Physiotherapy Management of Children and Young People with Cerebral Palsy Mini Series

Session Two: The importance and implication of early intervention on children with Cerebral Palsy

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Study Notes: The importance and implication of early intervention on children with Cerebral Palsy

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Kids Physio Works

Aims:

- To be able to define *neuroplasticity* and to understand cortical re-organisation and how this can be influenced positively with therapy.
- To be understand the 10 factors that influence neuroplasticity and how these can be applied to a Paediatric group.
- Discuss why intervention as early as possible following brain injury helps optimise neuroplasticity
- What are the Therapies/Treatment that offer the most researched results to enhance neuroplasticity?
- Discuss how we can apply the principles of Neuroplasticity to our therapy intervention

Content

Definition of Neuroplasticity:

- Refers to the ***"phenomenon of neurons and neural networks modifying their connections and/or behavior in response to new information, sensory stimulation, development, damage or dysfunction"*** Boyd, Cunnington, Rose and Reid, 2016.

Current evidence:

- Current data strongly suggests that neurons among other brain cells possess the remarkable ability to alter their structure and function to a response of internal and external pressures – including behavior training

10 principles that influence neuroplasticity:

- Article written by Klein and Jones, 2008. called Principles of Experience-Dependent Neural Plasticity: Implications for rehabilitation after brain damage, discussed the 10 principles of neuroplasticity:

Table 1. Principles of experience-dependent plasticity.

Principle	Description
1. Use It or Lose It	Failure to drive specific brain functions can lead to functional degradation.
2. Use It and Improve It	Training that drives a specific brain function can lead to an enhancement of that function.
3. Specificity	The nature of the training experience dictates the nature of the plasticity.
4. Repetition Matters	Induction of plasticity requires sufficient repetition.
5. Intensity Matters	Induction of plasticity requires sufficient training intensity.
6. Time Matters	Different forms of plasticity occur at different times during training.
7. Salience Matters	The training experience must be sufficiently salient to induce plasticity.
8. Age Matters	Training-induced plasticity occurs more readily in younger brains.
9. Transference	Plasticity in response to one training experience can enhance the acquisition of similar behaviors.
10. Interference	Plasticity in response to one experience can interfere with the acquisition of other behaviors.

Research around neuroplasticity currently falls into two categories:

1) Limiting the severity of initial injury to minimise loss of function
2) Working towards brain re-organization to restore and compensate for function that has been lost.

How does brain damage affect the way the brain responds to learning?

- Brain damage results in many changes in neurons, and non-neuronal brain cells that can alter learning processes.
- Loss of tissues at site of the primary injury
- Major neurodegenerative and neuroplastic changes in connected regions
- Results in clearance of degenerating debris, a cascade of changes related to the clearance of degenerating debirs, the remodeling of neuronal processes, and the production of new neural connections (synapses) by remaining inputs called Reactive Synaptogenises.

Intervention:

- There are now at least 64 different interventions for cerebral palsy currently being used. (Novak, 2014).
- Even more are under clinical trial
- There is an ever expending need for neurologists to take a leading role in advancing cerebral palsy treatment options in the fields of neuroplasticity, neuroregeneration and neuroprotection research.
- Current clinical picture: Late conservative diagnosis of CP following failed milestones conflicts with current neuroscience evidence on how early intervention, close to the time of injury is strongly advised in order to optimize neuroplasticity.
- A diagnostic label is often a gateway to access the rehabilitation services the child requires. Delaying diagnosis might impact negatively on the child for a number of reasons:
    - Deprives them of early intervention for months or even years
    - Delaying bad/ negative news is known to worsen parental depression and stress rather than helping them to feel more positive
    - Important to help families access specific evidence- information on how best to help their child Novak, 2014

Management of cerebral palsy is categorised into 3 areas of focus:

1) Child active rehabilitation approaches
2) Compensatory and environmental adaption approaches
3) Health and secondary prevention approaches

International Classification of Functioning, Disability and Health (ICF):
The ICF classification system focuses on human functioning and provides a unified, standard language and framework that captures *how* people with a health condition function in their daily life rather than focusing on their diagnosis or the presence or absence of disease.
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Putting the Child First - Guidance for Professional Communication:

- Document published in 2018 focusing on paediatric physiotherapists ensuring the needs of the child or young person are always put first and that all communication is in their best interests.
- This does entail overcoming significant barriers currently and the purpose of this document is to help paediatric physiotherapists collaborate with all types of service provision to produce the best outcomes for the families in their care