b) Ocular health - the patient was counselled that there was no apparent ocular pathology or systemic condition causing ocular signs.
c) Ametropia and binocular vision - with the ametropia corrected the patient meets all criteria (both Sheard's and Percival's) while viewing at 6 meters and .40 meters. The visual acuity measured binocularly at 6 meters equals the monocular visual acuity.
The AC/A (calculated) is determined as 3.8^{Δ} convergence per 1 diopter of accommodation. Percival's criterion is no longer met at 6M when the stimulus to accommodation is increased by .75 D. (It is to be noted that the unaided visual acuity is less binocularly).
The von Graefe measures would be altered by the following:
3.8^{Δ} x .75 D = 2.7^{Δ} or +2.5 and would be habitually 2.5^{Δ} esophoria at 6M

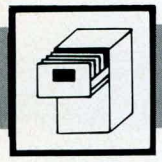
NFV: x/3.5/1.5
PFV: x/15.5/7.5

1.5 exophoria at .4M

NFV: 12.5/16.5/8.5
PFV: 21.5/25.5/13.5

Therefore by correcting the small amount of ametropia the binocular coordination at six meters was treated and at 40 centimeters the stimulus to accommodation was reduced to 2.5 diopters.

Effectiveness of recommended therapy: The patient was contacted 3 weeks after receiving the spectacles. His report indicated no blurriness when looking at the blackboard even after long periods of reading. There were no indications of eye fatigue when reading for extended periods of time. The patient was advised to have yearly ocular evaluations to ascertain that environmental visual demands, ocular health, ametropia and binocular vision has not varied.



CASE REPORT

Improvement of Visual Function of a Cerebral Palsied Child with Periodic Exotropia of the Divergence Excess Type

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Abstract

Frequently, children who have a systemic disease which coincides with a very high incidence of visual anomalies are considered untreatable. This article describes the visual therapy given to a 10 year old child with cerebral palsy and the apparent success of the treatment.

Abrégé

Fréquemment, on considère que certains enfants souffrant d'une maladie générale et de plusieurs anomalies visuelles, sont intraitables. Ce travail décrit la réhabillitation visuelle d'un enfant de dix ans souffrant d'une paralysie cérébrale.

Patient, PT-male, age 10 was examined at the School of Optometry Clinic, University of Waterloo and consequently referred to the Binocular Vision Clinic. At age 4 the patient was diagnosed as having a "mild case" of cerebral palsy. He had attended classes for fine motor control and was in the regular classes at school. Evaluation by the school indicated that he could do all verbal and auditory skills above average but all reading and writing skills were below average. Case history revealed that previously no visual therapy was recommended.
Diagnosis was as follows:

Unaided V.A.

6M	O.D. 20/30	.4M	O.D. .37M
	O.S. 20/25		O.S. .37M
	O.U. 20/25		O.U. .37M

Refractive error:

O.D. -0.75-0.50x045 20/20
O.S. +0.50-0.75x165 20/20

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Sensory fusion:
Fusion and no suppresion at 6M and 40 cms was noted. Stereoacuity at 6M was now 120 secs. as measured on the AO Vectographic Slide.

Binocular Coordination:
At 6M: 22$^{\Delta}$ alternating constant comitant exotropia with left eye preferred.
At 40 cms: 18$^{\Delta}$ comitant exophoria. (in dim illumination bifoveal fixation was maintained out to 3.5 meters. i.e. while viewing further than 3.5 meters the deviation became manifest.)

Retinal correspondence:
Since the condition was occasional there was a possibility of covariance. All tests indicated normal retinal correspondence even when the deviation was manifest.

Sensory fusion:
At 40 centimeters the stereoacuity of 30" was indicated. In dim illumination there was no suppression at 6 meters (diplopia was experienced).

Recommended visual therapy:
1) Correction of the refractive error to equalize the clarity of the retinal stimulus patterns and the stimuli to accommodation.

2) Typical visual training for an intermittent exotropia of the divergence excess type[1].

The visual training for the exotropia consisted of:
1) Anti-suppression training
2) Accommodative facility training
3) Voluntary vergence-vergence accommodation[2] training
4) Positive fusional vergence
5) Sensory integration.

Since fusion was achieved only at distances closer than 3.5 meters visual training was commenced at three meters and then gradually extended to infinity as the binocularity improved. The rationale of the above procedure is dependant upon the relationship between accommodation and convergence during refixation from a dissociated position[2].

After 4 weeks of visual training (6 in-office visits and home training) a binocular vision evaluation was performed. The diagnosis now consisted of:

Refractive error and aided visual acuity:
O.D. -0.75-0.50x045 20/20
O.S. +0.50-0.75x165 20/20

Binocular coordination:
At 6M: 25$^{\Delta}$ exophoria with sufficient positive and negative fusional vergence.
At 40 cms: 7$^{\Delta}$ exophoria with sufficient positive and negative fusional vergence

Ocular Health:
All pupillary reflexes (direct, consensual and accommodative) were found to be present, equal and responsive. Ophthalmoscopy indicated healthy ocular media and fundi. Further evaluation proved to be unremarkable.

The visual training procedures consisted of:

Anti-suppression training
—following a rotating penlight with a red filter and a vertical prism in front of the nonpreferred eye[1]
Accommodative facility training
—accommodative rock and jump directions[1]
Voluntary vergence-vergence accommodation training
—refixation training[1]
—beads-on-string[1]
Positive fusional vergence training
—anaglyphic targets[1]
—vectograms[1]
—loose prisms[1]
—pencil push-ups[1]
—amblyoscopic procedures[1]
—vodnoy aperture rule[1]
Sensory integration training
—telebinocular

Patient, PT-male, age 10 was given a maintenance program and was re-evaluated in 6 months. It was found that his acquired binocular status had not regressed and sensory/motor fusion was present at 6 meters. His mother and school teacher noted an improvement in his learning performance over this period. However the possibility of a coincidence was not investigated.

Discussion:
The diagnosis of cerebral palsy suggests chronic motor dysfunction because of motor control area involvement[3]. Also the literature indicates that the incidence of visual anomalies in the cerebral palsied population is higher than in the normal[4]. Previous results which have been presented[5] indicate that through visual training a change in visual function of the cerebral palsied can be effected. It is apparent that the binocularity of this cerebral palsied patient has also improved with visual training. Therefore there is a need to include the cerebral palsied population in all aspects of visual care and therapy.

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