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Visual problems in children with brain damage. What is new?

Abstracts

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Overview of vision loss due brain damage, especially visual processing disorders

Prof. Elisa Fazzi, MD, PhD (Italy)

It is well known that the visual functions play a crucial role for early development of children and, in the past 20 years a growing interest has been give to the consequences of early brain damage on visual system.
It has been documented that brain hypoxic–ischemic injury give rise ophthalmologic disorders (e.g. strabismus, refractive errors, retinopathy) but also to visual problems due to the brain damage, usually called Cerebral Visual Impairment (CVI). The term CVI refers to a neurological disorder caused by damage to or malfunctioning of the retrogeniculate visual pathways (optic radiations, occipital cortex, visual associative areas) in the absence of major ocular disease (Good et al., 2001) . From a clinical point of view, the sign and symptoms of CVI could be represented by a reduction of visual acuity or/and visual field, alteration of contrast sensitivity, stereopsis –related to a damage of retrogeniculate systems-, or disorders of fixation, smooth pursuit, saccadic movements – related to a damage of oculomotor control system (Fazzi et al., 2007). In 2001, Good proposed extending the clinical spectrum of CVI to include also disorders linked to impairment of the ability to analyse and process visual information, manifest themselves through a disorder of higher visual abilities (Dutton, 2003) related to malfunctioning of occipito-temporal system (the ventral stream concerned with visual object recognition) or/and occipito-parietal system (dorsal stream concerned with visual-spatial abilities) (Goodale, 1998).
These disorders, known as cognitive visual dysfunctions (CVDs) or grouped under the heading “visual-perceptual impairment” (Braddick et al., 2003; Fazzi et al., 2004; Stiers et al., 2002) can be associated with the neurophthalmological dysfunctions typical of CVI, or constitute the main clinical expressions of CVI in subjects with normal or near-normal visual acuity (“higher-functioning CVI”) (Dutton, 2003).
A main reason for the association between early brain damage, particularly in preterms infants, and CVI is the contiguity between the site of periventricular leukomalacia, the most frequent cerebral lesion due to hypoxic-ischemic damage in preterm, and the visual pathway structures (e.g. optic radiations lateral geniculate body, calcarine cortex and visual associative area). Moreover, the PVL, which could be assumed as paradigmatic example of anatomo-pathological substrate, involved not only the visual structure but also the contiguous cortico-spinal fibers justifying the association between visual and motor symptoms (cerebral palsy like spastic diplegia).
The visual picture of born preterm children is very complex and heterogeneous both for expression and in gravity, nevertheless in the last years many studies have defined the main characteristics of CVI in preterm children (Dutton et al., 2004; Fazzi et al., 2007; Hoyt, 2003; Hood & Atkinson 1990; Jacobson et al., 2002).
Focusing the interest on the higher visual abilities, the Literature, starting from the earlier sixties years (Abercrombie et al., 1964) reports an impairment of visual-spatial and visual-motor integration abilities in born preterm children with periventricular leukomalacia (PVL) which can even manifest itself in very young children (Atkinson & Braddick 2007; Braddick et al., 2003; Fazzi et al., 2004; Stiers et al., 2002, Stiers & Vandenbussche 2004).
First Abercrombie (1964) observed visual perceptual disorders related to PVL considering it to be caused by motor handicap and strabismus, a hypothesis subsequently rejected by other Authors who maintain that visual impairment and ocular motility dysfunctions are not directed causes of VCD, even thought they are frequently present in affected subjects.

Others Authors documented the presence of impairment to visual motor coordination and integration correlated with the reduction of periventricular white matter (Koeda & Takeshita, 1992), with the lateral ventricular dilatation, with the optic radiation involvement or thickness of corpus callosum (Fedrizzi et al., 1996). Fazzi et al., (2004) using the Developmental Test of Visual Perception, documented an impairment in the oculomotor coordination tasks and correlated it with the occipito-parietal white matter reduction. The Authors suggested that the neuropsychological picture could be due a malfunctioning of dorsal stream. Moreover, a deficit in movement analysis and processing has been documented in the subjects with PVL (Gunn et al., 2002; MacKay et al., 2005; Pavlova et al., 2006) that should be related to a interruption of occipito-parietal network by PVL or be related to an impairment of cortico-thalamus projections which are interconnected with extrageniculate visual system (Behrens et al., 2003; Hoon et al., 2002). Recently, Atkinson et al. (2007) described in 6-7 years old children born preterm a dorsal stream vulnerability and a deficit in the attentional processes, that correlated with the severity of brain abnormalities documented on structural MRI. Nevertheless, deficit on certain visuo-spatial and executive tasks were apparent even in children with minimal damage apparent on MRI.

In summary, the visuo-spatial impairment related to dorsal stream damage has been well documented in the Literature, and it has long been considered the hallmark of CVDs. Nevertheless, some recent studies reports also difficulties in born preterm children with PVL involving the object recognition, abilities attributed to ventral occipito-temporal stream. Stiers et al (2001), reported that subjects with early cerebral damage are able to recognise forms and prototipical presented objects but they fail in the recognition of objects presented in unusual way (i.e. overlapping, incomplete or rotated), as the classic agnosic patient described in Literature (De Renzi, 2000; Warrington & James, 1988). Fazzi et al, (2004) observed a deficit in incomplete figure recognition on TPV in preterm with PVL that could be interpreted as a difficulty in gestalt perception related to ventral stream processing.

These observations suggest that in born preterm children the CVDs is represented by a more complex neuropsychological picture that should be characterised not only from a visuo-spatial dysfunction, but also from a deficit in object recognition. But, at present, if for the ventral stream functions evaluation in adults there are different instruments of assessment, one of the major problem is the paucity of clinical tools useful in childhood, in particular in the school age. Thus, to better define the diagnostic and neuropsychological profile of born prematurely is necessary developed a suitable clinical protocols.

In this prospective, in the past 5 years, our research activity was focused on: 1) develop a clinical protocol for the assessment of visual object recognition skills in school age children, and studying the development of these abilities; 2) apply that protocol on a sample of school age born preterm with spastic diplegia and PVL which respond to the characteristic of higher-functioning CVI (Dutton, 2003) to define the cognitive profile children.

Face processing in children

Gudrun Schwarzer (Germany)

Notwithstanding infants' impressive preference for faces after birth, face recognition continues to undergo development during the first decade of life. Infants and children recognize more and more with increasing age, that a specific face identity has been encountered before and assess its familiarity. It is so far under discussion which potentially underlying determinants contribute to this development at a certain age. It is important to specify such determinants because they might have an impact on the understanding where our face processing system per se derives from and how we could manage face processing problems in children. The present contribution will demonstrate the relevance of three determinants of children's face processing development in three sets of experiments.

The first determinant comprises the modes of face processing that infants and children use when they perceive and recognize faces. The results of our experiments show a re-occurring shift from analytical to configural processing underlying infants' and children's face processing.

The second developmental determinant is the significance of emotional facial expression for infants' and children's face processing. Our results revealed that emotional expression of a face facilitates infants' face recognition because facial identity and emotional expression are processed interactively with each other at that particular age. However, processing of face identity becomes independent from emotional expression processing in older children, although emotional expression processing is still strongly associated with face identity information. It will be shown that this developmental change only appears in typically developing children.

The third determinant includes the impact of experience with various ethnic faces on the development of infants´ face processing. We demonstrate the so called other race effect at 9-months of age, like it was reported in previous findings, but in addition to those findings we show that increased experience with faces of an unfamiliar ethnic category can delay the onset of the other-race effect.

All in all, children's increasing face processing abilities during their first decade of their life relies on an effective processing mode, such as configural processing, an appropriate processing of emotional facial expression and a specialization to those ethnic face categories children are mainly familiar with.

Could the „profile of visual functioning“ become a carrier of information between education, medicine, and social services?

Prof. Lea Hyvärinen, MD, PhD (Helsinki)

In several vision rehabilitation teams “profile of visual functioning” has been studied as a way of roughly depicting the numerous visual and vision related functions of children with brain damage related vision loss so that an overview of each child’s situation is possible. Before we can assess the functions in the ventral and dorsal stream we need to know how ocular motor functions, head and body control and the quality of the incoming visual information affect the higher visual functions and what is the quality of coding and processing in the visual cortices.

OCULAR MOTOR FUNCTIONS AND REFRACTION

- Fixation, Saccades, Accommodation, Following
- Strabismus, Nystagmus, Head and body control
- Refractive errors, corrective spectacles and devises

VISUAL SENSORY FUNCTIONS

- Visual acuity, near (single, line, crowded), distance, Grating acuity
- Contrast sensitivity, optotype and grating tests
- Colour vision, Visual adaptation to changes in luminance level, filter lenses
- Figure in motion, Biological motion, Perception of motion at high speeds
- Visual field, size and scotomas, Goldmann, flicker, automatic, campimeter

EARLY VISUAL PROCESSING

- Perception of length and orientation of lines and objects
- Figure-ground, object-background, stereovision, Vernier acuity
- Short time visual memory, matching colours

IN THE VENTRAL STREAM/ INFEROTEMPORAL NETWORKS

- Details in pictures, Noticing errors and missing details, Perception of textures and surface qualities
- Recognition of familiar and unfamiliar faces, Facial expressions, Body language
- Landmarks, Concrete objects, Pictures of concrete objects
- Abstract pictures of objects of different categories, Abstract forms (letters, numbers)
- Reading words and lines of texts, Optimal reading strategy
- Comparison with pictures in memory, ‘Reading’ series of pictures
- Visual problems in copying pictures from blackboard and/or at near
- Crowding effect, Scanning lines of text

IN THE DORSAL STREAM/ PARIETAL NETWORKS

- Awareness of surrounding space, directions and distances in space, Body awareness
- Perception of near and far space, Orientation in space, map based, Memorising routes
- Motion perception, Depth perception, Simultaneous perception
- Eye-hand coordination, Grasping and throwing objects, Drawing, free hand,
- Copying from near/ from blackboard, motor planning and execution

This medical and neuropsychological information is a foundation for the detailed analysis that teachers and therapists perform for assessment of reading, mathematics and other subjects. The findings are marked in tables, in columns “normal (N)”, “impaired but useful (I)” or “profoundly damaged (P)” or with numbers 1, 2 or 3 for Excel, or to document variation in a function on different days (2/4 versus 6/4). Tables like this nearly always show that there are more normal functions than impaired functions, which is important information to the families and teachers.

	N	I	P
	1	2	3
	2/4	6/4	

The impact of baclofen on perception and awareness of space and motor functions

Ilari Kousa (Finland)

This presentation reports the improvements in visual, visuomotor and cross-modal functions in myself during intrathecal baclofen treatment. I was born in 1984, 2 months prematurely by cesarean section due to placental ablation and developed spastic cerebral palsy.
In my early childhood most motor functions were severely restricted by intense spasticity. This severely affected my development so that, for a long time, interaction with the environment was limited resulting in visuocognitive deficits such as lack of spatial awareness and virtual visual space, but otherwise intact cognitive faculties. The problem areas included:

- Spasticity severely restricted mobility of muscles and joints. Motor memory was weak.
- Virtual visual world was nonexistent with no visual memory.
- I had an inability to create virtual environments based on textual descriptions.
- Fictional texts and lyrics could be understood but not emotionally experienced.
- The flexibility of shifting attention was limited and slow.

Until 2004, the physiotherapy was Neuro - Developmental Therapy (NDT). This, however, proved insufficient. Therefore, in January 2004 intrathecal baclofen therapy was started with a subcutaneously implanted computer controlled pump. At the same time Orthopedic Manual Therapy (OMT) was started, a form of therapy involving normalization of joint, muscle and nerve physiology by manual techniques. After implantation of the pump, in addition to the expected drastic drop in spasticity, dramatic but slow improvement started in many areas:

- Awareness of the body parts increased slowly, starting with toes.
- Spasticity decreased first in superficial muscles and is still decreasing in the deep muscles.
- The visual fields became of normal size after two and half years of treatment.
- Inhibitory processes of movements developed allowing smoother movements.
- Awareness of directions and distances developed leading to 3D world in 2007.
- Dividing attention between two different tasks became possible in fall 2009.
- Speech has slowly become easier and faster.

These phenomena highlight the brain‘s plasticity. CP is not a stable condition. Significant improvement can take place, most probably due to baclofen‘s neuroregenerative effects on the central nervous system and several years of OMT.

Learning math: from difficulties to practice

Eija Häyrynen (Finland)

Number sense is the child's understanding of quantity, number words and number symbols (Aunio 2006, 2- 5) and it also is the ability to look the world through "math lenses", make comparisons, know what numbers and their relationship mean (Malofeeva et al 2004, 648). Subitizing depicts a preverbal ability in infants to determine the amount of items in sets of four or less - a magnitude processing mechanism and it also has a role in math learning (Desoete, Ceulemans, Roeyers & Huylebroeck 2009).

The learning of conventional counting system (Aunio 2004, 3) starts normally at around the age of two when children show knowledge how different number words refer to different amount of objects. By the age of five years children are able to say number words correctly starting from one, understand that countable objects should be marked only once and that the last said number-word indicates the number of objects in the set.

About the cognitive antecedents (Aunola et al 2004) is known that children who start with good skills/ good number sense improve their performance faster than those with poorer skills. Good metacognitive knowledge and good listening comprehension in a school beginner predict good performance in math. The higher the level of visual attention at the of age six, the faster is the subsequent rate of growth in math performance. Problems with executive control and attention directing flexibility/directing of attention are positively correlated to learning difficulties in mathematics. Poor working memory is associated with low math performance. Visuospatial working memory and mathematical skills are connected (Kyttälä 2008).

When working with children who have brain damage it is crucial that the child and his family as well as all professionals around know the child's condition, the way he/she sees, what the different measured values mean and what functions will be trained and supported in near future. These children face a lot of difficulties already in the early stages. They may have sensory deficits: visual, hearing, tactile, kinaesthetic deficits as well as motor and muscle and memory disorders. Pathcy loss of function in the central visual field makes reading of numbers much more difficult than reading words. The posture may collapse, perception is random, attention shifts to unimportant details – the world around them occurs chaotic and the link between cause and effect may remain unclear. Their possibilities to go around and get experiences crucial for learning and understanding are very limited. Right and left are the most difficult spatial concepts. Above – under - in front of – behind may not exist, if body awareness is weak or has not developed. Number line may not exist at all or directions when moving on the number line may be weak. Procedural and conceptual difficulties challenge the learning.

The learning process is vulnerable because of the weak inhibitory processes for the stimulus from outside and inside - the smallest sound, noise, visual detail, sorrow, excitement can derail the activity. Calm environment and stable life would be optimal. With math teaching there must be used time to help the child to understand the place value and the basic 10 system (decimal number/numeral system); to understand the value of a digit within a number and its relation to other digits, its visuospatial location. In the presentation there will be examples of good practice like verbalizing, storytelling, materials and useful tools to understand algorithms.

Assessment of vision for early intervention

Namita Jacob, PhD (India)

From the moment of birth, infants start assimilating information about the world through their experiences of it. The sensory system receives information about the environment. In the very early stages, it is these systems that help the infant develop an understanding of their own body as belonging to them and under their control, an understanding of spaces and places, and an understanding of things and people. These are key concepts that enable a child to control and interact successfully with the world.

Vision is a powerful sense, implicated in all areas of development as the coordinating and integrating sense. Consider the world from the perspective of the infant in his crib, a mass of sensations – sounds, movement, smells and unpredictability. Vision, with its particular capacity to provide simultaneous input of all things in the vicinity, is what helps the child to begin to create schemas of the world around him.

For the rehabilitation worker, the primary responsibility is the promotion of development and enabling learning. In order to do this effectively, the availability and use of vision for learning, the possible impact of vision loss on other areas of development and specific impact in acquiring and processing information become the focus of assessment.

When assessing, the question that is relevant to the educator is how vision contributes to how the child explores and learns about the world. The visual functions that are clinically measured are valuable in that they tell the educator about the visual potential of the child. However, they yield little information about the child's capacity and willingness to use vision in more typical settings. Clinical tests require a standardized environment so that each visual function can be isolated and studied. However, in real life, the light, the size of the target, it's distance and position and the quality of the background against which it must be seen is not only varied, but may vary during viewing. Further, senses are rarely used in isolation and the capacity to use senses together is rarely assessed in a typical clinical examination. In order to understand the role of vision in a child's learning and development, it is important to observe visual functioning in situations that more nearly mimic real life.

Functional vision assessments focus on gathering information about how children use their vision to explore, learn, plan and execute their plans in the context of their daily activities. Use of vision is typically observed in the areas of movement, communication, literacy and interaction with people and objects. For the educator, identifying the circumstances and strategies that facilitate the use of vision and determining how best to support the child's learning and development are major objectives of a functional vision assessment.

Visual disorders and their assessment in children with CVI at the Vision Rehabilitation Clinic in Tübingen

Prof. Susanne Trauzettel-Klosinski, MD (Germany)

Background: In children with CVI, the neurological symptoms can be so dominant that additional visual deficits are often overseen. If correctable visual impairments are not detected, visual function is underestimated. This is why knowledge of visual function and potential treatability of deficits is extremely important for optimal educational support of these children. Another problem is the difficult and time-consuming examination, which requires specific experience and methods for assessing functions beyond visual acuity, which – in reality – is often the only measure used in conventional settings.
Purpose: The purpose of this study was to develop a test battery with readily available means to assess, at least semi-quantitatively, important visual functions in a way that can, to a large extent, be independent of the examiner and therefore reproducible. This test battery then was tested and evaluated in CVI children of our Vision Rehabilitation Clinic.
Methods and Patients: We used refraction by retinoscopy, ability to engage fixation, spontaneous nystagmus, optokinetic nystagmus, smooth pursuit, reflexes of pupils and lids. Visual acuity for far and – if possible - near was measured dependent on the age and co-operation as grating acuity, the Pearl Test, the point detection test, Lea symbols or, if possible, according to DIN norm, with standardized optotypes. Contrast sensitivity was assessed by Lea`s Hiding Heidi Low Contrast Faces (100, 25, 10, 5 %). Orthoptic status: eye position, convergence, motility and effect or necessity of accommodative support. Visual fields: The functional visual fields were assessed as gaze fields: We developed a 30° campimetric screen with LEDs, which provoke eye movements towards the stimulus. These saccades can be observed by the examiner. Morphology: anterior segment, lens, optic nerve, retina, orbit, lids and head. We examined 61 patients, age 54.6 +/- 40.5 months, range 8-188 months, with this test battery. Referral was mostly by the neuropediatrician (28%), spastic tetraparesis was present in 59.7%, hemiparesis in 12% and hypotonia in 25.8%. Epilepsy was associated in 59.6%.
Results: Visual acuity (va) was no LP in 19.7%, only LP 14.8%, va = 0.1 or less in 41%, > 0.1 – 0.3 in 14.8% and > 0.3 in 9.8%. Refractive errors were present in 59%, nystagmus in 67.2%, reduced contrast sensitivity in 52.5%, strabismus in 67.4%, convergence was assessable in 39.3%, campimetry of the 30° field was assessable in 26.2%. The optic disc showed atrophy in 33 patients (54.1%) and hypoplasia in 4 patients (2 with de Morsier syndrome).
Conclusions: The pre-existing test methods and the new campimetry were meaningful and allowed a reliable examination of the children. Additionally, all children received specific rehabilitation measures: Early support (16), consulting for school material (6), admission to an institution for the multiply handicapped (6), low vision school (4), regular school with integrative support (2), social support from the government (36). This shows that adequate assessment of visual function can lead to practical decisions for the future educational and social development of the children and their families.

Developing observational skills in kindergarten teachers

Verena Petz (Germany)

Nearly half of the children who enrol in elementary schools have not had their vision assessed. Several studies show that the German "U-Untersuchungen", designed to detect diseases and developmental problems early, can only detect some visual problems. In case children are referred to an ophthalmologist, mainly refraction, visual acuity, stereovision and oculomotor functions are assessed. However, visual processing is not assessed at all.

Tests and observation lists available for assessing child development in early intervention and kindergarten contain some visual tasks without any concept why and how exactly they should be observed in daily activities. DTVP-2, the test most often used for assessing visual perception, refers to practices used in the early seventies. Research on neurological basis of vision and tests for visual functions have been developed further during last 30 years.

Our daily life requires many more visual skills and strategies than what can be tested with these instruments: seeing in different light conditions, seeing while moving, interpreting and recognizing other peoples faces and facial expressions, to visually orient in near and far space as well as using vision in sustained near tasks such as reading. We need to make use of our vision in tasks of daily living such as pouring fluids, dressing and eating. In summary: most of our daily visual tasks are not like laboratory tests: a still picture in good lighting and high contrast.

My PhD study focused in working with kindergarten teachers. It is a challenge to think of play situations for group settings. Most of functional vision tests are designed for a face-to-face, one child – one tester setting. Kindergarten teachers are not used to test children and it should not become their task in the future. Their task instead is to observe children's development, their behaviour in the group, and in daily activities – at least for a time span of up to five years. Eight kindergarten teachers working in five different companies, diverging in their mission concepts, confirmed that they had little knowledge about vision in children. Learning about visual functioning and observation was not in their vocational training and is not offered as professional training nowadays. Nearly every game situations and material – which were close to 35 – weren't ever seen by the teachers before. The teachers themselves were surprised how long the children were playing with them, sometimes one and a half hours, up to six different games. They appreciated this style of intensive contact in working with the children.

The extract of results shows that in the future, a high acceptance of my instrument can be expected. By observing the child's vision in daily context, professionals working in kindergarten have an important role in the interdisciplinary team for vision assessment. This instrument could thus be integrated in a process of assessment and interdisciplinary cooperation.

All work that is done at present and in the future in early intervention should aim to developing supportive strategies in communication, spatial orientation and learning for children with probable ocular and visual processing problems. We work for the children to develop skills and strategies so that disorders do not cause problems.

Assessment of visual functioning in children with intellectual disabilities

Laurent Dura (Luxembourg)

Observations throughout personal professional experience and exchange with colleagues working in the field of children with intellectual disabilities led to the hypotheses that vision in children with intellectual disabilities is seldom or not at all assessed and information on visual functioning is missing and can therefore not be integrated and considered in the educational and didactical work with and around the child. Like this, special visual needs cannot be fully identified nor satisfied.
Different explanations on the reasons why this kind of information is lacking can be found, one being the difficulty of the assessment of these children. That leads to findings such as a high prevalence of so-called non-assessability, recorded in the student's files, and leaving the question about visual functioning open and unclear.
Another possible hypothesis was that appropriate test materials and/or methods might be missing.

These questions led to a PhD-Thesis where the topic being the assessment of children with intellectual disabilities, should be analyzed by:

- Setting up a test procedure for the assessment of visual functioning in children with intellectual disabilities.
- Evaluating the adequation of the test procedure for the target population (children with intellectual disabilities).
- Realizing an explorative study on the visual functioning of children with intellectual disabilities by applying the test procedure.

The short presentation on the ongoing of the mentioned thesis focuses on the explorative study and should give an overview on:

- The visual functions to be assessed,
- the tests chosen for the assement,
- the methodological proceedings,
- the study sample
- and some early findings.

Devices for Children with visual disorders

Stefanie Holzapfel (Germany)

Objective:

The purpose of this study was to investigate the supply and the use of devices for children with visual disorders who attend schools for children with visual impairments in Germany.

Methods:

Information were collected about the devices of 119 children with visual disorders that attend primary schools for children with visual impairments in Germany based on questionnaires. Teachers and parents of the children filled in these questionnaires. In addition 30 children out of this group were observed at school and the children, their teachers and some parents were interviewed.

Results:

The devices, used by children with visual disorders, showed wide differences in number, type and place of use, depending on the visual functions and the age of the child as well as on the personal and environmental context. Differences could also be noticed between the information from parents and teachers about a specific child. Several children had difficulties in using their devices properly and some devices did not meet the child's need.

Conclusions:

The use of devices for children with visual disorders is a multifarious topic depending on the abilities of the child, the complexity of the device and the context. The context can be differentiated in the personal context, which includes the people surrounding the child and the environmental context, which includes e.g. the school, the equipment of the school and the availability of a resource centre.
The results suggest that important factors which influence the use of devices are: 1) the available information about the abilities of the child, based on a functional vision assessment and 2) on observations during different school and spare time situations as well as 3) a regular communication between those people, who care for the child, e.g. parents, teachers, ophthalmologists, optometrists and rehabilitation specialists, and 4) a proper training.

Transdisciplinary Teamwork

Prof. Lea Hyvärinen, MD, PhD (Finland) &
Prof. Renate Walthes, PhD (Germany)

In the care of children with brain damage related vision loss, education and medicine share several difficulties:

1. Too little knowledge of each other's work:

a. Medical personnel, except occupational therapists at some special schools, rarely know-how detailed information teachers need to help children to develop their learning strategies.

b. Teachers are taught to accept the results of medical assessment that they do not properly understand because they do not yet repeat the measurements at schools. At schools where basic vision tests are routinely used, awareness of students' functional difficulties and their causes has greatly improved and has lead to development of new teaching and learning strategies.

2. Too little knowledge about brain damage and special needs

a. In most hospitals ophthalmologists assess these children as if they were typical children with strabismus and/or amblyopia. Communication problems or intellectual disability lead to superficial examination in many places. Accommodation, fixation and saccades are not assessed and therefore many children have only distance correction in their spectacles and few or no devices. Assessment of visual ergonomics is rarely done so that head and body control are considered.

b. If classroom teachers notice unusual behaviours they may not know that the behaviours are related to vision loss. Some teachers have learned to use +3 ready-made spectacles to help the child, not knowing that +3 spectacles work only when basic refractive error of hyperopia is fully compensated. It is becoming better known that in work at close distances myopic children may function better without their spectacles, even if these have been prescribed for "all time use".

3. Wrong statistics of brain damage related vision loss in children

a. Based on ICD, only one diagnose is registered to depict the cause of a child's impairment. This leads to that only children without other more visible impairments are registered as visually impaired. They are 10-20% of all visually impaired children. Children with brain damage related vision loss represent 20-25% of visually impaired children and many of them function quite well in most tasks at school. There is in each country a large group of multidisabled children whose vision problems are not registered and thus officially these children do not exist. Based on limited studies at special schools that function as resource centres and serve a major part of children with motor and intellectual disabilities, the size of the group of visually impaired children with multidisability can be estimated as 5-7 per 1000 school age children in western countries.

b. Also in education the same principle of only one principal impairment/disability is accepted. Training of teachers for children with motor problems or developmental delay/ intellectual disability does not include courses in vision impairment and thus teachers are not aware of the causes and variation of functional visual problems, which are taken as an integral part of the "primary" impairment.
   Teachers of children with other "primary" impairment should have special courses in the impaired visual functions typical to that specific impairment. In several countries there are regular courses of teachers and rehabilitation workers where brain damage related vision loss is discussed within the framework of ICF-CY. In some countries also ophthalmologists, paediatric neurologists and optometrists participate in these courses. This training should become a part of the basic training of all occupations involved in the care of children with brain damage related vision loss. Children are entitled to special education that meets their needs and supports their development.

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