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EFFECTIVENESS OF INTENSIVE TRAINING FOR CHILDREN WITH CEREBRAL PALSY – A COMPARISON BETWEEN CHILD AND YOUTH REHABILITATION AND CONDUCTIVE EDUCATION

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Objectives: **To compare the short-term effectiveness of 1 intensive training period in child and youth rehabilitation with Move&Walk conductive education and describe the effects of 1 intensive training period in terms of changes at 1 year. The amount and influence of additional consumption of training during the 1-year follow-up was also analysed.**

Design: **Quasi-experimental with 2 groups: Lemo ($n = 23$) and Move&Walk ($n = 29$).**

Patients: **A total of 52 children with cerebral palsy, age range 3–16 years.**

Methods: **Data included repeated measures with Gross Motor Function Measure (GMFM) and Pediatric Evaluation of Disability Inventory–Functional Skills (PEDI-FS). Data on additional consumption of training was collected at the 1-year follow-up.**

Results: **There was no difference in proportion of change on the clinical measures between the training programmes, except for a higher proportion of improvement on the GMFM total score in Lemo. At the group level, small improvements were shown on GMFM and PEDI FS in the short-term and on PEDI FS only at 1 year. A higher proportion of children who participated in repeated intensive training periods showed improved social functioning.**

Conclusion: **No major differences were shown between the 2 training programmes. One intensive training period facilitated small improvements in gross motor function. The majority of children had a high consumption of training during the 1-year follow-up and the added value of repeated intensive training periods was limited.**

Key words: evaluation studies, exercise therapy, cerebral palsy, treatment outcome.

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INTRODUCTION

At the end of the 1990s there was an increasing demand for intensive training and group activities for children with cerebral palsy (CP) in Sweden. One reason was a lively debate criticizing child and youth rehabilitation for being too pessimistic about the development of the child, making the children passive by compensating too much with assistive devices and environmental adaptations and failing to support active functional and more intensive training. There was also a debate among professionals whether treatment of the capacities of the child was sidelined in favour of actions taken to support social aspects and participation of the child in their environment. Another suggestion as to why treatment was sidelined was the uncertainty about treatment effects and utility from the aspect of health (1).

At present, CP occurs in about 2.2 per 1000 liveborn children in Sweden (2–4). A commonly cited definition of CP is "an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions and anomalies of the brain arising in the early stages of development" (5). CP is subdivided by type (spastic, ataxic or dyskinetic) and topography (hemiplegia, diplegia or tetraplegia) representing different motor dysfunction manifestations (5). CP is frequently accompanied by additional neuroimpairments, such as learning disabilities, epilepsy, visual impairments, speech and language disorders and perceptual problems (6). Improved grouping due to severity of impairment in gross motor function has been achieved (7, 8) and increasing degrees of physical disability are accompanied by increasing degrees of additional neuroimpairments (6, 9) and functional limitations (10). The heterogeneity of CP comprises a wide range of functional problems and gives rise to a large variety of needs in the children and their families.

A modified form of conductive education (CE), the Move&Walk method, was held up by parent organizations and adults with CP as a model achieving superior results and improvements compared with rehabilitation within the traditional healthcare system. Reasons for the increased interest in the Move&Walk method among parents have been reported to be curiosity, opening for improvements in rehabilitation, or discontent with the rehabilitation (11, 12).

In response, different training programmes for children with CP were developed within the traditional healthcare system in Sweden. One training programme was called Lemo (learning motor skills). The aim was to offer intensive training in motor skills. The group setting was also considered to provide opportunities for social training and improvements in communication skills.

There is no coherent theory underlying CE (13) or contemporary physiotherapy (14). A number of emerging therapy

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approaches (15–17) based on dynamic system theories of motor learning (18, 19) are described within neurological rehabilitation in traditional healthcare and influence the training strategies used in Lemo.

A basic tenet that influences the philosophy of CE is that CP is considered a learning problem and needs are met with educational principles (13, 20–22). The primary aim is to stimulate the developmental process (20) and the general goal of CE is defined in the concept of "orthofunction", which implies "the ability to function as a member of society, to participate in normal social settings appropriate to their age without assistive devices and environmental adaptations" (Cottam and Sutton (1986), quoted in (13)). The use of adaptive equipment and assistive devices is not encouraged by CE, but there are "modified forms" which allow for a limited use (21). Today, CE is applied to different diagnoses in CP as well as to different levels of severity. Originally children with a higher level of functioning and walking capacity were addressed (22). These modifications are applicable to CE in the Move&Walk method.

In many respects, both traditional healthcare for CE and Lemo resonate with contemporary thinking (22). Objectives in common encompass a wide range of functional domains, including fine and gross motor function, communication, psychosocial and cognitive functions (13, 22).

One major difference between CE and traditional healthcare is the role of the conductor compared with the therapists. In CE the conductor has the responsibility of unifying and supervising learning within different fields of knowledge (13, 20). In traditional healthcare different team members: physiotherapist, teacher of special education, speech therapist, occupational therapist, psychologist, etc., meet different needs. In Lemo, physiotherapists and a teacher of special education lead the group activities and other team members assist if needed.

It is a mutual interest of parents, therapists and healthcare providers to build up a sound knowledge of the effects of different intervention programmes offered to children with CP. Studies have been undertaken to investigate whether different intensities or conditions of training influence the outcome compared with different treatment methods. There is some evidence of short-term improvement in gross motor function with increased intensity of training (23–26). However, long-term effects of more intensive training have not been reported (27, 28). Intermittent periods of more intensive training have been suggested to facilitate improvements in gross motor function that are maintained over rest periods (26).

Studies comparing different treatment methods or rehabilitation programmes, such as conductive education or infant stimulation, have not shown considerable differences in outcome compared with traditional neuro-developmental treatment (NDT) approaches (13, 29–31). One study suggests that functional physiotherapy based on motor learning theories compared with traditional NDT training may lead to greater improvements in functional skills but similar improvements in gross motor function (32).

When new training programmes are introduced, evaluation of the effectiveness of the technologies is needed. This project focuses on the general question of effectiveness of 2 different intensive training programmes: Lemo and Move&Walk. Short-term outcome is also evaluated with respect to changes after 1 year.

The evaluation as a whole includes clinical and self-reported measurements of performance, health-related quality of life, perceived quality and healthcare utilization. This article focuses on the short- and long-term outcomes of the clinical measures of Gross Motor Function Measure (GMFM) and Pediatric Evaluation of Disability Inventory–Functional Skills (PEDI-FS).

The aims of this study were:

- to compare the short-term effectiveness of the 2 different training programmes, Lemo and Move&Walk.
- to describe the effects of 1 intensive training period (ITP) in relation to changes at 1 year and to study the amount and influence of consumption of training during the 1-year follow-up.

MATERIAL AND METHODS

The study design was quasi-experimental, i.e. the group of children studied was followed in accordance with a prospective single case experimental design. Each child was examined before (phase A1), during (phase B) and after (phase A2) an ITP and at 1 year. Short-term outcome (phase A1–A2) was analysed in relation to the 1-year outcome (phase A2–1-year). One-year outcome was also analysed in relation to additional consumption of training.

Subjects

A sample of 54 children participated in a short-term follow-up after an ITP and was followed up at 1-year. A total of 24 children participated in Lemo and 30 children in Move&Walk. Randomization to either training programme was not possible due to travel distances.

Inclusion criteria were a diagnosis of CP, age 3–16 years and children who were expected to benefit from an ITP in a group setting. None of the children had participated in any form of intensive training 3 months prior to the research period.

Background data and consumption of training

A semi-structured questionnaire was constructed to describe the amount of additional consumption of ITPs or customary training following the ITP during the 1-year follow-up. Customary training was defined as treatment/training and/or counselling at the rehabilitation centre, at home, in school, at the after-school recreation centre or in any location during leisure time. The data was collected via a telephone interview with 1 of the parents (in 4 cases with the teenage child) at the 1-year follow-up (Table I).

A questionnaire about medical background was completed by the responsible paediatrician for each child during the ITP (Table II). Children's level of gross motor function was classified according to the Gross Motor Function Classification System (GMFCS) (33), an ordinal scale, ranging from level 1 "Walking without restrictions; limitations in more advanced gross motor skills" to level 5 "Self-mobility is severely limited even with the use of assistive technology" before, after the ITP and at 1 year. The instrument is reliable (33, 34) and valid (7). Background data was presented for each child at Lemo and Move&Walk short-term and for 2 groups defined according to consumption of training during the 1-year follow-up: 1 group of children who chose to continue participation in 1 or more repeated intensive training-periods (rITP

Table I. *Quantity of training and frequency of children who participated in 1 or more additional repeated intensive training periods (ITP) and/or customary training (Cust) during the 1-year follow-up for the total group* (n = *51)*

Questions to the parent	Yes	No
Did your child attend any form of intensive training programme after the ITP at Lemo or Move&Walk 1 year ago?	22 (43%) rITP	29 (57%) Cust
Quantity of training if yes:		
1 ITP		
2 weeks	4	
3 weeks	3	
4 weeks	4	
2 ITP		
3 + 3 weeks	4	
3 + 4 weeks	1	
3 ITP		
2 + 3 + 3 weeks	4	
3 + 3 + 3 weeks	1	
3 + 4 + 4 weeks	1	
Does your child attend any regular activity/training which may be seen as a direct follow-up of the ITP at Lemo or Move&Walk 1 year ago?	23 (45%)	28 (55%)
Quantity of training if yes:		
Daily	11	
Once a week	9	
Once a month	3	
Does your child do any activities or training on their own that you see as a direct follow-up of the ITP at Lemo/Move&Walk 1 year ago?	37 (73%)	14 (27%)
Does your child participate in any regular activities at the rehabilitation centre, such as taking part in support, training/treatment or other activities?	29 (57%)	22 (43%)
Quantity of training if yes:		
Once a week	19	
Every second week	6	
Once a month	4	
Does your child take part in any other regular activity other than the rehabilitation, at home, in school, at the after-school recreation centre, or other things as you see as training or treatment activities?	42 (82%)	9 (18%)
Quantity of training if yes:		
Every day	5	
Once a week	29	
Several times a week	6	
Every second week	2	

Lemo = Learning motor skills.

group) ($n = 22$) and 1 group of children who chose customary training without added intensive training periods (Cust group) ($n = 29$) (Table I).

The rITP group and the Cust group were each further divided into 2 subgroups depending on the quantity of customary training. Low quantity of customary training was defined as less than 2.5 hours/week and high quantity of customary training was defined as $\geq$2.5 hours/week. Group 1: rITP + low quantity of customary training ($n = 9$); group 2: rITP + high quantity of customary training ($n = 13$); group 3: no rITP + low quantity of customary training ($n = 12$); group 4: no rITP + high quantity of customary training ($n = 17$). The quantity of intensive training was 4.4 weeks (SD 2.6), range 2.0–9.0 weeks, in group 1 and 5.8 weeks (SD 2.6), range 2.0–11.0 weeks, in group 2.

Clinical measurements

Gross Motor Function Measure (GMFM) (35) was used repeatedly 3 times before the ITP (phase A1), 1 time during the ITP (phase B), 3 times after the ITP (phase A2) and at 1 year. The GMFM total score ranges from 0% to 100% achievement of motor function. Every item was scored on a 4-point ordinal scale from "does not initiate" to "completes the movement". GMFM total score and the scores for the 5 dimensions: (A) lying and rolling; (B) sitting; (C) crawling and kneeling; (D) standing and (E) walking, running and jumping were calculated. GMFM total score has shown to be highly reliable, valid and sensitive to change (24, 35–37).

Changes on GMFM total score and the dimensions A–E represent the mean difference between the 3 measure points before (phase A1) and the 3 measure points after the ITP (phase A2). Changes at 1 year represent the differences between the mean of the 3 measure points after the ITP (phase A2) and the measure point at 1 year.

Pediatric Evaluation of Disability Inventory (PEDI) (38) was administered as an interview with the same parent (in 2 cases with the included child, who was teenaged) at the first and seventh occasion of testing and at 1 year. A Swedish manual supplement (39) of the American PEDI administration manual (38) was used as an interview guide. PEDI includes 3 sets of measurement scales: functional skills (FS), caregiver assistance (CA) and modifications. Each individual scale illustrates different aspects of the child's capability and performance in self-care, mobility and social function. PEDI FS is designed to measure meaningful subtasks of a set of complex functional activities vs PEDI CA, which measures the amount of help the child needs to carry out functional activities. Scores for the PEDI CA and modification scales are not presented in this paper. PEDI FS comprises 197 items, each scored "unable"(0)" or "able"(1) by the interviewer. Raw aggregate scores were transformed to scaled scores and were used to identify change in performance. Scaled scores represent increasing degrees of functional performance along a scale from 0 to 100 without reference to age. PEDI is primarily designed for younger children but can be used if the functional ability of the child falls below that expected of a 7.5-year-old child without disability. The interviews were scheduled to last for 60 minutes. Changes on PEDI FS scaled scores represent the difference between the first and seventh measurement point before and after the ITP. Changes at 1 year represent the difference between the seventh and eight measurement points.

Reliability, validity (38, 40) and responsiveness to change (41) for the PEDI are reported to be good. Both GMFM and PEDI have been considered to fulfil the criteria of reliability and validity with respect to responsiveness to change (42).

Mean difference of change, proportion of clinically relevant change, number of changes in any dimension or domain and number of children showing changes on GMFM or PEDI FS will be presented as dependent variables. The lowest level accepted as a clinically relevant change was considered to be the $\pm$4% on GMFM total score and the dimensions A–E and $\pm$4 scaled scores on PEDI.

Procedure

The same researcher performed all the tests and interviews with GMFM and PEDI within the same case throughout the 8 occasions of examination during the short-term and the 1-year follow-up. Due to travel distances 1 researcher made all the tests at Lemo and the other researcher at Move&Walk. Both researchers had accomplished the criterion test to ensure reliability of testing GMFM.

The telephone interviews to describe the consumption of training were performed by 2 specially trained physiotherapy students and 1 of the researchers (PÖ). The interviews were distributed in equal proportions between the interviewers and the training programmes.

Neither of the researchers was involved in the training programmes and they should therefore be regarded as independent objective assessors. Both training programmes were free from fees during the ITP. Informed written consent was obtained from the parents. The study was approved by the ethics committee at the Faculty of Health Sciences, Linköping University, Sweden (10 January 2000, Dnr 00-016).

Intensity and character of Lemo and Move&Walk

The intensity of training was 3 hours/day, 4 days/week for 4 weeks at Lemo and 2–4 hours/day, 4–5 days/week during 4 weeks at Move&

Table II. *Background characteristics for the total group, the 2 training programmes Lemo and Move&Walk and for the 2 groups formed on the basis of consumption of repeated intensive training periods (rITP group) or customary training (Cust group) during the 1-year follow-up*

	Total group $n = 54$	Lemo $n = 24$	Move&Walk $n = 30$	rITP group $n = 22$	Cust group $n = 29$
Gender, male:female	32 : 22	10 : 14	22 : 8	10 : 12	19 : 10
Age					
3–8 years	27	12	15	14	12
9–16 years	27	12	15	8	17
Diagnosis					
Spastic					
Hemiplegia	4	1	3	2	1
Diplegia	30	17	13	11	18
Tetraplegia	5	0	5	1	3
Dyskinetic	13	5	8	7	6
Ataxic	2	1	1	1	1
Intellectual capacity (ICD-10)					
Normal	19	12	7	11	8
MMR (F70.0)	16	10	6	6	8
SMR (F71.0 + 72.0)	14	1	13	2	11
Missing data	5	1	4	3	2
Visual impairment					
Normal	34	12	22	13	20
Impaired without specification	6	4	2	3	3
Partially sighted 0.3–0.1	8	2	6	1	5
Blind >0.1	1	1	0	0	1
Missing data	5	5	0	5	0
Epilepsy					
Yes	11	3	8	3	8
Resistant to therapy >1 time/mths	4	0	4	1	1
No	36	18	18	17	18
Missing data	3	3	0	1	2
GMFCS					
Level 1	2	2	0	1	1
Level 2	9	4	5	4	5
Level 3	9	4	5	3	6
Level 4	21	11	10	9	10
Level 5	13	3	10	5	7

GMFCS = Gross Motor Function Classification System; MMR = mild mental retardation; SMR = severe mental retardation; Lemo = Learning motor skills.

Walk. On average 14 (SD 2) days of training were accomplished at Lemo and 15 (SD 2) days at Move&Walk.

In both training programmes the child was an active participant with or without minimal assistance from parents, close relatives or assistants. Both training programmes emphasized attendance from parents, close relatives or assistants during the training period. Gross and fine-motor body function as well as activity components according to International Classification of Functioning, Disability and Health (ICF) (43) were goal areas of training. Communication was implemented as an integrated part of the group activities.

Two physiotherapists and a teacher of special education were in charge of Lemo, and conductors educated in Hungary were in charge of Move&Walk. Lemo can be described as an eclectic approach. Lemo included self-training in relaxation, stretching and structured group activities during which the children actively performed motor or communicative tasks. There was also time for individualized training sessions during the programme with the physiotherapist or the teacher of special education mainly as instructors for the child and parent or assistant. The Move&Walk method included the common features defined as: CE 1: group activities in a highly structured way; 2: use of a task series; 3: use of rhythmical intention with songs; 4: use of specific equipment, e.g. ladder-back chair, etc.

Statistical analysis

The quantity of continued consumption of training and background characteristics were presented with descriptive statistics. Differences in proportions between subgroups were analysed with a χ^2 test. Change and group differences were analysed within groups with Wilcoxon signed-rank test and between groups with Mann-Whitney *U* test and Kruskal-Wallis test. Clinical measures were also presented as proportions of clinically significant predefined change. Proportion of change was compared within and between groups with a χ^2 test. Probability for statistical significance was set at $p \leq 0.05$.

RESULTS

Background characteristics

Background data showed that CP diplegia was the most common diagnosis. Most of the children were classified as GMFCS level 4 and 5, i.e. with extensive movement disorders. There were a higher number of children classified as GMFCS 5 and with severe mental retardation (SMR) in Move&Walk (Table II). Accordingly, initial differences in pre-test values on mean GMFM total score, GMFM dimension A, PEDI FS mobility and social function domain showed a higher level of function among children in Lemo than in Move&Walk (Mann-Whitney *U* test *p*-values ranging from 0.02 to 0.05). There were no differences

Table III. *Scores for Gross Motor Function Measure (GMFM) before (baseline A1), and after (baseline A2) the intensive training period (ITP) for Lemo and Move&Walk*

Variables	Baseline A1 Mean (SD)	Range	Baseline A2 Mean (SD)	Range	After ITP *p*-value
Lemo					
Total score	53.2 (29.1)	12–98	55.9 (29.5)	15–99	0.0003
Dimension A	82.0 (17.0)	40–100	85.5 (14.8)	53–100	0.002
Dimension B	68.9 (30.5)	17–100	72.5 (30.6)	17–100	0.001
Dimension C	53.9 (37.9)	0–100	56.0 (40.0)	0–100	0.02
Dimension D	34.3 (37.3)	0–95	37.0 (38.2)	0–97	0.0009
Dimension E	26.9 (31.6)	0–97	28.7 (33.3)	0–98	0.001
Move&Walk					
Total score	37.7 (30.0)	2–90	38.9 (30.4)	3–92	0.0001
Dimension A	62.1 (32.3)	5–100	64.7 (31.8)	7.3–100	0.0001
Dimension B	53.2 (36.0)	5–100	54.6 (36.1)	6.3–100	n.s.
Dimension C	35.3 (39.2)	0–100	36.1 (40.1)	0–100	n.s.
Dimension D	22.1 (30.6)	0–87	23.6 (32.3)	0–90	0.007
Dimension E	15.6 (23.7)	0–75	16.1 (24.3)	0–79	n.s.

Means, SDs, ranges and *p*-values obtained with Wilcoxon signed-rank test. Lemo $n = 24$ and Move&Walk $n = 30$. n.s. = not significant.

Table IV. *Scores for Pediatric Evaluation of Disability Inventory-Functional Skills (PEDI FS) before and after the intensive training period (ITP) for Lemo and Move&Walk*

Variables	Before Mean (SD)	Range	After Mean (SD)	Range	After ITP *p*-value
Lemo					
Self-care	49.8 (12.8)	29–75	51.1 (13.4)	29–85	0.05
Mobility	50.1 (21.8)	15–94	50.9 (22.9)	15–100	n.s.
Social function	62.6 (13.7)	34–96	64.7 (12.9)	38–100	0.03
Move&Walk					
Self-care	42.9 (17.4)	12–81	43.6 (18.1)	12–93	n.s.
Mobility	37.1 (21.8)	6–89	38.3 (21.2)	6–80	n.s.
Social function	52.8 (19.3)	10–100	53.8 (18.2)	10–96	0.03

Means, SDs, ranges and *p*-values obtained with Wilcoxon signed rank test. Lemo $n = 22$ and Move&Walk $n = 30$. n.s. = not significant.

in pre-test values on GMFM and PEDI FS if children classified GMFCS 5 or SMR were excluded.

Comparison of Lemo and Move&Walk

Small improvements occurred after an ITP on GMFM and PEDI FS in both training programmes (Tables III and IV). A better result was shown for Lemo than Move&Walk after the ITP on the GMFM total score, dimension B and dimension E (Mann-Whitney *U* test *p*-values 0.02–0.04) and no differences on PEDI FS. The difference disappeared when children classified GMFCS 5 or with SMR were excluded, except in dimension B.

The proportion of clinically significant change on GMFM total score, the dimensions A–E or PEDI FS showed no differences except a higher proportion of improvement on the GMFM total score in Lemo (8 out of 24 cases vs 1 out of 30 cases) short-term. The difference disappeared if children with SMR or younger than 9 years were excluded. As there were no major differences in outcome on the clinical measures between Lemo and Move&Walk, further investigations on the short-term effect of an ITP were investigated in relation to changes at 1-year for the total group.

Short-term compared with 1-year outcome

A total of 52 children out of 54 completed the 1-year assessment. There were 2 drop-outs, 1 in Lemo and 1 in Move&Walk. In 1 case, due to unwillingness of further participation and in 1 case a child who died during the year. In addition there was 1 more drop-out on GMFM due to post-operative orthopaedic surgery and 1 parent who did not want to participate in the telephone interview about consumption of training.

Gross Motor Function Measure. The mean GMFM total score and dimension A–E scores improved during the ITP. Mean differences of change in gross motor function were small, ranging from 1.1% to 3.0% (SD 2.6–5.4). There was no improvement at the 1-year follow-up except for improvements in the crawling and kneeling dimension C (Table V).

Table V. *Scores for GMFM and PEDI FS before (baseline A1), after the intensive training period (ITP) (baseline A2) and at 1 year for the total group. Short-term changes after the ITP (A1–A2) and changes after the ITP in relation to the 1-year follow-up (A2–1 year) were tested*

Variables	Baseline A1 Mean (SD)	Range	Baseline A2 Mean (SD)	Range	1-year Mean (SD)	Range	After ITP *p*-value	At 1 year *p*-value
GMFM %							(A1–A2)	(A2–1 year)
Total group	$n = 54$		$n = 54$		$n = 51$			
Total score	44.6 (30.3)	2–98	46.5 (30.9)	3–99	48.1 (31.4)	4–98	0.0001	n.s.
Dimension A	71.0 (28.2)	5–100	73.9 (27.5)	7–100	74.1 (29.3)	0–100	0.0001	n.s.
Dimension B	60.2 (34.3)	5–100	62.5 (34.6)	6–100	64.0 (35.3)	7–100	0.0001	n.s.
Dimension C	43.6 (39.4)	0–100	44.9 (40.9)	0–100	47.7 (41.5)	0–100	0.008	0.04
Dimension D	27.5 (33.9)	0–95	29.6 (35.3)	0–97	31.5 (35.3)	0–97	0.0001	n.s.
Dimension E	20.6 (27.8)	0–97	21.7 (29.1)	0–98	23.0 (28.9)	0–94	0.0009	n.s.
PEDI FS								
Total group	$n = 52$		$n = 52$		$n = 51$			
Self-care	45.9 (15.8)	12–81	46.8 (16.6)	12–93	49.6 (19.2)	12–100	n.s.	0.02
Mobility	42.7 (22.5)	6–94	43.6 (22.6)	6–100	43.7 (22.8)	6–100	0.03	n.s.
Social function	57 (17.6)	10–100	58.4 (16.9)	10–100	62.7 (17.6)	30–100	0.003	0.0002

Means, SDs, ranges and *p*-values obtained with Wilcoxon signed-rank test. n.s. = not significant. GMFM = Gross Motor Function Measure; PEDI FS = Pediatric Evaluation of Disability Inventory-Functional Skills.

Table VI. *A comparison of the proportion of change on Gross Motor Function Measure (GMFM) total score and the dimensions A–E after the intensive training period (ITP) with the proportion of change at 1 year for the total group* n = *51*

GMFM	Change	After ITP	At 1 year	*p*-value
Total score	Improvement	8	10	n.s.
	Unchanged	42	34	
	Deterioration	1	7	
Dimension A	Improvement	13	12	0.03
Lying and rolling	Unchanged	38	31	
	Deterioration	0	8	
Dimension B	Improvement	14	12	n.s.
Sitting	Unchanged	35	31	
	Deterioration	2	8	
Dimension C	Improvement	10	13	0.05
Crawling, kneeling	Unchanged	39	34	
	Deterioration	2	4	
Dimension D	Improvement	13	8	0.01
Standing	Unchanged	38	36	
	Deterioration	0	7	
Dimension E	Improvement	6	9	0.002
Walk, run, jump	Unchanged	45	33	
	Deterioration	0	9	

A clinically significant change was defined as ± 4%. Proportion of change was analysed with the χ^2 test *p*-value. n.s. = not significant.

There was a low proportion of improvement (8 out of 51 cases) on GMFM total score and (6–14 out of 51 cases) for each dimension A–E during ITP (Table VI). A low but a higher proportion of deterioration was seen in the GMFM dimensions A, D and E at the 1-year follow-up compared with after the ITP (Table VI).

Of the 8 children who improved after the ITP on the mean GMFM total score (range 3.7–10.3%) 3 children further improved, 4 children retained and 1 child lost the improvement after 1 year.

A total of 34 children improved in at least 1 dimension A–E (mode 1 dimension) after the ITP. No child deteriorated on GMFM total score or in a dimension A–E after the ITP and at the 1-year follow-up.

PEDI FS. The mean PEDI FS scaled scores improved in the mobility and social function domain after the ITP and in the self-care and social function domain at the 1-year follow-up (Table V).

The proportion of change on PEDI FS after the ITP and at the 1-year follow-up did not differ (Table VII). However, 25 out of 51 cases improved in the social function domain (range 3.9–26.6 scaled scores) at the 1-year follow-up compared with 9 out of 51 cases (range 3.7–24.5 scaled scores) after the ITP.

Twenty children improved in at least 1 domain (mode 1 domain) after the ITP. Two cases deteriorated in the PEDI FS self-care and social function domain after the ITP and at the 1-year follow-up.

1-year outcome in relation to continued consumption of training

The comparison of background data between the children who continued with repeated ITP (rITP group) and children who received customary training (Cust group) showed that the groups were essentially similar concerning type of CP and gross motor function level (Table II). The mean age for the rITP group was lower, 9 years (SD 4.0), than for the Cust group, 11 years (SD 4.0), (Mann-Whitney *U* test $p = 0.02$).

Table VII. *A comparison of the proportion of change on Pediatric Evaluation of Disability Inventory-Functional Skills (PEDI FS) after the intensive training period (ITP) compared with the proportion of change at 1 year for the total group (*n = *51). No significant differences were noted*

PEDI FS	After ITP	At 1-year
Self-care		
Improved	8	17
Unchanged	39	27
Deteriorated	4	7
Mobility		
Improved	12	13
Unchanged	35	21
Deteriorated	4	17
Social function		
Improved	9	25
Unchanged	39	20
Deteriorated	3	6

A clinically significant change was defined ± 4 scaled scores on PEDI FS. Proportion of change was analysed with the χ^2 test *p*-value.

There were no differences between the rITP group and the Cust group in the mean difference of change or proportion of change on GMFM total scores or dimensions A–E at the 1-year follow-up.

The mean difference of change on PEDI FS social function was larger for the rITP group than the Cust group, 6.3 scaled scores (SD 6.0) compared with 2.2 scaled scores (SD 8.5) (Mann-Whitney *U* test $p = 0.02$) at the 1-year follow-up. A higher proportion of children in the rITP group compared with the Cust group improved on PEDI FS social function at 1 year (15 out of 22 cases compared with 9 out of 28 cases) (χ^2 *p*-value = 0.01).

An alternative analysis of the clinical measures excluding children with SMR and GMFCS 5 did not alter the differences in outcome between the rITP group and Cust group.

Differences between the rITP group and the Cust group were further analysed according to low or high quantity of customary training. A higher number of children classified as GMFCS 4 and 5 received a high mean quantity of customary training with or without additional rITPs. Children with a low quantity of customary training in addition to rITPs showed a better outcome on PEDI FS social function than children with a high quantity of customary training in addition to rITPs at 1 year.

DISCUSSION

No differences in effectiveness were shown between the training approaches, Lemo at the child and youth rehabilitation and conductive education at Move&Walk. A considerable proportion of children improved after the ITP, regardless of training programme, if an improvement in 1 dimension *or* domain on GMFM *or* PEDI FS was acknowledged. Moreover, most

improvements were retained or further improved at 1 year. The level of clinical significance chosen for GMFM and PEDI FS was supported by earlier research (28, 44).

The 1-year follow-up was designed to evaluate the effect of 1 period of intensive training. As the natural clinical course was studied the analysis of the 1-year follow-up had to take into consideration further consumption of training. The majority of children had a high consumption of training during the year either with rITP or customary training or both. The analyses for the total group regardless of training programme showed small improvements in gross motor function after the ITP. Improvements in functional skills self-care and social function appeared after 1 year. A better outcome for social function was obtained by the children who participated in rITPs, which might suggest a benefit of intensive training in group activities in comparison with customary training. The hypothesis that rITPs reinforce gross motor function development, suggested by Trahan & Malouin (26) was not confirmed for the study group under investigation and with this pragmatic approach.

GMFM and PEDI measure a broad spectrum of activities, from less complex motor abilities within a standardized context to more complex activities of daily living in the environment of the child (42). Thus, each item can be seen as a challenge to improve and each ability may be of significance for the child. The instruments were expected to be sensitive to change, but it can be questioned whether GMFM and PEDI could be expected to detect change over such a short evaluation period as 4 weeks. A wash-out period of 3 months without intensive training could be set up, but it was considered unethical to withdraw the child's customary training. The high quantity of training during the 1-year follow-up indicates a high level of consumption of training prior to the ITP. Thus, all improvements after the ITP must be seen as the increased value over the customary training these children already received. The anxiety about the ineffectiveness of customary rehabilitation seems to be unjustified since the children seemed to function close to their optimal level and the added value of intensive training was limited.

A similar size of the effect on GMFM as in this study was obtained for comparable study groups concerning ages and disabilities after intensive short-term (24, 45) and long-term (28) training.

It seems reasonable that a majority of children with moderate to severe motor disorders, over the age of 6 years probably already function close to their best possible gross motor function level. Gross motor developmental curves have been shown to flatten out at the age of 3–4 years, thereby decreasing the responsiveness to change on GMFM for children with CP who are older than 6 years (7). The 1-year follow-up indicated a greater potential of change in self-care and social function compared with gross motor function and mobility skills. Improvements in functional skills were also shown to be the added value of a functional approach to traditional treatment described by Ketelaar et al. (32).

The improvements in social function were found to be the only benefit of participation in rITPs in comparison with customary training. Improvement in communicative and social skills may be facilitated by a group setting. The participation of parents, close relatives or assistants provides opportunities for mutual learning and may facilitate transference into daily routines. Moreover, parents are experts in their own children and one can expect that the children who continued with rITPs were also those whose parents thought they were benefiting from the group activities.

This study has been restricted to the outcome of clinical measures and needs to be complemented by different angles of approach. Notably, the majority of children with extensive movement disorders received the highest mean quantity of customary training in addition to ITPs. This indicates that even if the principal reason for attending different training programmes is improvements in function, participation in a training programme fulfils other needs of the child, parent and other caregivers that need to be investigated. An important area of concern is to validate the effect of Lemo and Move&Walk with self-reported measures of performance on individualized goals and perceived quality of the 2 training programmes.

The aim of this study was to evaluate the effectiveness of 2 existing training programmes based on what is normally offered and embraces a variety of children with CP who were all considered to benefit from intensive training. The design has not allowed for analyses of clearly defined subgroups as suggested (46) and subgroup analyses risk creating small groups that are still heterogeneous depending on the complexity of clinical manifestations. Even though knowledge about specific subgroups needs to be developed, it does not rule out the necessity of pragmatic studies of interventions in ordinary clinical settings.

In conclusion, a 4-week intensive training period facilitated small improvements in gross motor function. Intensive training at Move&Walk with conductive education or at Lemo within the traditional healthcare system showed similar effects. The majority of children had a high consumption of training during the study period and the added value of repeated intensive training periods was limited to a positive effect in social function at the 1-year follow-up.

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