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ORIGINAL ARTICLE

Occupational performance goals and outcomes of time-related interventions for children with ADHD

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ABSTRACT

Background: Children with attention deficit hyperactivity disorder (ADHD) have difficulties with occupational performance, related to difficulties with time-processing ability.

Aims: To examine the outcome of a multimodal time-related intervention designed to support children aged 9–15 years with ADHD, to achieve their occupational performance goals and improve satisfaction with occupational performance. A further aim was to compare the children's ratings of outcome with their parents' ratings and to analyse the occupational performance goals.

Material and Methods: A pre-post design was used. Participants were 27 children, aged 9–15 years. Children and parents rated occupational performance and satisfaction at baseline and follow-up, after 24 weeks, using the Canadian Occupational Performance Measure (COPM). The intervention consisted of time-skills training and time-assistive devices (TADs). Descriptive and non-parametric statistics were used.

Results: Significant improvements were found in reported performance and satisfaction. Children's were higher than those of their parents. Most goals were about carrying out daily routines, knowing the duration of an activity and knowing what will happen in the near future.

Conclusion and significance: The study contributes to knowledge about suitable interventions for children with ADHD who have time-related difficulties. Occupational therapy interventions, including TADs and time-skills training, resulted in significantly improved occupational performance.

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Activities of daily life; ADHD; children; COPM; treatment outcome; occupational therapy; time-assistive devices

Introduction

Children and adolescents with attention deficit hyperactivity disorder (ADHD) have deficits in executive functioning, including organizing materials and activities, time management and planning [1–6]. Specific problems related to time duration discrimination and time reproduction have also been recognized in children with ADHD [4,6–8]. Noreika et al. [7] stated in a review that persons with ADHD have deficits in motor timing, time estimation and temporal foresight. Mioni et al. [9] found that children with ADHD performed less accurately on time-based prospective memory tasks and used less efficient clock-checking strategies than typically developed children of the same age. Time-based prospective memory is a part of time management functions and can 'ensure that one behaviour stops and another begins at a specific time' [10]. This is in line with earlier research showing that children with ADHD have a time-processing ability (TPA) below age expectations [11,12].

Time-processing ability (TPA) is a cognitive function and develops with maturation during childhood and adolescence, starting with time perception, followed by time orientation and time management [13,14]. Time perception is a mental function related to the subjective experiences of the length and passage of time. Time orientation is the awareness of day, date, month and year, the understanding of time concepts, and being able to tell the time. Time management is the mental function of ordering events in chronological sequences and allocating the correct amount of time for activities [13,15,16]. Time

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management develops last and is part of executive functioning. The results of three studies statistically support the use of one unidimensional construct, TPA [11,13,16], in which the three concepts may mirror a developmental sequence from time perception via time orientation to time management, indicating increasingly complex levels of TPA. The three concepts are defined in the International Classification of Functioning, Disability and Health (ICF) [17].

Daily time management (DTM) is partially based on a person's mental function of TPA. DTM is defined as 'managing one's time in daily life, both alone and along with others, and adapting to time demands' according to the ICF [14,17]. DTM is important in becoming independent and autonomous as well as for performing everyday activities successfully [16,18]. A person's DTM is also influenced by the environment (both physical, e.g. access to products, and social, e.g. attitudes); and by personal factors (e.g. motivation and temperament) [19].

For children with ADHD deficits in TPA and DTM can result in consequences in daily life, such as difficulties with automatizing routines. The importance of routines is highlighted in Cole's model of time mastery [20]. According to this model, mastering time implies having the ability to organize one's own time, which in turn contributes to developing habits. Taylor [21] also highlights the development of habits as a tool that allows us to complete routine activities in a consistent and effective way. Habits have an impact upon occupational performance and also upon how time is used. Additional consequences of deficits in TPA and DTM for children with ADHD are problems with: understanding the concept of time, achieving an overview of time, being on time for an appointment, starting and completing daily activities independently, planning and completing long-term projects, understanding and using a calendar, and hurrying up if required [1,4,22]. Such difficulties affect different aspects of life: education, self-care, and social relations [4,6] and children's quality of life [23–25]. This huge impact on so many parts of a child's life is also illustrated in the recently developed Brief ICF Core Set for children with ADHD aged 6–16 years [26].

The primary treatments for children with ADHD are pharmacological and/or psychosocial, such as psychoeducational programms or behaviour classroom management [6,27,28]. Pharmacological treatment reduces the core symptoms of ADHD [27,29–31] and thus can improve daily functioning, but a considerable number of children and adolescents on medication still present continuing difficulties with DTM, and therefore need additional treatment [5,32,33]. Psychosocial treatments focussing on training for organization, time management and planning (OTMP) meet the criteria for a well-established treatment in children and adolescents with ADHD [28]. However, these interventions have mainly focussed on organizational skills in a school context and in schoolwork, for example, organizing the necessary material for the school situation and doing homework [34–37].

As a complement to other interventions for children with ADHD, assistive technology for cognition is recommended [6]. Time-assistive devices (TADs) are a form of assistive technology for cognition aimed at compensating for difficulties in TPA, that is, time perception, orientation to time and time management. Examples include: reminders/alarm clocks, weekly schedules or step-by-step schedules with text or pictures, and timers visualizing time graphically [10,14,38–40]. TADs may be high-tech, for example, apps for smartphones and electronic planning devices, but they can also be low-tech, consisting of paper and pictures [6,10]. Greater independence, a sense of self-control and improved DTM when using TADs have been reported for children, adolescents and adults with autism, acquired brain injury, developmental disabilities, intellectual disabilities and psychiatric illness [10,40–46]. Time-related interventions, including TADs, are a relatively new research area in children with ADHD. To our knowledge, there are only two previous studies evaluating interventions involving TADs in children with ADHD. Janeslätt et al. [43] evaluated such interventions in children aged $6-11$ years with intellectual and developmental disabilities, including some children with ADHD. The results imply that DTM can improve and that the intervention group improved their TPA significantly more than the control group. In our recent randomized controlled trial (RCT) study [47], using a new, multimodal time-related intervention, children with ADHD gained significantly in TPA and in parent-rated DTM.

During recent years, children's participation in surveys has increased, on the basis that it has been more common to use self-reports as a complement to proxy reports. This is evident in the growing body of knowledge about parents' and children's agreement about the Health-Related Quality of Life (HRQoL) of children with ADHD [23], using both self-reports and proxy reports. It is essential that interventions targeting goal attainment are conducted in a client-centred

manner, enabling the client to identify occupational performance problems and, together with, for example, an occupational therapist, to set goals for the intervention and, later on, to evaluate the goal attainment [48]. However, there are few studies in which children set their own occupational performance goals. To the best of our knowledge, there is no study in which children with ADHD and their parents have identified occupational performance problems related to time in daily activities and set their own goals for interventions. Furthermore, apart from the two studies mentioned above [43,47], we found no study on children with ADHD that focussed specifically on time-related deficits in daily activities.

Aims

The aims of this study were to examine the outcome of a multimodal, time-related intervention designed to support children aged 9–15 years, with ADHD, to achieve their occupational performance goals and to improve satisfaction with occupational performance. A further aim was to compare the children's ratings of outcome with their parents' ratings and to identify and analyse the occupational performance goals.

Materials and methods

Study design

A pre-post design using children's and parents' ratings of occupational performance and satisfaction at baseline and follow-up was used.

Participants

The participants were children with ADHD from an intervention study [for more information see 47], including both children from the intervention group and children from the control group, who were later offered intervention. Participants were recruited between September 2012 and March 2015 from three child and adolescent psychiatric clinics and one children's habilitation service in Sweden. Inclusion criteria were: a diagnosis of ADHD, age 9–15 years, and parent-reported difficulties with DTM despite medication for ADHD (i.e. ten points or more on a clinical rating of 15 statements related to problems with DTM). The exclusion criteria were: autism spectrum disorder, intellectual disabilities (IQ $<$ 70), or language barriers (e.g. not being able to speak and understand Swedish). Complementary inclusion criteria for the present study were the completion of the Canadian Occupational Performance Measure (COPM) instrument [49] at baseline and at follow-up. Twenty-seven children met the criteria: 10 girls (37%) and 17 boys (63%), with a mean age of 11.7 years (range 9.1–15.1, SD 1.85). All children were on stable ADHD medication, mostly long-acting stimulant.

Just over half of the children (55%) had TPA scores that were one or two standard deviations below the mean compared to children of the same age, as measured by the structured assessment 'Kit for assessing Time-processing ability' (KaTid) [15]. One child had a TPA significantly above the mean and just under half of the children (41%) had a TPA within the mean range for children of the same age.

The parents of the children with ADHD who met the inclusion criteria were informed about the study during regular visits to their child and adolescent psychiatric clinics or children's habilitation service. Information about the study's purpose and structure was provided both orally and in writing in the form of a booklet containing brief information. Parents who agreed to participate received written invitations for a visit for the purpose of data collection, one invitation for the parents and an adapted version for the child, accompanied by a consent form each. Parents were also asked to enroll a person, preferably a teacher, another member of the school staff or a relative the parent suggested to function as the child's coach.

Instruments

The Canadian Occupational Performance Measure (COPM) [49] was used as the outcome measure. It was chosen because it is client-centred and enables clients to identify, validate and prioritize issues that restrict or impact on their performance in everyday living and provides the basis for setting individual intervention goals [49]. The client identifies their performance problems and then rates the actual performance and satisfaction for each performance problem using a 10-degree scale. The scale for performance is from 'cannot perform it at all' (1p) to 'can perform it extremely well' (10p) and the scale for satisfaction is 'not satisfied at all' (1p) to 'extremely satisfied' (10p). Changes in scores pre- and post-intervention in performance and satisfaction could be determined separately and an increase of two or more points indicates a clinically significant change [49]. The reliability and validity of COPM have been reported as acceptable [50,51] and it is considered to be clinically useful [52]. COPM has been used with clients of different

ages, diagnoses and backgrounds [53], including proxy reports of children with ADHD in interventions focussing on executive strategies [54–57].

The Kit for assessing time-processing ability (KaTid) [15] is an instrument for the assessment of time perception, time orientation and time management for children with a developmental age of 5–10 years (KaTid-Child) and adolescents with a developmental age of 10–17 years (KaTid-Youth). The result of a KaTid measurement shows a child's development in TPA and gives information that is useful for designing interventions in compensation and/or training. In this study, KaTid-Youth version 19 was used for children aged from about 10 years upwards ($n = 21$) and KaTid-Child version18b for the youngest children ($n = 6$). Data from the two KaTid versions were only used for descriptive purposes and as a complementary basis for intervention not as an outcome measure.

Procedure

Data collection was performed at baseline (t1) and at follow-up (t2, after 24 weeks), and took place at the outpatient clinic. During the first visit, information was given to the child and parent(s) about the study and written informed consent was collected from both parents and older children (from about 12 years), before or at the start of the visit. During this first visit, at baseline, data collection was carried out with the child and the parent(s) separately. The parent(s) responded to demographic questions, and met an occupational therapist for a semi-structured interview (COPM) to identify occupational performance problems with activities related to DTM that the child wanted to do, or had to do. In most cases, only one parent participated. If both parents took part, they agreed on the occupational performance problems. During the same visit, the child met an occupational therapist for an assessment of time-processing ability (using KaTid).

The next visit included parents and coaches receiving a one-day, manual-based education session. This education was given for two reasons: firstly, as a basis for parents and coaches to increase their understanding of deficits in the child's TPA and how this could affect the child's DTM; and, secondly, to motivate the parents and coaches to facilitate the child's participation in the intervention. The education session lasted for 6 h, was given in small groups, and included group discussions, exchanging experiences and discussing strategies. The focus was on lectures about DTM and the development of TPA in typically developing children as compared to children with ADHD. It also contained information about the consequences of TPA deficiencies in daily activities, strategies to compensate for these consequences, and how to support children with deficiencies in time-related skills. The content of the education was written down and one author (GJ) was responsible for the content and conducted all the sessions. The occupational therapists performing the intervention had an experience of working with children with disabilities and time difficulties. They also participated in the education day, along with the parents and coaches.

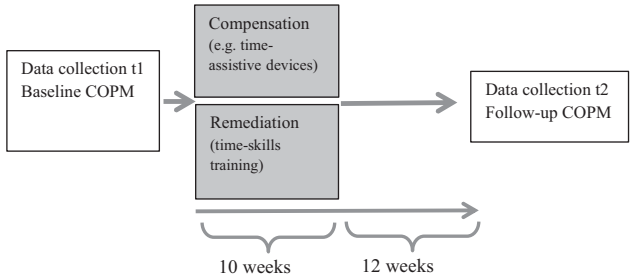

Figure 1. Overview of the design and intervention, from baseline (t1) to follow-up (t2).

Intervention

The intervention was designed to be multimodal, based on guidelines for interventions with children and adolescents with ADHD [6,27], and had two components: *compensation* and *remediation* [58] (Figure 1). Both intervention components were applied in parallel (Figure 2).

During the second baseline visit, the child and parent(s) met an occupational therapist together to receive feedback from the assessment findings. Based on the occupational performance problems identified using the COPM, the parent(s) and child separately rated the importance of the activity and afterwards, in cooperation with the occupational therapist, decided on between one and four occupational performance goals related to DTM. The child and parent(s) then separately rated the current level of occupational performance and satisfaction with the performance. If two parents were present, they each gave their own rating. The occupational therapist worked deliberately to facilitate the child to actively participate in the goal setting and also in planning the intervention together with the occupational therapist and the parent(s). Examples of the child's participation in the intervention included allowing the child to choose which goal they would start with, in what order the details on

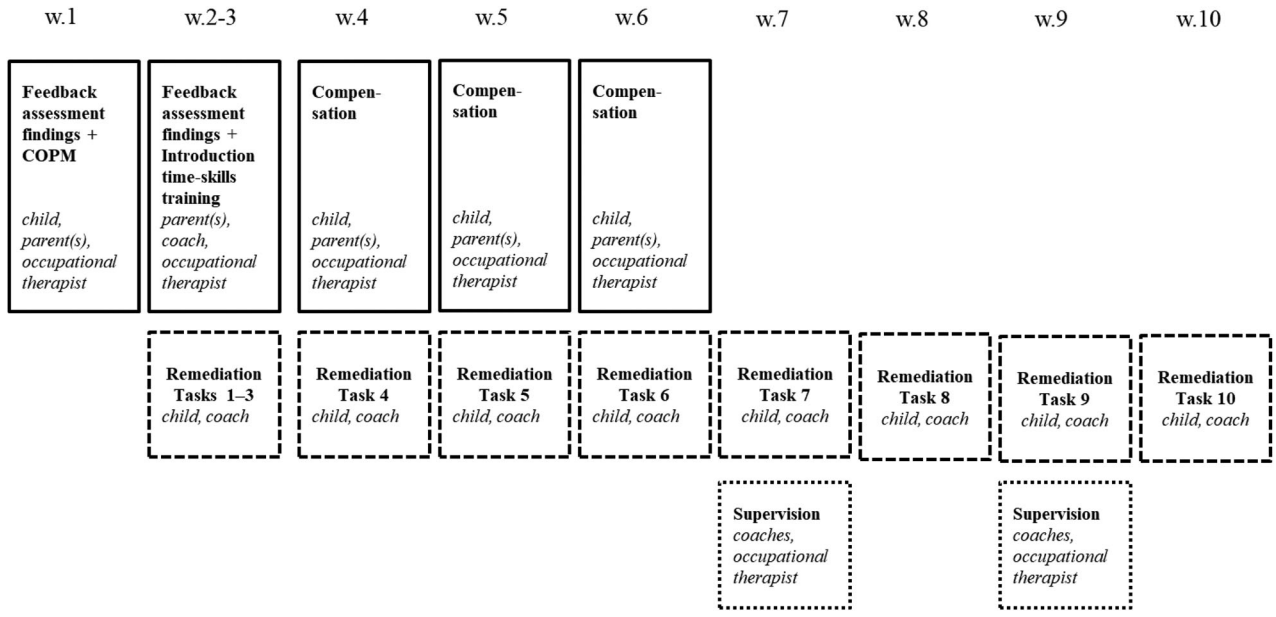

Figure 2. Plan for parallel intervention sessions over 10 weeks (w). Compensation (including time-assistive devices), Remediation (including time-skills training and number of challenging tasks) and Supervision for coaches; (including who participated at each session).

the morning schedule should be presented and with what pictures, and where in the home the digital day-calendar should be placed.

The *compensation* component was tailored to the individual needs of the child, based on the occupational performance goals chosen by the child and parent(s) and on the time-processing ability of the child. The compensation intervention included three or four treatment sessions (each lasting about 90 min) with the occupational therapist, with both parent(s) and child participating. The focus was on working around the occupational performance problem by identifying individual activity-compensating strategies for the child, structuring the physical environment [58] and the fabrication of TADs or the prescription of publicly funded TADs. Compensating strategies were used to address goals related to: establishing and maintaining morning and evening routines, establishing daily routines to check the next day's activities and helping the child to develop their own inner reflection. Examples of structuring the physical environment included: organizing sportswear so that it was easy to find and take to school and making sure there were clocks visible in every room at home. The prescription or fabrication of TADs included choosing an adequate TAD depending on the chosen goal, the child's TPA, and the environmental prerequisites; the introduction of the TAD and training the child to use it; and later follow-up on its use. TADs used in this intervention were both low-tech and high-tech. Examples of low-tech TADs are, step-by-step schedules showing how to perform an activity in timely order, and daily, weekly or annual schedules on plastic-coated paper with pictures showing the planned activities. High-tech TADs included timers visualizing time as dots that decrease in number to show time passing, electronic day schedules with pictures, and smartphone apps for reminding and planning. Most TADs were publicly funded and available in the ordinary prescription assortment – for example, visual timers and a whiteboard clock – and some were fabricated by the occupational therapist, such as pictures to use on the weekly schedules or a step-by- step schedule with pictures or text. A few TADs were not available in the ordinary prescription assortment and had to be bought by the participants themselves. Examples of these included annual calendars and a specialized alarm clock that wakes one up with a simulated sunrise. Some of the products were adapted in different ways (e.g. with pictures or plastic strips) and sometimes more than one product was used together, such as a visual timer and a step-by-step schedule, to reach some of the occupational performance goals. One of the products (the Whiteboard clock) was used to reach all the different kinds of occupational performance goals for some of the children and also compensated for deficits at the three different levels of children's TPA.

The *remediation* component, consisting of time-skills training, was presented in a manual. Each child had a coach supporting them to perform the time-skills training. The majority of these coaches were

school staff (often teachers or school assistants), but for a few of the children the coach was a relative or a friend of the family. This set-up, with coaches supporting children to train often and regularly, was inspired by organizational, time management and planning programmes [28]. The time-skills training was presented in the form of 'challenging tasks'. The concept of challenging tasks was inspired by 'My time', a programme designed for children with intellectual disabilities to develop their TPA by systematically collecting experiences of time by visualizing, documenting and communicating how long different everyday activities take. In this study, the challenging tasks were specially developed for children and adolescents with ADHD (by GJ and BW). The time-skills training was the same for all children and consisted of 13 tasks of increasing complexity, starting with the child training his/her perception of time (challenges 1–3), followed by a training precursor to time management (challenges 4–8) and time orientation (challenge 9) and later on training in time management (challenges 10–13). Most of these challenging tasks were focussed on everyday activities to make it easier for the children to transfer their experiences to activities in daily life. An example task was to measure, in minutes, the duration of five to ten self-chosen recurring activities, and to document these in a binder. Another example was to compare the amount of time needed to perform an activity in two different ways, for example, walking to school or cycling to school. Using a computer program to learn to tell the time is another example. In training for time management, one challenge was based on one of the previous challenges and the child took the activities previously measured and documented and decided how many of them could fit into a 45-min period. Every child was expected to complete 10 different tasks. Three of the 13 tasks were exchangeable, depending on the age and maturity of the child. The child expected to do the challenging tasks for 20 min each day and was supported by the coach in a short meeting one to three times a week during the training period. All coaches were offered supervision by the occupational therapist for two sessions during the training period, as a group session or an individual session by telephone. The mean number of challenges performed by the children was seven. Approximately half of the children ($n = 11$) only undertook the challenges focussing on time perception and prerequisites for time management. Seven children (29%) completed the challenge focussing on time orientation and eight children (33%) completed the challenges focussing on time management.

The intervention lasted for 10–12 weeks. Then there was an implementation phase of another 12 weeks, during which the participants continued to use their TADs but did not receive any other treatment besides standard methods of care, that is, medication and/or psychological support. After 24 weeks, there was a follow-up assessment. This study design was chosen based on clinical knowledge that changing a habit and starting to use an assistive device takes some time to become integrated into a person's everyday life [59,60]. For data collection at follow-up (t2), the child and parent(s) met an occupational therapist who was not involved in the intervention. At this meeting, the child and parent(s) separately rated the current occupational performance and satisfaction, using the COPM. The baseline data was not presented at that meeting.

Statistical analysis

We used descriptive statistics to analyze demographics (age, gender, medication, living situation and TPA). To facilitate a comparison of the children's TPA, independent of which version of KaTid was used, we converted raw scores to scale scores [15]. We calculated the number of participants corresponding to the mean range and to the ranges of ±1SD and ±2SD from the reference range of typically developing children [61]. A preliminary analysis to calculate skewness and kurtosis using a Shapiro–Wilk's test [62] confirmed whether the assumptions of normality held for the different variables.

We calculated individual mean values for the ratings of occupational performance and satisfaction. Because of the small sample, we used a comparative analysis with non-parametric statistics using the Wilcoxon signed rank test with the statistical significance level set at $p < 0.05$. We analyzed the ratings for performance and satisfaction scores between the child's and the parent's ratings at baseline and at follow-up. In a few cases, both parents of a child participate at baseline and/or at follow-up. In these cases, we conducted the analysis using data from the parent who participate at both baseline and follow-up. If both parents participated on both occasions, data was reported as a mean of both parents' ratings. To examine the outcome of the intervention, we made a comparative analysis of the differences in scores for performance and satisfaction at baseline and at follow-up for the child and for the parent. We used

effect size to analyze the magnitude of the difference. This was calculated using Cohen's d with effect size $d = 0.2–0.5$ representing a small effect, $d = 0.5–0.8$ a medium effect and $d \geq 0.8$ a large effect [63]. We also calculated the proportion of children and parents rating an increase of two or more points on performance and satisfaction with performance. This magnitude demonstrates a clinically meaningful change in COPM scores [49].

Each goal, each reflecting an occupational performance problem, was identified and analysed according to the type of goal and level of TPA (time perception, time orientation or time management).

To analyse the data, we used the Statistical Package for Social Sciences (SPSS) version 25.0 (SPSS Inc. Chicago, IL), selecting a significance level of 0.05 and a confidence interval of 95%.

Ethical considerations

Ethical approval was granted by the Regional Ethical Review Board in Linköping, Sweden. Written informed consent was obtained from all parents of children in the study and from the older children. The ethical guidelines stipulated by the Helsinki Declaration [64] guided the research process.

Table 1. COPM—performance and satisfaction ratings (*M* and *SD)* for children and parents at baseline and at follow-up.

Baseline rating	Follow-up rating	Difference	*p*-Value	ES
Children's ratings				
Performance				
4.8 (1.59) ($n = 27$)	6.4 (1.72) ($n = 27$)	1.6	0.001	0.58
Satisfaction				
4.2 (2.06) ($n = 25$)	6.6 (1.50) ($n = 25$)	2.4	0.001	0.74
Parents' ratings				
Performance				
2.9 (1.1) ($n = 27$)	4.6 (1.56) ($n = 26$)	1.7	<0.001	0.93
Satisfaction				
2.4 (.92) ($n = 26$)	4.5 (1.84) ($n = 25$)	2.1	0.001	0.99

Average performance and satisfaction (range = 1–10). Significance level set at $p < .05$. Effect size using Cohen's *d*.

Results

Outcome of the intervention

Occupational performance

The majority of both parents and children rated occupational performance at follow-up higher than at baseline (see Table 1). The mean change is slightly less than two points, both for the children's ratings and those of their parents', but the difference is still statistically significant, both according to the children's ratings ($p = 0.001$) and to those of their parents' ($p < 0.001$). The effect size is medium ($d = 0.6$) for children's ratings and high ($d = 0.93$) for their parents' ratings. 14 of the 27 children and 13 of the 26 parents scored a change of two points or higher, which is seen as a clinically significant change (see Table 2). Three of the children and two of the parents rated the occupational performance as lower at follow-up than at baseline.

Satisfaction

Children and their parents rated their satisfaction higher at follow-up than at baseline (see Table 1). There was a clinically significant change both in the children's ratings (2.4 points) and in those of their parents (2.1 points). Statistical analysis also showed statistically significant differences for the children's ratings ($p = 0.001$) and for those of their parents' ($p = 0.001$). Effect sizes were high both for children's ratings ($d = 0.74$) and for their parents' ratings ($d = 0.99$). More than two-thirds of both children (70%) and parents (71%) rated the satisfaction change as two points or more (see Table 2). Two of the children and two of the parents rated their satisfaction as lower at follow-up than at baseline.

Agreement between children and parents

In general, children rated their occupational performance higher than their parents did; both at baseline and at follow-up (see Table 1). Similarly, children as a group rated their satisfaction higher than their parents both at baseline and at follow-up (see Table 1). These differences are statistically significant.

Table 2. Change over time in COPM scores (mean values) classified into those who had negative or no change (difference ≤ 0), a positive change between +0.10 and +1.99, and ≥ 2.

	Negative change/no change ≤ 0	Positive change $>0 < 2$	Positive change ≥ 2
Children's ratings – occupational performance ($n = 27$)	18%	30%	52%
Parent's ratings – occupational performance ($n = 26$)	15%	26%	50%
Children's ratings – satisfaction ($n = 23$)	17%	13%	70%
Parent's ratings – satisfaction ($n = 24$)	12%	17%	71%

Occupational performance goals

The occupational performance goals, which reflected the identified occupational performance problems as stated by the participants, varied from one to four per person ($M = 2.5$). In total, 72 goals were identified among the 27 children.

Most occupational performance goals were about carrying out daily routines, knowing the duration of an activity, and knowing what will happen during the coming day, week and month. The most common goal was to perform morning or evening routines independently, and without nagging. The children and their parents agreed that this was a recurring daily problem and that it could affect the child's entire day. In addition, daily routine goals were reported such as to take medicine in the morning and to make a light meal when coming home from school. Examples of goals attributed to time perception were to perceive the duration of different activities and feel when it was time to finish a specific activity; for example a break at school, reading a book, doing morning routines and different recurring activities at home. Another example was to know which activities have short or long duration. Goals attributed to time orientation included knowing what will happen and when—during the next day, week or month, to know how long it is until a time-specific activity and to tell time. A few goals were attributed to time management. An example was to plan and keep track of all weekly activities.

Discussion

Outcome of intervention

The results of this study indicate that a multimodal, time-related intervention, consisting of a combination of compensation with TADs and remediation with time-skills training, supported children with ADHD in achieving their occupational performance goals. The benefit of the compensational component of the intervention, the TADs, is consistent with the clinical experiences of children with ADHD and also with previous studies showing that children, adolescents and adults with a range of diagnoses including ADHD, enjoy greater independence and levels of participation when using TADs [10,40–47]. The observation of TADs compensating for different levels of TPA is in line with previous research in the field of TADs [10,38–40,43] and in recently published guidelines for the use of TADs [14]. The products prescribed for the children in the present study were compensating for different levels of TPA and the similar to those prescribed for children, adolescents or even young adults with other diagnoses than ADHD. It may be, of course, that this just mirrors the prescription assortment available, but it could also demonstrate the need for the same compensational products regardless of diagnosis, but dependent on the level of TPA needed to achieve the goal. This is consistent with the results of Janeslätt et al. [11], who concluded that the level of TPA seems to be a more important starting point for the design of an intervention than the child's diagnosis. In this study, some of the products were adapted in different ways and sometimes more than one product was used together, to reach some of the occupational performance goals. This demonstrates the need for customization for each child and activity [65].

The remediation component, time-skills training, is a new intervention for children with ADHD. However, training programmes focussing on OTMP for homework assignments with children with ADHD are a well-established intervention [28], but they do not focus particularly on deficits in TPA. In this study, the children ($n = 23$) performed an average of 7.4 tasks, including the first five remediation tasks designed to train time perception. It is reasonable to assume that many of the children found the tasks relevant, as many of them did choose goals in the area of time perception. The results show that more than two-thirds of the children (70%) rated the satisfaction change as two points or more, indicating that they found the intervention useful.

The present study expands the knowledge gained by earlier studies exploring the combination of compensation using TADs and remediation through time-skills training or education for parents about time difficulties in children with disabilities [43,47]. It is known that a combination of interventions (usually medication and psycho-education) directed towards children and adolescents with ADHD achieves better results than a single intervention [6,27]. Our previous RCT study [47] showed that a combination of TAD and time-skills training was more effective at improving TPA and parent-rated DTM in children with ADHD than only educational intervention. The present study adds the importance of active participation from the children in goal setting to achieve their occupational performance goals.

In this study, both children and parents rated occupational performance and satisfaction as higher at follow-up. However, in general, the children's ratings were higher than their parents', for both

occupational performance and satisfaction. This was also the case in Gharebaghy et al. [54].

Another interesting finding is the higher outcome of satisfaction compared to performance. This is evident in both the children's and the parents' ratings. An explanation could be a new awareness of their potential performance ability and satisfaction with this. Another explanation could be that even a minor positive change in occupational performance could create a major change in satisfaction with the situation. Moreover, perhaps merely the experience of being part of a client-centred intervention creates a feeling of satisfaction. The value of a client-centred approach and the knowledge that every child's needs and desires are individual, was highlighted to ensure that each child's participation in the intervention process was expected [21,49,59,65], and this could be a potential explanation for the results.

Occupational performance goals

The COPM resulted in three main areas of occupational performance goals: carrying out daily routines, knowing the duration of an activity, and knowing what will happen during the coming day, week and month. Carrying out daily routines was often about achieving morning or evening routines including overcoming resistance to going to bed or to sleep and prolonged tiredness upon wakening. Goals related to sleep were commonly reported in this study. This is in line with that sleep problems are common among children with ADHD [66,67]. In the present study time assistive devices, that is, step-by-step schedules and reminders were used as a way to establish and maintain habits regarding for example sleeping routines. The importance of developing habits in order to master routine activities in a consistent and effective way is stated by Taylor [21]. The present study gives support to the idea that occupational therapy interventions directed towards compensating for deficits in TPA and DTM can enable children and adolescents to develop new habits and thus to gain support for organizing the activities of daily life.

A quarter of the occupational performance goals could be attributed to occupational performance problems in experiences of time: feeling the duration of time and knowing when a time-based activity should end. The fact that so many of the children identified problems in a low level of TPA, experiencing time, in a degree that affected their occupational performance is interesting. It can strengthen what was shown in previous studies that TPA is one construct and problems at low level will affect levels of TPA developed later as well as DTM [15,16]. Many experimental studies examining the time duration discrimination and time reproduction have drawn conclusions about how problems at this level are related to estimating time and time management [7,66,68]. The present study can fill the knowledge gap, what is needed between the low level of interval timing and the top level of time management including estimation time. The importance of, not only perceiving the time passing, but also knowing the duration of different activities to acquire the skill to estimate time. This includes relating to experiences collected earlier of the duration of recurring activities. In the training included in this study, the children measured the duration of activities in minutes to collect many experiences [47]. This was the first challenging task and it was done by all children. Possibly it was essential for these children, to measure the duration of activities could fill this gap and contributed to increase their ability to estimate time and increase their occupational performance.

An interesting finding concerns the occupational performance goals directed towards knowing what will happen during the current day, week or month. Children in this age range are expected to be able to know what will happen during an actual day and week [67]. Taken together, these most frequently chosen occupational performance goals to reveal children who are having difficulties with everyday activities, indicating a need for interventions targeting these.

When comparing the occupational performance goals in the present study with the Brief ICF Core set for school-age children and adolescents with ADHD, 6–16 years old [26], some differences can be seen. In this study, nearly half of the occupational performance goals were attributed to time perception and time orientation. However, these categories are not included in the final version of the Brief ICF Core set. Based on the results of the present study we suggest that these two categories should be considered in future work with the Brief ICF Core set.

This is one of only a few studies in which children with ADHD set their own occupational performance goals and rate their own occupational performance and satisfaction, using the COPM. The present study shows that school-age children with ADHD, together with their parents, were able to set occupational performance goals and rate their performance and satisfaction with their performance using the COPM. This experience probably improved their participation in

the intervention process. This is in line with Enemark Larsen et al. [69] who state that COPM could enhance client-centred practice. Occupational therapists should therefore consider using concrete goal-setting in collaboration with children and their parents in order to enhance participation and improve outcomes.

Methodological considerations

The intervention lasted for 3 months. After a further 3 months, there was a follow-up. Data collection was performed at baseline and at follow-up, but not following the final intervention session. Having both a post-intervention test and a follow-up would have strengthened the study. When investigating the effects of an intervention, it is often preferable to have more at least three measurements [70]. This was unfortunately not possible in the present study due to limited access to the target group. We also wished to reduce the burden on the families; the intervention itself already included a large number of meetings (see Figure 2).

The multicentre study design offered an opportunity to recruit participants from a variety of different geographical areas, which is considered a strength. A weakness could be that several different people were active in the data collection and intervention A risk of deviations from the study design arises if the intervention design is more complex, such as when interventions are offered by many different people [71]. Intervention fidelity was therefore of particular importance in this study. It was checked *via* regular meetings with the occupational therapist, the number of completed 'challenging tasks' and the TADs received by the children. An additional way to improve the intervention fidelity could have been extended education and supervision of the coaches to ensure that there was compliance with the remediation component.

Children and parents rated positive changes for both performance and satisfaction at follow-up. Therefore, as a whole, the intervention can be seen as successful. However, it consisted of two components: compensation and remediation. A limitation is that we do not know for sure whether it was the combination that gave rise to these positive results or whether it was merely one of the components. Based on this and on the fact that the two interventions, compensation with TADs and time-skills training, have been sparsely or not at all studied in children with ADHD, there is a need for further research, both in combination and separately.

A limitation of this study is the pre–post design, with the lack of a non-intervention comparison group, which provides weak evidence to support the effect of an intervention. To include teacher ratings would have been a way to improve the evidence.

One weakness of this study is the relatively small number of participants, and therefore caution should be employed in generalizing the results. However, the recruitment was from regular children and adolescent psychiatric clinics and children's habilitation service from different parts of Sweden, and this demonstrates our ambition to strive, as far as possible, to mirror the wider population of children with ADHD who experience time and planning problems despite medication. Due to the relatively small number of participants, there is a need for further research with larger groups of children with ADHD and for research focussing on older adolescents and young adults. Further research is also needed to investigate the long-term effects of time-related interventions.

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