Action Understanding: An EEG Analysis of Mirror Neuron Activity in Children with Developmental Coordination Disorder

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INTRODUCTION

- Event-related desynchronizations (ERDs) occur during motor preparation and execution.
- Adults activate the same brain areas while observing movements performed by others within their own motor repertoire (i.e. Mirror Neuron System).
- The capacity for imitative learning could be tied to making connections between observed actions with a motor representation of an action.
- Imitative learning is a fundamental component of motor learning.
- Developmental Coordination Disorder (DCD) is an motor learning disorder characterized by movement difficulties that interfere with daily living.
- It's unknown if children with DCD have a disrupted MNS, which could contribute to motor learning difficulties.

RESULTS & DISCUSSION

• Typically in adults the alpha power decreases across the four conditions HAP=HAO>EO>EC.
• Two children (TD1 and DCD2) show no differences between condition.
• One TD child (TD2) showed the greatest desynchronization for HAO in comparison to all other conditions.
• TD child (TD2) also exhibited the same activation patterns during HAO and the rest conditions.
• May reflect (a) boredom during action observation (b) lack of MNS engagement during trial.
• One child with DCD (DCD1) showed greatest desynchronization during hand action observation IVOT hand action performance.
• May reflect (a) boredom during action performance (b) lack of motor planning and response preparation during trial.
• Previous studies have show that children with DCD have poor motor planning and hypoactivation of neural resources.
• These preliminary results indicate normal function in MNS in some child with and without DCD whereas other demonstrate divergent patterns from both adults and other children. Is this representative of TD children and those with DCD?

PURPOSE

The purpose of this study was to investigate potential differences in brain activation related to mirror neuron function between typically developing children (TD) and children with Developmental Coordination Disorder (DCD) during observation and performance of a meaningful and familiar goal-directed task (reaching and grasping an object).

METHODS

Participants

<table>
<thead>
<tr>
<th>Subject</th>
<th>Age</th>
<th>Gender</th>
<th>MABC</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD1</td>
<td>11.32</td>
<td>Male</td>
<td>96%</td>
</tr>
<tr>
<td>TD2</td>
<td>11.68</td>
<td>Male</td>
<td>22%</td>
</tr>
<tr>
<td>DCD1</td>
<td>11.41</td>
<td>Male</td>
<td>13.0%</td>
</tr>
<tr>
<td>DCD2</td>
<td>11.09</td>
<td>Male</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

* This child also has ADHD and speech articulation difficulties.

Data Analysis

- Wavelet (time-frequency analysis)
- Daubeches 4 Wavelet (level 3)

SPECTRAL ANALYSIS

- Spectral Analysis
  - Power Spectral Density (PSD)
  - Thomson’s Multitaper Method
  - 8-12Hz (Alpha)
  - 18-22Hz (Beta)

WAVELET ANALYSIS

- 1st Trial
- 10th Trial

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REFERENCES


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