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ORIGINAL ARTICLE

Eighteen-Month Follow-Up of Internet-Based Parent Management Training for Children with Conduct Problems and the Relation of Homework Compliance to Outcome

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Abstract The primary aim of the present study was to evaluate if previously reported treatment gains of a parent management training (PMT) program, administered via Internet, were retained from post to the 18-month follow-up. Another aim was to evaluate homework compliance as a predictor of short and long-term outcomes. Participants were parents of 58 children (3–11 years) with conduct problems who received a 10-week self-directed PMT program, with limited therapist support. Parents of 32 children (55.2 %) responded at all measurement point (baseline, post-test and follow-up) and analyses showed that child conduct problems continued to decrease during the 18-month period after the intervention whereas parenting skills deteriorated somewhat from post treatment. Pre- to post-treatment change in child conduct problems was predicted by parental engagement in homework assignments intended to reduce negative child behaviors. The findings provide support for the use of Internet-based PMT and stress the importance of parental compliance to homework training.

Keywords Conduct problems · Parent management training · Child · Internet · Homework compliance

Introduction

A large number of parent training interventions have been developed during the last 50 years and many of them have proven to be effective in reducing child conduct problems (for a review see the meta-analyses by Eyberg et al. [1], Dretzke et al. [2] and Serketich and Dumas [3]). A number of these parent training programs, such as the parent management training—Oregon Model [4], The Incredible years [5], Triple P [6] and the Swedish COMET program [7, 8] have emanated from social interaction learning (SIL) theory [9–11]. SIL theory is one of the most influential theories on the development of early onset conduct problems into youth delinquency. The theory stipulates that conduct problems in childhood are developed through an iterative process where parents in stressful life contexts start to use more coercive parenting strategies (characterized by hostility, intimidation and diminishing comments) and children's deviant behaviors become gradually more negatively reinforced (e.g., in situations where parents try to force the child to abide a rule, the child refuses and parents eventually give into the refusal). The increase of child conduct problems conveys more coercive parenting and, over time, children's problematic behaviors tend to spread to school environments and peer relations [12]. Typical PMT-program components derived from SIL theory are aimed to break this vicious circle of coercion and include teaching parents to interact with their children in a positively reinforcing manner and to set limits effectively [13, 14]. A common approach for many parent-training programs is to initially (during the first sessions) engage parents in exercises that intend to strengthen the parent–child relationship. This includes teaching parents positive communication skills, encouraging parents to praise/reward desirable behaviors and to create greater involvement by inviting parents to spend more time with the child [15]. Later on in these programs, conflict-management techniques such as limit setting, ignoring misbehavior, logical consequences, privilege removal and time out are

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gradually introduced (e.g., [5, 16–18]). This basic categorization of program components, and the order in which they are introduced to parents, could be applied to most behavioral parent training programs descended from SIL theory. The large number of studies on the effectiveness of PMT interventions, the related line of research investigating family interaction processes that contribute to the development of conduct problems and basic research on the main PMT components (reinforcement and extinction techniques), form a promising evidence base for these kinds of interventions.

The short-term effectiveness of face-to-face parent training programs has been well established [2, 3] but the long-term duration of these effects have been debated, e.g., in a recent Cochrane review [19]. A meta-analysis conducted by Lundahl et al. [20] identified a number of studies of parent training programs that included follow-ups, but the results were heterogeneous and the vast majority of studies had follow-up periods shorter than 12 months.

Self-directed PMT programs have also been found to efficaciously reduce child conduct problems [21, 22] but studies on follow-up effects have been even more limited by short follow-up periods. The Triple P self-help booklet in combination with telephone support by a therapist has been examined in a few studies: Connell et al. [23] reported maintained reductions of conduct problems at 4 months post intervention compared to a waitlist condition, Markie-Dadds and Sanders [24] conducted a 6-month follow-up where 65 % of children showed reliable changes of conduct problems, and Hahlweg et al. [25] reported that pre- to post-improvements of conduct problems were retained at 6 months follow-up. One study conducted by Sanders et al. [26] employed a follow-up at 3 years post intervention (the Triple P self-help booklet without therapist support) showing large within-group effect-sizes that were similar to those reported in the same study for the standard and enhanced (face-to-face) versions of the Triple P program.

In our previous RCT-study [27], post treatment and 6-month follow-up effects of an Internet-administered PMT program (*iComet*) were reported and compared to a waitlist group. Parents in the intervention group reported significant reductions of child conduct problems from pre to post, compared to waitlist families, and these changes were maintained at the 6-month follow-up. Similar improvements were seen in the intervention group for parenting practices, i.e., harsh parenting decreased and positive parenting increased. The iComet program incorporated limited therapist support via e-mail but was principally self-directed. A comparable study, but without any kind of therapist support, was conducted by Sanders et al. [28] where parents of 60 children (2–9 years) with conduct problems received the Triple P Online-intervention. Intervention families improved with regards to child conduct problems and dysfunctional parenting practices, compared to control group families, between pre- and post-measurement, and these improvements were maintained at a 6-month follow-up. Online delivery of self-directed PMT programs shows promising results and has a potential to improve the reach of parent training to rural areas in a cost-effective manner. However, more studies examining the duration of effects derived from these programs are needed prior to considering implementation in routine care.

Predictors of Treatment Outcome

Of interest with a newly developed parent training intervention is the prediction of treatment outcome. Predictors, or moderators, could be baseline measures of different parent or child characteristics [29], risk factors [30] or pre-treatment level of conduct problems [31]. Parent behavior, or other variables measured *during* the intervention, may also be analyzed as predictors of outcome such as done by Nix et al. [32] who investigated the effects of compliance to treatment (defined as group leader rated quantity and quality of participation during sessions and homework completion) and attendance, on the outcome of parent training. In that study, treatment compliance was found to predict the outcome, whereas number of attended sessions did not, supporting the notion that compliant participation in PMT is important, beyond just attending sessions. Similar findings have been reported by Garvey et al. [33] and Clarke et al. [34]. Baydar et al. [35] showed that parents' engagement (a construct indicated by attendance, number of completed homework assignments and group-leader rated quality of participation) in a PT program had significant impact on positive and ineffective parenting outcomes. Although that study did not report results separately for attendance and homework compliance, it suggests that the level of dedication to treatment is important and homework compliance is one way that parents express dedication.

Studies of predictors and moderators of outcome have been conducted almost exclusively on face-to-face PMT programs [22] and, to our knowledge, no previous PMT study (on either self-directed or face-to-face programs) has sought to evaluate if completion of different categories of homework tasks predict treatment outcome differently, i.e., if for instance completion of homework associated with initial program components (intended to promote positive child behavior) predict the outcome differently than homework tasks derived from conflict-management components. Such findings might have clinical implications to the extent that certain homework assignments could be more (or less) emphasized during the intervention, depending on their relative importance, which would hopefully help boost the outcome.

In a previous study we found elevated levels of child callous-unemotional traits to be predictive of an inferior response to treatment with the iComet program [36]. Of further interest is also if variables, other than baseline characteristics, might affect the outcome. One such suggested variable could be parents' ability to comply with homework assignments.

In the present study we investigated if the short-term effects of the PT program were maintained 18 months later and if homework completion (type and frequency), registered on a weekly basis during the intervention, predicted short- and long-term changes in child conduct problems. Ideally, the results will contribute to the understanding of sustainability of improvements from self-directed PMT programs, as well as help clarify the relative importance of different homework assignments commonly included in PMT programs based on SIL theory.

Aims

The specific aims of the current study were to investigate (1) if the post-treatment levels of child conduct problems and parenting strategies were retained 18 months after the end of a new promising internet-based treatment, (2) if conduct problem outcomes, post treatment and at the 18-month follow-up, were predicted by either total homework task completion, by subtypes of homework (tasks promoting positive behaviors and/or tasks intended to reduce negative behaviors) or by any specific kind of homework task.

Methods

Participants

In the original study [27], 104 families were randomized to either the PMT intervention or the waitlist control condition (Fig 1). All families in the intervention group ($N = 58$) were asked to participate in the 18-month follow-up. The current sample of children had a mean age of 6.71 years ($SD = 2.31$, range 3–11) at the start of treatment. The mean number of siblings in each family was 2.25 ($SD = .69$). Thirty-one (53.4 %) of the targeted children were boys and 27 (46.6 %) were girls. All children but one (98.3 %) were born in Sweden. A total of 33 (56.9 %) fulfilled criteria for Oppositional defiant disorder (ODD) and 5 (8.6 %) for Conduct disorder (CD). Diagnoses related to disruptive behaviors were obtained by a structured interview, the *Schedule for Affective Disorders and Schizophrenia for school-aged children* (K-SADS), present or lifetime diagnosis (version P/L) [37]. Seven children (12.1 %) received special educational services in school or kindergarten and 10 (17.2 %) had an ongoing contact with child psychiatric or social services. Of all parents, 64.6 % had a university education and 87.9 % were currently employed when they joined the study. Parents completed the study questionnaires either alone (37 mothers, 63.8 %, and 4 fathers, 6.9 %) or jointly (17 mother and fathers, 29.3 %). Parents were not invited to provide two separate sets of questionnaires at each measurement point. In 42 (72.4 %) of the cases, parents participated in the PMT program together (mother and father) and in the other cases, 15 (25.9 %) mothers and 1 (1.7 %) father participated alone. No family reported to have sought any additional treatment, or initiated medication, related to their children's conduct problems during the follow-up period. The study was approved by the regional ethics committee.

Procedure

Families were recruited to the study through advertisement in newspapers and schools, in urban as well as rural areas, targeting parents of children with disruptive behavior problems. Written consent was obtained from parents after providing information about the study. Next, parents were asked to respond to the Eyberg Child Behavior Checklist [38], with focus on the child in the household who presented with most conduct problems, and those who scored $\geq$1 SD above the Swedish norm-group mean [39] were eligible, and were subsequently randomized to either Internet-based PMT intervention or the WL control condition. Parents in the WL condition were offered the same PMT intervention as the intervention group after the 10-week WL period. Assessments were completed at pre-treatment, post-treatment and 6-month (reported previously in Enebrink et al. [27]) as well as at 18-month follow-ups (presented in this report). During the PMT program, parents were asked to register the kind of homework they had engaged in on a weekly basis (please see Homework assignments under Measures below for details). The recruitment took place between 2009 and 2010 and the 18-month follow-up was conducted between spring 2011 and spring 2012. Further recruitment procedures and inclusion criteria are detailed in the original study [27].

Attrition

All 58 families included in the study provided baseline data, 46 (79.3 %) families completed the post measurement assessment and 37 (63.8 %) the 18-month follow-up. Complete questionnaire data, from all three time points, was available for 32 (55.2 %) of the families. Most attrition, thus, occurred at the 18-month follow-up but there were neither any statistically nor clinically significant pre-

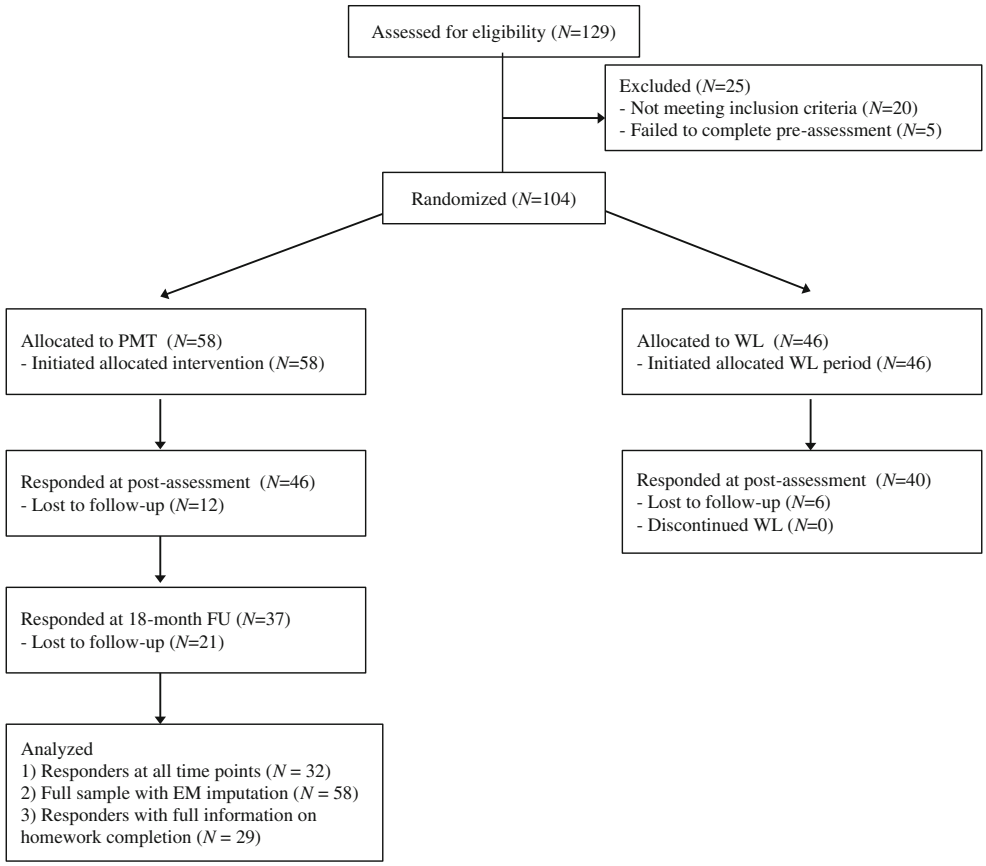

Fig. 1 Consort diagram showing the flow of participants from recruitment to analyses

treatment differences in demographic or clinical measures, between those who responded to the 18-month follow-up and those who did not. A comparison of pre- to post-changes and effect sizes between 18-month responders and non-responders revealed differences in one outcome measure only, praiseful parenting practices, where responders improved significantly more than non-responders. Apart from this difference, there is reason to believe that responders and non-responders had similar characteristics at baseline and were mostly affected by the intervention to the same extent.

The Internet-Based PMT Program

The iComet program targeted families with disruptive children aged 3–12 years. The program evolved from the Swedish PMT program COMET [7, 8], a face-to-face parenting intervention influenced by SIL theory and behavior therapy. The Internet-based version spanned seven sessions (distributed over 10 weeks) and contained written information, video vignettes and quiz-like parts at the end of each session where parents received automated feedback on their response to multiple choice questions. The program also contained a monitored chat forum where parent-to-parent communication was facilitated. Table 1 summarizes the core components of the program and the homework assignments that participating parents were advised to practice between sessions. The assignments were cumulative in the sense that parents, after each session, were encouraged to practice both the current strategy and to continue using strategies from earlier sessions. The first four sessions focused on strategies and homework assignments mainly intended to increase positive behaviors among children. By teaching parents to use a variety of positive reinforcers (e.g., praise, attention and rewards) and to communicate in more efficient ways, the main aim of this first half of the program was to improve the quality of the everyday parent–child interaction. During this part of the program, three homework tasks were assigned: Responsive playtime, Prepare and prompt and Tasks and rewards. The second half of the program aimed to provide parents with strategies to respond to children's misbehavior. With minor disruptive behaviors, parents were instructed to pay less attention to the problematic behavior and instead recognize and praise positive behaviors whenever possible. Other ways to handle misbehavior,

Table 1 Contents of the Internet-based PMT program: iComet

Session	Content/instruction	Homework assignments	Training period
	Promoting positive behaviors		
1	Spend more time with your child playing in a flexible and encouraging manner. Use direction of attention as a tool for changing behavior	Responsive playtime: Spend at least 15 min playing with your child every day, on the child's own conditions	1 week
2	Elementary behavior analyses is introduced. Prepare your child well in advance for upcoming events. Communicate in a simple and direct way, without nagging or yelling	Prepare and prompt: Choose situations where you prepare your child and then request/demand something	1 week
3	Pay attention to and praise positive behaviors. Learn different ways to praise effectively	Highlight a particular situation where you praise your child[a]	1 week
4	Ways to introduce new routines. Create clear and understandable tasks. Instructions are provided on how to administer a chart and star reward system	Tasks and rewards: Hand out tasks to your child every day. Tasks should be linked to praise and/or rewards	2 weeks
	Reducing negative behaviors		
5	Extinguish negative behaviors by paying less attention to them. Be assertive, but calm, when you decide to take a stand against a certain behavior	Ignoring misbehavior: Practice on focusing away from recurring misbehavior	1 week
6	Problem solving. Formulate the problem, brainstorm solutions, agree on one and put it into action	Problem solving: Practice problem solving	1 week
7	Being consistent about rules. Withdrawing privileges. Natural consequences. Remaining calm in conflicts. Using time out correctly	Time out: Practice time out	3 weeks

[a] Parents were not asked to register this homework assignment

such as distracting the child or removing privileges, were also illustrated in this part of the program. With severe outbursts or violent child behavior, parents were taught how to use time out. In the time out method used in iComet, parents were instructed to remove the child from the conflictual situation, while remaining by the child's side instead of leaving the child by him/herself, so called *non exclusionary time out* [40]. During this part of the program, three homework tasks were assigned: Ignoring misbehavior, Problem solving and Time out.

Measures

Eyberg Child Behavior Inventory (ECBI)

The ECBI is a 36-item parent-report measure of conduct problems for children aged 2–16 [38]. This well established instrument correlates highly with independent measures of child disruptive behaviors and shows good test–retest reliability [41]. The ECBI yields a measure of frequency of externalizing behaviors (intensity subscale, ECBI-IS) and a measure indicating whether these behaviors pose a problem for the parents (problem subscale, ECBI-PS). In the present sample, internal consistencies (Cronbach's alphas) for the intensity subscale were .82 (pre, $N = 58$), .96 (post, $N = 46$) and .93 (follow-up, $N = 37$) and corresponding values for the problem subscale were .79 (pre, $N = 58$), .88 (post, $N = 46$) and .87 (follow-up, $N = 37$).

Strength and Difficulties Questionnaire (SDQ)

The SDQ is a brief (25-item) behavioral screening inventory widely used to assess mental health in children [42]. SDQ has shown good psychometric properties indicated by satisfying internal consistency, test–retest stability and inter-rater agreement, as well as proper criterion validity when compared with other measures of psychopathology [43]. The proposed factor structure has also been replicated and confirmed with a Swedish population [44, 45]. The subscales capturing peer problems, hyperactivity-inattention, pro-social behaviors as well as the total sum score were used in the current study. Only the parent-rated version was employed. Internal consistencies (Cronbach's alphas) with this sample were .68 (peer problems), .73 (hyperactivity-inattention), .76 (pro-social behaviors) and .71 (total sum) at baseline ($N = 58$).

Parent Practices Interview (PPI)

The PPI is an 80-item questionnaire measuring parenting skills and strategies [14, 46]. Moderate to high test–retest reliability has previously been reported with this measure [35]. In the current study we included the subscales Harsh and inconsistent discipline and Praise and positive incentives, previously reported by the developers of the instrument [47]. In the present sample, Cronbach's alphas for the subscales were .78 (Harsh), respectively, .72 (Praise) at baseline ($N = 58$).

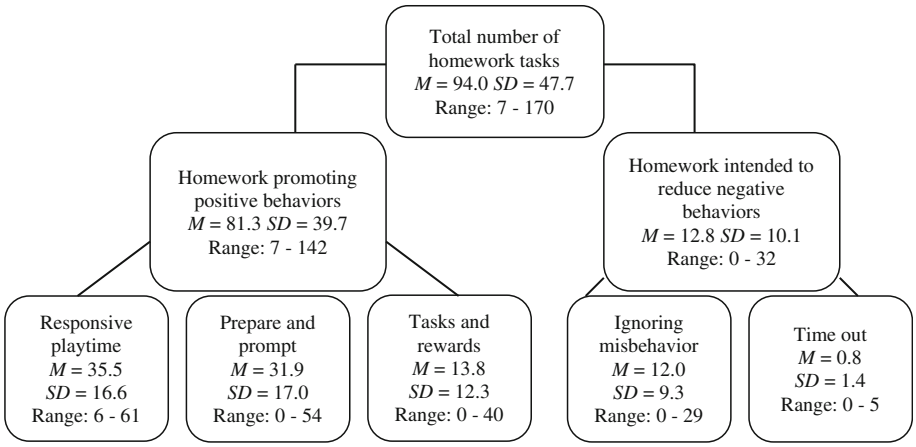

Fig. 2 Means, SDs and ranges of homework assignments completed by parents ($N = 29$)

Homework Assignments

By the end of each session, parents were given a summary and an outlined instruction on what homework to engage in during the following week. Parents were asked to register, on the website, how often they intended to practice (number of days), for how long each day (number of minutes) and how they planned to implement the strategy at home (by writing a few lines) in order to establish commitment to the tasks. A minimum level of homework activity per week was recommended, e.g., three days of practice with at least 15 min each day. This minimum recommended level increased by each subsequent session, as parents learned more and more strategies, and were encouraged to practice the most recently learned strategy, as well as previous strategies. Parents were then instructed to log on to the website every day to register homework activities. The form where completed homework assignments were registered was divided into all days of the week, so that it would be apparent on which days parents had practiced. A research assistant monitored each family's progress through the program, and made sure that homework assignments were conducted and registered properly, at the end of every week, before giving access to the next session. During the first week of the program, parents could only register one kind of homework activity, Responsive playtime, since they had only learned that particular strategy. After the second session, the next homework assignment was added and parents could register when they had practiced Responsive playtime and/or Prepare and prompt, etc. See Table 1 for descriptions of the different homework assignments, and when they were introduced in the program. All in all, six assignments were handed out, and registered by parents, during the seven sessions of the program: Responsive playtime, Prepare and prompt, Tasks and rewards, Ignoring misbehavior, Problem solving and Time out. Additionally, during week three of the program, parents were given an assignment where they provided positive reinforcement to their children whenever adaptive behaviors were exhibited. This assignment was however not registered, partly because parents could be expected to exercise this task so frequently that it would be unreliably reported and partly because positive reinforcement was an integral part of other homework assignments (e.g., Responsive playtime) and was therefore not a distinct technique. For each kind of homework, a total sum score was calculated indicating how many times during the entire program that a parent had practiced that particular assignment. All sum-score variables were normally distributed except for Problem solving that showed extreme kurtosis. This variable was therefore excluded from all analyses. Furthermore, two additional sum scores were calculated. One was the total number of Homework promoting positive behavior, including Responsive playtime, Prepare and prompt as well as Tasks and rewards. The other was the total number of Homework intended to reduce negative behavior, including Ignoring misbehavior and Time out. Finally, a total sum score was calculated for all homework assignments completed during the program (see Fig. 2).

Statistical Analyses

The main aim of the current study was to evaluate maintenance of effects from the Internet-based PMT program, from post-test to follow-up. Paired samples t tests were used to investigate differences between post-measurement and follow-up means, as well as between baseline and follow-up means. The main results presented in the following section are based on analyses of data from participants who responded at both post-measurement and the 18-month follow-up, i.e., the analytic sample thus comprised 32 participants (55.2 % of the intervention group). To verify the results, analyses were also conducted on a

complete dataset ($N = 58$) where missing values were imputed using the Expectation Maximization (EM) method (with estimations based on observed values for demographic and clinical features at baseline, as well as on all outcome measures). The results from analyses based on complete responders ($N = 32$) and those conducted on the full sample with imputations for missing values ($N = 58$) were equivalent on all accounts but one (concerning post to follow-up changes in praiseful parenting practices). Cohen's d effect sizes are presented with .2 indicating a small effect, .5 a medium effect and .8 a large effect [48]. Analyses of homework completion as a predictor of pre to post and pre to follow-up changes were performed with bivariate linear regressions. Parents of 29 children with full information on homework completion, as well as with post-measurement and 18-month follow-up data, were available and these families were included in the analyses. Scatter plots of the 8 predictors against the two outcome variables were created to detect possible outliers. An alpha level of $p < 0.05$ indicated statistical significance.

Results

Were the Improvements Maintained at 18-Month Follow-Up?

Table 2 displays parent-reported conduct problems at baseline, post treatment and 18-month follow-up, as well as post to follow-up changes on all outcome measures. Conduct problems decreased significantly by 18.7 % on the intensity subscale of ECBI, during the 18-month follow-up period, reflecting an effect size in the small range. The SDQ subscales measuring hyperactivity and prosocial behaviors remained stable between post and follow-up, suggesting that pre-to post-improvements from the self-directed PMT program were maintained. The level of peer problems also remained unchanged during the follow-up period. A significant deterioration of praiseful parenting practices (PPI subscale) was noted between post and follow-up, with a moderate within-group effect size (this deterioration was however not significant when analyses were conducted with the full sample, $N = 58$, with EM-imputation for missing values, $t(57) = 1.69$, $p = 0.10$). The level of harsh and inconsistent parenting practices on the other hand remained unchanged from post to follow-up, indicating retention of pre- to post-improvements on the PPI subscale.

To offer a more perspicuous description of the long-term effects of the iComet program and to allow for comparisons with other studies, additional analyses on changes in conduct problems from pre-treatment to the 18-months follow-up were conducted. These analyses suggested large within-group effect sizes for the ECBI-IS [$t(36) = 12.4$, $p < 0.001$, Cohen's $d = 2.11$] and the ECBI-PS [$t(36) = 12.3$, $p < 0.001$, Cohen's $d = 2.32$].

Predictors of Outcome at Post-treatment and Follow-Up

To investigate the importance of homework compliance, a series of bivariate regression analyses were conducted where different categorizations of training tasks were entered as predictors of pre to post (short-term) changes, as well as pre to follow-up (long-term) changes, in conduct problems (indicated by ECBI-IS change scores). Means, standard deviations and ranges for each predictor are

Table 2 Means and SDs of study variables and post to follow-up effect sizes, for participants who responded at all time points ($N = 32$)

Measure	Pre		Post		Follow-up		Maintenance Effect (T2 − T3)	
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*t* test	Cohen's *d*
ECBI								
Intensity scale	148.4	(15.7)	113.4	(45.9)	92.2	(22.5)	2.46*	.43
Problem scale	18.2	(5.3)	6.8	(4.9)	4.9	(4.1)	1.97	.35
SDQ								
Total sum	11.2	(4.6)	7.8	(5.2)	6.6	(3.0)	1.34	.24
Hyperactivity	3.8	(2.5)	2.7	(1.9)	2.8	(2.0)	−.40	.06
Peer problems	1.9	(1.9)	1.5	(1.9)	1.0	(1.3)	1.58	.29
Pro-social[a]	6.2	(2.0)	7.3	(1.6)	7.7	(1.5)	−1.35	.09
PPI								
Harsh and inconsistent discipline	50.0	(10.3)	42.9	(8.4)	42.7	(8.3)	.10	.03
Praise and positive incentives[a]	45.2	(8.8)	51.4	(6.9)	47.7	(7.1)	3.53**	.65

ECBI Eyberg Child Behavior Inventory, *SDQ* Strength and Difficulties Questionnaire, *PPI* Parent Practices Interview

* $p < 0.05$; ** $p < 0.01$

[a] A higher value indicates better parenting/child behavior on this scale

Table 3 Bivariate regression analyses of homework categories as predictors of pre to post as well as pre to follow-up changes in conduct problems

Predictors	ECBI-IS Pre to post change					ECBI-IS Pre to follow-up change				
	B	*SE B*	β	*p*	R^2	*B*	*SE B*	β	*p*	R^2
Homework promoting positive behaviors (sessions 1–10)	.01	.01	.32	0.088	.10	−.01	<.01	−.29	0.120	.08
Homework intended to reduce negative behaviors (sessions 5–10)	.06	.02	.50	0.005	.25	−.01	.01	−.13	0.500	.02

provided in Fig. 2. As evidenced, parents' total number of completed homework assignments during the intervention was large ($M = 94.0$, $SD = 47.7$, range 7–170), indicating that parents on average completed 1.34 assignments per day during their participation in the PMT program. Homework assignments introduced early in the program (promoting positive behavior) were more frequently practiced, $M = 81.3$ and $SD = 39.7$, than strategies appearing later on (intended to reduce negative behavior), $M = 12.8$ and $SD = 10.1$ [$t(28) = 10.43$, $p < 0.001$].

There were no significant correlations between number of completed sessions and changes in conduct problems (measured by ECBI-IS) from pre to post, or from pre to follow-up ($r = .26$, $p = 0.15$ and $r = .02$, $p = 0.90$ respectively) in the current sample. Thus, a concern that the number of completed sessions might be a confounding variable, associated with both the outcome and the predictors, was not warranted.

The total number of homework assignments performed during the intervention was entered as a predictor of change in conduct problems. Total number of homework tasks was a significant predictor of the short-term [$\beta = .37$, $t(28) = 2.10$, $p = 0.045$, $R^2 = 0.14$] but not the long-term [$\beta = -.27$, $t(28) = 1.48$, $p = 0.15$] changes in conduct problems. As illustrated in Table 3, the two subcategories of homework tasks were entered as predictors of short-term as well as long-term outcome. Homework tasks intended to reduce negative behavior, but not Homework tasks promoting positive behavior, was a significant predictor of the short-term outcome, explaining 25 % of the variance in conduct-problem change. Neither Homework tasks promoting positive behaviors, nor Homework tasks intended to reduce negative behavior were significant predictors of the long-term outcome.

Each specific kind of homework task (e.g., Responsive playtime, Prepare and prompt, etc.) was then entered as a predictor of short- and long-term changes in conduct problems, in a series of bivariate regressions analyses. The number of times parents practiced Ignoring misbehavior predicted the short-term outcome [$\beta = .48$, $t(28) = 2.88$, $p = 0.007$], explaining 23 % of the variance in conduct problem change, but not the long-term outcome [$\beta = -.12$, $t(28) = .65$, $p = 0.522$]. Similarly, parents' use of Time out was a significant predictor of short-term changes in conduct problems [$\beta = .39$, $t(28) = 2.23$, $p = 0.034$], explaining 15 % of the variance, but Time out did not predict long-term changes in conduct problems [$\beta = -.12$, $t(28) = .65$, $p = 0.520$]. None of the homework assignments intended to promote positive behavior, Responsive playtime, Prepare and prompt, and Tasks and rewards was a significant predictor of short-term [$\beta = .22$, $t(28) = 1.17$, $p = 0.252$; $\beta = .33$, $t(28) = 1.87$, $p = 0.072$; $\beta = .28$, $t(28) = 1.56$, $p = 0.130$] or long-term [$\beta = -.24$, $t(28) = 1.32$, $p = 0.199$; $\beta = -.34$, $t(28) = 1.90$, $p = 0.068$; $\beta = -.16$, $t(28) = 0.86$, $p = 0.395$] changes in conduct problems.

Discussion

The two main objectives of the present study were to assess the long-term effects of an Internet-based PMT program and to evaluate the predictive effect of parents' reported completion of homework assignments during the program. The findings showed that child conduct problems decreased after the intervention and that post-measurement levels of hyperactivity, pro-social behavior and harsh parenting practices were unchanged to the 18-month follow-up. Praiseful and positive parenting, on the other hand, declined during the follow-up period. The cluster of homework assignments intended to reduce negative behavior, but not tasks promoting positive behavior, predicted pre- to post-changes in conduct problems. No specific homework, or category of tasks, predicted long-term changes in conduct problems.

As previously demonstrated in Enebrink et al. [27], the Internet-based PMT program was effective in reducing child conduct problems (ECBI-IS and ECBI-PS) in the short term with effect sizes in the medium range, when the intervention group was compared to WL families. Child hyperactivity was significantly reduced and pro-social behaviors among children increased, while at the same time parents reported less use of harsh parenting practices, as well as increased use of positive and praiseful parenting skills, by the end of the PMT program. At the 18-month follow-up, post-measurement levels of conduct problems and other outcomes were either retained or had improved, except for praiseful and positive parenting that had

deteriorated somewhat. The within-group effect sizes (comparing pre-treatment to 18-month follow-up means) of the program were large for reductions of conduct problems (Cohen's $d = 2.11$ and 2.32 with ECBI-IS and ECBI-PS, respectively). The 18-month follow-up level of conduct problems (ECBI-IS: $M = 92.2$, $SD = 22.5$) in the current sample was within one-fifth standard deviation of the Swedish norm group level (ECBI-IS: $M = 88.2$, $SD = 26.0$, $N = 841$) as reported by Axberg et al. [39]. To put these results into a context, it can be noted that 25 participants (71.4 % of families who responded at follow-up, $N = 37$) were within ½ SD of the norm group mean by the time of the 18-month follow-up. In relation to the full sample ($N = 58$), this means that at least 43.1 % of the entire intervention group had basically no conduct problems as they were on a level that corresponds to the mean for a normal population of children, 18 months after termination of treatment. The effects of the PMT program could be compared to the mean within-group effect size of .87 (pre to follow-up), reported by Lundahl et al. [20], for follow-up studies of parent training programs. Given that the studies included in the Lundahl meta-analysis were mostly face-to-face programs and without exceptions had follow-up periods equal to or shorter than 12 months, this Internet-based PMT program appears to contribute to a sizeable and long-lasting change in children. Comparable results, but with younger children, were reported by Sanders et al. [26] in a study where baseline to three-year follow-up effect sizes were 1.70 and 1.18 (mother/father-reported ECBI) for children whose parents had received the self-directed version of the Triple P program.

The short- and long-term efficacy of these self-directed PMT programs may be explained by parents' motivation to independently seek solutions to child related issues. Many parents are accustomed to implementing strategies dealing with potty training, sleep habits, termination of breast-feeding etc., from information received online or from parenting books. Provided that the information is understandable and correct, this approach should also be viable in the context of parenting strategies for conduct problems. Another possible explanation could be that parents who participate in self-directed PMT programs may be more prone to attribute any reductions of child conduct problems to themselves (i.e., leaving the program with more self-efficacy), as opposed to a therapist or a group leader. If this is the case, then the improvements may be more durable, than those achieved in face-to-face programs. The conclusion reached by O'Brien and Daley [22] in a review, that self-directed PMT programs are less effective in the short term, when compared with therapist-led programs, but equally effective over the longer term, may be a reflection of this. The extent to which parental motivation and self-efficacy contributed to the positive outcomes was however not evaluated in the current trial. It would be interesting if future studies included measures of these constructs, ideally within the frames of a comparison of face-to-face and self-directed PMT, to establish if motivation and self-efficacy are related to the short- and long-term outcomes.

As evidenced in Fig. 2, Homework assignments promoting positive behavior was practiced to a far greater extent during the program than homework related to negative behavior. This might be, at least partly, a reflection of the order in which the different assignments were introduced. Responsive playtime was introduced during the first session, and was the most commonly practiced assignment, whereas Time out was the last strategy introduced, and was practiced to a much lesser extent (86.2 % of participants reported practicing Time out less than three times during the intervention and 13.8 % completed between three and five rounds of practice). Furthermore, when homework tasks intended to reduce negative behavior were introduced during the second half of the program, parents were consistently encouraged to continue practicing previously learned tasks such as Responsive playtime and Prepare and prompt. Parents were also reminded that assignments promoting positive behavior formed the basis of the program and that the tasks Ignoring misbehavior and Time out were to be used with caution and only when other alternatives had been exhausted. Notwithstanding these conditions, parents' implementation of the Ignoring misbehavior and Time-out tasks were the only significant predictors of short-term change in conduct problems, whereas Responsive playtime, Prepare and prompt and Tasks and rewards were not. Furthermore, when the five specific homework assignments were divided into two main functional categories of assignments (Homework promoting positive behavior and Homework intended to reduce negative behavior), only the latter category predicted the short-term outcome. This was a somewhat counterintuitive finding, given the emphasis in most PMT programs on parental skills that promote adaptive child behaviors (e.g., positive reinforcement), rather than on limit-setting skills. These results should however be interpreted with some caution as the study design restricts the comparability of the two different categories of homework tasks. Particularly because the different tasks were introduced to parents in a specific order (tasks promoting positive behavior first, and then tasks intended to reduce negative behavior) it may be the case that the limit-setting techniques were effective *because* they had been preceded by techniques that targeted and intended to increase positive child behaviors. The traditional sequential ordering of components in PMT programs is based on the assumption that limit setting is more effective when it occurs within the frames of a positive parent–child relationship, but this hypothesis,

however, has rarely been tested. A study by Eisenstadt et al. [49] explored the impact of the order in which the two main categories of components were introduced by allocating parents to receive PMT in either the traditional way (the relationship-strengthening part first and limit-setting part later) or in the reversed order (the limit-setting part first and the relationship-strengthening part later). The results indicated that there were few differences in outcomes between the groups and those differences that were significant favored children of parents who had received the limit-setting part first. All in all, it might be the case that there are alternative ways to structure PMT programs, with a more evenly distributed emphasis on relationship-building *and* limit-setting components, to possibly achieve better effects.

The short-term outcome was predicted by parents' completion of some of the homework assignments, but long-term changes in conduct problems could not be predicted by any of the stipulated variables. This may partly be explained by the proposed dynamic processes, or cascading effects [12], that take place following PMT interventions. Patterson et al. [12] argued that PMT programs, based on SIL theory, through the reduction of coercive patterns and enhancement of positive family interactions, launch a long chain of change processes that expands outside the family, affecting a wide array of environmental factors in the child's surrounding, and thereby alters the mapped developmental trajectory. The interlinked events that follow the participation in a PMT program may therefore be quite complex and the various homework assignments conducted during the brief program may not necessarily be linearly associated with the outcome by the time of the long-term follow-up.

Even though the acquisition and use of skills is often emphasized in behavioral interventions, only a limited number of studies have investigated the frequency of skills training, and its relation to the outcome [50]. We often derive evidence for the effectiveness of various treatment components from basic research when they are included in protocols and manuals, but to ensure that these components remain effective, when they are part of a larger treatment package, they should also be examined as predictors of outcome when placed alongside other treatment components. In the context of parent training, a few previous studies suggest an association between homework compliance and reductions of child conduct problems [32, 34] and in adjacent clinical areas, there is a growing body of evidence reporting the same thing. A recent meta-analyses concluded that the weighted mean correlation between homework compliance and treatment outcome was $r = .26$ (i.e., approximately 7 % explained variance) in CBT-studies on adult subjects [51]. Another recent CBT-study found homework compliance to account for 10 % of the outcome variance in an adult anxiety population [52], which is comparable to the 14 % explained variance in the present study when predicting the short-term outcome from the total number of completed homework assignments.

Future studies should combine measures of homework quantity and quality, to more thoroughly investigate what aspect of compliance that is important for the treatment outcome. Furthermore, there is a need for more long-term evaluations of self-directed PMT programs, particularly given that the short-term effectiveness of these programs have been reported on numerous occasions [22] and that their potential cost-effectiveness could make them appealing alternatives to face-to-face PMT programs.

A few limitations of this study should be noted. A single source of information (parent reports) was used for all outcome variables. It would have been preferable to include direct observations of parent–child interaction to further validate the findings. Furthermore, with the current study design, only within-group analyses were feasible, making it difficult to estimate and account for any spontaneous remission that may have occurred for some of the children during the follow-up period (unrelated to the PMT program). The substantial attrition may also have systematically affected the results, even though drop-out analyses did not indicate this to any greater extent. Non-responders at 18-month follow-up did improve to a lesser extent in praiseful parenting, compared with responders, during the intervention, but it is unclear whether this tendency impacted the outcome of the 18-month follow-up. Results for post to follow-up changes with the PPI praiseful parenting measure did also differ between analyses conducted on complete responders ($N = 32$) and those based on the full sample with imputation of missing values ($N = 58$), where the former suggested deteriorations and the latter retention of previous treatment gains. All in all, the interpretation of our follow-up results with the PPI praiseful parenting measure should be made with some caution. Lastly, due to the small sample size, caused by attrition, and the subsequent lack of power, the results should be interpreted cautiously. Future replications using larger sample size and more sensitive instruments are called for.

Summary

The Internet-based PMT program has previously been found efficacious in the short term and the present study showed that parents who responded at follow-up reported further alleviations of child conduct problems, 18 months after treatment. This indicates that self-directed interventions like the iComet, with limited therapist support, could be viable options to more established face-to-face PMT programs. Pre- to post-improvement was predicted by parents' implementation of Homework assignments

intended to reduce negative behavior. This underlines the importance of encouraging parents to engage well in these homework assignments, commonly presented during the last sessions of PMT programs, to achieve the best possible outcome.

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