Intensive Motor Skills Training Program Combining Group and Individual Sessions for Children With Cerebral Palsy

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Purpose: To describe and evaluate a local program of intensive goal-directed motor skills training for a small number of children with cerebral palsy. Methods: Multiple single-subject (ABA) design over a period of 18 weeks consisting of A1: 6 weeks of assessment and goal setting; B: 6 weeks of intensive goal-directed functional training combining group and individual sessions; and A2: 6 weeks of follow-up. Six children, 3 to 11 years old, Gross Motor Function Classification System levels I, II, and IV participated in this study. Outcome measures were Gross Motor Function Measure-66, functional hand grips, pediatric evaluation of disability inventory, fine motor speed, Assisting Hand Assessment, and Goal Attainment Scale. Results: On completion of the described program, 29 of 35 individual goals were reached. Gross Motor Function Measure-66, functional hand grips, and self-care and mobility scores of Pediatric Evaluation of Disability Inventory showed significant gains. Conclusions: An intensive program combining group and individual sessions resulted in a high rate of goal attainment and positive changes in relevant outcome measures even if the children had different age, goal areas, and functional levels. (Pediatr Phys Ther 2010;22:150–160) Key words: activities of daily living, classification, cerebral palsy, child, goal, motor skills/training, physical therapy methods, outcome and process assessment (health care), teaching methods, time factors

INTRODUCTION

Cerebral palsy (CP) is a group of complex developmental disorders caused by nonprogressive disturbances in the immature brain, occurring in approximately 2 to 2.6 of every 1000 live births in industrialized countries. Although brain damage is permanent, motor function continues to develop in these children over time. The recently published reference curves for the Gross Motor Function Measure (GMFM) have provided normative percentiles for gross motor change over time for children with CP and also show the great variability of change in children's percentiles. The great variability of change in gross motor development, the heterogeneity of the interventions under study, and methodological limitations have made it difficult to demonstrate the effectiveness of therapy for children with CP. However, specific factors associated with physiotherapy have been shown to have a positive effect. This includes increased exposure to therapy, setting specific treatment goals, and functional training. In goal-directed functional therapy, the goal is to enable a child to accomplish an identified task. Therefore, service providers try to provide frequent opportunities to practice activities toward predefined goals in many situations and many occasions throughout the day. Some of the parents in our local, rural area wanted their children to benefit from group training despite the fact that the children were of different ages and had different functional levels and different goal areas. In planning an intervention for such a group of children, we had to involve children and parents in defining goals that were specific, achievable,
and meaningful for the child. In creating group sessions with functional therapy, the challenge was to create meaningful and motivational joint activities with the goals in mind, ensuring that the children's individual goals were addressed specifically and frequently.

The purpose of this study was to describe the change in motor function for each of a small number of children after the intervention and whether the improvements in individual goal attainment were reflected in relevant standardized instruments. Furthermore, our goal was to describe an example of an intervention program, combining group and individual sessions, for a small number of children with CP who were of different ages and had different functional levels, and a broad range of goal areas.

METHODS

Participants

All the children with CP in a local rural area in Norway, Gross Motor Function Classification System (GMFCS) levels I through IV, younger than 12 years, without severe intellectual disabilities, who had identified a goal area suitable for intensive training, were invited to participate in the study. Seven children were eligible and 1 child withdrew from the study 2 weeks into the training period due to the death of an immediate family member. Therefore, 6 children at GMFCS levels I through IV, 3 to 11 years old (mean age, 6.3 years) participated in the study. The program was run twice. Child 6 did not participate the first time. Results are reported from the children's first participation period in the program.

The children's functional level was classified using the GMFCS, the Zancolli classification of deformities in the spastic hand, and the House classification of thumb deformities. The GMFCS levels were already determined at the habilitation center before this study by clinical judgment supported by plotting GMFM-66 scores on motor growth curves. The Zancolli and House classifications were performed by an external tester (occupational therapist [OT]), based on videos of the functional hand grips testing. According to parent report, 1 child had general learning problems, 1 child had specific learning problems, and 1 child had attention problems. Three of the children had documented average intellectual function. All children communicated verbally. Table 1 summarizes the description of the children.

TABLE 1

Description of the Children

<table>
<thead>
<tr>
<th>Child No.</th>
<th>Sex</th>
<th>Age at Recruitment, y</th>
<th>Diagnosis</th>
<th>GMFCS Level</th>
<th>Zancolli/House Level</th>
<th>Ambulatory Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boy</td>
<td>3</td>
<td>Right hemiplegia</td>
<td>I</td>
<td>1/1</td>
<td>Ambulatory</td>
</tr>
<tr>
<td>2</td>
<td>Boy</td>
<td>3</td>
<td>Left hemiplegia</td>
<td>II</td>
<td>1/1</td>
<td>Ambulatory, problem walking on terrain</td>
</tr>
<tr>
<td>3</td>
<td>Boy</td>
<td>7</td>
<td>Diplegia (hereditary)</td>
<td>II</td>
<td>Ambulatory, problem walking downhill</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Girl</td>
<td>7</td>
<td>Right hemiplegia</td>
<td>1</td>
<td>1/2</td>
<td>Ambulatory</td>
</tr>
<tr>
<td>5</td>
<td>Girl</td>
<td>7</td>
<td>Left hemiplegia</td>
<td>1</td>
<td>1/3</td>
<td>Ambulatory</td>
</tr>
<tr>
<td>6</td>
<td>Girl</td>
<td>11</td>
<td>Quadriplegia</td>
<td>IV</td>
<td>2/3</td>
<td>Not ambulatory</td>
</tr>
</tbody>
</table>

* The etiology in child 3 was hereditary spastic paraplegia and therefore did not fulfill the criteria for the diagnosis of cerebral palsy. The child nevertheless participated in the study because of the similarity of symptoms.
* Child 4 was also diagnosed with epilepsy.

TABLE 2

Overview of the Study Design

<table>
<thead>
<tr>
<th>Phase</th>
<th>Phase A1 (6 wk)</th>
<th>Phase B (6 wk)</th>
<th>Phase A2 (6 wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week</td>
<td>Assessment and goal setting (no treatment except maintaining ROM)</td>
<td>Intensive training</td>
<td>Follow-up (no training)</td>
</tr>
<tr>
<td>Period</td>
<td>1 2 3 4 5 6</td>
<td>7 8 9 10 11</td>
<td>12 13 14 15 16 17 18</td>
</tr>
</tbody>
</table>

Standardized assessments: T1, T2, GS, Recording of goal attainment, T3, T4

Goal-setting/goal attainment: GA, goal attainment recording; GS, goal-setting time; ROM, range of movement.

Design

We chose a multiple single-subject (ABA) design lasting 18 weeks. The first 6 weeks (phase A1) consisted of an assessment and goal-setting period with no treatment except for maintaining range of motion by parents or assistants on a daily basis if indicated, followed by 5 weeks of intensive goal-directed motor skills training (phase B), and finally a 6-week follow-up with no treatment (phase A2). Before the goal-setting period, the children received physical therapy or occupational therapy approximately once weekly, consisting of guidance to school staff regarding general aims according to their diagnoses and functional levels and maintaining range of motion if indicated.

Standardized instruments were administered at T1, T2, T3, and T4 (Table 2). The detailed goals were set within days before the training started, and goal attainment was recorded daily during the training period, at T3 and at T4 (Table 2).
The protocol was approved by the Regional Committee for Medical Research Ethics, Central Norway, and the Norwegian Social Science Data Services. The parents signed informed consent forms on behalf of their children.

**Outcome Measures**

Before recruitment, the parents or local therapists had identified a goal area for the child that they considered suitable for intensive training. After meeting with the local therapists and the parents of each child, standardized assessment instruments were administered. The assessment also included parent discussions and observation of the children in the relevant context of the goal area(s). Furthermore, we asked for a list of the children's interests and favorite leisure time activities to be used when designing the group activities. Based on the initial goal area(s) and assessments, 4 to 8 goals were negotiated with parents and local therapists. The goals were ideally set in terms of everyday activities. The children were not able to perform the goal activities without help at baseline (goal-setting time \( T_0 \)). Figure 1 summarizes the goals for each child.

**Goal Attainment Scaling (GAS),** an individualized criterion-referenced measure of change, was used to objectively measure each child's individualized functional change. GAS is responsive to change in individualized motor goals. Furthermore, it has been shown that it is possible to set relevant, achievable goals with clinically important levels of change using the GAS. We used GAS to specify 5 possible outcomes for each goal: baseline, less than expected, goal attainment, greater than expected, and much greater than expected (Figure 2). Both local therapists and specialists from the habilitation center participated in defining the Goal Attainment Scales. The scales were thereafter reviewed by another member of the staff, who was trained in setting goals, to ensure they had clearly demarcated steps. The GAS forms were put in a loose-leaf notebook that was kept during the intervention period.

**GAS**

<table>
<thead>
<tr>
<th>Criteria for goal attainment</th>
<th>Evaluation</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much greater than expected</td>
<td>Runs down gentle slope on skis holding on to a crossroad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than expected</td>
<td>Standing on skis on flat surface while pulled by an adult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal attainment</td>
<td>Ski 10 meters on flat surface in a trail without support from an adult (with or without ski sticks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than expected</td>
<td>Ski 10 meters on flat surface in a trail with support from an adult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>Not able to ski</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 2.** Example of a goal with the levels of Goal Attainment Scoring (GAS) specified.

The process of setting goals, as described, lasted approximately 6 weeks for each child.

Goal attainment was recorded by the therapist who happened to be with the child when the child reached a new level of functioning. The best level of outcome recorded during the intensive period had to be demonstrated at \( T_3 \) to be credited. Baseline level and levels at \( T_3 \) and \( T_4 \) were videotaped, and the videotapes were used by the recording therapist as support for the clinical judgment when goal attainment was recorded.

Change in gross motor function over time was assessed using GMFM-66. The GMFM-66 is validated for evaluative purposes and has proven responsiveness to change. Test-retest reliability (intraclass correlation coefficient = 0.99) is also excellent.

To assess how well the children performed hand grips frequently used in activities of daily living.
hand grips test, a nonstandardized instrument built on Sollemann's Grip Function Test, which shows good validity\(^2\) and is reliable and reproducible in adults,\(^2^2\) was used. This adult test has been adapted and is used for children.\(^2^5\) There are no reports of psychometric properties for the children's version. The grips chosen for this study were ball grip, vertical, horizontal, and extension grip; 5-finger pinch, key grip, and pulp pinch.\(^2^6\) For the children with hemiplegia, only the affected hand was assessed. For the child with quadriparesis, both hands were assessed. This test was not administered for the child with diplegia because there were no fine motor goals. The ordinal level raw scores on a scale from 0 to 4\(^2^7\) were converted to the percentage of maximum score to present the results in the same graphs as the other results.

Because all the children had goal areas of self-care and mobility, the Pediatric Evaluation of Disability Inventory (PEDI), a clinical assessment instrument of functional capabilities and performance in disabled children,\(^2^8\) was used through parent interviews. PEDI is a reliable instrument regarding internal consistency (α, 0.95–0.99) and inter- and intrarater reliability for clinical samples (intraclass correlation coefficient: 0.84 – 1 versus 0.74 – 0.96).\(^2^9\) Construct validity is also well established.\(^3^0\) The scaled scores of the self-care and mobility domains are found to be responsive to change.\(^3^1\) A Norwegian translation of the PEDI including Norwegian score forms was used.\(^3^2\) The scaled scores of the Functional Skills (FS) and Caregiver Assistance (CA) scales were used.

Fine motor speed was assessed using a stopwatch to record the time that the child needed to put 10 small cubes with 1.7-cm sides in a box, one at a time. This test was used because the time aspect was focused on some of the fine motor goals. For the children with hemiplegia, only the affected hand was tested. For the child with quadriparesis, the preferred hand was tested. The fine motor speed test was not administered for the child with diplegia, as there were no fine motor goals.

Because of the many goals related to bilateral hand function, the Assembling Hand Assessment (AHA), a Rasch-built standardized criterion-referenced test, measuring and describing how effective children with unilateral impairments use the affected hand in bimanual activity performance,\(^3^3\)\(^3^4\) was used for the children with hemiplegia. A few studies showed promising results concerning validity, reliability, and responsiveness.\(^3^5\)\(^3^6\) The children were observed when playing in a semistructured way, and raw scores were assigned on a 4-point ordinal scale and converted to interval-level scores using the manual's Excel program.

The outcome measures were administered at the habilitation center according to the manuals by 6 experienced external assessors (OTs, physical therapist [PT], and a social worker) blinded to the design. The same assessors tested each child all 4 times. The assessors were in no other way involved in the study. The parents gave written information in a log after every group session. They also completed a questionnaire after the intensive period and attended a group interview a week after the last group session, focusing on feasibility, whether the children enjoyed themselves, and about the children's progress.

### Intervention

The intensive training period ran for 6 weeks, 5 days per week with alternating days of group and individual training sessions. 3 days of group training 1 week and 2 days the next week, with a total of approximately 10 hours of training per week. The intervention could mainly be characterized as intensive goal-directed functional therapy but with some activities designed to give the children a basic experience in the motor requirement necessary to reach the goals. The intervention was designed by a group of local professionals including special teachers, music teachers, crafts teachers, OTs, PTs, and the staff from the habilitation center, including a special teacher, OT, and PT. At least one person who knew the child well was in the planning group. The planning of intervention started after the goal areas for the children were known and was completed after the detailed goals for each child were set and the children's interests were known. The PTs and OTs would work with the teachers to provide information about each child's specific goals and motor skills that need to be practiced in the group sessions. The teachers would then, for example, compose new movement songs or find crafts activities with the goals in mind.

Multidisciplinary group sessions lasted for 3 hours including 2.5 hours of group activity and 0.5 hours of individual goal-directed training in convenient smaller groups. Group sessions were held at suitable premises where physiotherapy services were usually offered from 1 to 4 in the afternoon, directly after the oldest children had finished their school hours. The same professionals who planned the intervention carried it out. Parents were invited to join in whenever they wanted. This provided at least 1 adult per child during the group activities. Most of the group activities were led by a music teacher or a crafts teacher, but the gross motor play and the outdoor activities were led by the OTs and PTs. While the music teacher or crafts teacher led the group activities, the PTs and OTs would work directly with the children using therapy-specific strategies, if needed. This would include the use of guidance techniques such as handling or supportive touch, verbal cuing, simplification of the task, or distributing the feedback according to the needs of the individual child.

The group sessions started with wardrobe activities such as removing winter clothes, putting on suitable clothes and shoes for training, a welcome song, and schedule presentation. Thereafter, the children were engaged in activities such as movement songs, playing rhythmic instruments, playing with plastic clay, painting, gross motor play (eg. African dance or obstacle course), and outdoor
activities. The individually adapted activities were designed to be fun and interesting and to give variable practice related to the movement problems inherent in the children's goals. For example, several of the children with hemiplegia had different goals including bilateral activities, and therefore the music instruments that they were to play required 2 hands but with different degrees of difficulty depending on the child's skills. Some children would stand while playing the instruments because they had goals including standing balance, whereas others would sit in a wheelchair or walk. If the child had goals regarding dressing or undressing, these goals would be addressed when arriving and leaving. Because of the goals regarding walking on uneven terrain, wheelchair mobility, and skiing skills, some of the group sessions were held outdoors.

The group sessions always included a meal, and because several of the children had goals of using a knife and a fork or spoon, we prepared meals for which a knife and a fork or spoon were needed. After the meal, the children had individual goal-directed training geared toward their own specific goals. At that time, the local therapist worked with the specialist from the habilitation center and was thereby able to do the individual training the next day.

Individual sessions held at the school/kindergarten or at home were integrated into the children's everyday activities, lasting for approximately 1 hour each time. The individual sessions used task-oriented principles of motor learning and were designed to enhance motor learning related to the children's specific goals. This included problem-solving activities and goal-directed practicing of the goal functions in relevant contexts. An example would be child 3, who did not have a strategy for tying shoe laces (Figure 3). In the first individual sessions, he would work with the PT to search for a strategy to solve the movement problem. The PT would use handling techniques, simplification of task, or verbal cuing if necessary in the beginning. Thereafter, he would practice tying his shoe laces shielded from disturbances for a period, before he would progress to tying his shoe laces in the wardrobe while having a conversation with the other children. The same strategies used in the individual sessions were used in the final part of the group sessions.

GAS forms were used to see what the next level of function was, to record new levels of function, and to enhance motivation by marking each new level with a sticker label (Figure 3). A separate log was used to ensure that all goals were addressed at every session.

Data analysis

Because of the small number of participants in this study, data were mainly analyzed on an individual basis. The data points were plotted in graphs for each child.

<table>
<thead>
<tr>
<th>GAS</th>
<th>Criteria for goal attainment</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tie shoe laces on football shoes</td>
<td>Date</td>
</tr>
<tr>
<td>Much greater than expected</td>
<td>Tie shoe laces on football shoes and at the same time having a conversation</td>
<td>16/1</td>
</tr>
<tr>
<td>Greater than expected</td>
<td>Tie shoe laces on football shoes</td>
<td>24/1</td>
</tr>
<tr>
<td>Goal attainment</td>
<td>Tie a knot, tighten and form a loose bow on football shoes</td>
<td>19/06</td>
</tr>
<tr>
<td>Less than expected</td>
<td>Tie a knot on football shoes and tighten</td>
<td>18-06</td>
</tr>
<tr>
<td>Baseline</td>
<td>No strategies for tying shoe laces</td>
<td>15.12.05</td>
</tr>
</tbody>
</table>

Fig. 3. Example of a Goal Attainment Scaling (GAS) form in use. Handwritten information indicates performance on the date noted: "going better," "both shoes," "the bow is placed at one side," and "struggling with the knot."
RESULTS

During the 6-week training period there were 14 days of group training and 16 days of individual training, with approximately 98 total hours of training. Children 1, 2, 3, 4, 5, and 6 attended 22, 25, 24, 31, 28, and 26 days, respectively. In general, a high level of goal attainment was seen. Of 35 goals, 29 were attained, 9 of which with a greater than expected outcome and 15 of which with much greater than expected outcome, as recorded using GAS. Children 1, 2, 3, 4, 5, and 6 attained 100%, 75%, 80%, 87.5%, 100%, and 40% of their goals at expected level of outcome or better, respectively. Mean goal attainment was 80.4%. Six weeks later, most of the goals were still maintained (Figure 1). Results from GMFM-66, PEDI, functional hand grips, and AHA for each child are presented graphically in Figure 4. Only results showing change are presented.

Child 1 (Figure 4A) reached all of his goals. Except for the change in GMFM-66 scores, all change in standardized instruments took place during the intervention period. His new ability to walk up and down stairs was reflected in the scores of the corresponding items in the GMFM-66 and in
the PEDI FS mobility domain. He learned to put on both a jacket and a sweater. The gains in the FS and CA scales in the self-care domain of the PEDI came in items related to dressing and undressing. A goal related to playing a memory game focused on fine motor ability; and both the functional hand grips and fine motor speed test clearly showed a change during the intervention period.

Child 2 (Figure 4B) reached 3 of 4 goals and had a remarkable rate of change in the standardized instruments. He even changed his GMFCS level. GMFMM-66 showed change in all periods, as did the FS scale of the self-care domain in PEDI. However, functional hand grips, fine motor speed, and the CA scales in the mobility, self-care, and social domains of PEDI changed after the intensive training period.

Child 3 (Figure 4C) reached 4 of 5 goals. He was highly motivated to reach his gross motor goals and showed improvement already during the goal-setting period. His new abilities in soccer ball, standing on 1 leg, and putting on winter shoes were directly reflected in corresponding items of the GMFMM-66, in the PEDI FS mobility domain, and in the FS and CA scales of the self-care domain of PEDI. He also changed GMFCS level.

Child 4 (Figure 4D) reached 7 of 8 goals. Except for the GMFMM-66 scores, the change in standardized instruments occurred in the intervention period. Her new abilities in self-care goals were directly reflected in relevant items of the PEDI FS self-care domain, in the functional hand grips assessment, and in the fine motor speed test. After the intervention, her walking pattern and 1-leg balance were better, which were reflected in the PEDI FS mobility domain.

Child 5 (Figure 4E) had 5 self-care goals with fine motor focus, which she reached during the intervention period. The change in functional hand grips, fine motor speed, and the AHA, mainly after the intervention, reflected this goal attainment, as did the change in the PEDI CA self-care domain. She also reached her 2 gross motor goals, which were reflected in the GMFMM-66 scores. She was the only child for whom the change in GMFMM-66 scores happened during the intervention period.

Child 6 (Figure 4F) was the oldest and most affected. She reached 2 of 5 goals. The progress in head stability was reflected in the GMFMM-66 items of sitting. The progress in GMFMM-66 scores started in the intervention period and continued in the follow-up period. In addition to functional training, the intervention focused more on modifying the task, which was not reflected in scores on the standardized instruments.

Table 3 shows mean change on standardized instruments in the different periods for the children on levels I and II. Table 4 shows change in GMFMM percentiles for each child.

Multiple standardized instruments showed substantial change during the whole period (T1–T4) for the children at levels I and II, reaching a significant level in GMFMM-66, PEDI FS self-care and mobility domains, PEDI CA self-care domain, and the functional hand grips test (Table 3).

---

**TABLE 3**

<table>
<thead>
<tr>
<th>Group Changes on Standardized Measures</th>
<th>T1–T2</th>
<th>T2–T3</th>
<th>T3–T4</th>
<th>T4–T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMFMM</td>
<td>3.58</td>
<td>2.48</td>
<td>4.23</td>
<td>10.79</td>
</tr>
<tr>
<td>PEDI FS self-care</td>
<td>4.35</td>
<td>2.69</td>
<td>3.87</td>
<td>8.29</td>
</tr>
<tr>
<td>PEDI FS mobility</td>
<td>0.00</td>
<td>2.32</td>
<td>0.96</td>
<td>3.39</td>
</tr>
<tr>
<td>PEDI FS social</td>
<td>1.59</td>
<td>0.54</td>
<td>1.76</td>
<td>3.88</td>
</tr>
<tr>
<td>PEDI CA self-care</td>
<td>3.34</td>
<td>0.32</td>
<td>0.74</td>
<td>10.32</td>
</tr>
<tr>
<td>PEDI CA mobility</td>
<td>0.00</td>
<td>2.80</td>
<td>0.00</td>
<td>2.80</td>
</tr>
<tr>
<td>PEDI CA social</td>
<td>0.92</td>
<td>1.72</td>
<td>0.00</td>
<td>2.64</td>
</tr>
<tr>
<td>Functional hand grips</td>
<td>0.95</td>
<td>1.14</td>
<td>0.00</td>
<td>1.14</td>
</tr>
<tr>
<td>AKA</td>
<td>0.00</td>
<td>0.30</td>
<td>0.00</td>
<td>0.30</td>
</tr>
<tr>
<td>Fine motor speed, sec</td>
<td>-4.93</td>
<td>5.39</td>
<td>3.09</td>
<td>6.71</td>
</tr>
</tbody>
</table>

Abbreviation: AHA, assisting hand assessment; CA, Caregiver Assistance scale; FS, Functional Skills scale; GMFMM, Gross Motor Function Measure; PEDI, Pediatric Evaluation of Disability Inventory. *P < .05.

**TABLE 4**

<table>
<thead>
<tr>
<th>Change in Gross Motor Function Measure (GMFMM) Percentiles for Each Child</th>
<th>T1-2</th>
<th>T2-3</th>
<th>T3-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child 1, level 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>7 y 3 mo</td>
<td>4 y</td>
<td></td>
</tr>
<tr>
<td>GMFMM-66 score</td>
<td>72.16</td>
<td>86.52</td>
<td></td>
</tr>
<tr>
<td>Percentile</td>
<td>60</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>Child 2, level 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>7 y 1 mo</td>
<td>3 y 5 mo</td>
<td></td>
</tr>
<tr>
<td>GMFMM-66 score</td>
<td>62.30</td>
<td>71.69</td>
<td></td>
</tr>
<tr>
<td>Percentile</td>
<td>93</td>
<td>Level 1: 65</td>
<td></td>
</tr>
<tr>
<td>Child 3, level 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>7 y 6 mo</td>
<td>6 y</td>
<td></td>
</tr>
<tr>
<td>GMFMM-66 score</td>
<td>74.75</td>
<td>92.63</td>
<td></td>
</tr>
<tr>
<td>Percentile</td>
<td>85</td>
<td>Level 1: 83</td>
<td></td>
</tr>
<tr>
<td>Child 4, level 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>7 y 1 mo</td>
<td>7 y 3 mo</td>
<td></td>
</tr>
<tr>
<td>GMFMM-66 score</td>
<td>82.99</td>
<td>87.99</td>
<td></td>
</tr>
<tr>
<td>Percentile</td>
<td>90</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Child 5, level 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>7 y 4 mo</td>
<td>7 y 5 mo</td>
<td></td>
</tr>
<tr>
<td>GMFMM-66 score</td>
<td>87.89</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Percentile</td>
<td>70</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Child 6, level 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>11 y 5 mo</td>
<td>11 y 9 mo</td>
<td></td>
</tr>
<tr>
<td>GMFMM-66 score</td>
<td>30.55</td>
<td>32.31</td>
<td></td>
</tr>
<tr>
<td>Percentile</td>
<td>15</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Four of the 6 domains in the PEDI showed the greatest change in the intervention period, reaching a significant difference in the FS mobility domain, and an almost significant level (P = .0545) for the CA self-care domain for children at levels I and II. Child 6 showed no change in the PEDI except in the FS social functioning domain, where the change score was 6.9. In addition, functional hand grips test, significantly greater gains in the intervention phase were seen compared with the A phases. In the fine motor speed test, all the children declined from T1 to T2, and improved in the training period. This trend continued in the follow-up period, leaving a total mean change of 6.7 seconds (standard deviation, 0.98) from T1 to T4, for the children on GMFCS levels I and II, and a total change of 25
seconds from $T_1$ to $T_4$ for child 6. Despite a large difference
between the B phase and the A phases, the difference did
not reach a significant level ($p = .0545$). In the AHA, no
significant differences were seen between phases, and in
GMFM-66 scores, significantly greater gains in the A phases
compared with the intervention period were observed.

Preliminary data from interviews, parent's logs, and
questionnaires show some promising results, which will be
presented in future reports. All the parents thought that the
children greatly benefited from the intensive period, and
all of them were proud of their children who bravely
attempted new challenges. They also underlined the impor-
tance of being goal directed. When a child reached his or
her own goal, the child would practice the newly learned
skills in natural settings without further requests, thereby
maintaining the goal functions throughout the nontreat-
ment period. All the parents preferred intensive periods
compared with less frequent therapy sessions over a long
time because there were visible gains for the children in
the intensive period, and they could look forward to a sub-
sequent period with no treatment. The obvious positive ef-
fect on the children caused all parents, except those of
child 1, to wish that their children could participate again,
despite the fact that they all also experienced the intensive
period as tiring and stressful.

**DISCUSSION**

The purpose of this study was to describe a multidisci-
plinary intensive intervention, with a combination of
group and individual sessions, for a heterogeneous group
of children with CP and assess whether the intervention
would lead to change in motor function. In this article, we
describe an intervention based on a thorough assessment
and goal-setting period in which the children's specific
goals and interests were directly used to design the inter-
vention. The intervention led to high attendance, high
level of goal attainment, positive gains on relevant stan-
dardized instruments, and positive feedback from parents.

A high level of goal attainment was seen in which only
6 of the 35 goals were not achieved at the expected level.
One of the 2 goals with no change can probably be ex-
plained by unfavorable weather conditions at $T_1$ (child 3:
walk downhill). For the other goal with no change (child 6:
wait with a spoon) in fact some progression was seen but not
enough to reach the next GAS level. The goal-setting pe-
riod was considered very important. We emphasized the
child's or the parents' identified goal area for the training
point as a starting point. Bower et al. demonstrated the
positive effects of having specific goals compared with gen-
eral aims, and during the many steps of the goal-setting
process in this program, we secured a transition from the
more or less general aims presented by the child or parents
to specific achievable goals. Once decided on, the goals
together with the list of each child's interests acted as a
guide to design the intervention, thereby securing a great
amount of practice directly focused on the goals. The
tightly decorated loose-leaf notebooks with the goals in
them, which were actively used multiple times daily,
added to motivation and goal directedness of the practice—
factors described to enhance goal attainment. One
could argue that the goals were set at a very easy level.
On the other hand, some of the standardized instruments
also showed large gains, suggesting that some of the chil-
dren in some areas experienced large and clinically rele-
ant improvements.

The mean change of 10.8 in GMFM-66 scores during
the whole period ($T_1$ to $T_4$) for the children on GMFCS
levels I and II was substantial, and greater than or at the
same levels as other intervention programs. Children 2
and 3 even moved from GMFCS level II to I, and the 3
children at level I moved 15 to 37 reference percentiles for
the GMFM-66. Hanna et al. found that the variability in the
amount of change in GMFM-66 percentiles was ±20 per-
centiles when the median time between assessments was 1
year for GMFCS levels I and II. Our results far exceeded
the expected variability, thereby reducing the chances that
the gains in this study represent maturation and therefore
indicate relevant change in gross motor function. However,
only children 2, 5, and 6 experienced the greatest gain in
GMFM-66 in the intervention period. The limited progress
in GMFM-66 for child 6 is expected, considering her age
and GMFCS level.

Mean changes in the PEDI scores from $T_1$ to $T_4$ for
the children at GMFCS levels I and II were on the same level as
other studies, except for FS self-care domain (8.3) and CA
self-care domain (10.3), where this study showed greater
gains. This may reflect that most of the children in the
study had goals in the areas of self-care activities. This
hypothesis is further strengthened by the attainment of
self-care goals being reflected in corresponding items in the
FS and CA scales of the self-care domain.

GMFM-66 showed some positive changes in the as-
essment and goal-setting period ($T_1$ to $T_4$) for all the
children except for child 6. Even though the majority of gains
in the PEDI scores took place in the intervention period
($T_1$ to $T_4$), positive changes on the PEDI were also shown
from $T_1$ to $T_4$ for children 2, 3, 5, and 6 in the self-care
and social domains. Based on a study by Bower and McEllan, we
suggest that the $T_1$ to $T_4$ period might represent a kind
of intervention for some of the children. Both the children
and the parents reacted positively to the testing and goal-
setting procedures, and the attention associated with them
may have acted like indirect teaching to both parents and
children. Furthermore, the results might be explained by
parents starting to reduce their help in skills that they
thought that the children might master in a short time. For
child 3, this might even be the most important inter-
vention. However, he was ill with a fever at $T_1$, and this may
camouflage the progression not credited before $T_4$. Similar
to the study by Bower and McEllan, we also assume that
the children continued to develop their newly learned
functions in daily life activities in the $T_1$ to $T_4$ period. As a
result, all the children, except child 5, had accomplished
more test items than expected on the GMFM-66, and chil-
dren 2, 3, and 5 had accomplished more test items than
expected on the PEDI at $T_4$. 

Pediatric Physical Therapy

**Intensive Motor Training: Group and Individual Sessions**

157
Maturation might have been a factor both in the T1 to T2 and T2 to T3 periods. However, this is not likely because of the short duration of the periods. On the other hand, testing variability could account for change in the T1 to T2 period because the children were familiar with tests, testing procedures, and testers at T2. Also, fatigue associated with the high intensity intervention could probably explain some gains not recorded until T3.

The tendency to start-changing during the goal-setting period (T1-T2) was not seen in functional hand grips or fine motor speed tests. In those outcome measures, almost all change can be attributed to the intervention period. Perhaps the reason for this is that the fine motor goals were so difficult for the children that they were not able to start the problem-solving process on their own, nor did the parents start reducing their assistance. It is also likely that it is more difficult to practice those tasks in a natural setting without specific intervention. A surprising result was that even though the children with hemiplegia reached their fine motor goals and had a large change in the functional hand grips and fine motor speed tests, no changes in the AHA scores were seen. This result may underscore the task-related factors in learning new motor skills. Mastering new skills does not automatically lead to generalization and more use of the affected hand in other situations.

The high attendance, the high rate of goal attainment, and the positive change in relevant standardized outcome measures may be due to several factors in the intervention, such as intensity, goal directedness, functional training, motivation, and integrated interdisciplinary programming. Each of these factors is discussed below.

Intensity: A lot of intervention programs have attributed success to high intensity as do we. In this intervention, we not only had high frequency of treatment (5 days per week) but also a high total amount of intervention (10 hours per week).

Goal directedness: Like other authors, we are convinced that a proper goal-setting period contributes substantially to the results. We also like to highlight the importance of being family- and child-centered in the goal-setting process, as elaborated by Law et al. among others.

Functional training: Multiple authors have described functional training. In this intervention, we chose to view functional training both directly and indirectly. For example, the goal to put on winter shoes was practiced directly by practicing putting on shoes with gradually less assistance from an adult, both in the group sessions and individual sessions. However, we also had movement songs and gross motor play in the group sessions where the children had to practice 1-leg balance and play with a range of other balance challenges.

Motivation: We enhanced motivation by focusing on the children's own goals and interests.

Integrated interdisciplinary programming: Through multidisciplinary effort, we found it possible to create joint activities based on common denominators of the children's interests, music, painting, or outdoor gross motor play, and then modify the way each child participated in the joint activity to be directed to individual goals. Through this way of planning the intervention with the goals in mind, the children had the opportunity to draw on all the positive aspects of being in a group, doing activities they liked, while still securing high-intense goal-directed functional therapy. The combination of group sessions, as described, and individual sessions may account for the high attendance, the high rate of goal attainment, and the positive changes on standardized instruments. Feedback from parents also suggests that high amounts of training are well tolerated when organized as described. To our knowledge, this is not described for heterogeneous groups before and may be of significant relevance for practitioners in rural areas.

Limitations

We realize that having a longer baseline period before the assessment and goal-setting period would make the conclusions sounder. In planning the study, this was taken into consideration along with our wish to administer a broad range of standardized instruments and lessen the testing burden on the children and the parents.

CONCLUSIONS

This study shows that it is possible to run a successful intensive intervention program combining group sessions in which the children work toward their individual goals within a joint social activity, with individual goal-directed training even if the children's age, functional levels, and goal areas differ. All the children reached most of their functional goals, which were maintained 6 weeks later, suggesting that clinically significant learning had occurred. The positive results on relevant outcome measures further strengthen that suggestion.

REFERENCES


