Adapted Cycling Physical Health Benefits for Children with Cerebral Palsy

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Outline

• Introduction and Background
• Methods and Participants
• Results
• Conclusion
• Acknowledgements
• References
Pedal Power
Child with Cerebral Palsy (condition)

- Body Structure and Function
  - Muscle weakness, muscle length changes

- Personal Factors

- Cycling as an Activity
  - May have the potential to maintain muscle length & strengthen muscles

- Environmental Factors

- Disabled child in society
  - Lack opportunities for Participation
Methods

- Ethical Approval: School of Healthcare Studies Research Ethics Committee, Cardiff University
- Mixed Methods: Different Subject Experimental Design
- Pre- & Post- Intervention assessment
- Mean of 4 bilateral quadriceps & hamstrings within session strength measures (Hand-held dynamometer)
- Mean of 4 Bilateral popliteal angle measures (silicon coach)
Participants

- 35 children participated
- 18 control group (non cycling group)
- 17 Intervention group (cycling group)
- Inclusion criteria: aged 2-18, GMFCS levels I – V, Cerebral Palsy, volunteered, informed consent / assent
- Exclusion criteria: ORTHOPAEDIC intervention and / or Botulinum toxin injections within the past 6 months
Participants: Cycle Assessment
Measurements

Figures 1 & 2: Quadriceps Strength measured with the Hand-held Dynamometer

Figure 3: Popliteal Angle measured with Silicon Coach
Intervention
## Participants: Demographics

### Age

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean (SD)</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cycling Group</strong></td>
<td>2</td>
<td>17</td>
<td>7.12 (4.69)</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td><strong>Control Group</strong></td>
<td>2</td>
<td>13</td>
<td>7.67 (3.41)</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>

### GMFCS

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cycling Group</strong></td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td><strong>Control Group</strong></td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

### CP

<table>
<thead>
<tr>
<th></th>
<th>Hemiplegia</th>
<th>Diplegia</th>
<th>Quadriplegia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cycling Group</strong></td>
<td>1</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>Control Group</strong></td>
<td>7</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>
## Results: Popliteal Angles

<table>
<thead>
<tr>
<th>Groups</th>
<th>Right Baseline</th>
<th>Right Post-Intervention</th>
<th>Left Baseline</th>
<th>Left Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycling Group</td>
<td>44.87° ± 14.47</td>
<td>44.21° ± 9.95</td>
<td>39.64° ± 13.57</td>
<td>42.2° ± 10.32</td>
</tr>
<tr>
<td>Control Group</td>
<td>50.53° ± 9.06</td>
<td>49.57° ± 10.64</td>
<td>49.14° ± 12.72</td>
<td>46.73° ± 11.83</td>
</tr>
</tbody>
</table>

**Data:** No significant difference in baseline measures between groups

An unpaired samples T-Test:

R: p=0.233

L: p=0.067

No significant difference between groups
## Results: Strength Measures

### Baseline Mean Strength Measures and Standard Deviations

<table>
<thead>
<tr>
<th>Group</th>
<th>R Quadriceps</th>
<th>L Quadriceps</th>
<th>R Hamstrings</th>
<th>L Hamstrings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycling Group</td>
<td>39.73 N (± 22.78)</td>
<td>33.41 N (± 17.06)</td>
<td>33.77 N (± 18.44)</td>
<td>33.69 N (± 15.00)</td>
</tr>
<tr>
<td>Control Group</td>
<td>60.56 N (± 30.03)</td>
<td>59.74 N (± 34.57)</td>
<td>45.16 N (± 21.07)</td>
<td>48.76 N (± 25.54)</td>
</tr>
</tbody>
</table>

### Quadriceps Strength Changes

<table>
<thead>
<tr>
<th></th>
<th>R Leg</th>
<th>L Leg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycling Group</td>
<td>Increased by 12.14 N (± 6.50)</td>
<td>Increased by 15.56 N (± 13.87)</td>
</tr>
<tr>
<td>Control Group</td>
<td>Decreased by 3.62 N (± 4.73)</td>
<td>Decreased by 0.41 N (± 1.40)</td>
</tr>
</tbody>
</table>

### Hamstring Strength Changes

<table>
<thead>
<tr>
<th></th>
<th>R Leg</th>
<th>L Leg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycling Group</td>
<td>Increased by 5.19 N (± 3.50)</td>
<td>Increased by 4.23 N (± 5.94)</td>
</tr>
<tr>
<td>Control Group</td>
<td>Decreased by 1.03 N (± 0.06)</td>
<td>Decreased by 1.05 N (± 3.05)</td>
</tr>
</tbody>
</table>
Results: Cycling Group

Within cycling group strength changes

- Wilcoxon ranks sign Test
- Statistically significant increase in quadriceps strength
  - Right: $p = 0.018$
  - Left: $p = 0.021$
- No significant change in hamstring strength
Results: Between Groups

- Significant differences in baseline measures between groups
- Comparisons made using ANCOVA (SPSS18)
- No significance in Quadriceps strength between groups
  - Right: $p = 0.08$
  - Left: $p = 0.79$
Conclusion

• Adapted cycling has potential health benefits

• Strength increased with cycling and decreased in the group not cycling

• Strength trends deserve further investigation with larger sample sizes and longer intervention periods

• Therapists, educators and policy makers should consider providing adapted cycling opportunities for children with disabilities
References


Acknowledgements

thank you * danke * thank you * danke * thank you * danke

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• Jenx, Ltd
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