Early Assessment and Intervention

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- What is early intervention
- Developmental theories
- Impact of primitive reflexes on early development
- Assessment tools

*Learning acquired in youth is an inscription in stone...*”

*Old Indian Proverb*
Early Intervention

- Birth – 5 yrs old
- **Promote** child health
- **Enhance** emergence of competencies
- **Prevent** developmental delay
- **Remediate** existing or emerging disabilities
- **Prevent** functional deterioration
- **Individualized** developmental and therapeutic programs
- **Mutually** planned with family and caregivers
Early Intervention

- When?
- Where?
- How?
<table>
<thead>
<tr>
<th>EARLY IN LIFE</th>
<th>EARLY IN EXPRESSION OF DISORDER</th>
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<tbody>
<tr>
<td>- Brain plasticity</td>
<td>- Usually later in life</td>
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<tr>
<td>- Highest at 6-8 months post term</td>
<td>- Dysfunction is identified</td>
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<td>- Can work towards specific goals</td>
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<tr>
<td>- No specific disorder</td>
<td>- Relatively late wrt Plasticity</td>
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<td>- Poor goal setting</td>
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Early Intervention - Where

- Where to start
  - NICU
    - Stress reduction
    - Parent child interaction
    - Passive handling
    - General developmental stimulation
  - Ward
  - Discharge home
Early Intervention

How?

- Tailoring of intervention
  - Regular sessions
    - Current setting
    - Priority setting
    - Parents key role player
  - Intensive block therapy
    - Timing is key
    - Behavioural factors
    - Personality and motivation
    - Mastering of current skills
    - Improved weight shifts transitions
    - Endurance
Theories in Neurodevelopment

- **Neural Maturation Theories**
- Developed in the 1930’s and 1940’s
- As the brain and musculo-skeletal system matures
- Identified that development would follow:
  - Set sequence
  - Specific timing
- Genetically determined
- Developmental milestones
Neural Maturation Theories (cont)

- General concepts
  - Cephalo-caudad
  - Proximal-distal

- No interaction from environment

- Development is the gradual cortical control over lower reflexes
Theories in Neurodevelopment

- **Dynamic Systems Theory**
- Interest in development was rekindled in the 1980’s
- How does the *external, peripheral and perceptual* factors influence development
- Factors all need to be in place for learning to take place
Theories in Neurodevelopment

- **Perception-Action Approach**
  - Perception and movements strongly linked
  - Perception required for adaptive movements
    - Perception of environment, body,
  - Perceptual information requires movement
    - Exploratory movements of eyes/limbs/head/body
Theories in Neurodevelopment

- **Neuronal Group Selection Theory**
- No specific cortical pathways but
- Variation is present in
  - Sequence
  - Duration
- Dynamic ensemble of cortical and subcortical systems arranged in networks of interconnected neurons - *neuronal groups*
Theories in Neurodevelopment

- NGST states that “development starts with primary neuronal repertoires”
- Each repertoire consists of multiple neuronal groups
- Variation decreases as behavioural and experience changes
- Secondary repertoires develop
  - Situation specific
"You've gotta help me! I can't read my own writing!"

Look at this email from my doctor. I mean, where did he even get that font?!
# Theories in Neurodevelopment

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<tr>
<th>NEURAL MATURATION</th>
<th>PERCEPTION – ACTION THEORY</th>
<th>DYNAMIC SYSTEMS THEORY</th>
<th>NEURONAL GROUP SELECTION THEORY</th>
</tr>
</thead>
</table>
| • Provides basis for milestones  
  • Understanding of why primitive reflexes disappear | • Provides link between nervous system and environment | Equal link between nervous system and external factors | • Situation based  
  • Task specific  
  • Variable sequence  
  • Variable period |

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**Nature** ➔ **Nurture**
How do these theories relate to early assessment?
Morrow (Startle) Reflex

- When baby hears a loud noise, will thrust arms out and head back and start crying
- Integrated at +- 6 months
- If persists
  - interferes with sitting and other postures
  - Inability to develop equilibrium and protective reactions
Asymmetrical Tonic Neck Reflex

- When head turned to the side the ipsilateral arm extends
- If persistent
  - Struggles with bilateral integration
  - Midline activities
  - Later skills like crawling, dressing, hand writing may also be poor
Rooting reflex

- Helps the baby find the nipple when side of cheek is stroked
- Integrated by 3-4 months
- If prolonged can result in asymmetry.
  - Struggle with midline
  - Fix and follow
  - Prone lying
Grasp Reflex

- Baby closes fingers tightly when palm stimulated
- Fades in a few months
- If weak:
  - poor hand development
  - Exploration of objects and environment
- If too strong
  - Difficulty to release objects
  - In-hand manipulation
Step Reflex

- When supported under the arms and feet touch the floor, baby will take steps
- If persists
  - Over active extensors
  - Muscle imbalance
  - Poor flexor and midline development
As an aside

- Poor bilateral integration
- Poor trunk control
- Muscle imbalance
- Visual-perceptual problems
- Spatial awareness
- Scapular control
  - Fine motor problems
- Muscle contractures
- Injuries
Assessment Tools

- Infant Neuro-motor Assessment
- Touwen Infant neuro-motor Assessment
- Alberta Infant Motor Scales

- Assesses “traditional” neurological signs
  - Tone
  - Reflexes
- Assesses posture, symmetry, function in various positions
- Quick easily reproducible tests
- Ideal age for assessment is 18 weeks corrected age
• **General Movements**
  - Are spontaneous movements present from early foetal life till the 1\textsuperscript{st} half of life
  - Thought to be produced by **Central Pattern Generators (CPG)**
  - Complex movements and involve the whole body
  - Variable sequence of movement between arm, neck, leg and trunk
  - Amplitude
  - Velocity
  - Intensity
Prechtl General Movement Assessment

- Changes in:
  - Velocity
  - Force
  - Speed
  - Intensity
- Gradual beginning and end
- Fluent and elegant
Prechtl General Movement Assessment

- Are assessed on the awake alert baby
- Must not be irritable or fussed, tired
- A 30 - 60 minute video recording in the preterm infant
- 5-10 minutes needed for term infant
- Minimal disturbances and distractions during recording
Prechtl General Movement Assessment

**Writhing Movements**

- **Age:**
  - term → 2 months

- **Characterised by:**
  - Small to moderate amplitude
  - Slow to moderate speed
  - Elliptical “writhing” movements
**Fidgety Movements**

- **Age:**
  - 6–9 weeks
  - As writhing movements disappear

- **Characterised by:**
  - Small amplitude
  - Moderate speed
  - Variable acceleration
    - Of neck, trunk and limbs
Fidgety Movements

- May be associated with other movements
  - Fiddling
  - Wiggling
  - Swiping
  - Finger and hand manipulation
  - Reaching and touching
  - Axial rolling
Prechtl General Movement Assessment

Abnormal General Movements

- Hypoxic-Ischaemic lesions
- Leukomalacia
- Haemorrhage in the Corona Radiata
- Peri-Ventricular lesions
- Quantity vs. quality
Abnormal General Movements

- **Cramped Synchronised**
  - “rigid” lacking smooth fluid movements
  - Poor dissociation
  - High predictive value for spastic CP
Abnormal General Movements

- **Poor Repertoire**
  - Monotonous sequence of movements
  - Lacks the complexity
  - Often found in infants with abnormal brain US
  - Low predictive value for CP but may indicate Minor Neurological Dysfunction
**Abnormal General Movements**

- **Abnormal or Absent Fidgety**
  - May look like normal GM
  - But amplitude, speed, jerkiness are greatly exaggerated
  - Absence is highly predictive of later neurological dysfunction, particularly CP
Abnormal General Movements

- **Chaotic GM**
  - Large amplitude
  - No fluency or smoothness
  - Abrupt
  - Often develop into Cramped Synchronised GM
Interpreting GMs

- **Signs of CP**
- **Cramped GM** predictor of Spastic Quadriplegia and Diplegia
- **Hemiplegia**
  - Bilateral Cramped GM with subsequent Absent Fidgety movements or poor repertoire
  - Asymmetry in segmental movements: reduced or absent on contralateral side of lesion
  - May be evident during 2\textsuperscript{nd} month
Interpreting GM

- **Dyskinetic CP**
  - Poor repertoire
  - Arm movement in circles with finger spreading
  - May be present up to 5 months post term
  - Unilateral or bilateral
  - Monotonous
  - Lack of movements to midline
Minor Neurological Dysfunction

- **Simple MND**
  - Motor dysfunction with a normal but NON optimal brain function
  - May progress well through developmental milestones but struggle fine tuning task specific activities
  - Clumsiness
  - DCD

- **Complex MND**
  - Pre & perinatal brain dysfunction
  - “borderline” CP
  - Associated more with dystonia and hypotonia
  - Reflexes may vary
  - Clumsy motor behaviour
<table>
<thead>
<tr>
<th>Cluster of Dysfunction</th>
<th>Sign</th>
<th>Criteria for dysfunctional cluster</th>
<th>MND</th>
<th>Complex MND</th>
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<tbody>
<tr>
<td>Dysfunctional Muscle tone</td>
<td>• Abn tone • Abn posture during sitting, walking, crawling, standing</td>
<td>Consistent mild deviation in one 1 cluster dysfunction</td>
<td>2 or more clusters dysfunction</td>
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<tr>
<td>Abnormal reflexes</td>
<td>Abn intensity or asymmetry in tendon reflexes</td>
<td>Presence of 2</td>
<td></td>
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<tr>
<td>Gross motor dysfunction</td>
<td>Discoordination during crawling, block movements of trunk, age inadequate imbalance, maneuverability</td>
<td>Presence of 2</td>
<td></td>
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<tr>
<td>Fine Motor dysfunction</td>
<td>Hand preference, poor quality arm and hand movements</td>
<td>Presence of 2</td>
<td></td>
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<tr>
<td>Rarely occurring disorders</td>
<td>Motor behavior of face, eyes, tongue, tremors</td>
<td>Presence of cranial nerve palsy or consistent tremor</td>
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Minor Neurological Dysfunction

- Often neglected or not identified until much later
- Most often identified in the school going age when specific tasks are required.
- Problems with
  - bilateral integration
  - Gross motor impairment
  - DCD or clumsiness
Early assessment is vital
Use combination of traditional screening tools as well as others such as the GM assessments
Early intervention can be started as soon as possible with individualized treatment programs
Thank you
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