Article ▸ Visual Function Status in Children with Cerebral Palsy

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ABSTRACT

Background: This study was conducted in the school for special children in and around Chennai, Tamilnadu, India. The study aimed at giving an appropriate refractive correction for the children with special needs.

Methods: Three hundred and seventy-six children with cerebral palsy were assessed. Visual function and accommodative status was evaluated. Visual acuity was assessed using LEA paddles and LEA symbols depending upon the age, co-operation, and cognitive ability of the child. Visual fields were assessed by using LEA flicker wand. The Hirschberg and cover tests were done to identify strabismus. Mohindra near retinoscopy was done to find the static refractive status of the children followed by cycloplegic refraction. Accommodation was measured using a modification of MEM and Nott dynamic retinoscopy technique. The values were compared with the age-matched normal values.

Results: The mean age of the children was 6.48 years. Near normal vision was observed in 12.67%, 43.66% had moderate low vision, 26.76% had severe low vision, and 16.91% had profound low vision. Strabismus was present in 43.89% of the children. Among those who had strabismus, nystagmus was present in 7.45%. The accommodative status was assessed by MEM and Nott dynamic retinoscopy. The findings were as follows: lead of accommodation 18.60%, lag of accommodation 50.27%, and normal accommodative status 31.13%.

Conclusion: This study shows that most of the children with cerebral palsy have a lag of accommodation. Hence, refractive error was corrected accordingly, considering their binocular status. The importance of testing binocular and accommodative status in children with special needs cannot be understated.

Keywords: accommodation, binocularity, cerebral palsy, cover test, refractive error, visual acuity, visual field testing

Introduction

Children with special needs, particularly those with cerebral palsy (CP), are at a higher risk for visual and eye health problems than their peers.[1-4] These children may receive various interventions through their school systems, including occupational, physical, and/or speech therapy. However, in most cases, they do not receive a comprehensive eye and vision examination. Frequently, those with special needs who have vision or eye health problems may be asymptomatic or unable to express the presence of symptoms. Because children with special needs often cannot communicate symptoms adequately, it is important for the professionals who treat these children to be aware of the possible ocular and visual disorders that are frequently present. Often, those involved with a child's care may be the first to suspect a problem.

Cerebral palsy describes a group of disorders of the development of movement and posture, causing activity limitation; those are attributed to non-progressive disturbances that occurred in the developing foetal or infant brain.[5] The motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behavior, and a seizure disorder.[6-10] The diagnosis of CP is usually made on the basis of uncoordinated muscle movements and delays in reaching developmental milestones.[11] In addition to a physical examination, computerized tomography and/or magnetic resonance imaging of the child's brain to look for the brain insults and abnormalities may help to diagnose the condition.[6] The assessment and management of visual disorders in physically or intellectually impaired children present a complex challenge for the clinician. Refractive errors, nystagmus, and strabismus often greatly affect the quality of vision of cerebral palsy patients. The earlier the diagnosis can be made and appropriate management instituted, the more the children will be helped in their learning and academic success.

Methods

This study was conducted in the school for children with special needs in and around Chennai, Tamilnadu, India. The study evaluated various aspects of vision, subjectively and objectively. Children from three different schools were included in the study. A detailed history about the child was noted, and written consent was obtained from the subject's parents. A diagnosis of CP was based on physician's diagnosis, school records, or disability certificate information. Children ranging from birth to 18 years were included in the study. Those who were having motoric impairments that were not diagnosed as CP were excluded.

Visual acuity was assessed using LEA paddles or symbols and Central, Steady, Maintain (CSM) technique depending upon age, co-operation, and cognitive ability. LEA paddles were

used for preferential looking situations. The handle on each paddle allows the tester easily to administer the test. Grating levels printed on each handle are: 0.25, 0.5, 1.0, 2.0, 4.0, and 8.0 cpcm (cycles per centimetre of surface). LEA symbols are used to measure the smallest size of the optotypes that an individual can recognize. They are available in 5 contrast levels: 1.25%, 2.5%, 5%, 10%, and 25%. Acuity is tested at a 10 foot (3 meter) testing distance.

Visual fields were assessed using the LEA flicker wand. The LEA flicker wand is 26.5" (67.3 cm) long with a 20" (50.8 cm) flexible wand with a diode at the end that can be used as a flickering or non-flickering stimulus at 4, 40, and 400 cd/m^2. The curved wand is moved from behind the person forward in all four quadrants of the visual field to detect losses in the periphery of the visual field.

The Hirschberg and cover tests were performed to identify the presence of strabismus. The position of the corneal reflexes in both eyes under binocular conditions was noted, and the position of the reflex in monocular conditions was compared using a penlight. The unilateral and alternating cover tests were done to elicit any manifest or latent deviations.

Cycloplegic retinoscopy was done by instilling 2 drops of 1% cyclopentolate and 1 drop of tropicamide in each eye. Retinoscopy was performed after half an hour from the instillation of the last drop when accommodation will be at rest.

The accommodative status was measured using a modification of Monocular Estimation Method (MEM) and Nott dynamic retinoscopy technique. The Nott method was used to measure the accommodative lag at near under binocular conditions. Nott dynamic retinoscopy is performed while the patient attends to a near target through the distance or near refraction; the observer views from a position above the near target and slightly temporal to the midline. Initially, the retinoscope aperture is located behind the near target, farther from the patient. The position of the near point (punctum proximum) is located and bracketed by moving the retinoscope aperture away from or toward the patient's eyes.

Monocular Estimation Method is performed at the patient's customary reading distance with the distance correction being worn. The fixation target, words or symbols on a small white card, is fixed at the retinoscope itself. Retinoscopy is performed along one meridian. If with motion is present it indicates a lag of accommodation, while against motion indicates a lead of accommodation. This motion is neutralized using lenses dropped and removed quickly from the patient's field of view. The values of the MEM retinoscopy were compared with the age-matched values.

Results

A total of 374 children with CP ranging in age from 5 to 216 months (mean age, 77.92 months) were included in the study. Among them 54% were males (mean age, 77.99) and 46% were females (mean age, 78.14). Ocular abnormalities were detected in 54.78% of the children. Multiple ocular abnormalities were present in 45.22% of the children.

Visual Acuity

Visual acuity was assessed in all the children. Acuity was checked with spectacles if the child was already wearing them. The most frequently used method to assess visual acuity was the Lea gratings (44% of the children), followed by the CSM technique (36%) and Lea symbols (18%).[12] The remaining 2% of the children were lost to follow up. A presenting visual acuity of 6/6 was measured in 12.67% of the children, 6/9 to 6/18 in 43.66% of the children, 6/18 to 6/36 in 26.76% of the children, and 16.91% had visual acuity less than 6/36-6/60. A positive CSM was recorded in 74.21% of the children.

Visual Field

Visual field was assessed using Lea flicker wand in all the children. Symmetrical visual fields were found in 74.47% of the children.

Binocular Function

Both the cover and Hirschberg tests were done to detect whether any form of strabismus was present or not. The tests revealed that 43.89% of the children had strabismus. Among those with strabismus, 50.44% had exotropia, and 49.56% had esotropia. Nystagmus was noted in 7.45% of the children.

Refraction

Cycloplegic refraction was performed following the routine static dry retinoscopy technique. Findings reveal that 3.26% of the children were myopic, 16.33% were hyperopic, 80.39% had astigmatism, and 1.06% were antimetropic. Among the 80.39% with astigmatism, 49.60% had with-the-rule astigmatism, and 50.40% had against-the-rule astigmatism, which was prescribed to the children as per the age-matched normal values.

Accommodative Status

The accommodative status of the children was assessed using MEM and Nott retinoscopy technique.[13,14] The findings were as follows: lead of accommodation (18.60%), lag of accommodation (50.27%), and normal accommodative status (31.13%).

Discussion

The children included in this study were undergoing rehabilitation at their schools regularly, so the routine ocular examination was done in their respective rehabilitation centers. This gave the clinician an important advantage in that the subjects cooperated more fully in the examination because of the familiar environment. Moreover, their teachers were immediately available to be educated about the children's difficulties and were offered interventional suggestions.

One factor for poor visual acuity might have been some children's relative non-motivation, fatigue, and prolonged inattention to the acuity tests during the testing duration. Moreover, it cannot be said whether the presenting acuity recorded for each child was actually their best acuity or merely the best effort the child could offer. Even the children in whom CSM was positive might have had better visual acuity than estimated. The accurate measurement of visual acuity in cerebral palsy patients is a difficult task.[1] For most children in this study, reliable methods of assessing visual acuity like Lea paddles and symbol chart were used. The less reliable and qualitative vision assessment method, the CSM technique, was used in the remainder.

A spectrum of visual disorders is prevalent in children with CP and has been described extensively in the literature.[2,3,6,15-19] Our findings are in agreement with the higher figure, showing a prevalence of 79.6%. In this study, 300 children had more than one visual deficit. The prevalence of ocular abnormalities in children with CP is higher than the general population of school children. This emphasizes the need for a proper ocular examination of all persons diagnosed with CP.

Refractive error, as defined in this study, was the most common type of abnormality documented (79%).[20] This is in contrast to the study by Govinda et al. who found strabismus (35.7%) to be the most frequent abnormality. However, prevalence rates of abnormal refractive errors in patients with CP (28.5% to 54%) have been reported in other parts of the world.[6,15,17,18,21] Moreover, only 25% of our children were wearing spectacles when first examined. This emphasizes the need for appropriate referral and management of refractive problems and counseling of parents on the need for vision care in children with cerebral palsy.[6,15,19,20,22] Much of the literature quotes a higher prevalence of hyperopia in cerebral palsy.[13,14] Our study agreed with the prior studies. We found the incidence of myopia and hyperopia to be considerably larger than that reported in normal children. Fant and Perlstein report a higher prevalence of myopia in those with spastic CP and found that hypermetropia was more prevalent in CP with dyskinesia.[23] The prevalence of astigmatism in our study population (43.15%) is similar to several previous studies. Kozeis and Anogeianaki et al.[16,24] reported the incidence of astigmatism to be 40.9%, and Govinda and Lamba reported an even higher incidence (50%).[15] The higher prevalence of refractive error, even in the lower age group, suggests that the emmetropization process may have been hampered. Our findings on the prevalence of refractive error were similar to the findings in children with Down syndrome. As the present study shows a significant prevalence of refractive errors, additional studies should be conducted in order to understand the development of refractive errors in CP in our context.

The prevalence of strabismus observed in the present study (36.83%) matches well with other parts of the world (India-35.7%, 39%; Japan-33.1%; Africa-50%).[2,6,15,18,21,25] Alternating exotropia was seen to occur more frequently in CP patients than in normally developing children. Various ranges for the incidence of nystagmus have been reported in CP (1.02% – 18%),[6,13,15-18,26] and our study agrees with this range (7.45%).

The accommodative status found shows that most of the children with CP have a lag of accommodation (50.27%)[28] and hence the refractive error was corrected accordingly considering their binocular status.[28] Both MEM and Nott dynamic retinoscopy techniques showed similar findings.

Conclusion

Ocular abnormalities are very common in children with CP. Our findings are similar to previous studies in the literature and confirm that children with CP are at more risk of developing ocular abnormalities. Parents and the health practitioners who are responsible for the health and overall development of children with CP should be aware of the ocular defects that may be present in these children. Early intervention will help for the child's physical, social, academic, and visual development. A full eye examination should be sought as soon as a diagnosis of CP is made and yearly thereafter.

Thorough ocular assessment of subjects with CP can be difficult. However, familiar surroundings, a caring environment, and adequate clinical attention can facilitate assessment of all the visual disorders of these patients. Early referral of the children diagnosed with cerebral palsy for ocular examination is of utmost necessity for better visual prognosis.

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