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Motor development and (early) intervention in blind and severely visually impaired babies, toddlers and children

Introduction (1)

- Visual impairment interferes strongly with gross and fine motor development in blind and severely visually impaired babies and children (Prechtl et al., 2001; Fazzi et al ,2010).

- This situation creates a paradox:

  → Motor development is at risk, delayed and follows its own sequence in blind children (Helders, 1992; Prechtl, 2001; Dik, 2005; De Boer-Drenth, 1993; Rosen,1997; Fraiberg, 1977; Reimer, 1994; Boter, 1996; Fazzi et al, 2010; previous studies in Spermalie Bruges and Bartimeus Zeist, 1988 - 1998).

  ← A blind individual is highly in need of optimal motion possibilities in order to discover his/her world through moving, touching etc., and to achieve a maximum of self-reliance and independence allowing participation to daily social life.

- Therefore offering support to the parents and developmental stimulation of blind children is necessary.

- This is provided by an early intervention team (*e.g. Thuisbegeleiding Accent BC Spermalie, Bruges, Belgium*).

- The specialized home care assistant can rely on specific and multidisciplinary assessment and follow-up of the (motor) development.

Introduction (2)

- The multidisciplinary research team consists of an ophthalmologist, a developmental psychologist, and physiotherapist, and is coordinated by a pediatric neurologist.

- The physiotherapist evaluates the motor development and advices the home care assistants and the parents. We rely on neurodevelopmental approaches, different (sensory-)motor scales (AIMS, Bailey etc), literature on motor development in blind children and own experience.

Objectives

- To give an overview of the most important findings and characteristics of the neuromotor development found in literature and acquired by own experience through dealing with blind and severely visually impaired individuals:
  - Babies and toddlers
  - (Young) children

- To concentrate on the most important guidelines to apply during the accompaniment of the children

Results: blind babies and toddlers (1)

Neuromotor characteristics:

(H. Prechtl, 2001; S. Rosen, 1997; P. Helders, 1992; M. Dik, 2005)

- No differences during first 2 to 3 months
- From 2 months onwards: delay of head control (prolonged vestibular fine-tuning)
  - Up till 6 months later for lifting the head in prone position
  - Head is bent 30° downwards when sitting, standing etc.
  - Head lays back when pulling to sit (up till 7 months)
- Exaggerated, 'jerky' fidgety movements: until 8 to 10 months (prolonged proprioceptive fine-tuning)
- Postural instability: atactic features in head and trunk until 12 to 14 months (prolonged cerebellar fine-tuning)
- Trias of motor phenomenons as an early signal of visual impairment in neurologically normal blind babies:
  - More activity of lower than upper limbs (especially first 6 months)
  - Orienting ear towards sound (hence turning head away)
  - Older babies: motor activity stops when listening to sound

- Delay in hands coming together on midline (2nd half first year), in hands playing with feet

Results: blind babies and toddlers (2)

Altered sequence and delayed motor milestones: 2 to 6 months delay, increasing with age:

(P.J.M. Helders, 1992; M. Vink, 1994, 2002; M. Dik, 2005; E.Fazzi, 2010)

	median blind babies	normal sighted babies
• sits alone a short while	6mo3we	[5mo1we]
• rolls from supine to prone	7mo1we	[6mo2we
• sits alone	8mo	[6mo2we]
• Lifts head in prone	8mo3we	[2mo]
• few steps with support	10mo3we	[8mo3we]
• reaches out and grasps on sound	10 -11 mo (*)	
• alone from lying to sitting	11mo-13mo	[8mo1we]
• alone to standing (with support)	13mo	[8mo2we]
• standing alone	13mo	[11mo]
• crawling on hands and knees	13mo1we	[7-8mo]
• first steps	15mo1we	[11mo3we]
• walking alone	19mo1we (ranges from 13 to 32mo, average 19,8 mo)	[12-13mo]

(*) Important breakthrough for the blind child's further development (Fraiberg 1977, Fazzi et al. 2010)

Results: blind babies and toddlers (3)

Possible motor difficulties requiring special attention and stimulation:

- Fear of being moved and fear to move
- Distinguished preference for moving only in sagital plan, wide supporting surface (i.e. looking for safety)
  - delay or absence of lateral and backwards supporting reactions of upper limbs
  - lack of lateral transfer of weight
  - lack of rotations of the trunk
  - rocking for- and backwards

- Delay in/not gaining postural transitions
  - supine to prone and back to supine
  - lying to sitting
  - sitting to crawling position, crawling
  - sitting to standing

- Increased sensibility of the hands (tactile defence for soft materials); decreased tactile exploration, delay in constructive play (up to 1 to 1,5y+). Prolonged exploration with the mouth (untill the end of 2nd year)
- Focus on quality and variation of movement. Give time to register the tactile, proprioceptive, vestibular, auditory information when ‘handling’ the baby.

Results: older blind and severely visually impaired children (1)

Motor characteristics:

(S. Rosen, 1997; R. Boter, 1996; A. Hallemans et al, 2011; A. Navarro et al, 2004; P. Helders, 1992)

- Hypotonia (30%): can cause extra delay in motor development
  - ↑ when visual impairment ↑
  - ↓ in more mobile and active children
  - ↓ with age ↑

- Standing posture:
  Anteflexion of the head (30°), thoracal kyphosis, lumbar lordosis, sometimes elevation of the shoulders fixating the head, more flat feet, more flexion in hips and knees (sometimes hyperextended knees), sometimes 'hanging on the ligaments', toeing out etc.
- Gait pattern:
  Toeing out, wider base of support, reduced stride length, slower walking speed, prolonged duration of the double support phase, less trunk rotation, little reciprocal arm-sway, less heelstrike and more feet shuffling (link with echo-localization?), less fluency, dynamic balance↓ with visual impairment↑, more stimulation and balance training reduces the immaturity of the gait pattern
- General fitness:
  Less active, less physical endurance, weak shouldergirdle and abdominal muscles, no optimal use of the motor possibilities, etc.

Results: older blind and severely visually impaired children (2)

General dynamic coordination:

(A.M. Reimer et al. 1989, 1994, Bartimeus Zeist - Netherlands; L. Dewerchin, 1994, 1998, De Kade Spermalie Bruges - Belgium)

- Körper Koordinationstest für Kinder (Shilling & Kiphard 1974), adapted for visually impaired and blind children by A.M. Reimer
  - Walking backwards on small beams (dynamic balance)
  - Hopping for height on one leg
  - Jumping sideways
  - Moving sideways by shifting platforms

- From 1988 untill 1998 several groups, aged 5 to 14 years, have been tested in *Bartimeus Institute* (Netherlands) and *Spermalie Institute* (Belgium). Results were pooled.

  Blind: n = 45; Visually impaired: n = 61
- Visually impaired: 60 < average MQ < 75 (*)
- Blind: 40 < average MQ < 65

  MQ ↓ when CA ↑ (**) in blind children. Significant individual variation !!

  'Balance' is most weak item in visually impaired children. 'Shifting platforms' in blind children.

(*) "MQ" = motor quotient; average MQ in normally sighted population = 100

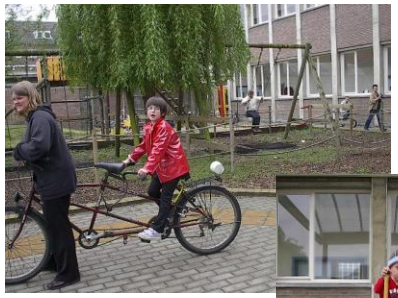
(**) "CA" = chronological age

Results: older blind and severely visually impaired children (3)

Specific motor stimulation, education and training on a daily basis is necessary, consisting of varied gross motor exercices and activities with focus on:

- time for exploration of environment and materials
- sufficient repetition, rest, attractiveness
- power, speed, balance, endurance









Conclusion

- Visual impairment interferes strongly with gross and fine motor development in blind and severely visually impaired babies and children (Prechtl et al., 2001; E. Fazzi et al ,2010).
- In the blind baby almost all motor milestones are delayed. We see an altered sequence. The delay increases with age.
- The older child is faced with a distinct retardation on general motor coordination.
- The different sensory neuro systems need more time for fine-tuning. The loss of vision however will never be fully compensated.
- Specialized support to the parents for handling their baby and motor stimulation of blind children requires multidisciplinary (early) intervention.
- In the blind babies and toddlers we focus especially on self-initiated mobility, transition of posture, locomotion and constructive play. Sometimes individual physiotherapy is recommended.
- Varied and thorough motor exploration must be offered to older children to limit their delay towards sighted children and to enhance their general possibilities to independent living.
- Show them the way of motion!