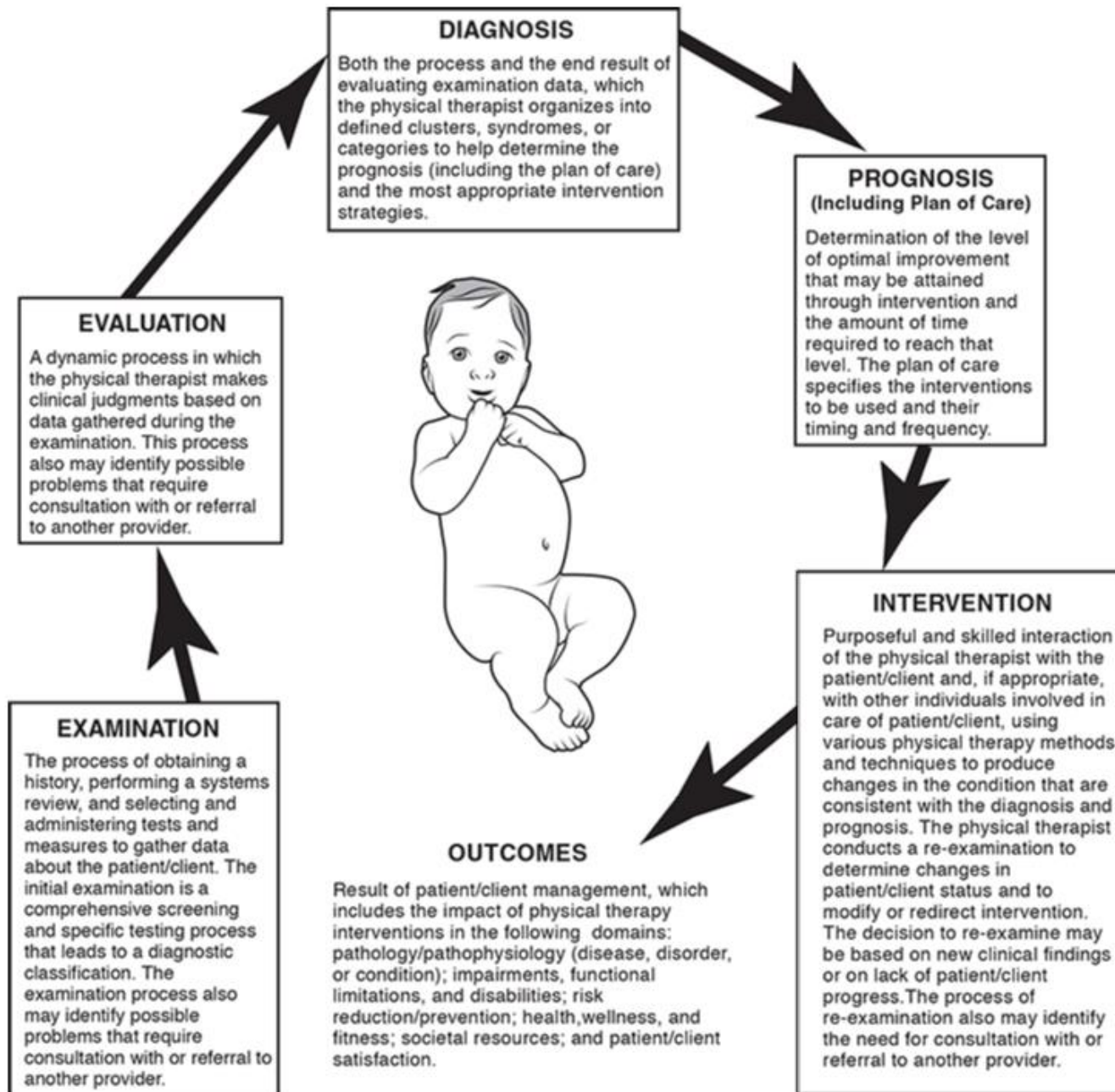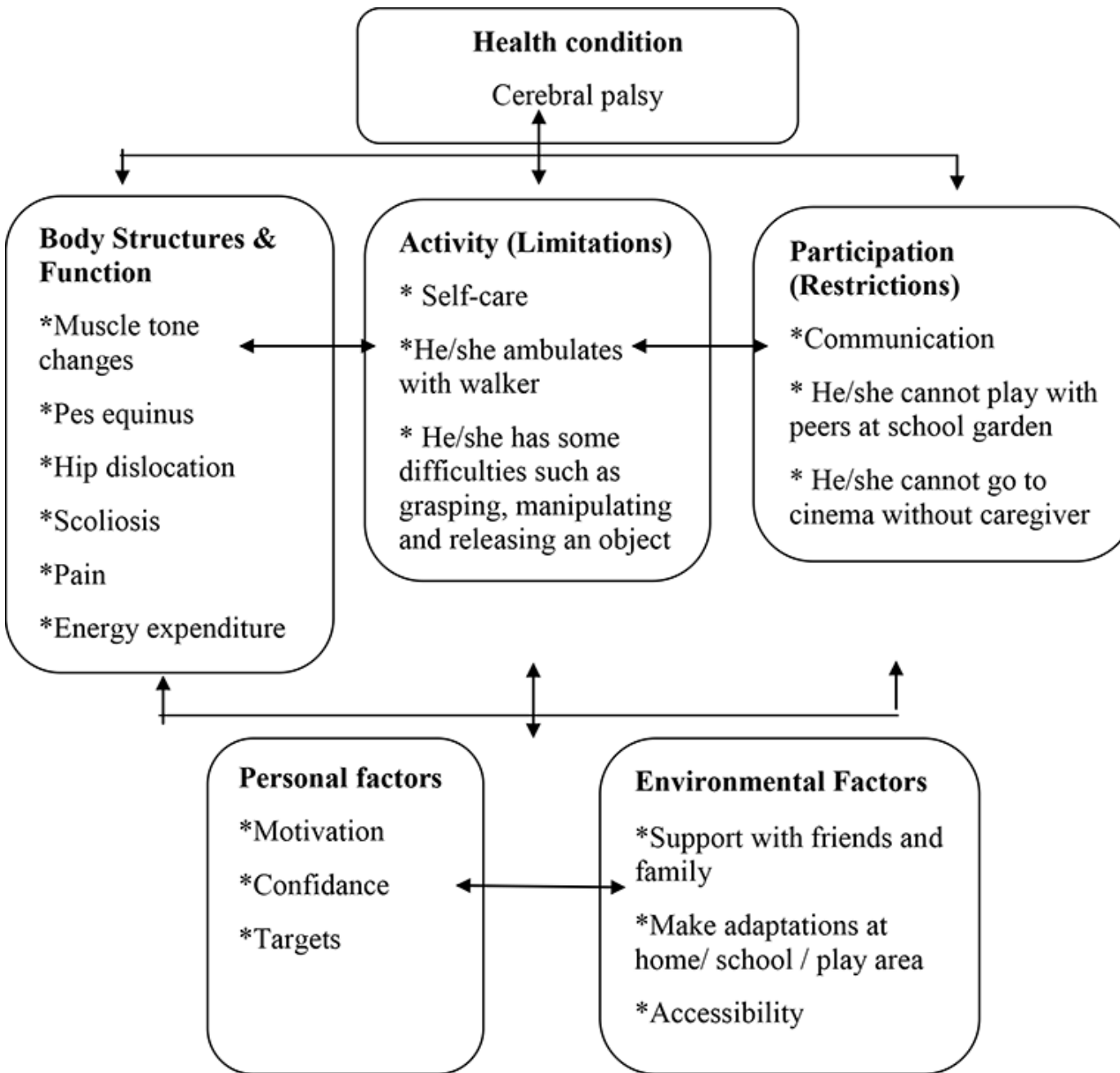**Physiotherapy is not only a science but also an art**

Early Motor development of preterm and term infants. Recognizing early motor delays.

Assoc. prof. Vilma Dudoniene

DIAGNOSIS

Both the process and the end result of evaluating examination data, which the physical therapist organizes into defined clusters, syndromes, or categories to help determine the prognosis (including the plan of care) and the most appropriate intervention strategies.

PROGNOSIS
(Including Plan of Care)

Determination of the level of optimal improvement that may be attained through intervention and the amount of time required to reach that level. The plan of care specifies the interventions to be used and their timing and frequency.

EVALUATION

A dynamic process in which the physical therapist makes clinical judgments based on data gathered during the examination. This process also may identify possible problems that require consultation with or referral to another provider.

EXAMINATION

The process of obtaining a history, performing a systems review, and selecting and administering tests and measures to gather data about the patient/client. The initial examination is a comprehensive screening and specific testing process that leads to a diagnostic classification. The examination process also may identify possible problems that require consultation with or referral to another provider.

OUTCOMES

Result of patient/client management, which includes the impact of physical therapy interventions in the following domains: pathology/pathophysiology (disease, disorder, or condition); impairments, functional limitations, and disabilities; risk reduction/prevention; health,wellness, and fitness; societal resources; and patient/client satisfaction.

INTERVENTION

Purposeful and skilled interaction of the physical therapist with the patient/client and, if appropriate, with other individuals involved in care of patient/client, using various physical therapy methods and techniques to produce changes in the condition that are consistent with the diagnosis and prognosis. The physical therapist conducts a re-examination to determine changes in patient/client status and to modify or redirect intervention. The decision to re-examine may be based on new clinical findings or on lack of patient/client progress.The process of re-examination also may identify the need for consultation with or referral to another provider.

Health condition

Cerebral palsy

Body Structures & Function

*Muscle tone changes

*Pes equinus

*Hip dislocation

*Scoliosis

*Pain

*Energy expenditure

Activity (Limitations)

* Self-care

*He/she ambulates with walker

* He/she has some difficulties such as grasping, manipulating and releasing an object

Participation (Restrictions)

*Communication

* He/she cannot play with peers at school garden

* He/she cannot go to cinema without caregiver

Personal factors

*Motivation

*Confidance

*Targets

Environmental Factors

*Support with friends and family

*Make adaptations at home/ school / play area

*Accessibility

ICF-CY

International Classification of Functioning, Disability and Health

Children & Youth Version

World Health Organization

Examination

- Observation
  - Position (supine, prone, side-lying, and, for the older and more stable baby, ventral suspension and supported sitting)
  - Movements (spontaneous, passive, active…).
  - Primitive reflexes (disappearing of primitive reflexes indicates CNS maturation level (3-4 months).
  - Coordination of sucking, swallowing, breathing.

Newborn – physiologic flexion
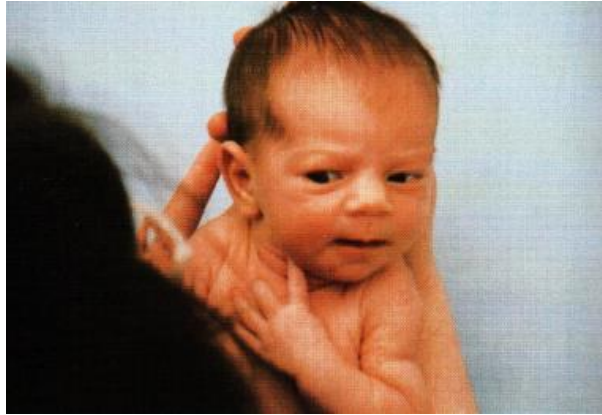
1 month

Neonate in prone; note anterior pelvic tilt and hip flexion, with buttocks up in the air; position prevents infant from lifting his head from the surface.

2 mo
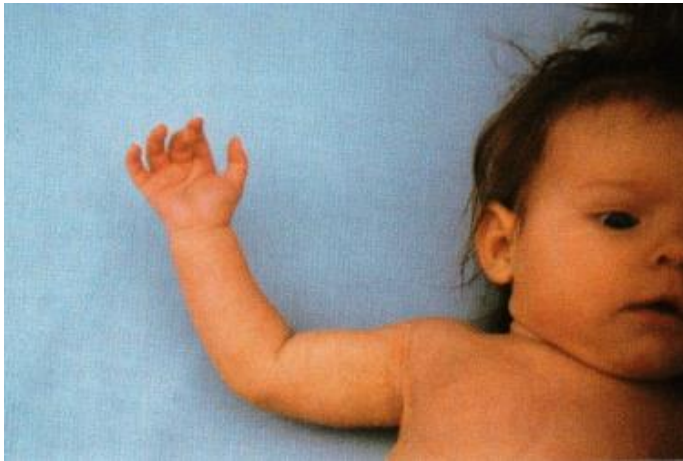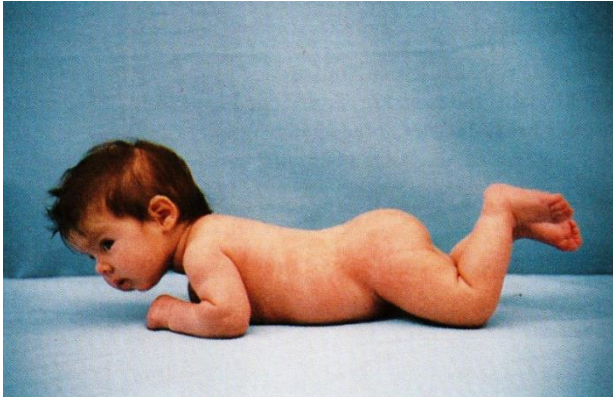
3 mo
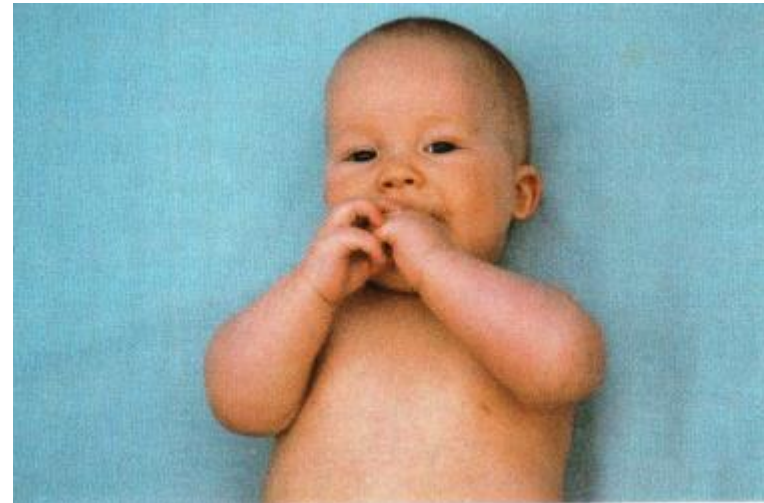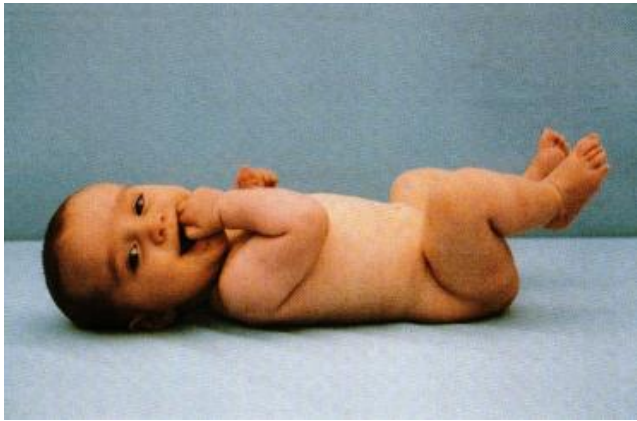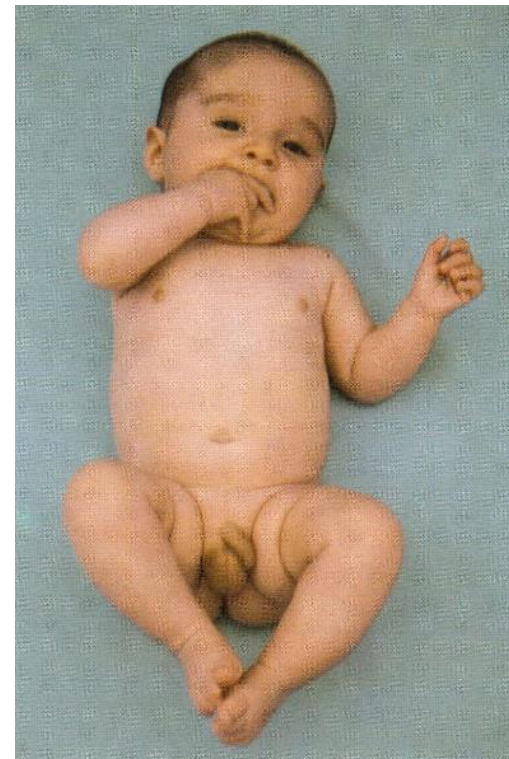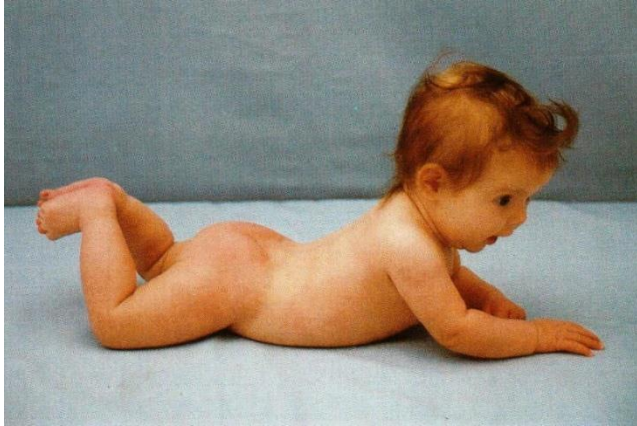
4 mo
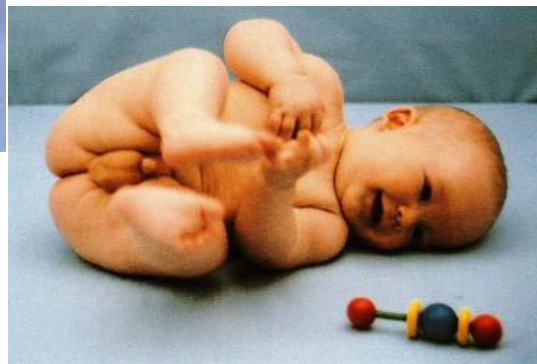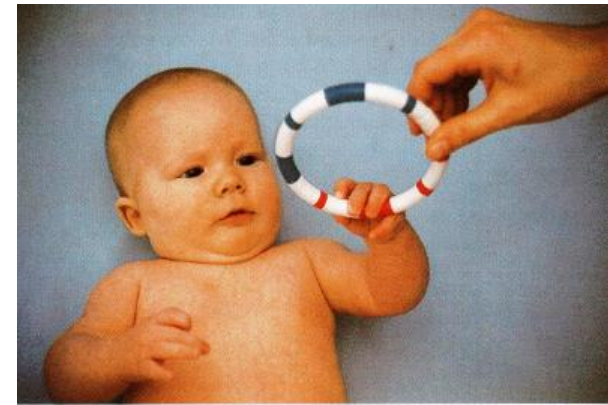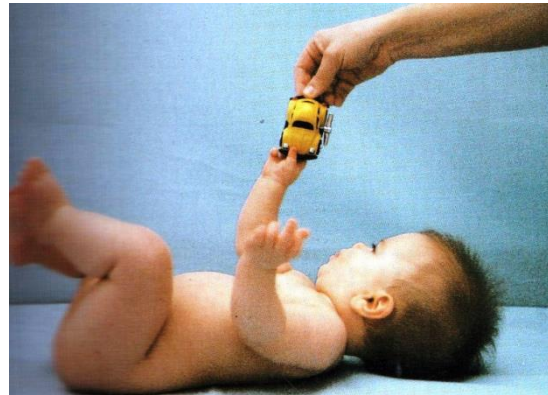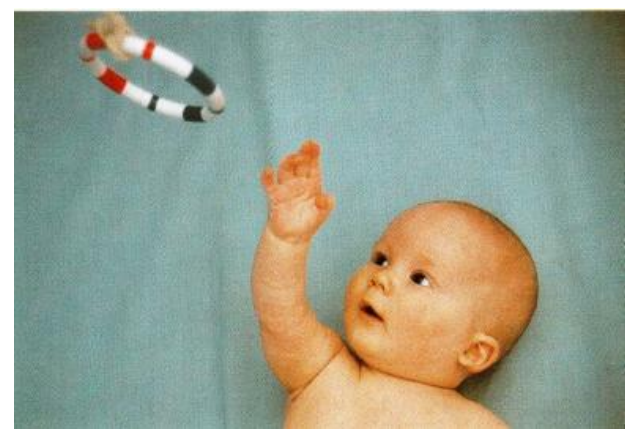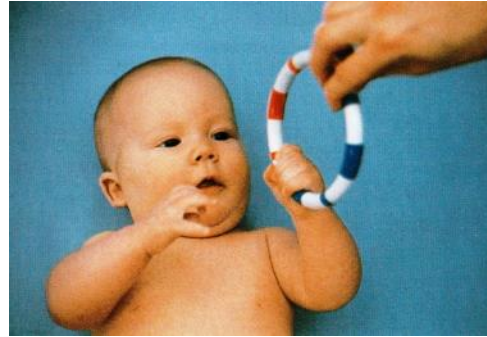
5 mo
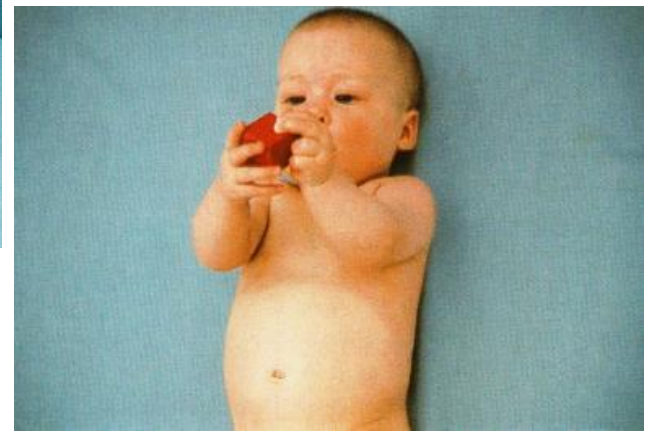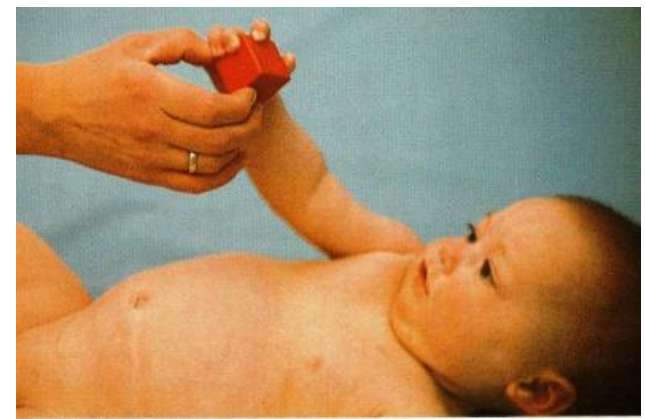
Supine at 5 months, foot-to-foot contact.

6 mo
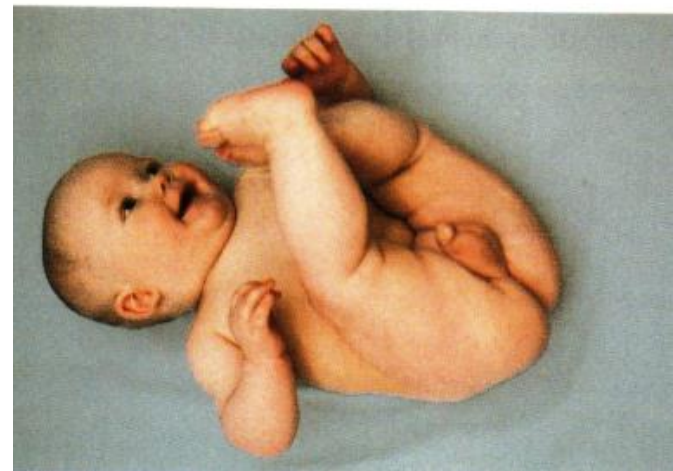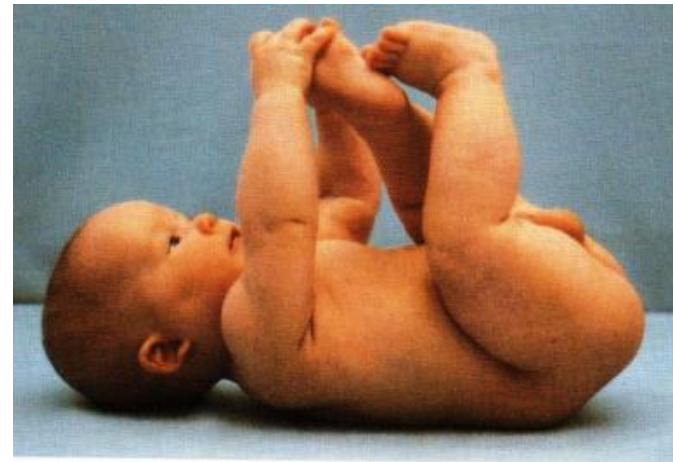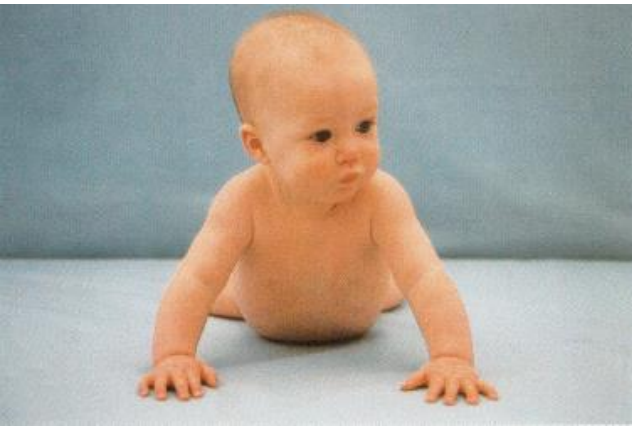
7 mo
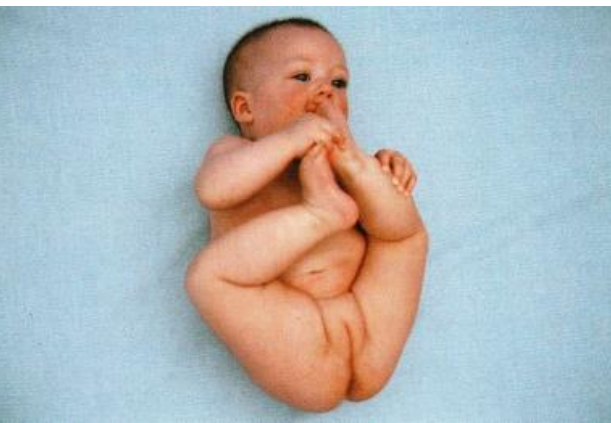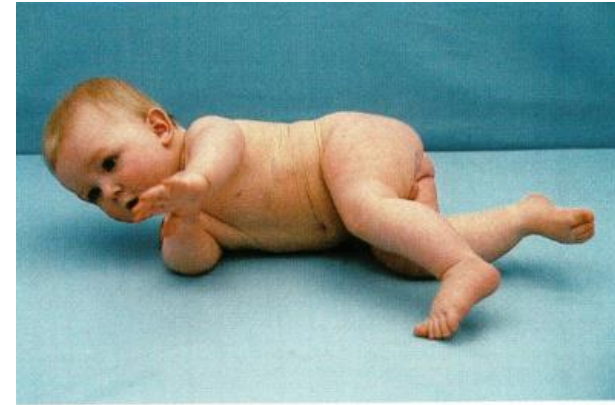
Independent sitting

Independent ring sitting; note the high guard position of the upper extremities, used by the child to enhance trunk stability.

• Half-ring sitting.

Mature long sitting with narrowed mediolateral base of support.

8 mo
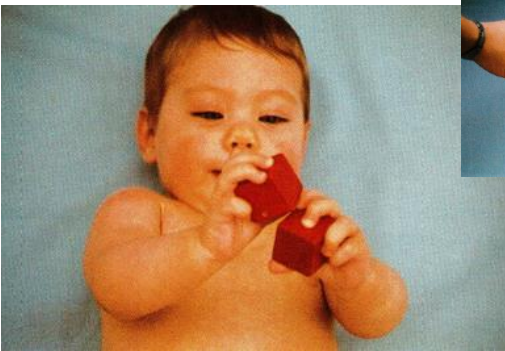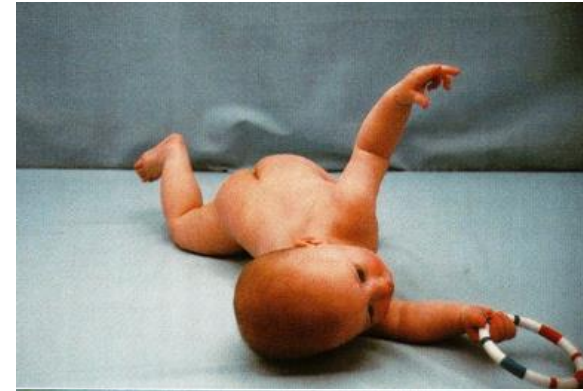
9 mo
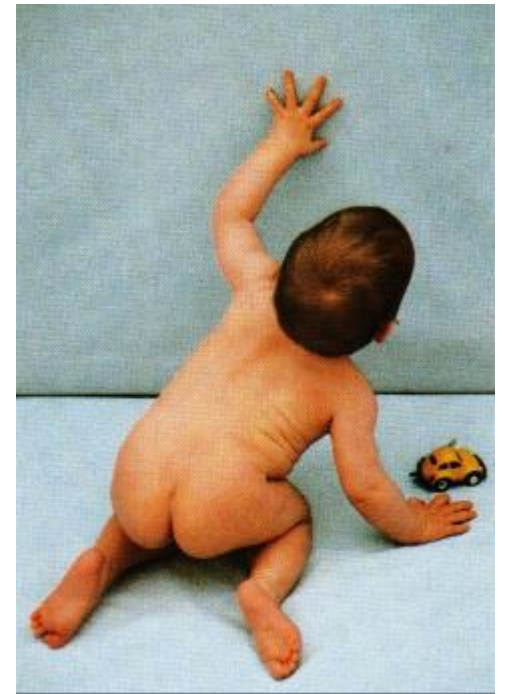
10 mo
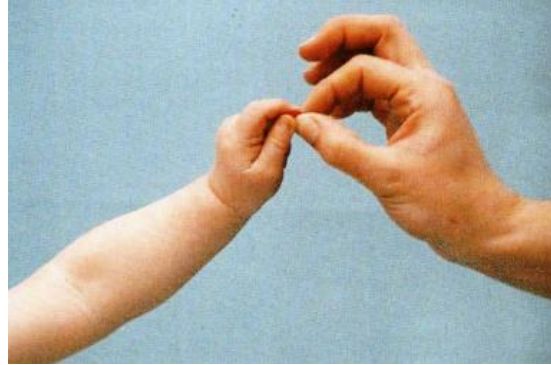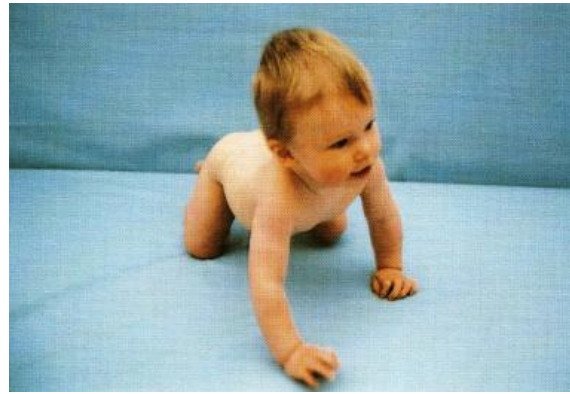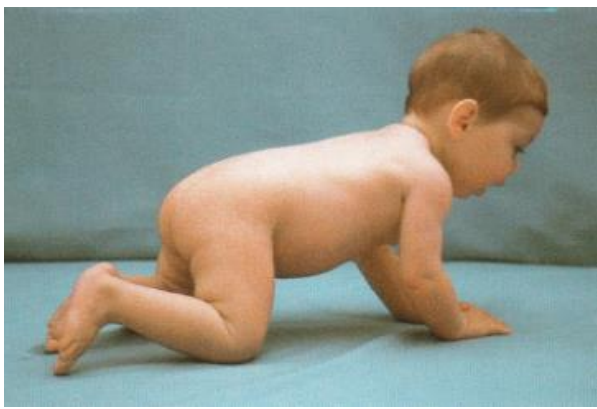
11 mo
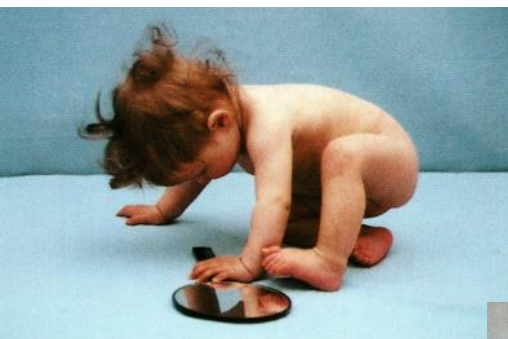
12 mo
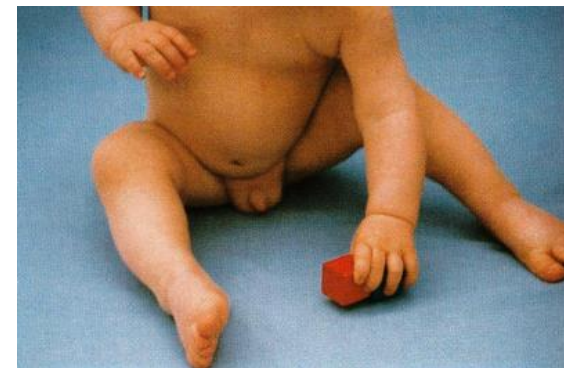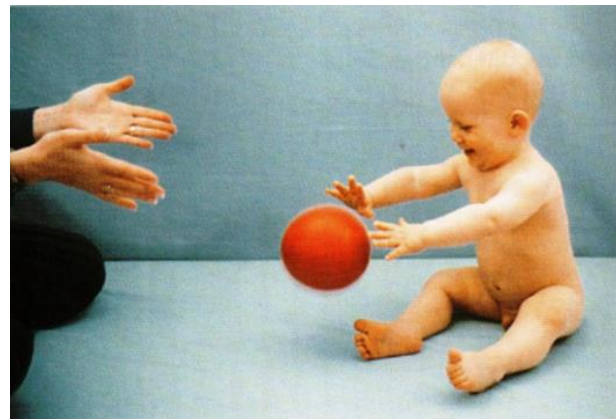
Progression

1. supine,
2. prone,
3. rolling,
4. sitting,
5. standing.

1. Fetal posture (newborn)
2. Holds chin up (1 month)
3. Holds chest up (2 months)
4. Sits when supported (4 months)
5. Sits alone (7 months)
6. Stands holding furniture (9 months)
7. Crawls (10 months)
8. Walks if led (11 months)
9. Stands alone (11 months)
10. Walks alone (12 months)

Extremities:

1. Mobility.
2. Stability.
3. Controlled mobility.
4. Functional distal control.

!!!!!

- Hypotonia
- Hypertonia
- Asymmetric posture (except tonic neck reflex)
- Opisthotonic posturing
- Signs of paralysis
- Tremors, twiches, and myoclonic jerks Тремор, подергивание и судорожное мышечное движение
- Marked head lag in all positions

!!!!!
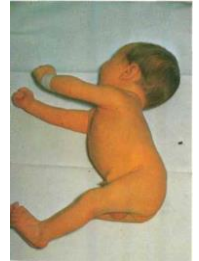
- 4 mo. – no ability to control head;
- 9 mo. – no ability to control trunk (sitting);
- 18 mo. – no ability to walk.

Hypotonus

Infant hangs like rag doll when lifted under abdomen.

Infant is unable to sit up or hold up head. Head drops back when infant is lifted by the hands.

Infant exhibits weakness and flaccidity of all musculature.

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Rag doll
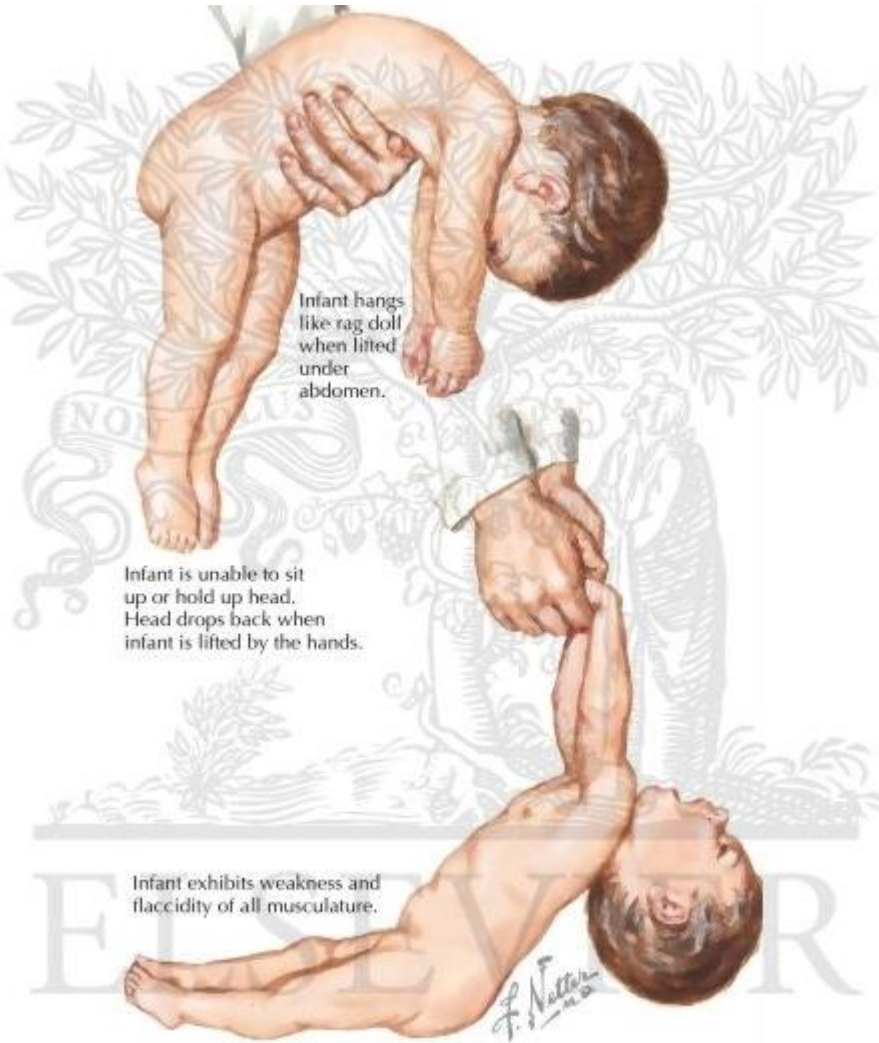
Hypotonus
Examination / evaluation
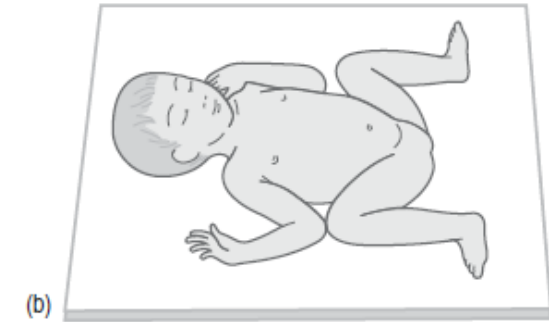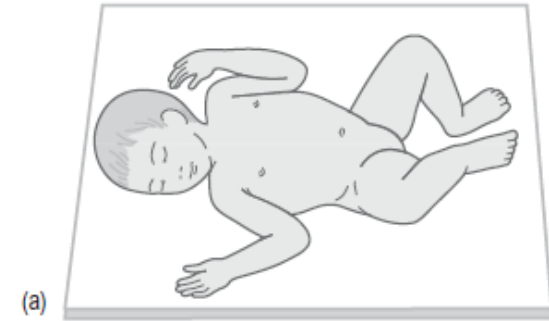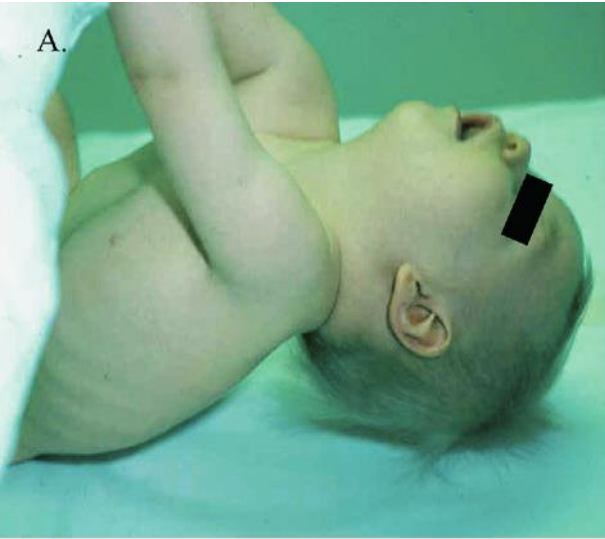
Evaluation instruments
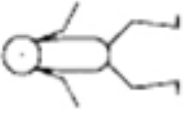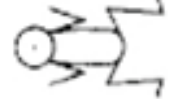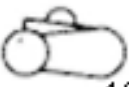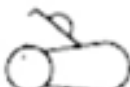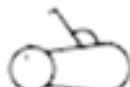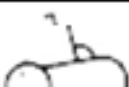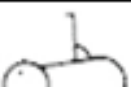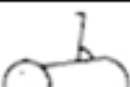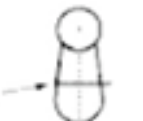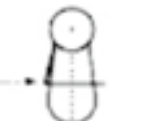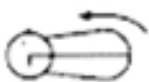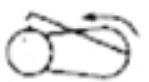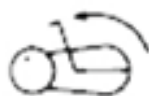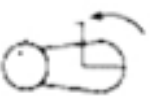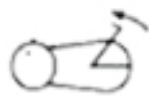
ALBERTA INFANT MOTOR SCALE (AIMS)

Source: Piper MC, Darrah J *Motor Assessment of the Developing Infant* 1994. Philadelphia, PA: WB Saunders.

Purpose: To measure the motor development of infants aged 0–18 months to identify children who are delayed or deviant in their development or maturation and evaluation of development and maturation over time.

Groups tested: Children aged between 0 and 18 months.

Description: Takes on average 30 minutes to complete. It is an observational scale requiring minimal handling by the assessor and aims to identify the positive aspects of a child's motor development. A user-friendly measure, assessing the child in four main postures: prone, supine, sitting and standing. The measure scores the child on the achievement of key postures and transitions.

Standardization: Standardized scores enable comparison with age-expected levels of ability. There is a manual available and some equipment is available with the testing kit to assist standardization of administration.

Reliability: High = >0.9 for single occasions and over time.

Validity (concurrent): High: 0.98.

Strengths
- Easy to administer. Children often cooperate with this test as it is quick and easy. Any appropriate toys can be used to stimulate movement and postures during the test
- Administered in school or rehab setting
- Gives ordinal and interval measure, norm-referenced.

Weaknesses: Can be problematic in scoring and you need to keep an eye on the quality of movements as well as the accomplishment of developmental milestones. The measure will not recognize asymmetry or poor-quality movement. The scoring system identifies a window for investigation and assumes the child can accomplish all the skills in the lower developmental levels.

Clinical utility: Useful for sharing age-equivalence scores with parents and at multidisciplinary team meetings. May also provide useful information for statement reports.

PRONATION – position prone

DESCRIPTION OF MOVEMENTS	POSITION	EVALUATION	
Gulėjimas ant pilvo (1): -Svoris ant skruosto, plaštakų, dilbių ir viršutinės krūtinės dalies; -Galva pasukta į šoną; -Fiziologinė fleksija; -Rankos arti kūno, alkūnės sulenktos; -Pasuka galą, patraukdamas nosį nuo paviršiaus.		NP	P
Gulėjimas ant pilvo (2): -Svoris ant plaštakų, dilbių ir krūtinės; -Rankos arti kūno, alkūnės sulenktos; -Klubai ir keliai sulenkti; -Kelia galvą 45 laipsnių kampu; -Negali išlaikyti galvos vidurio linijoje.		NP	P
Gulėjimas ant pilvo atsirėmus: -Svoris ant plaštakų, dilbių ir krūtinės; -Alkūnės kiek atitrauktos; -Klubai ir keliai sulenkti; -Kelia galvą iki 45° laipsnių kampo ir pasuka ją.		NP	P
Atrama dilbiais (1): -Svoris simetriškai paskirstytas dilbiams ir liemeniui; -Rankos atitrauktos nuo kūno; -Šlaunys atitrauktos ir pasuktos į išorę, keliai sulenkti; -Atsistumia nuo paviršiaus,kad pakeltų galvą, kelia ją daugiau kaip 45°kampu ir išlaiko; Krūtinė pakelta		NP	P

Neuromuscular maturity Examination / evaluation

Sign	Score							Sign score
	-1	0	1	2	3	4	5	
Posture								
Square window	>90°	90°	60°	45°	30°	0°		
Arm recoil		180°	140-180°	110-140°	90-110°	<90°		
Popliteal angle	180°	160°	140°	120°	100°	90°	<90°	
Scarf sign								
Heel to ear								
						Total neuromuscular score		

Development of neuronal networks
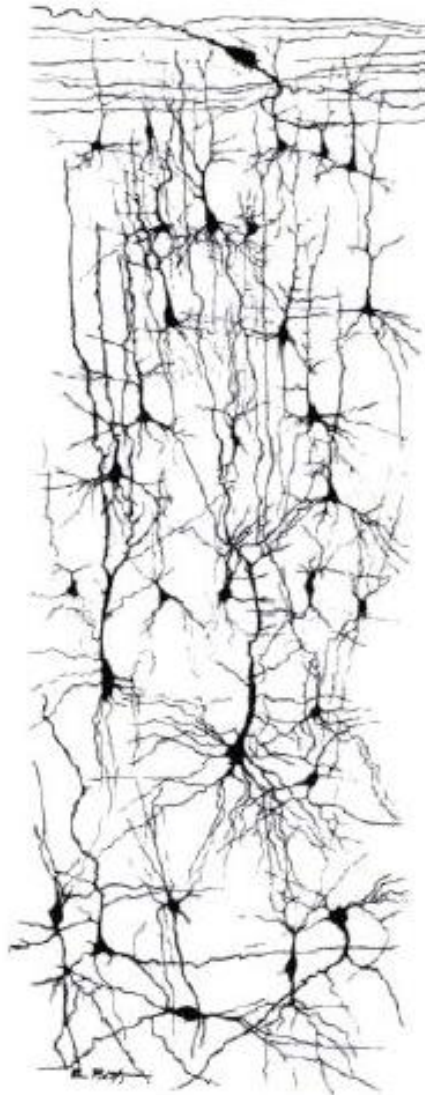
Newborn   3 Month   2 Years

Hadders-Algra, M. (2018). Early human motor development: from variation to the ability to vary and adapt. *Neuroscience & Biobehavioral Reviews*, *90*, 411-427.
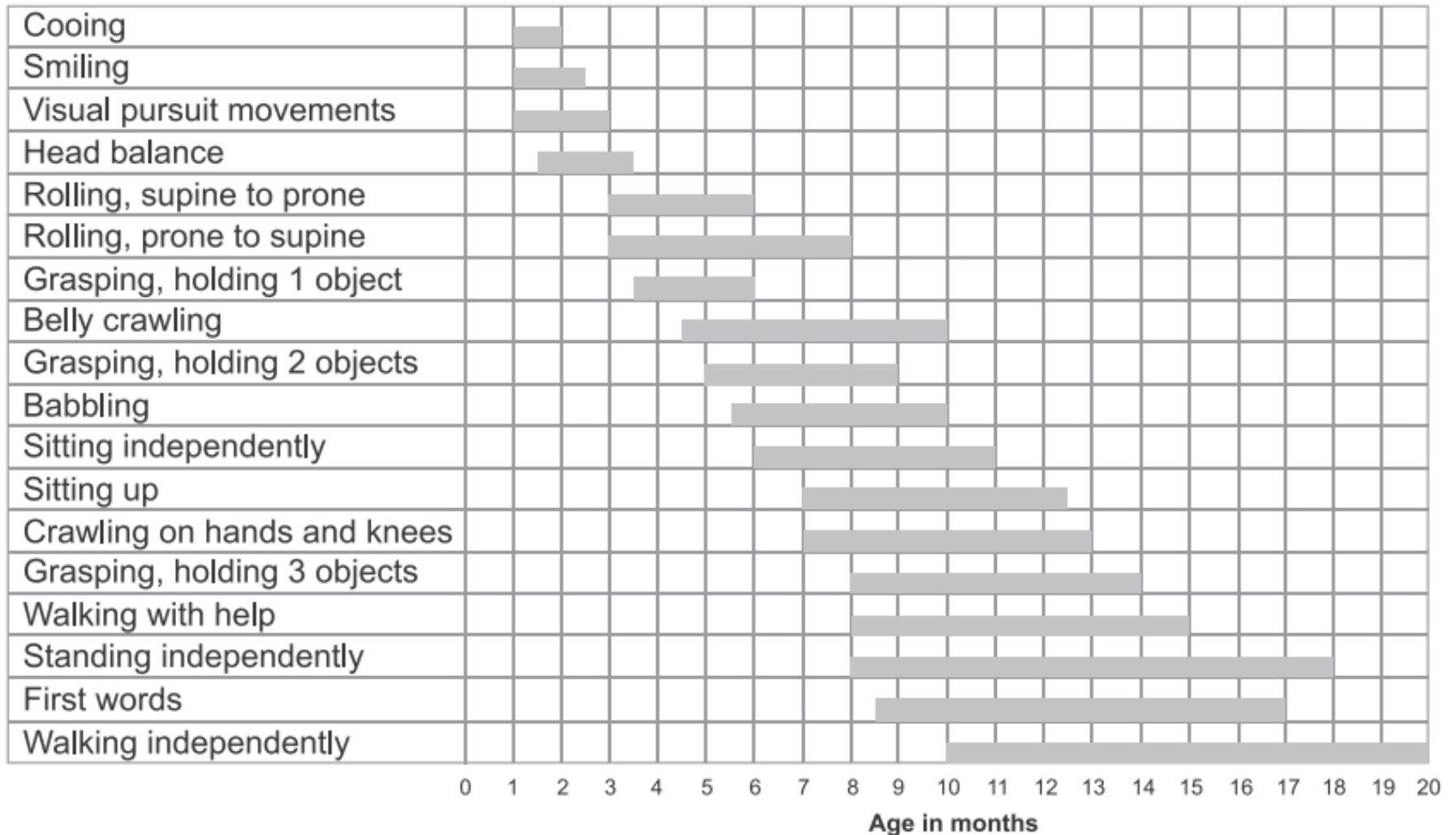
ORAL MOTOR ACTIVITY

Communication
- ability to select and adapt
- varied protophone repertoire

Sucking, swallowing & chewing
- ability to select and adapt
- varied CPG repertoire

FINE MOTOR ACTIVITY

Manipulation
- ability to select and adapt
- varied repertoire of independent finger movements

Reaching
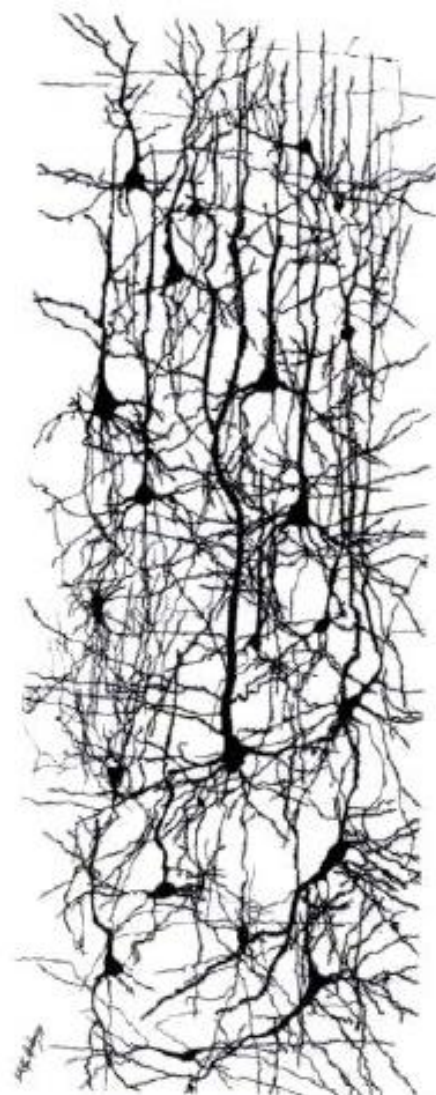- ability to select and adapt
- varied repertoire of goal-directed arm movements

GROSS MOTOR ACTIVITY

Locomotor activity
- ability to select and adapt
- varied CPG repertoire of stepping movements

Postural control
- ability to select and adapt
- varied repertoire of direction-specific adjustments

GENERAL MOVEMENTS

?

0 10 20 30 40 3 6 9 12 15 18 21 24

NEONATUS PREMATURUS

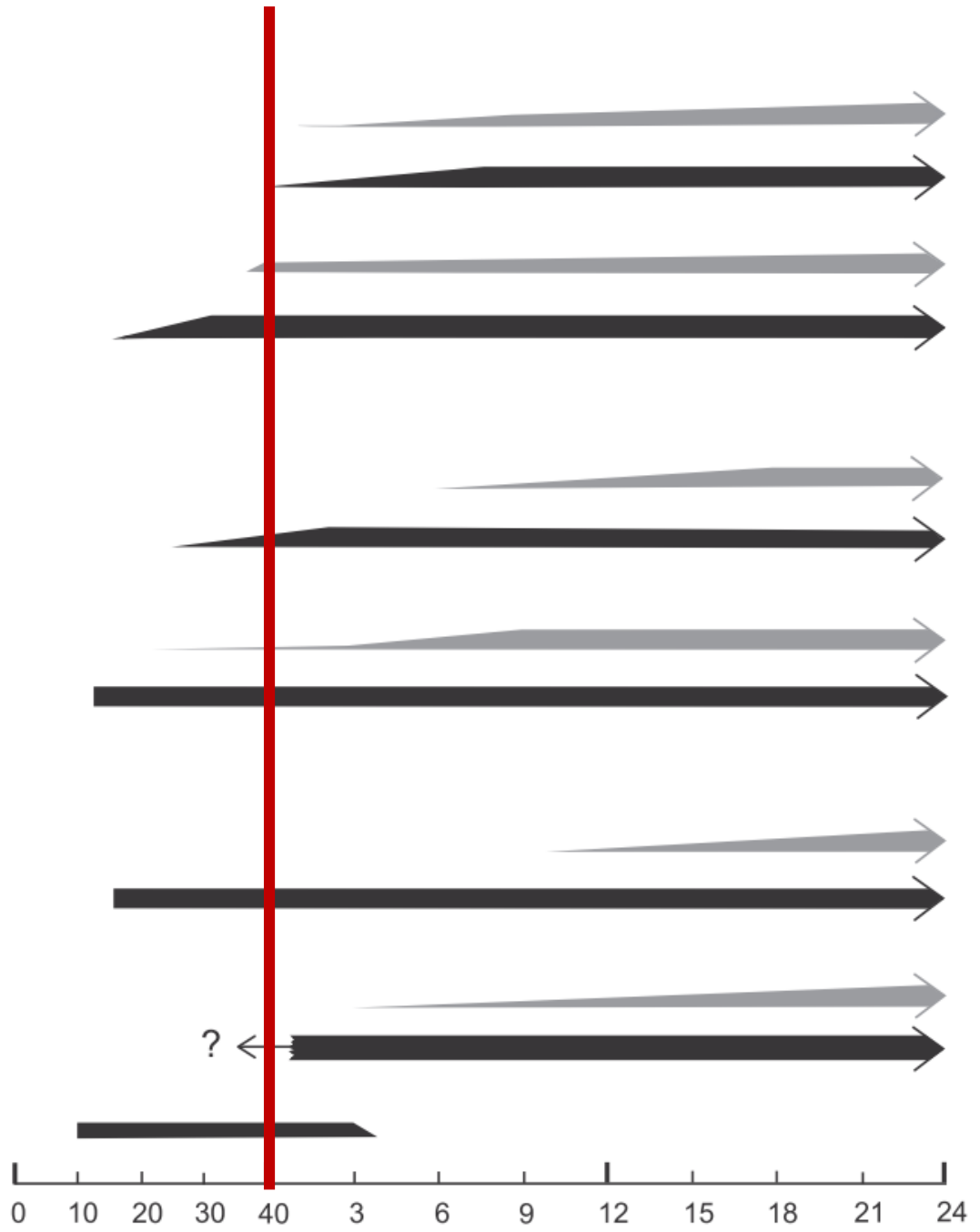- Low-level lighting.
- The reduction of noise levels.
- Positioning (nesting).

From week 32 legs are more flexed;
From week 36 - arms.

Unstable neonatus prematurus:
- Minimal handling
- Allow rest to grow.
- Provide positive touch not stimulation.

(a)
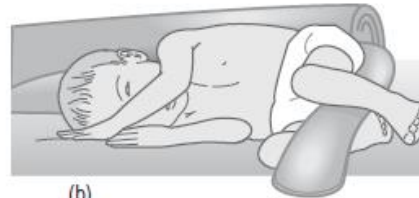
(b)

(c)

For all newborns:
- Flexion (not too much);
- Midline orientation (hands together, legs not too much abducted;
- Keep body symmetry;
- Emotional safety;
- Different body positions to ensure good head shape.

Ratliff-Schaub et al. (2001). Relationship between infant sleep position and motor development in preterm infants. *Journal of Developmental & Behavioral Pediatrics*, *22*(5), 293-299.

Cephalocaudal direction

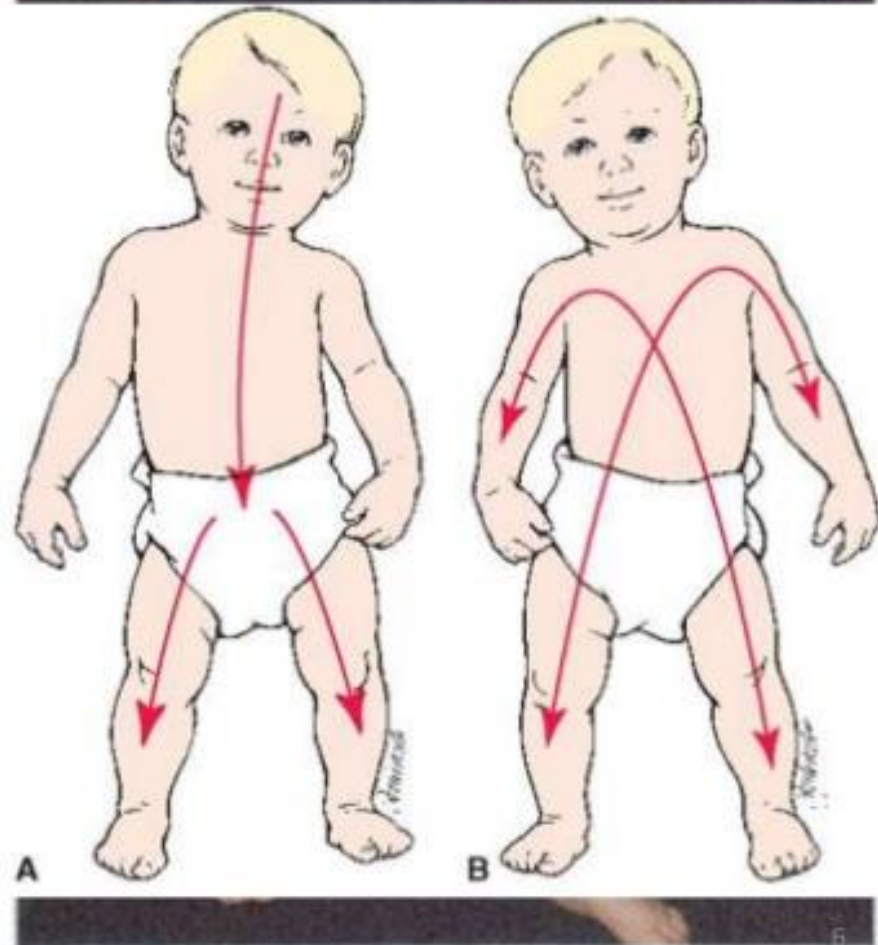- The process of
  cephalocaudal direction
  from **head** down to **tail**.
  This means that
  improvement in structure
  and function come first
  in the head region, then
  in the trunk, and last in
  the leg region.

Proximodistal direction

The process in proximodistal from center or midline to periphery direction. development proceeds from near to far - outward from central axis of the body toward the extremities

Cephalocaudal
head to foot

Proximodist
midline to extremities

7
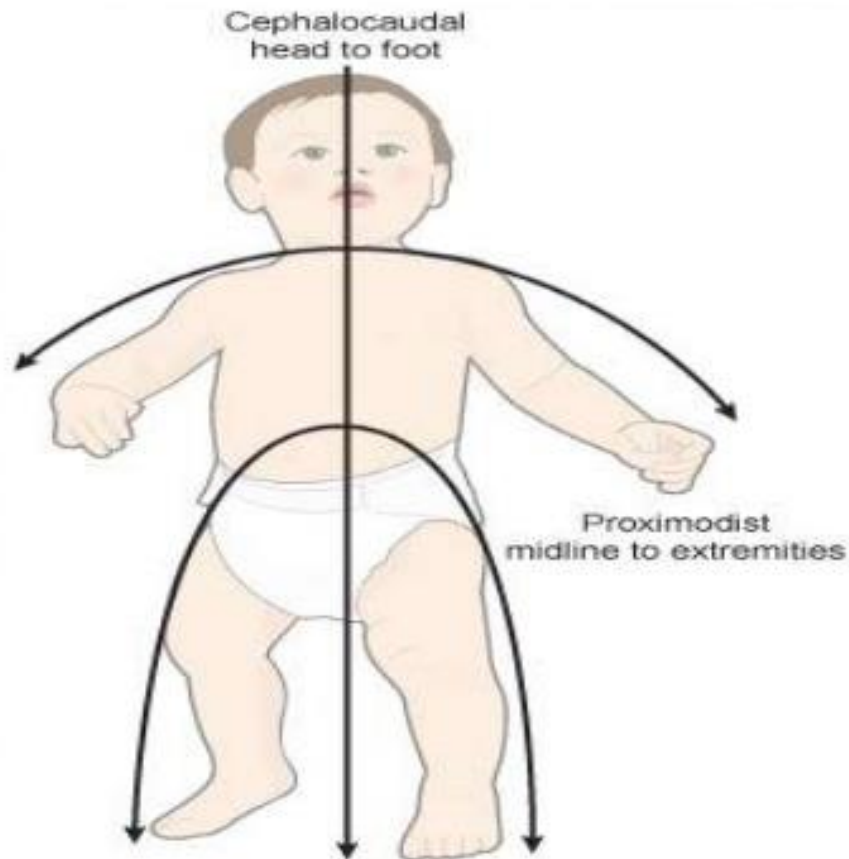
Development

1. Control of the body against gravity.

2. Maintain the body's center of mass within the base of support.

3. Perform isolated movements.
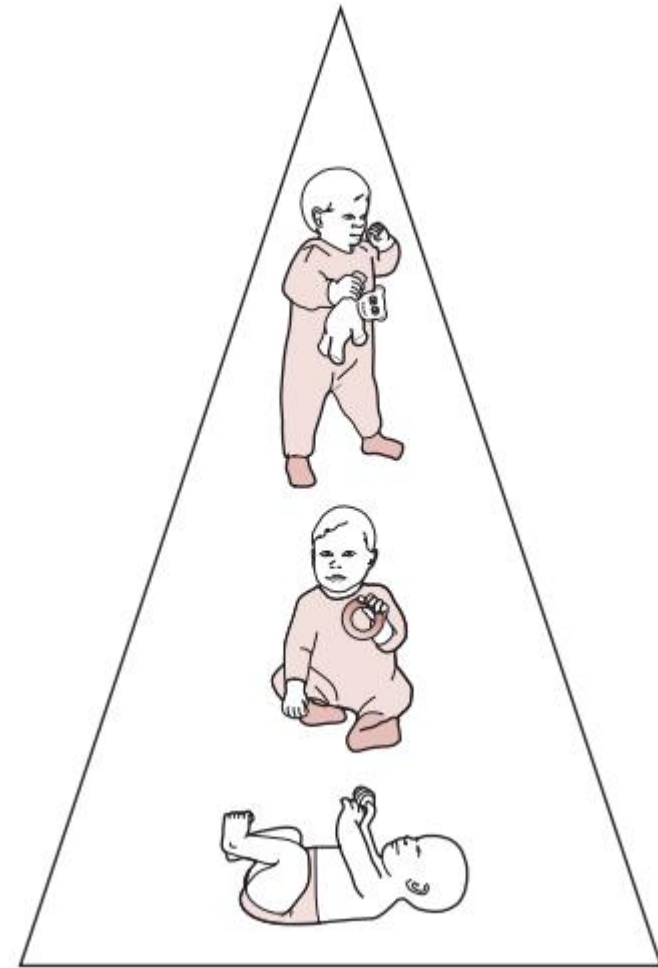
PHYSICAL THERAPY

- From 1.5 mo. – reflexive movements.
- From 3-4 mo. – passive movements.
- From 6 mo. – active movements.

- 3-6 mo. – passive + reflexive + massage.
- 6 – 9 - 12 mo.   - active + passive + massage.

The stages of the psychomotor development of the child

- I stage - 0-1 month
- II stage - 1 - 3 months
- III stage - 3-6 months
- IV stage - 6-9 months
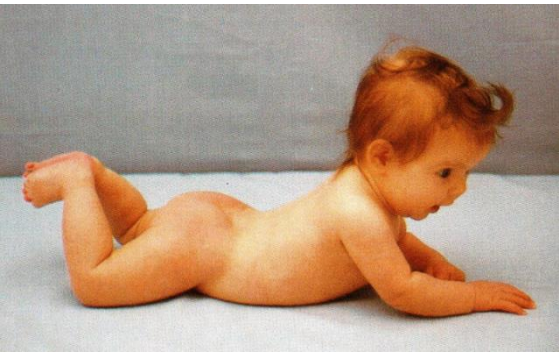- V stage - 9-12 months
- VI stage - 1 - 3 years

Positioning (supine, prone, side lying)

Positioning, play, handling

Symmetry

Early development

- the age of 3 months post-term – period **between 2 and 4 months** - is an age of major transition in motor development (Hadders-Algra, 2018; Prechtl, 1984).

Hadders-Algra, M. (2018). Early human motor development: from variation to the ability to vary and adapt. *Neuroscience & Biobehavioral Reviews*, *90*, 411-427.

Piek et al. (2008). The role of early fine and gross motor development on later motor and cognitive ability. *Human movement science*, *27*(5), 668-681.

Interventions

- Pull to sit (to promote head control, the head must be protected).

- Rolling promotion / with visual stimulation.

- Stretch shortened muscles,

- Passive rotations for infants who cannot roll over.

- Colorful toys and visual stimuli (Before term age some professionals advise pastel colors only).

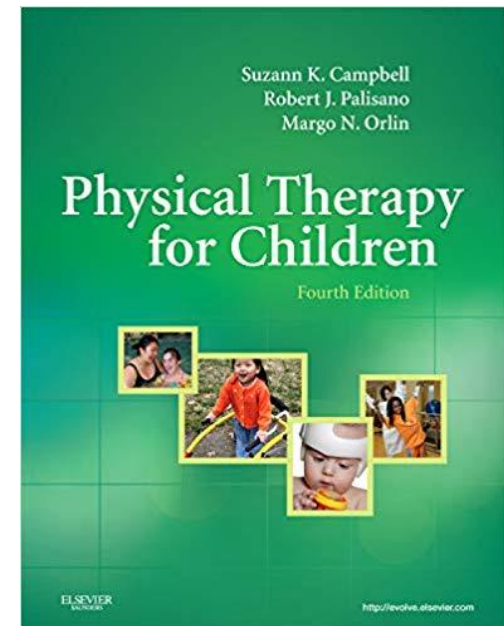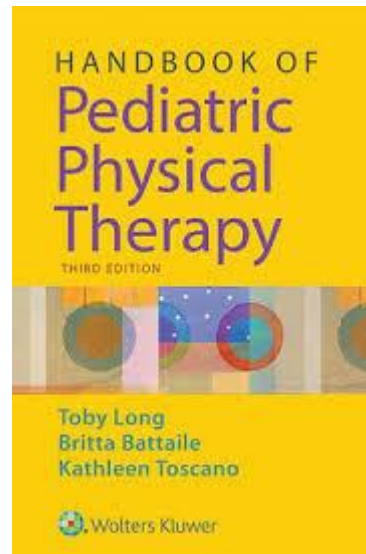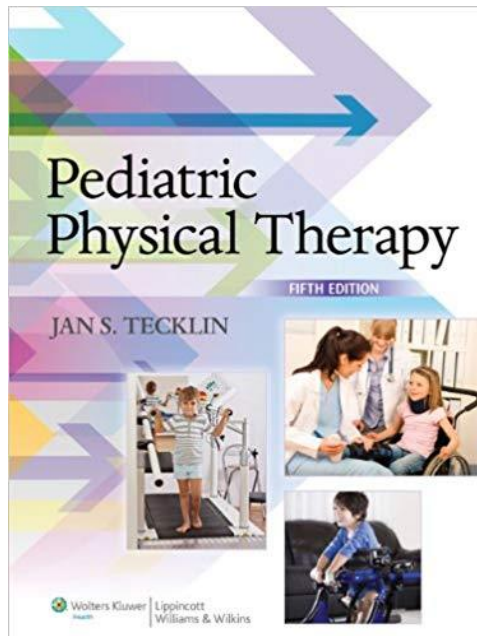- Early communication.

- Games in prone.
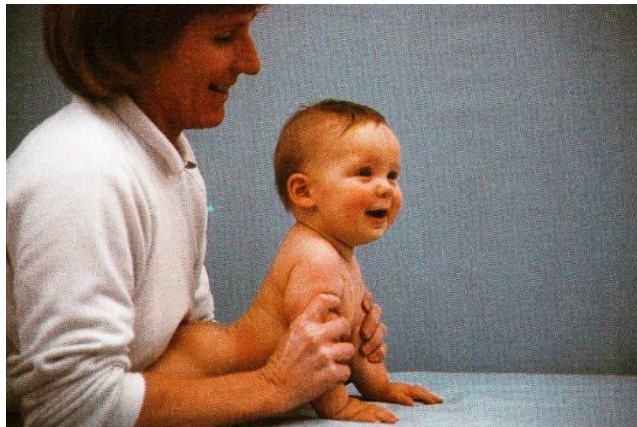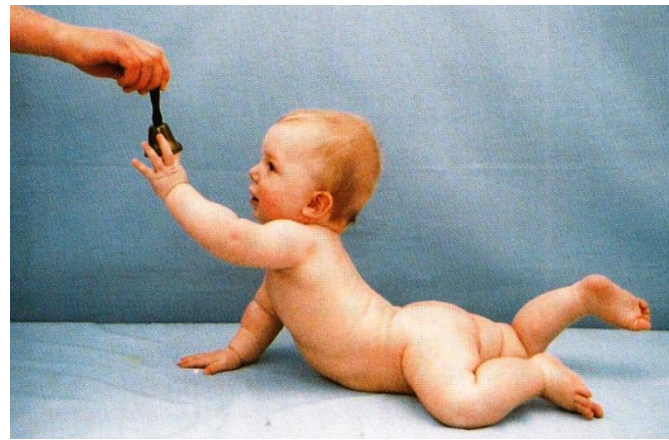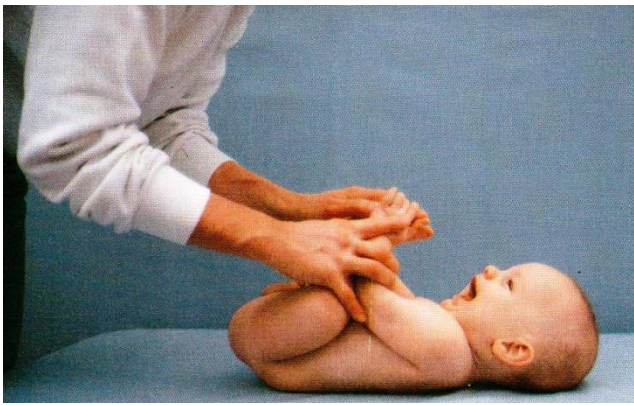
Interventions for hypotonus

- Clapping,
- Rubbing,
- Plantar stimulation by rubbing, clapping,
- Head flexion with stimulation of one hand,
- Diagonal rubbing of feet and palms, rubbing of hands and feet,
- Passive centering of hands (midline keeping).

References

1. Tilton, A. H. (2006). Therapeutic interventions for tone abnormalities in cerebral palsy. *NeuroRx*, 3(2), 217-224.

2. Noritz, G. H., & Murphy, N. A. (2013). Motor delays: early identification and evaluation. *Pediatrics*, *131*(6), e2016-e2027.

3. Blauw-Hospers, C. H., & Hadders-Algra, M. (2005). A systematic review of the effects of early intervention on motor development. *Developmental medicine and child neurology, 47*(6), 421-432.

Thank you for your attention