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RESEARCH PAPER

Activity focused and goal directed therapy for children with cerebral palsy – Do goals make a difference?

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Abstract

Objective. To compare the effects of goal directed functional therapy (GDT) to activity focused therapy (AT) for preschool children with cerebral palsy (CP) on everyday activities and gross motor function. Another aim was to evaluate goal attainment in the GDT group.

Methods. A prospective intervention study comparing two types of intervention carried out in ecological settings. Forty-four children with CP, (25 boys, 19 girls; mean age 4 year 1 month [SD 1 year 5 month]), Gross Motor Function Classification System (GMFCS) and Manual Ability Classification System (MACS) levels I–IV participated. Twenty-two children were recruited to the GDT group and 22 to the AT group. Outcome measures were the Pediatric Evaluation of Disability Inventory (PEDI), and the Gross Motor Function Measure-66. Furthermore, goal attainment scaling (GAS) was used in the GDT group. The assessments were performed before and after an intervention period of 12 weeks.

Results. The children in the GDT group improved more in most aspects of everyday activities measured by the PEDI than the children in the AT group ($p < 0.001$). Only functional skills in social function did not differ between the groups. Furthermore, gross motor function improved more in the GDT group than in the AT group ($p < 0.001$). Goal attainment to the expected level or higher was achieved in 93/110 goals in the GDT group. The variance of improvements in the different PEDI scales in the GDT group could not be explained by either age, sex, distribution of CP, GMFCS or MACS levels.

Conclusion. GDT demonstrated clear gains for children with cerebral palsy in everyday activities and gross motor function in comparison to AT.

Keywords: *Functional therapy, GAS, GMFM-66, PEDI*

Introduction

Promoting functional performance and gradual independence in everyday life activities are keystones in goal directed functional therapy (GDT) [1–3] and in activity focused therapy (AT) [4–6]. Traditionally, treatment approaches were predominantly directed towards 'normalising' the dysfunctional control of movement and posture which is present in all children with cerebral palsy (CP) [7]. As CP is caused by a lesion to the immature brain, other aspects of functioning are also frequently affected such as perception, vision, learning and language. Epilepsy as well as behavioural problems can also be observed [8]. These additional dysfunctions can in addition influence the child's ability to learn and perform tasks in everyday life [9] and should therefore be taken into account in therapy. The GDT and AT approaches address these aspects.

In Sweden a shift towards AT has gradually occurred during the last decade while goal directed therapy was introduced more recently [2]. Both approaches put emphasis on task-dependent adaptation of the child's motor behaviour using the dynamic systems theory [10] and/or the neuronal group selection theory [11] as theoretical frameworks for motor control. Within these two frameworks, emphasis is on ample and variable opportunities for playful practise in ecological settings as the child is actively involved in learning everyday skills [12]. Principles of motor

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learning are applied in therapy to support the learning process [13]. Both the GDT and AT approaches have a family-centred attitude, wherein the needs from both the child and the family are incorporated. It is recognised that the well-being of parents and families is central to the well-being of the child [14].

Even though the approaches are basically similar, the GDT approach differs from the activity focused intervention in some important aspects – the identification of individually tailored treatment goals, the use of regular group-meetings for therapy and specific parental education at the start of therapy. The goal setting process includes the identification of goal areas, initial assessments of the child's daily performance and optimal motor capacity, to form a baseline from which realistic steps for goal attainment are created. The aim with setting specific goals is to enhance the awareness of the objectives of the therapy and affect performance by focusing attention, directing effort, increasing motivation and enabling the development of strategies to achieve the goal [15,16]. The goal activities are preferably practiced in the context where the child will use the new skills to motivate and encourage the child's progress [17]. The GDT approach also uses weekly group gatherings to support peer-learning [18]. Furthermore, goal setting could enhance coordinated care [2] and thereby provide support for a family-centred treatment approach [14].

The aim of the study was to compare GDT to AT with respect to achievement of everyday activities and gross motor function.

The following questions were asked: (1) What differences in everyday activities and gross motor function can be detected within the groups and between the two groups after 12 weeks of training? (2) Is their a relation between progress in everyday mobility and progress in gross motor capacity? (3) If everyday activities improve, can a specific factor explain the variability in the improvements? (4) Finally, we were interested in to what extent the children in the GDT group attained the set goals.

Method

Study design

The study was a prospective intervention study comparing two therapy-approaches in an ecological setting. The study is part of a larger longitudinal study performed during the time period 2004–2006.

Participants

All habilitation centres ($n = 13$) in Stockholm, Sweden were invited to participate in the study and they recruited a total of 44 preschool aged children with CP from their catchments regions. The children had uni- or bilateral CP, were 1–6 years of age (mean 4 years 1 month, SD 1 year 5 month), and were classified at Gross Motor Function Classification System (GMFCS) levels I-IV [19] and Manual Ability Classification System (MACS) levels I-IV [20]. They were all able to understand uncomplicated instructions. All children were integrated in preschools in their local communities. Exclusion criteria were orthopaedic surgery or extensive treatment with other interventions during the time of the study.

The GDT approach included training in a group of approximately eight children once a week at a habilitation centre. With respect to the number of preschool aged children with CP at each centre, five centres had the possibility to arrange groups, and thereby participate in the GDT approach. One centre organised a group of seven children and four centres cooperated and arranged two groups including seven and eight children respectively, for a total of three groups of children. In this way long travelling distances for the children could be avoided.

Subsequently the other 22 children, who were recruited from eight centres, received the regular AT at the centres nearby their homes. Descriptive data demonstrated that the two groups were comparable with respect to distribution of CP, sex, age, GMFCS and MACS level (Table I). Both groups were recruited from catchments regions with similar socioeconomic structure.

The study was approved by the Regional Ethical Committee. Informed consent was obtained and signed by the children's parents before participation in the study.

Table I. Descriptive data, age at start of the intervention presented as mean and standard deviation and as median age and range.

Participants	GDT group	AT group	Total group
Participants	22	22	44
Gender, male: female	11:11	14:8	25:19
Age at start, mo, mean	46:16	52:18	49:17
Age at start, mo, median	46:16–71	51:24–84	48:16–84
GMFCS I	10	9	19
GMFCS II	5	5	10
GMFCS III	3	5	8
GMFCS IV	4	3	7
MACS I	7	9	16
MACS II	9	6	15
MACS III	5	5	10
MACS IV	1	2	3
Bilateral	14	13	27
Unilateral	8	9	17

All other variables are presented as numbers of children. Goal directed therapy (GDT) group $n = 22$, activity focused therapy (AT) group $n = 22$ and in the total group $n = 44$.

Outcome measures

The primary outcome measure was the Pediatric Evaluation of Disability Inventory (PEDI) [21] and the secondary was the Gross Motor Function Measure (GMFM-66) [22]. They were used to compare the effects of the two therapy approaches. In addition, Goal Attainment Scaling (GAS) was applied in the GDT group [23,24].

PEDI was used to evaluate the child's performance in everyday activities in the domains of self-care, mobility and social function within two dimensions; functional skills and caregiver assistance. PEDI was completed as a standardised interview for the parents, containing 197 items reflecting the child's functional capability and 20 items concerning the child's need for caregiver assistance. The raw score was calculated and transformed to a scaled score which provides a possibility to compare the child's performance over time. PEDI is reliable, valid and sensitive to change. A Swedish version was used [25].

GMFM-66 is an observational measure evaluating change in gross motor function. The measure consists of 66 items assessing motor functions from lying and rolling, to walking, running and jumping. Each item is scored on a four-point Likert scale (0–3). The items are organised in increasing difficulty from 0 (low capacity) to 100 (high capacity) along an interval scale. The GMFM-66 is valid, reliable and sensitive to change in gross motor function in children with CP [22].

GAS is an individualised, criterion referenced measure of change. GAS consists of five grades and ranges from -2, indicating the child's performance at the time of goal setting (baseline) through 0, indicating the expected performance and $+2$, signifying a much greater outcome than expected [24].

Procedure

PEDI and GMFM-66 were performed with a range of 1–6 days before the 12 weeks of intervention and 1–8 days after the intervention in both groups. Furthermore, five individualised goals were set for each child in the GDT group before the start of therapy and evaluated after 12 weeks. The scaling of the goals was based on a careful analysis of the child's performance with respect to the child's strengths and weaknesses and prerequisites in the child's environment. The parents of each child defined the goal areas. The grading of the goals was thereafter performed in close collaboration with two of the researchers (KL, AB), therapists and preschool staff.

The two researchers (KL, AB) had extensive experience of assessing PEDI, GMFM-66 and GAS and performed all the evaluations. Both researchers had accomplished the criterion test to ensure reliability of testing GMFM-66. They did not participate in the children's therapy. They were not blinded to which intervention the child received. The evaluation of goal attainment was performed by the parents in collaboration with the researchers, from a perspective of performance in everyday situations.

Intervention

The intervention in the GDT group was multifaceted. Initially the professional team, who participated in the GDT intervention, discussed the principles underlying goal directed functional training. The professional team consisted of a special needs teacher, a speech pathologist, an occupational therapist and a physical therapist. They were all working at the centres from which the participants were recruited. Subsequently, the parents participated in a one day education containing (1) information about the diagnosis CP and possible co-morbidity, (2) principles of motor learning and how to efficiently assist the child and (3) how play can facilitate a child's cognitive, social and emotional development. Concurrently, the children and the professional team participated in a play and get-together program.

For 12 weeks the children practised in their day-to-day environment and once a week they participated in group activities (7–8 children). Focus was on motivating the child to be active in the individually tailored goal directed treatment, on offering a high frequency of opportunities to practice both goal-skills and sub skills and on facilitating the child to meet with peers for inspiration and joyful play. The parents and the preschool staff were guided to optimise their participation in the goal directed therapy by receiving support and instructions during regular (twice a month) preschool and home visits and at the weekly group meetings from members of the professional team. Each child had a diary in which the goals were written and in which the parents, preschool staff and the professionals wrote proposals for good practice. Together with the child, they also inserted pictures and photos to visualise the activity for the child, making it easier to understand the goal.

The children in the AT group received treatment according to individually written habilitation plans, in which general aims for a time period of 6–12 months were written. They were surrounded by a professional team consisting of a special needs teacher, a speech pathologist, an occupational therapist and a physical therapist. In accordance to the aims and the child's needs, these diverse professionals from the team treated each child using

an activity focused approach, which was the prevailing treatment approach. The treatment frequencies occurred in agreement to the plan and took place at the rehabilitation centre, the preschool and the child's home. The children received individually tailored treatment sessions approximately once a week during 12 weeks, parents and preschool teachers received support and instructions, to optimise the possibility for the children to practice in their everyday environment.

Statistical analysis

Statistics were performed with SPSS software (version 15). Changes in interval data (PEDI, GMFM-66) were analysed using paired students *t*-test for within group comparison and for comparisons between treatments groups the independent student *t*-test was used. The sum of achieved goals was calculated. Parametric correlations were performed between both dimensions in the mobility domain in PEDI and GMFM-66 in the GDT group and the AT group. Multiple linear regressions using a model consisting of age, sex, distribution of CP, level of GMFCS and MACS were utilised to explain the improvement in PEDI outcome in the GDT group. Effect sizes (ES) were calculated using Cohen's d [26]. Significance level was set at $p < 0.01$.

Results

Pre-intervention

PEDI caregiver assistance scale in self care before the intervention was higher in the AT group than in the GDT group. No significant differences in any other assessments were present at the initial assessments between the two groups (Table II).

Table II. Initial assessments at start of the intervention, presented as mean and standard deviation: independent group comparison.

Assessment PEDI:	GDT group	AT group	*p*
FS Self Care	52.48 ± 9.42	58.63 ± 10.64	n.s.
FS Mobility	55.59 ± 15.52	62.15 ± 19.42	n.s.
FS Social Function	55.95 ± 10.92	61.97 ± 7.97	n.s.
CA Self Care	43.15 ± 13.32	54.92 ± 14.42	0.007
CA Mobility	54.01 ± 17.41	63.61 ± 17.62	n.s.
CA Social Function	50.65 ± 19.84	60.28 ± 13.09	n.s.
GMFM-66	58,52 ± 13.64	63.06 ± 16.02	n.s.

Assessments: Pediatric Evaluation of Disability Inventory (PEDI); Functional scales (FS); Self care, Mobility and Social Function, Care giver assistance scales (CA); Self care, Mobility and Social Function and Gross Motor Function Measure-66 (GMFM-66). Goal directed therapy (GDT) Group $n = 22$, activity focused therapy (AT) Group $n = 22$. $p < 0.01$.

Everyday activities: functional skills and caregiver assistance

Within group comparison showed significant improvements after 12 weeks of intervention in all measured aspects of PEDI in the GDT group, in contrast to the AT group where no significant improvements were found (Table III, Figures 1 and 2).

Between group comparison demonstrated that the improvements in mobility and self care were significantly larger in the GDT group than in the AT group. The improvements were reflected in both the functional scales and the caregiver assistance scales (Table IV, $p < 0.001$). The improvements in the caregiver assistance scale in social function was also significantly higher in the GDT group ($p < 0.001$; Table IV), but no significant difference between the groups was found in the functional scale in social function.

The effect sizes (ES) in the GDT group were for the functional scales/caregiver assistance scales; self care 1.7/1.9, mobility 1.1/1.4, social function 0.7/1.5. ES were not reported in the AT group since there was no significant improvements within the group as a result of therapy.

Gross motor function

Within group comparison demonstrated significant improvement in GMFM-66 in the GDT group, but not in the AT group (Table III). Between group comparison demonstrated significantly higher improvements in GMFM-66 in the GDT group than in the AT group (Table IV $p < 0.001$). The ES in the GDT group was 1.4. ES was not calculated in the AT group since no significant improvement occurred with therapy.

Correlations and linear regression

The improvements in functional skills and caregiver assistance in the mobility domain in PEDI correlated significantly to improvements in GMFM-66 (Pearson $r = 0.60$ and 0.58; $p < 0.01$) in the GDT group. The correlation between gross motor progress and mobility in the AT group was weak ($r = 0.29$ and 0.18; n.s.). Multiple linear regressions using a model consisting of age, sex, distribution of CP, level of GMFCS and MACS level could not explain the variance of the improvements in the different PEDI scales in the children who had trained towards specific goals.

Goal attainment

Five activity goals were assigned to each child in the GDT group, for a sum of 110 goals. Goal attainment

Table III. Within group comparisons in the goal directed therapy group and the activity focused therapy group before and after 12 weeks of intervention are presented as means and standard deviations (SD).

	Before mean, SD	After mean, STD	*p*	Difference mean	95% confidence interval
Goal directed therapy group					
PEDI:					
FS Self Care	52.48 ± 9.42	57.35 ± 9.40	0.001	4.87	3.328 to 6.417
FS Mobility	55.59 ± 15.52	61.44 ± 13.89	0.001	5.845	3.515 to 8.175
FS Social Func	55.95 ± 10.92	61.22 ± 8.85	0.001	5.281	3.325 to 7.238
CA Self Care	43.15 ± 13.32	54.14 ± 13.17	0.001	10.99	9.013 to 12.968
CA Mobility	54.01 ± 17.41	63.41 ± 14.60	0.001	9.406	5.795 to 13.017
CA Social Func	50.65 ± 19.84	61.26 ± 17.32	0.001	10.618	6.847 to 14.388
GMFM-66	58,52 ± 13.64	63.59 ± 13.15	0.001	5.07	3.765 to 6.375
Activity focused group					
PEDI:					
FS Self Care	58.63 ± 10.64	58.66 ± 11.63	n.s.	0.031	−0.939 to 1.003
FS Mobility	62.15 ± 19.42	62.48 ± 17.75	n.s.	0.327	−1.532 to 2.186
FS Social Func	61.97 ± 7.97	63.61 ± 10.25	n.s.	1.645	−0.993 to 4.284
CA Self Care	54.92 ± 14.42	55.88 ± 17.18	n.s.	0.554	−2.273 to 3.382
CA Mobility	63.61 ± 17.62	64.10 ± 16.52	n.s.	0.486	−1.554 to 2.527
CA Social Func	60.28 ± 13.09	60.84 ± 11.89	n.s.	0.141	−2.248 to 2.530
GMFM-66	63.06 ± 16.02	64.15 ± 17.33	n.s.	1.094	−0.187 to 2.376

The differences between assessments before and after 12 weeks are presented as mean and 95% confidence interval (95% CI). Assessments were the Pediatric Evaluation of Disability Inventory (PEDI); Functional scales (FS) of; Self care, Mobility and Social Function, Care giver assistance scales (CA) of; Self care, Mobility and Social Function and the Gross Motor Function Measure-66 (GMFM-66). The number participants in each group were 22.

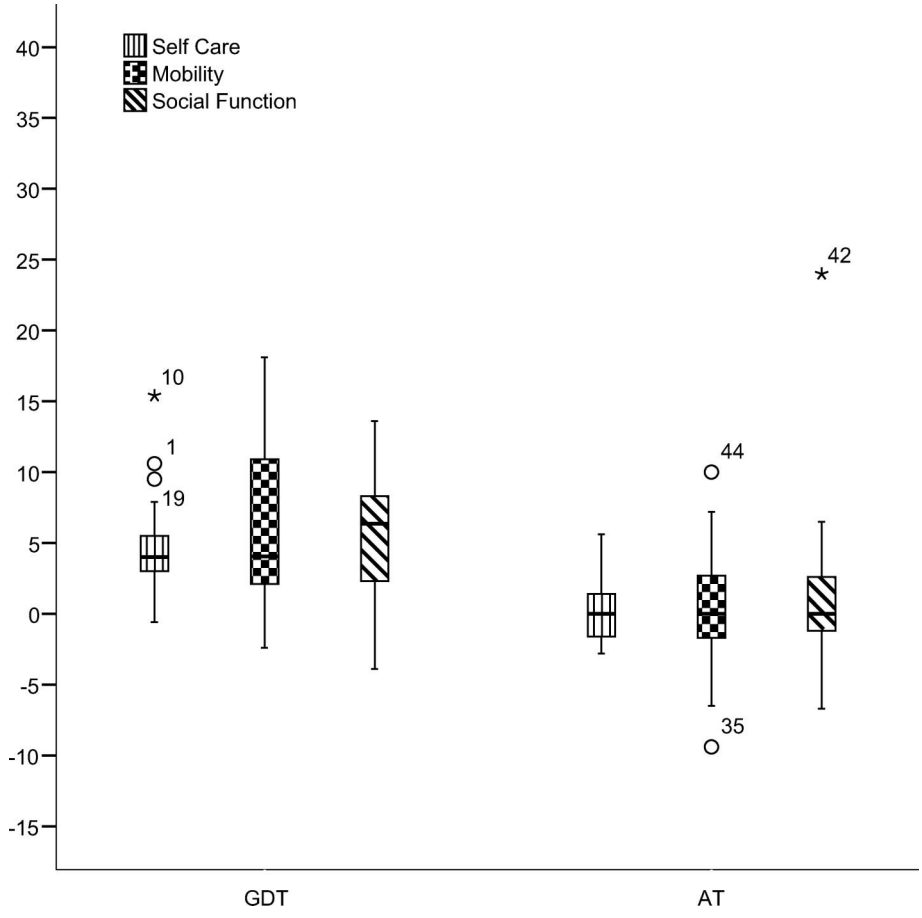

Figure 1. Within group differences in functional skills (scaled score) of the Pediatric Evaluation of Disability Inventory (PEDI) in the domains of Self Care, Mobility and Social Function. The differences after 12 weeks of intervention are presented as median and 25 and 75 percentiles, in the Goal Directed therapy group (GDT Group, $n = 22$) and in the Activity.

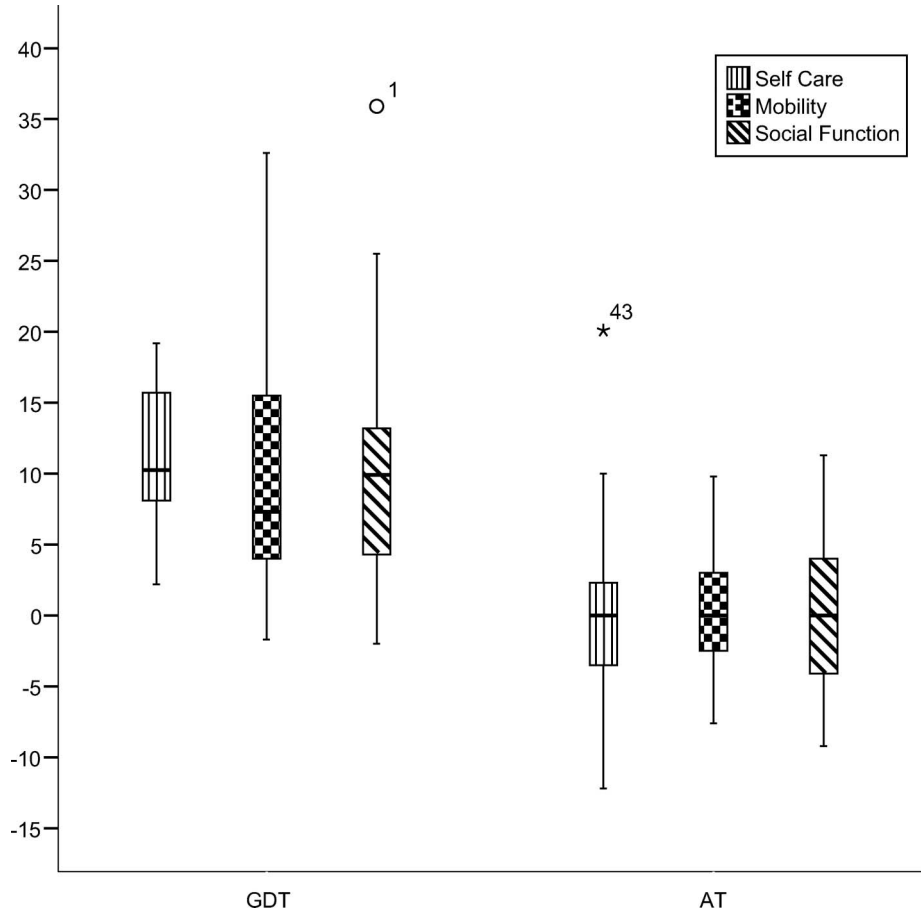

Figure 2. Within group differences in caregiver assistance (scaled score) of the Pediatric Evaluation of Disability Inventory (PEDI) in the domains of Self Care, Mobility and Social Function. The differences after 12 weeks of intervention are presented as median and 25 and 75 percentile in the Goal Directed therapy group (GDT Group $n=22$) and in the Activity Focused Therapy group (AT Group $n=22$) represent outliers and * represent extremes.

Table IV. Independent *t*-test comparison of improvements after 12 week of intervention in the goal directed therapy (GDT) group and the activity focused therapy (AT) group.

PEDI:	Difference mean	95% CI	*p*
FS Self Care	4.84	3.07–6.61	0.001
FS Mobility	5.52	2.63–8.41	0.001
FS Social Function	3.64	0.45–6.82	0.026
CA Self Care	10.44	7.09–13.79	0.001
CA Mobility	8.92	4.90–12.94	0.001
CA Social Function	10.48	6.14–14.81	0.001
GMFM-66	3.98	2.20–5.75	0.001

Assessments: Pediatric Evaluation of Disability Inventory (PEDI); Functional scales (FS); Self care, Mobility and Social Function, Care giver assistance scales (CA); Self care, Mobility and Social Function and Gross Motor Function Measure-66 (GMFM-66). Data are presented as mean and 95% confidence interval (CI). The number participants in each group were 22.

to the expected level or higher was achieved in 93/110 goals. None of the children remained at level −2 in any goal, but 17/110 of the goals were achieved at level of −1 (Figure 3).

Discussion

GDT for preschool aged children with CP gave a superior outcome in comparison to AT after a period of 12 weeks. The children in the GDT group improved their performance of everyday activities and gross motor function and they attained to a large extent the set goals. The improvements are corroborated by previous studies using a similar treatment approach [1,2].

The only aspect of everyday activities measured by PEDI, in which no difference between the two approaches was found, was in the functional scale of social function. A clear decrease, however, was exhibited in the amount of assistance within this domain that the parents using the goal directed therapy provided to their children. Only two previous studies have, to our knowledge, focused on how intervention can affect social functioning in children with CP [2,6]. Ahl et al. [2], who performed an intervention study without control group, recognised that the children improved their social performance after a 5-month long goal directed intervention, a

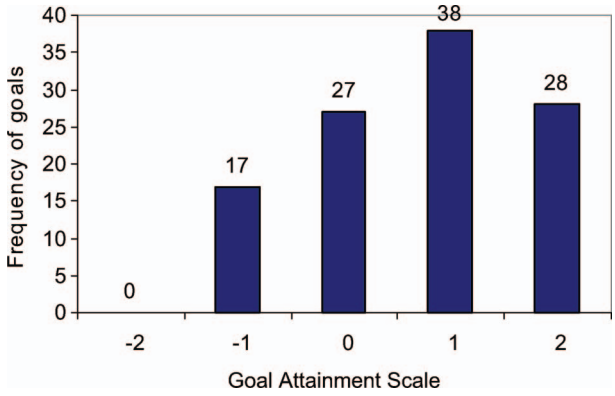

Figure 3. Goal attainment according to goal attainment scaling in the goal directed therapy group after 12 weeks of intervention. Each child had five goals and the number of participants was 22 adding up to 110 goals.

finding in line with this study. The amount of caregiver assistance was however unchanged in the study by Ahl et al. [2] in contrast to the present study where both within and between group comparisons pointed to a clear decrease in caregiver assistance. The improvements in social function after goal directed therapy could reflect the child's active, problem solving participation in the treatment, requiring the use of communicative and cognitive skills. This feature also seems to be present in the AT approach to some extent since no significant difference was detected between the groups, a finding corroborated by Ödman and Öberg [6]. The decrease in caregiver assistance might reflect that the parents in the GDT approach had realised the importance of their behaviour towards the child and therefore met their child with higher expectations during cooperation than the parents in the AT group. Possibly the initial education could have encouraged this behaviour. Furthermore, the weekly group gatherings gave ample opportunities to interact with peers and people in the environment. An additional explanation could be the overall increased activity, fostering social development of the child [27].

Significant improvements were also found in the secondary measure GMFM-66, both within the GDT group and between groups, a finding partly corroborated by previous studies [1,2]. Ketelaar and co-workers (2001) demonstrated within group improvement but no difference between the compared groups. The children in the study by Ahl et al. (2005) improved their gross motor capacity significantly with goal directed therapy.

The gross motor progress correlated to a high degree with advances in both dimensions of the mobility domain of the PEDI in the GDT group but not in the AT group. Previous research has indicated a relationship between gross motor capacity and everyday functioning [28–30] indicating an interdependence which is not surprising. The therapy was directed towards functional goals in everyday life, resulting in improvement of gross motor capacity, while the AT did not result in similar improvements. The finding further underlines that the formulation of individually tailored goals appears to be a key factor for the positive results achieved in the GDT group. If the improvements achieved after twelve weeks persist in a long-term perspective we do not know. This is a question that calls for further research.

A family-centred attitude to service provision is central in AT, but the goal directed therapy has the intention to give the family even more control over service provision. The families in this study were responsible for prioritising the treatment goals, ensuring that the activities were essential to them. The focus for therapy was made clear to people in the child's environment [2]. Thus the child could be offered ample opportunities to practice as the activities were integrated in the everyday environment [14]. A thorough analysis of the chosen goal activities including the child's own performance, the type of assistance the child needed and the nature of the environment in which the child performed the activity served to create a clear picture of the child's strengths and difficulties and to make the parents aware of their amount of caregiver assistance. The improvements indicate that they had comprehended how to restrict their assistance to the child in order to enhance goal attainment and independence, supporting the idea that person-environment interaction is a dynamic and reciprocal process [31].

The clear construction of the goal attainment scale provided a structure for the individually tailored intervention and made it possible for persons in the child's environment to treat the child with joint expectations and demands that could encourage the child to perform an activity at increasingly more difficult and independent levels. Consequently, each child was continuously challenged to perform activities slightly more difficult than they had previously mastered – a field Vygostsky called the 'proximal zone' [32]. Motor skill acquisition could induce reorganisation of motor maps [33] and changes in synaptic efficacy [34], processes that could underlie the large improvements accompanying goal directed therapy.

In addition, the children met once a week to practice goal related activities. This was a time for intensive activity and joyful play including emotional and cognitive elements. Recent studies have indicated the importance of integrating emotional and cognitive aspects in interventions [35] preferably in the company of peers allowing learning through imitation [18].

A large number of goals were reached to a higher level than expected. The finding is in line with

previous studies, both the ones using a five graded GAS [36,37] and the one using a three graded modification [2]. This fact supports the idea that the chosen goal activities were important to the child and the family and that routine for practicing the activities at home and at the preschool had been established and integrated in the everyday life to ensure a high frequency of practice [38]. One example was a boy (3 years, bilateral CP, GMFCS III, MACS II) who had the following five goals; (1) raise to standing in his key-walker, (2) put on a T-shirt, (3) stand in front of a table and play with a garage for 10 min (4), eat the whole meal with a spoon, (5) play children's memory game and remember 5 pictures. The family and the preschool staff experienced that these five goals were easy to incorporate in the child's daily activities. They also expressed a relief as they could focus on these five goals in contrast to 'being responsible for the child's entire development'. One parent said; 'now when I go to bed, I think that we have practiced towards all the goals, usually I think of all things we have not done'.

The two treatment approaches were studied in the day-to-day environment where the treatment would normally occur. This could be regarded as strength or as a weakness of the study. Effectiveness studies carried out in the ordinary setting are well suited for assessing the ecological validity of treatments. On the other hand, a randomised controlled trial (RCT) could have allowed us to draw causal inferences about the effect of intervention, but only if the two groups had been large enough to provide adequate statistical power. In this study, the geographic distances and the amount of eligible participants at each centre were the main factors that determined therapy group and the size of the groups.

The evaluators were not blinded to which therapy the child received. The fact that the evaluations were performed using PEDI and GMFM-66, both highly reliable assessment instruments, may however to some extent reduce bias [22,39]. The examiners adhered strictly to the protocol and they were not to look in the previous assessments.

Both groups received comparable treatments in many aspects, built on the same theoretical framework. The main difference was the formulation of specific, individualised goals. The group meetings and the initial education in the GDT group supported the approach. The present study investigated the impact of these features as a unit, and therefore the importance of each factor separately cannot be defined.

Conclusion

Children with CP demonstrated clear gains in everyday activities and gross motor function as a result of goal directed, functional therapy in comparison to activity focused therapy. Goals make a difference!

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