Single Symbols at near

Line Test at near

Confrontation Visual Field

Cambridge Low Contrast Gratings

Effron Rectangles

Direction of lines

Improvements in Vision Assessment of Children with Motor Impairment for Rehabilitation and Special Education I

Project team

Tuula Kiviranta[1], Ulla Eronen[2], Kristiina Jokinen[1], Eija Jääskeläinen-Heikkinen[3], Inkeri Kekäläinen[1], Elisa Kyllönen[3], Paula Lehtomäki[1], Inkeri Miinalainen[2], Hilve Nenonen[2], Johanna Rontti[3], Ulla Stenbäck[1], Eija Särkelä[3], Aulikki Tervo[2], Liisa Virkkunen[3], Lea Hyvärinen[4],

[1]Mäntykangas School, Kuopio, [2]Ruskeasuo School, Helsinki, [3]Lohipato School, Oulu, [4]Faculty of Behavioural Sciences, University of Helsinki, Helsinki, Finland

Introduction

Children with motor impairment may have varying vision problems. The aim of our project was to develop new assessment practices for thorough assessment of visual functioning at the schools and to adapt the results of the assessments to the every day activities of these children. The study was performed in the three State Schools for Children with Motor Impairments in Finland as a multi- or transdisciplinary project.

The subjects

Fifty three children were chosen to this study based on a need for further investigation because of difficulties in visual functioning at school. Most of the children (77 %) were studying at the three State Schools and the rest of them (23 %) in their local municipal schools. The age of the 53 children in the project varied from 5.5 to 17 years. The mean age was 10.8 years. A great majority of children had cerebral palsy. The main neurological diagnoses of the children are presented in Table 1. Many of the children had also learning problems and associated neurological disorders (epilepsy, need of augmentative or alternative communication, etc).

Table 1. Neurological diagnosis.

Diagnosis	N (%)
Spastic diplegia	22 (41.5)
Spastic quadriplegia	5 (9.4)
Spastic hemiplegia	4 (7.5)
Dystonic quadriplegia	13 (24.5)
Ataxic cerebral palsy	1 (1.9)
Mixed cerebral palsy	1 (1.9)
Myelomeningocele	4 (7.6)
Other motor impairment (mitochondral disease, Coats disease with cerebral calcifications, holoprosencephaly)	3 (5.7)

All children had earlier been examined at least once by an eye specialist in the local hospitals. Before this project, seven children had been diagnosed vision impaired and the Finnish Registry of Visual Impairment at the National Research and Development Centre for Welfare and Health in Finland had been notified. Notification must be made if the corrected visual acuity is permanently less than 0.3 (6/18, 20/60) in the better eye of the person/ child, or there are other impairments of visual functioning that are equally disabling.

In this study, impaired visual functioning was evaluated as described in the ***Management of Low Vision in Children*** (WHO/PBL/93.27, 1993): the effect of vision impairment shall be evaluated in communication, orientation and moving, activities of daily life and in sustained near vision tasks.

Study protocol

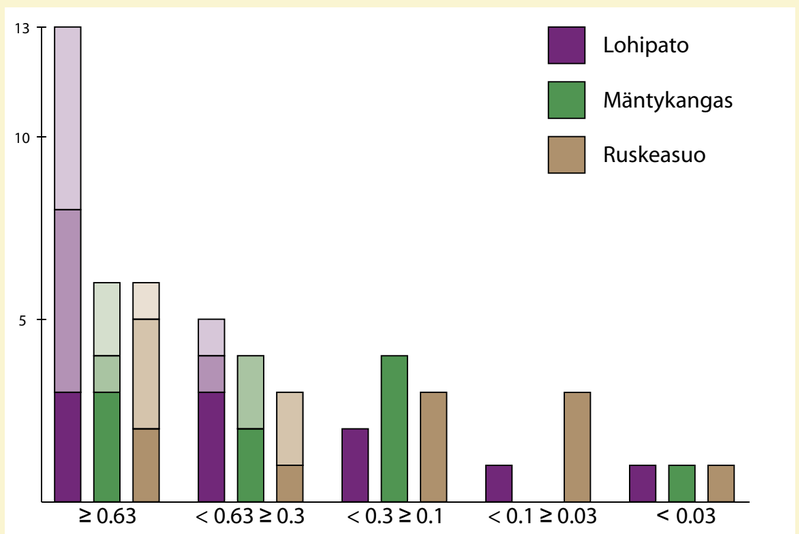
Information was collected with a questionnaire to the parents and teachers on children's visual functioning. The multi-professional investigation group consisted in each school of the consulting ophthalmologist (LH), a child neurologist or a paediatrician, a special teacher, a neuro- psychologist or a psychologist and an occupational therapist or a low vision therapist. Psychological examinations evaluated the level of cognitive and higher visual functions. The results of these tests are preliminary.

In the first phase, the assessment of visual functioning at the schools covered ophthalmologic examination of oculomotor functions, visual acuity with single, line and tightly crowded optotypes (LEA Symbols and Numbers), grating acuity, contrast sensitivity with optotype and grating tests, colour vision with Panel-16 sorting test, visual field by confrontation (flickering toy and non-flickering ball) and in some cases with Goldmann perimetry, perception of motion (Pepi- picture moving slowly on the screen) and length and direction of lines. After that, the assessment of problems in processing visual information is still going on.

Results

Vision impairment has been diagnosed in more children than expected. The most common problems were irregular oculomotor functions. Decreased visual acuity, often with increased crowding effect (inability to keep details separated from each other) found with the 25% spacing, which depicts the demand on near vision in reading usual school books. Decreased contrast sensitivity and loss of visual field in the lower part of the field were also common findings. Variation in the severity of impairment was great. Visual acuity groups of the children are presented in Figure 1.

Figure 1. Visual acuity groups.



In the visual acuity groups '≥ 0.63' (≥ 6/10, 20/30) and '<0.63 ≥ 0.3' (<6/10 ≥6/18, <20/30 ≥20/60) of distance visual acuity using the LEA Symbols line test, 14 of the 37 children are now registered in the Registry of Visual Impairment (the lowermost part of each column with the darkest shade of the colours). The next lighter shade depicts children who have not been registered but who have problems in visual functioning and may be registered later. The lightest shade of the colours depicts children who have so mild changes in their visual functioning that no special services or changes in teaching have been considered.
This diagram clearly demonstrates that visual acuity 0.3 measured with a line test at a distance of 3 meters does not depict the severity of vision impairment.

Altogether there were 30 children with such a severe visual impairment that they have been registered in the Register of Visual Impairment (7 diagnosed earlier and 23 in this project so far). The increase in the number of children with moderate to severe visual impairment is based on the assessment of visual acuity both at distance and at near; at near also with tightly crowded optotypes (25% spacing). A child may have several visual acuities:

Distance test –	single optotypes:	1.6, 6/4, 20/12
	line test:	0.75, 6/9, 20/25
Near vision test –	single optotypes:	0.40, 6/15, 20/50
	line test:	0.20, 6/30, 20/100
	25% spacing:	0.12, 6/50, 20/160

In the clinical examinations often only distance visual acuity with single optotypes is measured.

It is apparent that information related to visual functioning that has been given to schools is insufficient. Even severe vision impairment of many children was undiagnosed. Therefore early intervention programs had not contained enhancement of visual functioning and children's individual educational plans had not considered vision.

Children's learning environments had earlier been improved based on their motor disabilities and to some extend on their vision impairment. After this multi-professional evaluation of vision, several recommendations and improvements in their school situation have been made (Table 2).

Table 2. Recommendations based on the multi-professional evaluation of vision.

Recommendation	N (%)
New eye glasses or alterations in old ones	31 (58)
Magnifying devices	5 (9)
Improved lighting condition in classroom	7 (13)
Positioning learning material at preferred working distance (desk with adjustable surface)	16 (30)
Talking books	15 (28)
Demarcation of learning material	13 (25)
Modification of learning materials:	24 (45)
1. Enlargement of the learning material	20 (38)
2. Using larger print sizes	15 (28)
3. Individually chosen spacing between letters	12 (23)
4. Increased contrast of learning material	19 (36)

In their classrooms the pupils have now less visual and auditory noise than before, as well as better orientation and mobility instructions in their schools. Modification of learning materials is improving learning.

Conclusions:

Vision impairment was found to be far more common than expected and problems in visual functioning more varying than known before in children with motor problems. These findings cause new requirements in teaching and rehabilitation of children. Children should have a well-structured ***transdisciplinary assessment of vision*** as a part of evaluation of their needs for services.

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