Neurodevelopmental Treatment (NDT)

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Neurodevelopmental Treatment (NDT)

- Advanced hands-on approach to the examination and treatment of individuals with disturbances of function, movement and postural control due to a CNS lesion
  - Used primarily with children who have CP and adults with CVA
- A holistic approach dealing with the quality of patterns of coordination and not only with the problems of individual muscle function.
- NDT involves the whole person, sensory-motor problems, problems of development, perceptual-cognitive impairment, emotional, social and functional problems of the daily life as well.

Origins of NDT

- NDT was first known as “The Bobath approach”
- Originated & developed by Berta Bobath, physiotherapist, and Dr. Karel Bobath, neuropsychiatrist, in the late 1940s
- The name of the approach to NDT was changed by Bobaths in 1960 (North America)
- In the scientific literature, both terms (the Bobath Concept and NDT) are used to describe the same intervention.

Origins of NDT

- Developed from B. Bobath's clinical observations and practical applications
  - By preventing patient from moving into an abnormal pattern of activity by his spasticity, a more normal movement and functional activity became possible.
  - By moving the proximal part of the body it is possible to change the movements of the distal parts.
- Recognized the recovery potential of the patient's affected side (neuroplasticity)
- It is a clear deviation from the conventional compensatory approach
- Introduce the idea that a therapist could have an impact on client's functional movement by influencing the CNS through carefully guiding the motor output through handling

Evolution

- NDT was initially understood in the context of the reflex, hierarchical model.

- **Reflex theory:**
  - The basic unit of motor control are reflexes changed to purposeful movement
  - Damage to the CNS: re-emergence of and inability to control the reflexes

- **Hierarchical Theory:**
  - Motor control is hierarchically arranged: HIGHER, MIDDLE, and LOWER levels of CNS
  - Higher centers regulate and control the middle and lower centers
  - Damage to the CNS results to disruption of the normal coordinated function of these levels

Evolution

- **Initially**, inhibition or decreasing muscle tone through reflex inhibiting postures (RIP)
  - Too passive & static. Reduce spasticity but not to improved function so this was abandoned.
- **Then**, facilitation of automatic movement sequences
  - The use of afferent information to effect improvements in motor performance
- Inhibition combined with facilitation

Evolution

- **Initially**, incorporation of hierarchical normal developmental motor sequences into therapy, with one activity following another during facilitation (head control, rolling, sitting, quadruped, kneeling)
  - The treatment should not follow rigidly the developmental milestones (simultaneous development, big variability and inconsistency in normal development)

- **Consequently**, systematic preparation for specific functional tasks was instituted with an aim of treating the children in actual settings where they live, play, and learn.

Neurodevelopmental Treatment

- *"The aim of treatment for children with disabilities due to brain damage is to prepare them and guide them towards their greatest possible independence and to prepare them for as normal adolescence and adult lives as can be achieved"*

  (Bobath, 1984)

- Their goal was the establishment of normal motor development and function and/or the prevention of contractures and deformities.

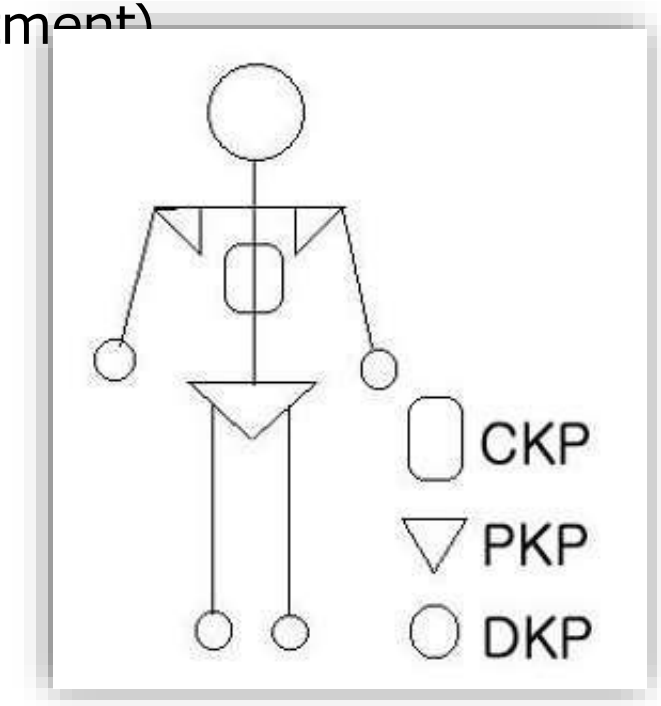
Key Fundamental Principle of NDT

- The role of sensory information in motor control.
  - Done by "**handling techniques**" that controlled various sensory stimuli
    - Normal patterns of activity used to modify abnormal patterns of posture and movement
    - Differentiates NDT intervention from other approaches
    - To inhibit spasticity and also to facilitate normal muscle toneand movement patterns.

Key Fundamental Principle of NDT

- **Key Points of Control (KPC)**
  - Parts of the body where the therapist can most effectively control and change patterns of posture and movement in other body parts
  - The patient is active and the therapist is guiding & controlling the activity moving through KPC (Dynamic treatment)

- **CKP (Central Key Point)**
  - Ant (sternum)
  - Post (spine)



Key Fundamental Principle of NDT

- **PKP (Proximal Key Point):**
  shoulder/scapula, pelvis/hip
  - Located closer to the source of the problem
  - Used to influence posture and movement in all three planes (sagittal, frontal, and transverse)

Key Fundamental Principle of NDT

- **DKP (Distal Key Point):**
  - Located away from the source of the problem, usually at the upper and lower extremities level
  - Used to allow the client to engage in activities with minimal control of the therapist
  - **Jaw, wrist, base of the thumb, ankle, big toe, elbow, knee**
  - Head may be a proximal or distal KPC

Key Fundamental Principle of NDT

- Problem-solving concept
- Repetition to enable to perform various different activities.
- Reduce the therapist's control during the treatment
- Treatment in functional situation
- Treatment should adapted to the needs of the individual child
- Parent participation, education and guidance
- Team approach

Redefine the Basis of NDT

System Approach of Motor Control

- CNS does not operate in a strictly descending manner
- No higher levels with which to control the operation of the lower levels
- There is a mutable relationship between the various levels so that each level will alternate between command and subordinate roles in relation to the other levels.

- Normal development Interplay between stability and mobility
- Reciprocal innervation - interplay between agonist and antagonist muscles during coordinated muscle movement
- ***Righting reactions*** - restore and maintain the vertical position of the head in space, the alignment of the head and trunk and trunk and limbs
- ***Equilibrium reaction*** - serve to maintain or regain balance during a shift in the Cog
- The ability to dissociate movements
- Development of postural control in the three planes of space

- NDT therefore provides the therapist with flexible treatment guidelines they can use to select individualised treatment strategies for their client

- **"It is not a recipe"** each child is different need to be able to use the principles in the context of each individual patient.

Living Concept

OLD THEORY	NEW THEORY
Hierarchical brain organization	Systems Model
Static postures and positions used for treatment	Client is an active participant in the session
Progressing the client through normal developmental milestones	Developmental milestones serve as guidelines but should not be strictly adhered to
Development of control proceeds in a cephalocaudal direction	Control of movement develops in proximal to distal or distal to proximal directions
Work on components of motions which the child will then apply to function	Client must work on functional tasks to learn the skill

Living Concept

OLD THEORY	NEW THEORY
CNS viewed as the "controller".	The CNS determines the pattern of neural activity based on input from multiple intrinsic systems and extrinsic variables that establish the context for movement initiation and execution
"Positive signs" including spasticity and abnormal coordination of movement are the most important aspects of sensorimotor impairments	"Negative signs', including weakness, impaired postural control & paucity of movement are recognized as equally important as the "positive signs" in limitations of function
Muscle & postural tone determine the quality of the patterns of posture & movement used in functional activities	Task goals, experience, individual learning strategies, movement synergies, energy and interests all affect the quality of the final action

Examination

- Thorough assessment to identify:
  - Functional abilities, limitations & Potential to change function
  - Posture & movement components and compensatory strategies
  - Gross & fine motor control
  - Assistive devices, splinting and orthothics
  - Alignment, weight bearing, balance, coordination, muscle & postural tone
  - Individual systems related to function: neuromuscular, musculoskeletal, sensory, perceptual, cognitive, respiratory, cardiovascular systems, attention, emotional and behavioral responses, fear, pain

Sequence of Intervention

- Preparatory activities for passive movement or body alignment
- Selection of the key points for therapeutic handling according to the child's postural tone
- Facilitation of active or automatic movement patterns by applying graded and varied therapeutic input
  - **Techniques:** tapping and intermittent compression to provide proprioceptive and tactile stimulation
- Inhibition of spasticity, abnormal reflex and movement pattern
  - **Techniques:** traction and light joint compression

Principles of Intervention

- **Weight bearing and weight shifting promote:**
  - Postural alignment, Child's movements, Proximal stability
- **Adaptive equipment and orthothic devices**
  - Allows more independent movement
  - Decreases the possibility of deformities and contractures
- **Role of Play in NDT Intervention with Children**

- As this 3-year-old moves from sitting with hands on the floor, to lifting hips off the bench and then returning to sitting, he must grade the quadriceps and hamstrings in midranges using reciprocal combinations of concentric and eccentric patterns as he raises and lowers his hips from the bench.

- Forward weight shift is encouraged by the selection of the activity, setting up the environment, and hands-on facilitation.

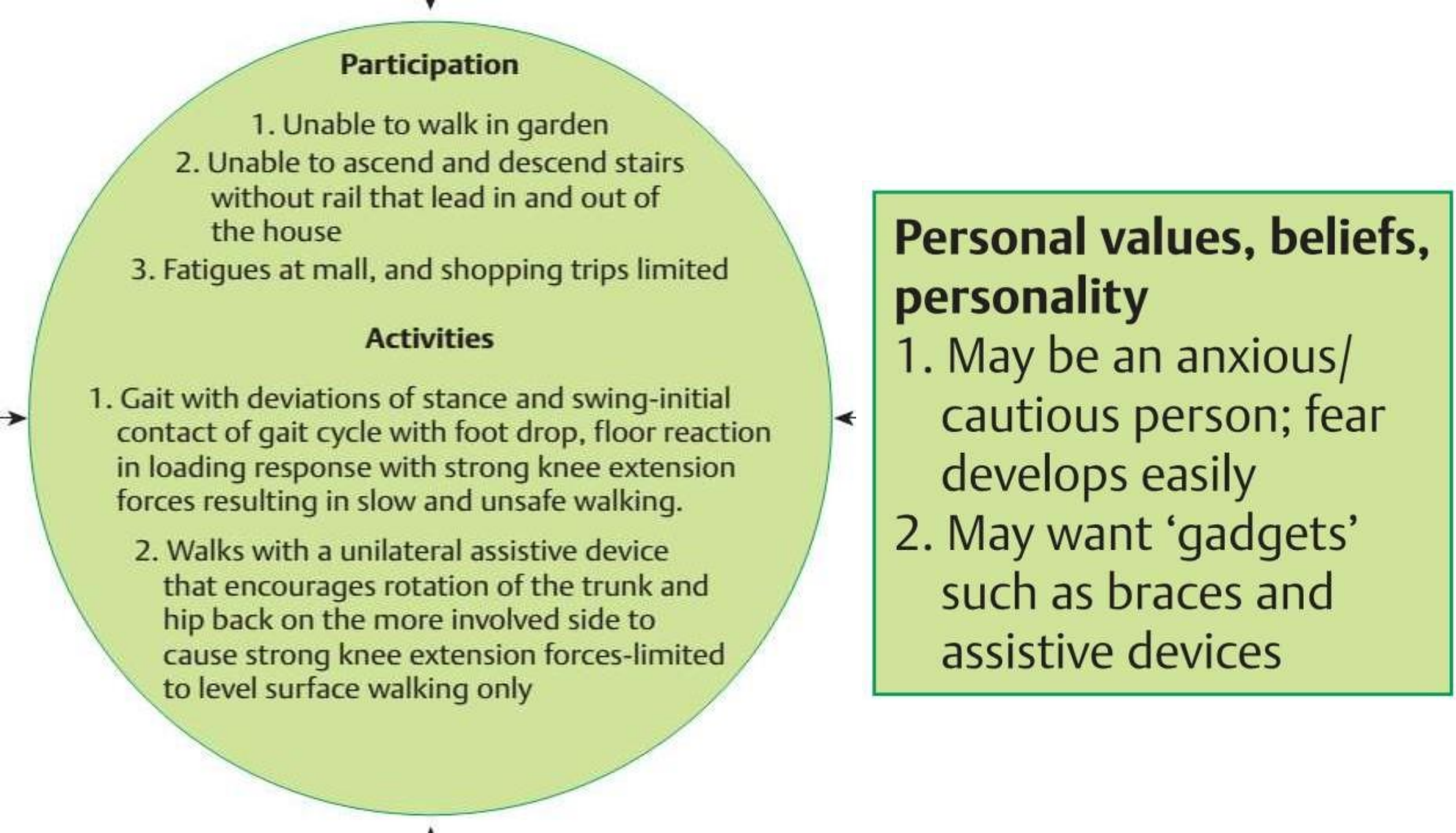
- This child practices toothbrushing while standing in a partial body-weight-bearing walker in front of a mirror to eliminate the need to balance and maintain alignment for this task.

Example of problem solving around the ineffective movement or alignment of knee hyperextension

Possible body system structure impairments

1. Shortened gastroc-soleus muscles
2. Overactive gastroc-soleus relative to dorsiflexors/toe extensors
3. Lacks dorsiflexion strength and/or timing in swing phases of gait
4. Inability to sustain co-activation of the abdominal and back extensor muscles
5. Weakness in abdominal muscles
6. Weakness in back extensor muscles
7. Weakness of the hip abductor and/or extensor muscles
8. Tightness of the hip flexor muscles
9. Tightness of the hamstring muscles
10. Tightness of the ankle joint and mid foot joints into inversion and

*There can be other impairments too.


Participation
1. Unable to walk in garden
2. Unable to ascend and descend stairs without rail that lead in and out of the house
3. Fatigues at mall, and shopping trips limited
Activities
1. Gait with deviations of stance and swing-initial contact of gait cycle with foot drop, floor reaction in loading response with strong knee extension forces resulting in slow and unsafe walking.
2. Walks with a unilateral assistive device that encourages rotation of the trunk and hip back on the more involved side to cause strong knee extension forces-limited to level surface walking only
Personal values, beliefs, personality
1. May be an anxious/ cautious person; fear develops easily
2. May want 'gadgets' such as braces and assistive devices

Environment conditions/contexts

1. Use of assistive device
2. Cannot negotiate uneven surfaces
3. When walking in crowded places (i.e, increases fear and thus, increases muscle recruitment)
4. 'Handlers' push knee back into hyperextension to stop from buckling

An example of problem solving around the ineffective posture of poor head control

Possible body system impairments*:

1. Lacks some ability to initiate and sustain superficial and deep cervical flexors and extensors; trunk flexors and extensors
2. Imbalance of antagonist muscle activity
3. Lacks isolation of muscles necessary for swallowing
4. Skeletal deformities or joint/ muscle restrictions that cause poor alignment for head (primary and/or seccondary)
5. Decreased PROM in cervical and/or thoracic spine
6. Lower trunk and hip alignment does not support head erect posture
7. Decreased attention/arousal
8. Various visual impairments and/or altered visual perception
9. Vestibular impairments or altered perception
10. Some type of respiratory compromise or obstruction that causes poor air exchange when head held upright

*There can be other impairments too.

Participation

1. Unable to visually search for people walking around a room
2. Does not participate in groups in class
3. Cannot eat with class on a field trip

Activities

1. Lies in bed or on beanbag chair
2. Lifted, carried, placed for activities
3. Meals given in reclined position

Personal values beliefs, personality:

1. May or may not be motivated and seeking visual information
2. Family worried that trying to lift head hurts
3. Some people belive that that person is stubborn or lazy or not trying

Environment conditions/contexts

1. Lies supine much of the time
2. Limited time in more than one or two places (home, hospital bed, classroom)
3. Lacks equipment to support upright
4. Interested in auditory information only- music, singing

THANK YOU