identified by any agency or professional as having mental retardation, cognitive delays as measured by formal assessment, or significant learning or vocational problems due to cognitive delay that require or have required specially designed instruction.[1] There is no cost to participate. Through the Special Olympics Motor Activities Training Program, even individuals with profound disabilities can participate.

As the visual characteristics of disabled individuals are often different than the general population, one of the goals of Opening Eyes is to gather data on this special population. Various studies have found that astigmatic correction exceeds 30% in mentally retarded populations.[2,3] In a screening of athletes at the 1995 World Games, Block et al[8] found astigmatism of greater than one diopter in 28% of the subjects. This can be referenced to a study of normal adults by Saw et al[4] which found 18.5% of adults needing astigmatic correction. McCulloch et al[5] and Black[6] reported a higher incidence of strabismus ranging from 41.2% to 52.5%. However, Block et al[8] found a lower number (18.5%) of athletes screened had strabismus, still significantly higher than the non-handicapped population prevalence of 3.7%. Berk[7] reported an increased incidence of lens opacities (20%), blepharitis (34.5%) and nystagmus (12.7%).

Persons with mental retardation also tend to have less frequent access to health care than the non-handicapped population. For example, at the 1999 World Summer Games, the Opening Eyes Program found that 32% of athletes had never had an eye exam, and almost 20% had not had their last eye exam within the two previous years.[9] This was similar to the 1995 screening which showed that more than 65% of the special athletes had received no eye care for more than 3 years.[8] Further, a study of Scottish hospitals indicated that 56% of patients with disabilities had no record of any past eye examination, and a disproportionate number of those who did have eye exams had only mild or moderate disabilities.[5]

The purpose of this study is to determine the incidence of vision problems in this special population at the Special Olympics Michigan 2001 State Summer Games, as well as examine the techniques used in the screening process.

This paper will examine the data gathered during the Opening Eyes vision health program held during the Special Olympics Michigan 2001 State Summer Games.

Methods

Volunteers consisted of 26 optometrists, 9 members of the Michigan Affiliate of the American Foundation for Vision Awareness (AFVA), 14 optometry students, 9 members of the Michigan Paraoptometric Association (MPA), 22 members of the Lions Club of Michigan, 6 opticians, 18 optometric office staff members and spouses of other volunteers. Over 3,500 athletes competed in the games held at Central Michigan University (CMU) in Mt. Pleasant, Michigan. Over seven hundred of those athletes were evaluated at the Opening Eyes Vision Screening Program.

The screening protocol used is standard for the Special Olympics Opening Eyes program.[9] Each athlete received a three-part form, which was taken to each individual testing station. The data from these forms was used in our tabulation following the screening.

The screening begins with a short history taken by a volunteer. The athlete's name, age, sex and sport are recorded on the form. Questions asked are when the athlete's last eye exam was, type of current correction worn, and any history of injuries, surgeries or infections. Athletes are also asked about any current symptoms. The parents, guardians and/or coaches frequently assisted additional history. If athletes were wearing glasses, their lenses were neutralized.

Athletes would then proceed through the various vision screening stations. After each station was completed, the volunteer checked a box on the athlete's form marked *Pass*, *Refer*, or *Unable to Test*, based on specific criteria. Visual acuities were taken using Lea Optotypes when possible or Tumbling E's. Lea symbols included cards that the athlete could hold up or point to (like a matching game) if they were unable to verbalize. Acuities were taken monocularly at 3 meters and binocularly, (when appropriate) at 40 cm. Athletes needed to identify 3 out of 5 symbols per acuity line. The referral criterion was 20/40 or worse at near or distance.

Cover test was also done at distance and near and neutralized with prism when possible. The target used was a single letter "A" and habitual spectacles were worn if present. Referrals were made for any overt strabismus, greater than 2-prism diopters esophoria or exophoria at distance, or greater than 6 exophoria or 2 esophoria at near. Optional testing included near point of convergence, with referral made for measures greater than 10-12 cm. Oculomotor fields were also optional and referral made for any significant restrictions of gaze.

Color vision testing was performed on all athletes using the "Color Vision Testing Made Easy" series with 9 plates. Athletes were to tell the volunteer if they saw a circle or a ball, or point/trace if they were nonverbal. If more than one plate was missed a second trial was performed. If any plates were missed on the second trial a referral was made.

Stereopsis testing was also performed, using six trials of the Random Dot E at near. Testing was done at 50 cm and the E was presented in a raised position. Referral was made if more than one trial was missed.

Auto refraction was performed when possible. If indicated based on history, symptoms, visual acuities or auto refraction results, a volunteer optometrist performed retinoscopy and refraction in the phoropter or with trial lenses.

Pupils were evaluated for differences in size, shape, reaction rate and afferent defect. Any abnormality was referred.

Ocular health assessment was made of the anterior and posterior segment of the eye. Anterior segment was evaluated using a biomicroscope on cooperative athletes. Internal health was evaluated using both direct and indirect ophthalmoscopy. Any abnormality of internal or external health was referred. Tonometry was also measured using a non-contact tonometer on cooperative athletes.

Following completion of the screening, a volunteer would review the athlete's screening form. If referral was needed, an appropriate doctor was suggested near the athlete's home, or if appropriate they were referred to return to their current doctor. Referral forms were completed and a copy was given to the athlete.

Eyewear was ordered or dispensed based on the criteria shown in Table 1. If needed, adjustments to the athlete's current eyewear were made. The Optical Center Lab of Ferndale donated eyeglass lenses for the project and Liberty Optical and the Luxottica Group provided frames.

Table 1. **Eyewear Criteria**

Check-out Criteria
Aquatics A) Visual acuities worse than 20/40 1) prescription Aqua Specs 2) all others - Plano Aqua Specs AS NEEDED
Team Handball A) Visual acuities worse than 20/40 1) prescription Rec Specs 2) all others - Plano Rec Specs
Volleyball A) Visual acuities worse than 20/40 1) prescription Rec Specs 2) all others - Plano Rec Specs
Athletes with Vision in One Eye Only A) Visual acuities worse than 20/40 1) prescription Rec Specs 2) all others - Plano Rec Specs
All Other Athletes A) Visual acuities better than 20/40 - NO RX B) Visual acuities worse than 20/40 1) refract for best visual acuity 2) prescribe glasses if appropriate 3) pinhole for attempt at best visual acuities

Results

A summary of the pertinent data collected was tabulated and presented as follows. Seven hundred and one (701) athletes were screened, ranging in age from 8 to 67 years. The age breakdown is presented in Table 2. The breakdown of sports represented is shown in Table 3. Four hundred and ten, (410 or 58.5%) were male and 291 (41.5%) were female. When asked when their last eye exam was, 243 (35%) responded within 1 year, 150 (22%) within 1 - 3 years, 54 (7%) in over 3 years, 60 (8%) responded never and 194 (28%) did not know. Two hundred and eighty (280) athletes (39.9%) presented with glasses, while one athlete wore contact lenses. One athlete was monocular.

Table 2. **Age Breakdown**

Age	Number
8 - 10 years of age	42 (6%)
11 - 20 years of age	352 (54%)
21 - 30 years of age	133 (21%)
31 - 40 years of age	45 (7%)
41 - 50 years of age	49 (8%)
51 - 60 years of age	14 (2%)
61 - 79 years of age	12 (2%)

Table 3. **Number of Athletes per Sport**

Pentathlon	2	Horseshoes	4
Softball	41	Bowling	57
Walking	4	Bocce	37
Wheelchair Track	8	Aquatics	91
Developmental	4	Team Handball	81
Track & Field	196	Volleyball	71
Gymnastics	18	Weightlifting	7
Golf	1	Basketball	6

Two hundred sixty-four pairs of eyewear were dispensed with the following breakdown: Eighty-two (31.1%) Plano Rec Specs, 67 (25.4%) prescription Rec Specs, 15 (5.7%) plano swim goggles, 17 (6.4%) prescription swim goggles and 83 (31.4%) dress prescriptions. Three hundred and twenty four (324) prescription lenses were made. Of all lenses made, 252 (77.8%) were toric (astigmatic). Sphere power ranged from -15.75 D to +8.75 D. The distribution is shown in Figure 1. A majority of the lenses made (59.9%) had sphere powers falling within the range of -2.00 to +2.00 D. Cylindrical power ranged from spherical to -6.00 D. The distribution is shown in Figure 2. Of the toric lenses, 182 (72.2%) had cylinder power of -1.00 D or greater, or 56.2% of the total lenses made. Multifocal lenses accounted for 16 of the lenses made, or 4.9%. Add powers ranged from +1.25 to +3.00 D. One prescription was written for slab-off prism.

Figure 1.

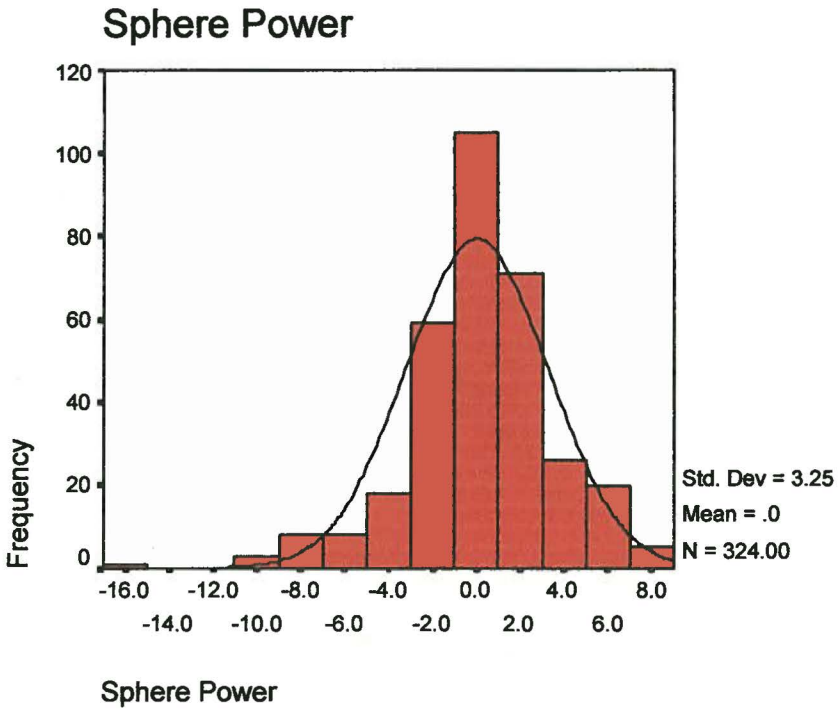
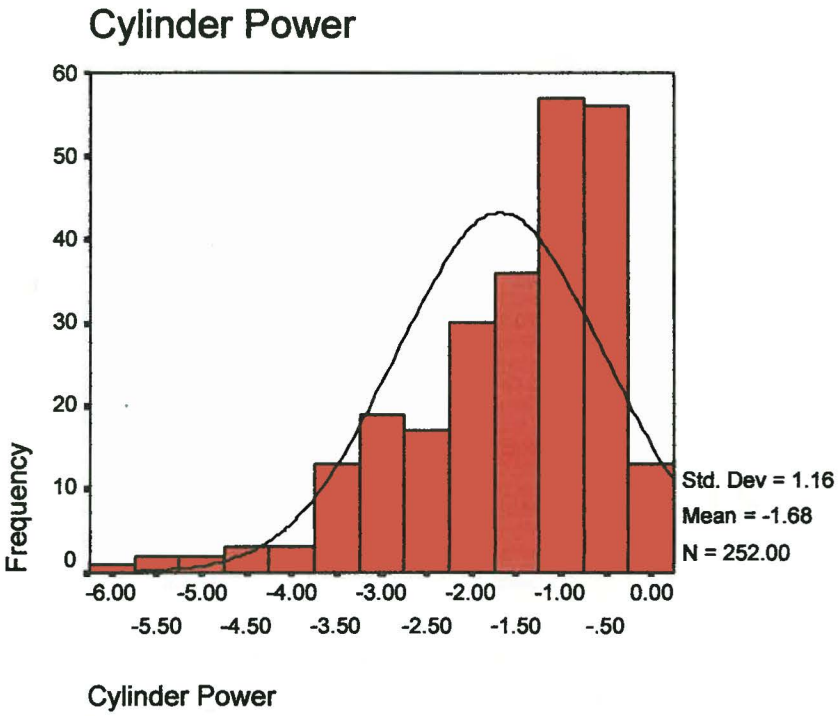


Figure 2.



Visual acuities at distance ranged from 20/20 to less than 20/400. One hundred sixty-seven athletes (23.8%) had monocular visual acuity worse than 20/40. Most testing was done using the Lea Optotypes. Only 10 participants were not able to complete a valid distance visual acuity. Near acuities also ranged from 20/20 to 20/400. One hundred seventy athletes (24.3%) had binocular visual acuity worse than 20/40. Eighteen athletes were not able to complete the near acuity task or had no recorded data.

Of all the athletes, 117 (16.7%) were noted to have some type of ocular health concern, the most common being cataracts (25, or 3.6%). Only 13 athletes were recorded to have blepharitis (1.9%). Only 6 athletes were reported to have overt nystagmus (0.9%). A review of health findings is shown in Table 4. Thirty-eight (6.2%) of 614 eyes tested with non-contact tonometry had intra-ocular pressure (IOP) greater or equal to 21 mmHg. The highest IOP measured was 29 mmHg.

Strabismus was found in 74 athletes, or 10.6%. Of these, 27 (36.5%) were exotropic, 33 (44.6%) were esotropic, 13 (17.6%) were hypertropic and one was not classified. Significant phorias (classifying as referrals) were noted in 27 (3.9%) of the athletes. These results are summarized in Table 5.

Table 4. **Ocular Health**

Location	**Frequency**
No pathology	584 (83.3%)
Lid	22 (3.1%)
Cornea	12 (1.7%)
Conjunctiva	15 (2.1%)
Lens	25 (3.6%)
Retina	2 (0.3%)
Optic Nerve	26 (3.7%)
Nystagmus	6 (0.9%)
Pupils	12 (1.7%)
Iris/Anterior chamber	8 (1.1%)

Table 5. **EOM-- Binocular Function**

Description	**Frequency**
Strabismus	74 or 10.6% of the Total
Esotropia	33 of the 74 or 44.6%
Exotropia	27 of the 74 or 36.5%
Hypertropia	13 of the 74 or 17.6%
Phorias	27 or 3.9% of the Total

Discussion

The screening in 2001 was the second year of Opening Eyes at the Michigan Summer Games. A larger venue and experienced volunteers allowed for screening of more athletes than the previous year (701 vs. 663) and a seemingly smoother and more efficient process. Both athletes and volunteers enjoyed the interaction of the screening and the athletes appreciated the stuffed toy animal they received at the completion.

The screening protocol has been in use by National Special Olympics for over five years, and thus has been "fine-tuned" to run smoothly. Several barriers, however, are difficult to overcome. The athletes are often poor historians. If a parent or guardian was present the history became much easier, but this was not always the case.

The question of last eye exam presented some issues simply because many of the athletes had been through the screening the previous year. It was indicated on a few forms that the athlete's answer referred to last year's screening. The volunteers who did the questionnaires were aware that screenings did not constitute an eye exam. However, inevitably some athletes were probably referring to this when answering the questions.

It is difficult to analyze the numbers relating to previous eye exams for the reasons listed above. However, in their 1995 screening at the International Special Olympics games, Block et al[8] found that 65% of athletes had received no eye care for more than three years. Our data would seem to indicate a much better rate, with only 15% responding three years or never.

Visual acuity ranging from 20/20 to 20/400 is to be expected. The percentage of athletes with poor monocular acuities (23.8%) is very similar to what Block, et al[8] found in 1995 at the World Games.

Refractive errors covered a broad range. Of all lenses made, 59.9% of spherical powers fell within two diopters of emmetropia. Woodruff et al[2] recorded 55.3%, but this looked at all subjects. Our data is biased by the fact that we only looked at those athletes who required correction. Astigmatism was found in 77.8% of the athletes needing correction. Astigmatism greater than -1.00 D was found in 56.2% of the lenses made. While this may seem higher than the data presented in the background information (approximating 30%), again this data is skewed because only those who needed lenses made were considered.

Of the prescriptions made, 84 out of 167 (50.3%) were made into protective eyewear. Including plano eyewear dispensed, 68.6% were protective eyewear. Ocular sports injuries are a concern in any population, and especially in many of the sports represented at the summer games (see Table 3).

Strabismus was only found in 10.6% of the athletes. While this is higher than what is found in the non-handicapped population, it is much lower than the rates referred to in the earlier background (18.5% to 52.5%). However, when you combine the overt strabismus found with the failures on the Random Dot E (RDE) test, the percentage becomes significantly higher and more in line with what others have found.

Ocular health concerns also showed a lower rate than that found in other studies. Only 1.9% of the athletes were reported to have blepharitis, much lower than the rate of 34.5% expected in this population. This could be due to what the doctors felt was "abnormal". A minimal blepharitis may have been close enough to normal findings for

some doctors not to record it. Also personal hygiene in the central Michigan area, with more the average volunteer/coach to athlete ratio, could have played a significant role. The rate of cataracts and nystagmus were also much lower than expected. Of the optic nerve findings, many referred to myopic degeneration, expected with the number of high myopes found in our screening population.

Only 6.2% of the eyes tested had an IOP greater than 21 mmHg, and no IOP's were greater than 29 mmHg. Because of the difficulty in performing non-contact tonometry on this population, some of these may have been falsely elevated, but referral was still made. It should also be noted that none of the eyes with elevated IOP were reported to have overtly increased cup-to-disc ratios on internal exam.

A box was checked on the bottom of each athlete's form, whether to refer or not, suggesting regular eye care. The need for full eye exams as a requirement for entering school versus the current vision screenings is a somewhat controversial topic. It affects young mentally retarded individuals as well as non-handicapped children. Those screening tests that target pre-school children are also well suited for the mentally retarded population. Tests like the Lea visual acuity cards and the Random Dot E are well accepted as useful screening tools and are already used in the current Opening Eyes protocol.

Photoscreening technology is also being looked at carefully. The MTI Photoscreener employs special modified Polaroid film to provide instant photographs of each of the patient's eyes. A trained evaluator must then read the images for misalignment, opacities and significant refractive errors. The trained evaluator will determine whether the patient should be referred for an examination. New technology like the computerized EyeDx Digital Vision Screening System uses a digital camera and analysis software, eliminating the need for a trained examiner. In their study of a population that included many children with astigmatism, Miller et al[10] found that objective, fully automated screening methods (such as auto refraction and auto keratometry) were superior to both visual acuity screening and photoscreening with subjective interpretation in identifying children who had astigmatism requiring correction.

Availability of the photoscreening device and time needed to screen a large number athletes with a limited number of instruments may limit its use at Opening Eyes screenings. Doctors would still need to be present to refract those who needed updates or new prescriptions. The current method of screening with various stations including visual acuity and auto refraction would seem to be more sensitive than the newer technology.

Vision screenings traditionally (being merely "screenings") are less comprehensive than the Opening Eyes protocol. The gold standard screening protocol stems from the Orinda Vision study[11]. This study made use of the Modified Clinical Technique (MCT) as a way to satisfy certain goals of the various parties interested. It of course wanted to be as sensitive and as specific as possible, but also had to take into account cost, time and utilization of school nurses or teachers. Opening Eyes, because the doctors and other screeners were volunteers, and because the lenses and frames were donated, can be much more comprehensive without having to take those considerations into account. Also, the MCT was used on a normal young school-aged population. Because the prevalence of many ocular conditions tends to be much higher in the mentally retarded population, a more thorough screening would seem to be indicated.

Conclusions

The Opening Eyes program has become an established and popular part of the Summer Special Olympics Games in Michigan. The number of athletes screened has continued to increase from 663 in 2000, to 701 in 2001, and to 719 in 2002. At the 2002 screening, 279 pairs of dress or protective eyewear were dispensed, versus 264 in 2001.

True measures of success of the program are multiple and listed as follows;

- Identification of the acute need for glasses and/or referrals
- Awareness of the need for protective eyeware
- Basic vision care education to all those involved including the coaches, parents, volunteers and of course the athletes
- Personal gains and growth of all involved in the program

It is with utmost importance that the athletes, their parents and coaches need to be reminded/educated that this screening does not replace a comprehensive vision exam. For those who are unable or unwilling to seek care, however, it can provide a reasonable alternative. The true goal must always remain to educate the athletes and their families about proper eye care and encourage regular comprehensive exams.

As the program continues to grow and improve, benefit will come to both the athletes and the volunteers, who learn to better communicate with and understand this special population.

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