

#### Assessment of Visual Functioning of Disabled Infants and Children as Transdisciplinary Team Work

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#### Transdisciplinary Assessment

Involves numerous specialists in:

- medicine, in hospitals and locally
- early intervention team(s)
- social services
- education, local school, resource centres

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- FAMILY of the infant(s) child(ren) or
- FAMILIES of the infant(s) child(ren)

### Retinocalcarine pathway

#### to the visual cortex in the occipital lobe



### Processing of visual information



Early processing in the occipital lobe:

Ventral stream Dorsal stream Mirror neuron system

### What if an infant is functionally blind?



Congenital glaucoma Cloudy corneas, flat anterior chambers "Developmental emergency" Patricia Sonksen





Corneal transplants, activation of use of vision during 10 weeks of clear cornea + support to motor development >> normal development

### First days and weeks

- First child
- Parents have no experience of blindness
- Treatment of the disease in the eyes Worries not knowing the future
- Immediate contact with early intervention
- Assessment of vision, near spectacles
- Assessment of general functioning
- Assessment of the needs of the family

### First days and weeks

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- Assessment of general functioning
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Early intervention should start as an integral part of treatment, at birth if visual impairment is noticed during the first day. First information is a part of early intervention.

### Visual communication



Eye contact, copying of expressions At 6 weeks, 8 weeks at the latest BONDING

### Social smile, active interaction at the age of 12 weeks.



### Eye contact and social smile

#### are important to the baby and the parents

#### 4-month-old baby refuses visual communication



Insufficient accommodation? Mirror neuron system?



### Accommodation

#### eye contact and social smile



#### Weak accommodation can be compensated with "reading glasses".

#### Penalisation+bifocal Amblyopia did not develop, binocularity remained



Late development of accommodation may lead to esotropia, which reguires glasses with special structure: bifocal for the left eye and near correction for the reight eye = "penalisation".





At school age esotropia is corrected with progressive glasses, no surgery was needed in this case.

#### Transdisciplinary Assessment of infants and children with multiple impairments

- family of the child
- obstetrician, neonatologist, ICU
- paediatric neurologist: neurologic dg
- early intervention team
- paediatrician, health care nurse
- ophtalmologist: anatomy, diseases,
- optometrist: functional diagnosis, glasses
- teachers, therapists: observations, re-testing
- genetic diagnostic team
- audiologist, ENT-specialist
- (neuro)psychologist: specific tests

### Clinical examination

and a few clinical tests prepare for the assessment of visual functioning



Few tests to measure visual functions







Hiding Heidi test Pepi-test



### Hiding Heidi

#### low contrast pictures for assessment of communication distance



Facial expressions are fast moving low contrast shadows on the face. Copying smiling face = the infant must have seen the smile to copy it. In a few seconds we have observed key brain functions for visual communication.

### Communication

#### Training of Baby Tadoma



Early interaction uses smell, body contact, voice, eye contact, facial xpressions



### Figure-in-motion, Pepi-test







Near correction, head support

Pepi-test, copy from www.lea-test.fi

Never mention what you saw moving on the screen!! You can ask "Should I play it again?"

## Before the assessment of visual functioning

Clinical examination:

- structure of the eyes
- structure of the visual pathways
- refractive errors
- spectacles, under- or overcorrections
- ocular motor functions
- accommodation

The above functions are assessed and reported by opthalmologists. The infant should have proper glasses fitted by an optometrist. Assessment is a part of Early Intervention.

#### Age appropriate assessment

Normal development of vision as a guide:

- Most visually impaired infants have other impairments that affect the development of vision and communication
- Eye contact, social smile, keen observation of movements of hands, hands to midline and into mouth, copying of goal-directed hand movements are they present?

Other functions related to mirror neuron system functions:

- resiprocal movements in baby massage (see Leo video)
- anticipation of daily activities like meals



#### At the Art Museum Pori, Finland

Infant artists using Mirror neuron functions

Visually impaired infants can participate as soon as they have sufficient control of head and hands or can be supported by a wedge.

Photo: Päivi Setälä



#### Low tonus and poor head control



Include vision as an integral part in the early general intervention. Strong visual stimuli activate motor control. Avoid passive stimulation!

### Constricted visual field



#### Large illuminated ball used by the child's own therapist.

### Assessment >> Early Intervention



### Awareness of hands



Normal hand
 Spastic hand

### Eye contact

#### when reading lenses give a clear image on the retina



Have several pairs of plus lenses from +4 to +10 in soft frames for trial.

#### Visually active infant ten weeks later: improved visual and motor functions



Use favourite toys to entice movements.

Right eye's Grating Acuity less than in the left eye >> training as a part of physiotherapy.

### Vision loss

often affects development of following areas of functioning:

- communication
- interaction
- motor development
- spatial concepts
- orientation in space
- object permanence
- language

Support of all these functions should be included in the functions of each day day – several times so that the infant experiences activities in all functional areas like a sighted baby, preferably also as many.

#### Play situation as training orientation in space, listening skills, object permanence



Light coloured surfaces rough, dark surfaces smooth >> visual and touch information coinside.

Resonance board, plastic vaste basket, metal washing basin, big ball and mirror as playthings.

"Little room" for wareness of small spaces; tactile, auditory, haptic information in exploration of toys hanging on rubber band.





### Help for Early Intervention

#### Leo learns by doing



DVD sokean lapsen arkikäsittelystä

### Leo Video

how to create play situations for motor and spatial experiences



















### Contrast sensitivity

#### the better the lower contrast is perceived



#### Low contrast information & image quality Lamberto Maffei 1981



Visual information for percetion of round forms and in communication is NOT transferred by fine lines (high VA) but broad lines (low VA) at low contrast.

## A: fine and broad linesB: no fine linesC: no broad lines





### Vision loss after the first year

- Inherited diseases, retinal dystrophies and degenerations, optic nerve, brain disorders
- Brain damage related vision loss, late dg
- Infections and inflammations
- Accidents
- Non-accidental damage
- Numerous syndromes

Early intervention starts as a part of diagnostic work. Information early also to the school and resource centre.

### Testing Vision

### Training for assessment



Learning the concept "same" with colours as preparation for the measurement of VA



with B & W forms



comparing concrete object with the picture of the object

Playing Cards





#### Learning to match forms may require months of fun play situations



Infants with Down syndrome should have their near correction at the age of a few WEEKS if the error is +6.0 as in this girl or a high minus.

#### Transdisciplinary assessment



The persons with the best communication test the different visual functions.

#### Assessment

#### for schools and for early intervention, 3 main areas

- 1. Oculomotor functions
- 2. Quality of the image: Clinical tests and observtions
- 3. Processing of the image
  - ventral stream
  - dorsal stream
  - mirror neuron system
- Compensatory strategies

### Clinical tests

#### results are important for EI and education

- Ocular motor functions, spectacles
- Grating acuity
- Optotype acuity
- Contrast sensitivity
- Visual field
- Colour vision
- Visual adaptation, filters
- Motion perception
- Fusion, stereo vision TESTS REPEATED AT KG and SKOOL





#### Use of tests

Nearly all tests can and should be used by teachers, therapists, and psychologists, not only by ophthalmologists, orthoptists, and optometrists who need to assess refraction, glasses and eye movements.

Succesful testing is more common at schools and during early intervention activities than in doctors' offices.

#### Use of tests

Nearly all tests can and should be used by teachers, therapists, and psychologists, not only by ophthalmologists and optometrists.

Test results become better understood when one uses the tests in play situations, at school or at home.

### Early processing in occipital lobe



Early processing: Coding of Colours Contrast edges Movement/ motion Line directions & length Stereovision Object/ background Figure/ ground Visual closure, filling-in Visual illusions

> Short term memory Tactile, haptic, and Auditory space

### LEA Rectangles & Mailbox Colorama Game & Heidi Expressions



### Assessment in day care

- Vision for communication, eye contact, interaction
- Hiding Heidi, Pepi-test
- Oculomotor functions: fixation, saccades, accommodation
- Glasses? Fitting, near correction?
- Grating acuity
- Spatial concepts, body awareness, object permanence
- Language
- Exploration with all senses, concepts

#### Assessment in day care, 2

- Orientation in near and far space, cane
- Quality of visual field
- Copying parallel lines, cross, angles
- Drawing a picture of himself, house
- Puzzles, noticing missing details in pictures
- Completing incomplete pictures
- Perception of complex pictures, scanning
- Eye-hand coordination in detail

#### Assessment of vision for school

should answer even more questions
related to the numerous functions
in the parietal lobe (dorsal stream),
in the temporal lobe (ventral stream),
and the mirror neuron system.

#### 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, visual imagination Copying from near/ from blackboard, motor planning and execution Mathematics, Visual attention

#### Ventral Stream Inferotemporal Networks, Recognition Functions

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

CASE	N	I	1
OCULAR MOTOR FUNCTIONS			
A Fixation			
B Following movements			
C Saccades			
D Nystagmus			Τ
E Strabismus		1	T
F Accommodation			Π
G Convergence			Τ
CLINICAL FINDINGS, sensory H Binocularity			
I Visual Acuity			
J Grating Acuity			
K Contrast sensitivity, optotype, grating			
L Colour Vision			
M Adaptation speed, observation			
N Photophobia			
O Visual field, central scotoma?			T
P Visual field nerinheral			Т

P Visual field, peripheral Q Motion perception, Pepi-test R Biological motion, Walking Man

#### S Refraction T Correction of refractive errors

#### EARLY PROCESSING

V Length of lines	
W Orientation of lines	
X Objects/figures on a patterned background	
Y Textures and surface qualities	

#### DORSAL STREAM

#### OTHER PROFILES AVAILABLE

A Developmental level	
B Motor Functions	

	N	I	P
VENTRAL STREAM	-		
A Lenght of lines, purely visual test			
B Direction of lines, purely visual test			
C Recognition of details			
D Noticing missing details in pictures			
E Recognition of faces	1		
F Interpretation of facial expressions			
G Reading body language			
H Landmarks			
I Concrete objects			
J Pictures of concrete objects			
K Abstract pictures of objects of different categ			
L Abstract forms (Roman letters, numbers)			
M Reading words, characters			
N Cartoons			
O Visual problems in copying pictures			
P Increased crowding effect			
Q Recognition problems n math tasks		-	-
MIRROR NEURON SYSTEM			
A Early communication and interaction			
B Interpretation of emotions and intentions			
C Observation and copying of movements			
D Effect of image quality, motion perception			
E Effect of image quality, contrast sensitivity	l li		
F			
G		1	

#### OTHER COMMON PROBLEMS

N Visual and auditory overload	
O Specific memory problems	
P Head control	
Q Body control	
R Hand functions	
S Moving	
T Hearing	
U Executive functions	
V Other	
W Use of devices at school, KG, work	
X Use of devices at home	
Y Services of educational resource centre	
Z Vision services as medical care 82	

#### MAIN FUNCTIONAL AREAS

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PROFOUND loss of function in \_\_visual funcitions IMPAIRED but useful visual functions in \_\_ NORMAL visual function in \_\_ functions

CASE	N	Ι	P	
OCULAR MOTOR FUNCTIONS	2:			1
A Fixation				
B Following movements				
C Saccades				
D Nystagmus				
E Strabismus				
F Accommodation		1		
G Convergence				

#### CLINICAL FINDINGS, sensory

H Binocularity	
I Visual Acuity	
J Grating Acuity	
K Contrast sensitivity, optotype, grating	
L Colour Vision	
M Adaptation speed, observation	
N Photophobia	
O Visual field, central scotoma?	
P Visual field, peripheral	
Q Motion perception, Pepi-test	
R Biological motion, Walking Man	
S Refraction	
T Correction of refractive errors	

#### EARLY PROCESSING

1-1

	Ν	Ι	P
VENTRAL STREAM			
A Lenght of lines, purely visual test			
B Direction of lines, purely visual test			
C Recognition of details			
D Noticing missing details in pictures			
E Recognition of faces			
F Interpretation of facial expressions			
G Reading body language			
H Landmarks	iC.		
I Concrete objects			
J Pictures of concrete objects			
K Abstract pictures of objects of different categ			
L Abstract forms (Roman letters, numbers)			
M Reading words, characters			
N Cartoons			
O Visual problems in copying pictures			
P Increased crowding effect			
Q Recognition problems n math tasks			

#### MIRROR NEURON SYSTEM

A Early communication and interaction	
B Interpretation of emotions and intentions	
C Observation and copying of movements	
D Effect of image quality, motion perception	
E Effect of image quality, contrast sensitivity	
F	
G	

### Profile of visual Functioning

For IEP/ILP 2004, Learning strategies to be trained

N= normal (1), I= impaired but useful (2), P=profound VI or blindness (3)

	N	Ι	P
DORSAL STREAM			
A2 Perception of near and far space			
B1 Observation of surrounding			
C3 Orientation in space, map based			
D2 Route based orientation			
E1 Simultaneous perception			
F1 Eye-hand coordination			
G1 LEA-Rectangles			
H1 LEA-Mailbox			
I1 LEA-Puzzle			
J1 Grasping and throwing objects			
K2 Drawing, free hand			
L2 Copying from blackboard			

10.2 TC		N	I
CLINICAL FINDINGS, ocular motor funct			
Al Fixation	-		
B1 Following movements			
C1 Saccades			
D1 Nystagmus			
E3 Strabismus			
F2 Accommodation	_		
CLINICAL FINDINGS, sensory			
G2 Binocularity			
H1 Visual Acuity			
Il Grating Acuity			
Jl Contrast sensitivity, optotype			
K Contrast sensitivity, grating			
L1 Colour Vision			
M4 Adaptation speed	4		
N2 Photophobia			
Ol Visual field, central			
Pl Visual field, peripheral			
Q2 Motion perception, high speed			
R1 Biological motion			
S Depth perception			
T5 Vernier acuity			
U5 Other	_		

#### EARLY PROCESSING VI Length of lines.

	_
W1 Orientation of lines,	
X2 Objects/figures on patterned background	
Y Visual closure	
Z2 Textures and surface qualities	
AAl Shorttime memory, if text is large	

#### DORSAL STREAM

A2 Perception of near and far space	
B1 Observation of surrounding	
C2 Orientation in space, map based	
D2 Route based orientation	
El Simultaneous perception	
F1 Eye-hand coordination	
G1 LEA-Rectangles	
H1 LEA-Mailbox	
Il LEA-Puzzle	
Jl Grasping and throwing objects	
K2 Drawing, free hand	
L2 Copying from blackboard	

	N	I	P
VENTRAL STREAM			
Al LEA-Rectangles, purely visual part of the test			
Bl LEA-Mailbox, purely visual part of the test			
Cl Recognition of details			
D1 Noticing errors and missing details in pictures			
E3 Recognition of faces			
F2 Interpretation of facial expressions			
G2 Reading body language			
H2 Landmarks			
Il Concrete objects			
JI Pictures of concrete objects			
K1 Abstract pictures, objects of diff. categories			
Ll Abstract forms (Roman letters, numbers)			
M1 Sequencing non-sense words			
N1 Comparison with pictures in memory			
Ol Funny pictures			
P1 Pictures of different activities, occupations			
RI Reading series of pictures			
S1 Visual problems in copying pictures			
T2 Increased crowding effect			
U1 Recognition in mathematical tasks,	125	Г	
V1 Memory functions			
W2 Spatial problems			E
X5 Other			

OTHER COMMON PROBLEMS	
M1 Integration of sensory information	1000
N2 Visual and auditory overload	
O1 Specific memory problems	
Pl Head control	
Q1 Body control	
R2 Hand functions	
S2 Moving	
T1 Hearing	100
U2 Executive functions	
V5 Other	
WI Use of devices, categories decided locally	

#### Early Diagnose



#### Strategies planned

#### Transdisciplinary Assessment

In the assessment of children with vision loss:

- ophtalmologist: anatomy, refraction results of all clinical tests in plain English
- optometrist, spectacles, devices, functional tests
- teacher, therapist: observations
- neurologist: dg, neurologic impairements
- neuropsychologist: cognitive vision

#### Transdisciplinary Assessment

- family of the child, history, functioning
- obstetrician, neonatologist, ICU
- paediatric neurologist: neurologic dg
- early intervention team
- paediatrician, health care nurse
- ophtalmologist: anatomy, diseases, glasses
- optometrist: functional diagnosis, devices
- teachers, therapists: observations, re-testing
- genetic diagnostic team
- audiologist, ENT-specialist
- (neuro)psychologist: specific tests video documentation

#### Opinion of the student

- Which functional area is most important?
   In which function does (s)he not do well?
   (an open ended question)
- Which one of the four main visual functioning areas does (s)he value most? Why?
- Which one of them is most difficult? Why?
- Which one of them does (s)he have most/ least interest in? Why?

### Participation

- How does the student experience his/her participation in activities?
- How does (s)he experience daily communication at school, evening activities, camps, during trips.
- How does the student see **his/her** future?
- Family's experience/opinions.

#### Environment

- Attitudes and actions of people
- Physical structure of the environment
- Adaptations possible/ made
- Integration
- Inclusion
- "Least restrictive environment"



# Thank you for your attention