Original article

A pilot study of combining social skills training and parenting training for children with autism spectrum disorders and their parents in Japan

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Abstract

The purpose of this study is to investigate the effects of a program containing a combination of social skills training (SST) and parenting training (PT) for the enrichment of social interaction skills and reduction of parenting stress for children with high-functioning autism spectrum disorder (HFASD) and their parents in Japan. Twenty-two patients with HFASD from second to fourth grade and their parents were assigned to a training group (TG) or treatment as usual (TAU) and compared. The children with HFASD and their parents who were assigned to the TG participated in the manualized program for over a period of five to six months. Subjects provided demographic and medical information and completed teacher and parent-rating scales for social competence (Social Responsiveness Scale-2: SRS-2) and parent-rating of parenting stress (Parental Stress Index: PSI) and mental health (General Health Questionnaire-28: GHQ-28). The participants exhibited some improvements pre-, middle-, and post-treatment, particularly regarding the GHQ, PSI and SRS-2, as reported by parents. However, the social skills improvement reported by teachers was not significant. At the three-month follow-up, parent-rated GHQ and PSI maintained improvement, and SRS-2 achieved the greatest improvement from the baseline rating. Although some findings indicate that a program combination of SST and PT might be useful for enhancing social skills and improving parental stress and mental health, some subscales did not show a sufficient effect. Future research should consider program contents and provide longitudinal follow-up data to test the durability of the treatment.

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1. Introduction

According to the Diagnostic and Statistical Manual for Mental Disorders, Fifth Edition (DSM-5), autism spectrum disorder (ASD) is characterized by qualitative
impairment in social interaction and communication, as well as restricted, repetitive and stereotyped patterns of behavior, interests and activities [1]. Prevalence rates of ASD are 1.81% in Japan [2], 2.00% in the U.S. [3], and 2.64% in Korea [4]. The number of youths diagnosed with ASD has increased significantly over the past fifteen years [5], and both empirical and clinical evidence suggests that children with high-functioning autism spectrum disorders (HFASD) may be the fastest growing segment of the ASD population [6] to be placed in regular education classrooms. Because these children are aware of their social limitations, they report feeling lonelier and more alienated than their typically developing classmates [7].

Impairments in social communication skills are a core feature of ASD and include deficits in social-emotional reciprocity, non-verbal communicative behaviors used for social interaction and developing, maintaining and understanding relationships. Children with HFASD do not simply “outgrow” these communication skills deficits; rather, these difficulties persist into adulthood, where they continue to negatively impact social and occupational functioning. Adults with HFASD are much more likely than the general population to be unemployed or underemployed, avoid social contact abnormally and have a secondary psychiatric disability [8,9]. Given the pervasive impact and long-term nature of these deficits, programs for the enrichment of relational skills for children with HFASD implemented in early childhood might prevent or at least attenuate subsequent social dysfunction. When developing an SST program for children with HFASD in Japan, target skills have to be well-considered because social communication skills required in Japan differ from those of other countries. For example, it is more important to consider the other person’s feelings than to clearly express one’s own opinion in Japan. Thus, it is necessary to develop SST programs specialized for Japan based on all overseas SST programs.

Social skills can be defined as specific behaviors that result in positive social interactions and encompass both verbal and non-verbal behaviors necessary for effective interpersonal communication [10]. Examples of social skills include smiling and making eye contact, asking and responding to questions, and giving and acknowledging compliments during a social exchange [11]. Social skills in childhood have been consistently linked to positive developmental outcomes, including peer acceptance, academic achievement, and mental health [12].

In a recent meta-analysis, the social skills group for ASD, aged 6–21 years old, improved overall social competence (The effect sizes [ES]; d, d = 0.47, 95% confidence interval [CI] 0.16–0.78, P = 0.003) and friendship quality (ES = 0.41, 95%CI 0.02–0.81, P = 0.04) [13]. On the other hand, this study showed that there was no effect on parental depression. Additionally, in a recent systematic review, a moderator analysis of the autistic traits and social behaviors showed that group social skills interventions that include parent groups, and are of greater duration or intensity, obtained a larger ES [14]. One of the problems in SST for children with ASD is that generalization is difficult [15]. The clinical impression is that parental involvement in interventions increases generalization of the learned skills. Parents may remind children to practice and to apply their learned skills in various situations in daily life. This may be especially beneficial to children with ASDs who generally have difficulty learning and changing behavioral patterns. There is no better way to improve the effect of SST for children with ASD than to innovate behavioral techniques for their parents.

The Program for the Education and Enrichment of Relational Skills (PEERS® [16]) is a manualized group social skills intervention for adolescents and with ASD. Recently, Frankel et al. have evaluated Children’s Friendship Training (CFT), a children’s version of PEERS® involving a manualized parent-assisted intervention to improve social skills [17]. Findings showed the CFT group was superior to the control group on the parent measure of social skills in the post-test and maintained this at the three-month follow-up. In this way, there are effective manualized group social skills interventions for children, but there is no Japanese version. Given Japanese cultural characteristics, it is very common to care more about someone else’s feelings than to defend one’s own perspective. Thus, the social skills that are required in Japan are different from other countries. This should be considered in the development of social skills interventions for children with ASD that follow a previous Japanese social skills training. Our hypothesis 1 is that the Japanese version of the SST program for Japanese children with HFASD enhances social interaction skills.

Raising a child with HFASD is associated with increased family chaos and parent distress. The limited research on family and parent outcomes, which to date has primarily stemmed from the evaluation of parent training (PT) programs, suggests a number of family- and caregiver-level benefits of interventions, including improved family relationships [18] and reduced levels of parenting stress and depression [19].

The PEERS® intervention, which includes social skills interventions, and extensive parent involvement throughout treatment, achieved beneficial effects for the experimental group in the domain of family chaos compared to the waitlist control. However, there was no significant difference between groups over time in total parenting stress. Thus, our hypothesis 2 is that the program combining SST for children with HFASD and PT for their parents enriches relational skills for interactions with their peers and parents, and decrease parenting stress.
Against this background, the present study examines the effectiveness of the Japanese version of the program, consisting of behavioral SST and PT for patients with HFASD and their parents in a clinical setting, in enhancing social interaction skills and reducing parenting stress.

2. Methods

2.1. Subjects

Eligible participants of this study were 39 pairs of University Hospital Department of Pediatrics patients and their parents between April 2012 and April 2017. Interested persons were sent study information sheets, and application forms at their doctor’s recommendation, and appointments were scheduled upon receipt of their informed consent during the intake assessments. Requirements for participation included: 1) an autism spectrum disorder diagnosis confirmed by a pediatrician, 2) achievement of a Wechsler Intelligence Scale for Children Third Edition (WISC-III) or a Fourth Edition (WISC-IV) pre-rated full-scale IQ score of 70 or above, 3) child aged 8–11 years, and 4) attending a regular classroom at the time of the baseline assessment. Exclusion criteria were 1) a parent with a severe mental disorder, 2) a parent being judged as inadequate to enter group therapy by their doctor.

2.2. Procedure

Children and their parents who were diagnosed according to DSM-5 diagnostic criteria based on behavioral observations and parental interviews conducted by an experienced child neurologist were included in the study. Participants were referred to the study by the attending physician according to the inclusion and exclusion criteria and eligibility criteria. Of these, the affected children and their parents who consented to participate were first enrolled on a waitlist to represent treatment as usual [TAU]. After enrollment, the flow of the study was as shown in Fig. 1. This study is quasi-experimental, and participants who were registered on a waitlist (after answering a questionnaire as the TAU group) were able to enter training after one year. N = 20 were collected as TG and N = 19 as TAU. Instruments (as indicated below) were administered to the parents of patients in the TAU group during the first visit to pre-training in the training group (TG) at baseline (Time 1; T1). The same parent-rating questionnaires were also used during the sixth session, that is, after SST (Time 2; T2) and in the TAU group three months after the first administration. After completion of the training, that is, after PT (Time 3; T3), the same questionnaires were administered to the TG and the TAU group six months after the first administration.

Participants in the TG answered the questionnaire after the three-month follow-up (Time 4; T4; see Fig. 1). The patient’s teachers of completed questionnaires at T1 and T3. This study was approved by the ethical review board of the Dokkyo Medical University Saitama Medical Center (1815) and the University of Tokyo Health Sciences (17-27H), Japan. Written informed consent was obtained from all participants.

2.3. Measures

2.3.1. Eligibility measure

Wechsler Intelligence Scale for Children-3rd and 4th revision (WISC-III [20] and WISC-IV [21]). The WISC, developed by David Wechsler, is an individually administered intelligence test for children between the ages of 6 and 16, which can be completed without reading or writing. The subtests of the Third Edition (WISC-III) were organized into Verbal and Performance scales and provided scores for Verbal IQ (VIQ), Performance IQ (PIQ), and Full Scale IQ (FSIQ). The subtests of the Fourth Edition (WISC-IV) were organized into Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), Processing Speed Index (PSI), and calculable FSIQ. All children were administered the WISC-III or WISC-IV.

2.3.2. Child outcome measure

Social Responsiveness Scale—Second Edition (SRS-2). The SRS-2 is a parent and teacher-report questionnaire, developed by Constantino and Gruber and currently the only commercially available social competency measure designed specifically for youth with ASD [22]. The scale was designed as a diagnostic tool and as a treatment-monitoring tool. The scale is a 65-item measure that covers social behaviors in addition to items related to other areas of autistic symptomatology, such as preoccupations, and other repetitive, stereotypical behaviors. The scale contains five sub-
scales: Social awareness (SRS-A), Social Cognition (SRS-Cog), Social Communication (SRS-Com), Social Motivation (SRS-Mot), and Autistic Mannerisms (SRS-Man). The SRS-2 is based on a normative sample of more than 1600 children (4–18 years of age) from the general population. The Japanese version of the SRS-2 was developed by Kamio et al. and the SRS-2 scores are converted to t-scores by using the conversion chart

Table 1
Overview of the Program (SST).

| Session | Didactic lesson | Description of the lesson | Skill Game | Homework |
|---------|----------------|---------------------------|------------|----------|
| 1       | Introduction and self-introduction skills | Children and parents are taught what the purposes of the SST program and children are introduced themselves to peer groups. (Nonverbal key point: voice volume, direction of eyes, physical direction) | Interview Game: Children have delivered a quarter paper in which they painted characters popular with kids. After children make themselves known to their peers, they interview each other on what painted in their papers. Through the self-introduction and interviews, children complete the picture. | none |
| 2       | Conversational skills I: Being a good listener | Children are taught how to be a better listener. Children understand that if they are a good listener, you can keep up a cheerful conversation and make a better impression on their peers. | “Who Am Me” Game: Children choose a paper that shows a character popular with kids blindly during each in turn. The child shows their chosen picture and asks the others for a clue about the character. While others provide hints, the child has to listen skillfully. | Behavior Rehearsal: Parents speak about something for half a minute and children practice being a good listener and having empathy with their parent. |
| 3       | Conversational skills II: Empathize with others | Children review what they learned in session 2. Children consider the appropriate supportive responses, depending on whether other people have positive feelings or negative feelings. | “A Magic Phrase” Game: Parents speaks about something for half a minute. Children consider whether parents have positive feelings or negative feelings offer a supportive response. Children also practice with the parents of themselves and others | |
| 4       | Provide encouragement to others | Children think about peers in trouble. Children provide encouragement when peers become depressed and come to the aid of peers who are in need. | Dice Game: Children roll a die corresponding to a story written about various situations. In the situation on the die, children provide encouragement to others. | Behavior Rehearsal: Children roll a die corresponding to a story about various situations and demonstrate the program-taught skills. |
| 5       | Peer interaction strategies | Children are given instruction about the precise steps involved in joining conversation and play with peers. | Puzzle Game: One chosen child has one piece of a puzzle that others are trying to put together. When the child enters the room, the others can finish the puzzle. | |
| 6       | Asking someone for something and turning down someone’s request | Children learn how to ask someone for something and turn down someone’s request. Children consider how someone and they feel about this and describe it with words. | “Complete The Picture With Peers” Game: Children color, cut, and paste pieces of paper to paint a picture. Children ask to borrow a colored pencil, scissors or glue. And children practice turning down other’s requests that are made to them | |
that was made when the standard Japanese version was created [23]. The total SRS-2 t-score of 59 or less as a normal range; people with a score of 60–65 were categorized as mild, people with a score of 66–75 were categorized as moderate and people with a score of over 76 were categorized severe [23].

2.3.3. Parent outcome measures

General Health Questionnaire-28 (GHQ-28). The GHQ-28 is a 28-item self-administered screening tool designed to detect nonpsychotic psychiatric illnesses [24]. The GHQ-28 has been shown to be reliable and valid. The GHQ-28 has four subscales: somatic symptoms, anxiety-insomnia, social dysfunction, and severe depression, each consisting of seven items. The items were scored using a Likert-type scoring system, i.e., 1, 2, 3 and 4, for the response categories; these scores were then converted into the corresponding binary values of 0, 0, 1 and 1. The sum of the scores can be interpreted as an indicator of the severity of psychological distress. The subjects were classified into higher and lower GHQ-28 groups based on a cutoff score of 8. The Japanese version of the GHQ-28 was developed by Nakagawa and Oubou [25], and the validity was proven by Suda, Nakayama and Morimoto [26].

Parental Stress Index (PSI). The PSI consists of 120 items measuring the subjective burden, labeled as parenting stress of adults parenting children from a newborn age up to 12 years old. The PSI is a self-reported scale developed in the U.S. [27]. The Japanese version of the Parenting Stress Index consists of a 76-item self-scored questionnaire. The Japanese version of the PSI was developed by Narama et al., and the validity and reliability have been proven [28].

2.4. Program content

The patients and their parents receiving SST with PT attended 12 biweekly group intervention sessions, each 120 min in length. The intake session began with an interview and case formulation about the children's social skills and parents' parental skills, and the parenting stress level, based on the functional analysis. The SST session and PT session were manualized [29]. The SST session included self-introduction skills (session 1), conversational skills I (session 2), conversational skills II (session 3), providing encouragement to others (sessions 4), peer entry strategies (session 5) and asking someone and turning down someone's request (session 6). The PT session included reinforcement strategies (session 7 and session 8), environmental setting and reinforcement (session 9), task analysis and reinforcement (session 10), functional analysis (session 11) and a general overview (session 12; see Table 1). The group sessions were facilitated by a clinical psychologist and behavioral therapist (J.O.). On the basis of the principles of behavioral analysis, a therapist practised SST for the first 90-minutes. For the remaining 30-minutes, a therapist explained contingency learning to each parent (e.g., if we can give good cues, a target behavior can occur, and there is praise reinforcing the appropriate behaviors) and built parents' supportive relationships with their children. At the PT session, the therapist and parents discussed how to motivate a target behavior and alternative behaviors (e.g., if your child hit their younger brother, the child should come to share their feelings and thoughts with a parent as an alternative behavior), subsequently engaging in a role-play about the plan and practicing the approach in the homework.
2.5. Intervention design and statistical analysis

Two-sample Mann-Whitney U tests, or \( \chi^2 \) tests, were used to examine the following demographic and clinical variables: age, grade, IQ, GHQ, PSI, and SRS-2 scores, each at baseline. The Mann-Whitney U test and ES were used to investigate differences between the interventions group vs. the TAU group in terms of treatment effects as measured by the change in scores (difference in values between the middle-point and baseline data (T2-T1), the end-point and baseline data (T3-T1) and the end point and middle-point (T3-T2) of each scale). In the TG, the ES was calculated between the baseline point and the three-month follow-up (T4-T1). Typically, values of 0.2 or below reflect a generally small ES, values around 0.5 reflect a moderate ES and values of 0.8 and above reflect a large ES [30].

3. Results

3.1. Baseline characteristics

In the TG, dropouts (N = 1) and cases with no pre- or post-data (N = 9) were excluded, resulting in N = 11 for analysis; in the TAU group, cases with no pre or post (N = 8) were excluded, resulting in N = 11 for analysis. In the TG, however, one patient’s teacher of did not answer at the four points (T1-T4), and the data was analyzed as missing. Missing values were imputed with the median. The age, grade, IQ, and scores on self-rated measures (GHQ, PSI, and SRS-2) did not differ significantly between the two groups at baseline (Table 2). Five patients (45%) in the TG group and five (45%) in the TAU group had a t-score of 76 or higher on the SRS-2, qualifying as having ASD-severe at baseline.

Medication statuses at the beginning of the program (and any changes during the program) were as follows: n = 1 used lamotrigine and sodium valproate (no change), n = 1 used methylphenidate and aripiprazole (increased the dose of aripiprazole), n = 1 used pimozide and lorazepam (discontinued lorazepam and administered properciazine), n = 1 used methylphenidate (no change), and n = 7 were not taking their medication in the TG. In the TAU, n = 1 used atomoxetine and risperidone (discontinued both atomoxetine and risperidone) and n = 10 were not taking their medication (n = 1 started taking aripiprazole during the intervention period and n = 2 started taking methylphenidate during the intervention period) (Table 2). The comorbidities of the participants were epilepsy in 1 participant and ADHD in 6 participants in the TG, ADHD and tic disorder in 1 participant and ADHD in 5 participants in the TAU group (Table 2).

### Table 2

Mean demographic and baseline variables for Treatment and Treatment As Usual groups (standard deviations are in parentheses).

| Group                           | Treatment n = 11 | Treatment As Usual n = 11 | p Value |
|--------------------------------|------------------|---------------------------|---------|
| Age (years)                    | 8.0 (0.7)        | 7.5 (1.1)                 | n.s.    |
| Grade                          | 2.9 (0.7)        | 2.5 (0.9)                 | n.s.    |
| IQ                             | 100.8 (18.5)     | 97.3 (17.7)               | n.s.    |
| Percent male                   | 2/11             | 3/11                      |         |
| Medications                    | Lamotrigine, Sodium Valproate (1), Methylphenidate, Aripiprazole (1), Methylphenidate (1), Pimozide, Lorazepam (1) | Atomoxetine, Risperidone (1) | |
| Comorbidity                    | Epilepsy (1), ADHD (6) | ADHD, TD (1), ADHD (5) | |

**Parent baseline measures:**

| GHQ                             | 13.6 (7.0)        | 10.7 (4.9)               | n.s.    |
| PSI C-total                     | 112.6 (17.0)      | 110.7 (15.5)             | n.s.    |
| PSI P-total                     | 121.0 (26.9)      | 119.8 (26.5)             | n.s.    |
| PSI total                       | 233.5 (35.7)      | 230.5 (41.6)             | n.s.    |
| SRS total                       | 78.9 (21.5)       | 79.6 (32.5)              | n.s.    |
| SRS-A                           | 10.7 (3.8)        | 10.8 (4.0)               | n.s.    |
| SRS-Cog                         | 14.0 (5.0)        | 16.2 (5.8)               | n.s.    |
| SRS-Com                         | 26.9 (10.4)       | 26.6 (12.7)              | n.s.    |
| SRS-Mot                         | 11.1 (2.9)        | 11.1 (6.8)               | n.s.    |
| SRS-Man                         | 16.2 (5.4)        | 14.9 (7.7)               | n.s.    |

ADHD: Attention-Deficit Hyperactivity Disorder, TD: Tic Disorder, GHQ: General Health Questionnaire, PSI: Parenting Stress Index, SRS: Social Response Scale-2, SRS-A: SRS social awareness, SRS-Cog: SRS-social cognition, SRS-Com: SRS-social cognition, SRS-Mot: SRS social motivation, SRS-Man: SRS autistic mannerisms.
Past medical care and education were as follows: n = 3 have received group therapy with a speech pathologist, n = 1 have received training at a local medical care and education center, and n = 7 have never had any medical training before the TG. In the TAU, n = 2 have received training at a local medical care and education center, n = 1 have received individual therapy with a speech pathologist, n = 2 have received support through support classes at school, and n = 6 have never had any medical training before.

3.2. Outcome measures

An examination of the findings in Table 3 shows that the results of the Mann Whitney U test applied to the change rate in scores of patient’s parents and teachers in the TG and the TAU group (i.e., T2-T1, T3-T2, T3-T1). Statistical significance was declared at p < .05, and values of p between 0.05 and 0.10 were considered a tend toward significance. Means and standard deviations for clinical measures at pre-test (T1), middle-test (T2), post-test (T3) and at three-month follow-up test (T4) are presented in Table 4. In the parent evaluation, significant differences were obtained for the GHQ T2-T1 (Z = −2.006, p < .05) and PSI-P total T3-T2 (Z = −2.102, p < .05) regarding the differences between the TG vs. the TAU group in terms of treatment effects as measured by the change in scores. Significant tends differences were obtained for the SRS-Cog T2-T1 (Z = −1.681, p < .10), SRS-Mot T3-T2 (Z = −1.879, p < .10), SRS-Man T2-T2 (Z = −1.711, p < .10) and PSI T3-T2 (Z = −1.809, p < .10) with regard to the change in scores. Regarding these changes in scores, the TG changed more positively than the TAU group; however, at the SRS-Cog T2-T1 (Z = −1.681, p < .10), the TAU group changed more positively than the TG. No significant difference was found the differences between the interventions group vs. the TAU group in the teacher evaluation (p’s > 0.31).

The rate of the patient’s parents’ normalization of psychiatric illness symptoms was raised from 18% at pre-treatment to 45% at post-treatment in the TG and from 27% at pre-treatment to 45% at the post-treatment in the TAU group.

3.3. Post-hoc power analysis

The ES (d) over 0.5, which is a moderate ES, were GHQ T2-T1 (d = 0.55), T3-T1 (d = 0.68), T4-T1 (d = 0.58), PSI C-total T3-T2 (d = 0.68), SRS-A T4-T1 (d = 0.51), SRS-Mot T4-T1 (d = 0.61), SRS-Man T2-T2 (d = 0.51), T3-T1 (d = 0.54) and SRS-total T4-T1 (d = 0.51) in the TG. In the TAU group, a moderate positive effect was observed for the SRS-Cog T2-T1 (d = 0.53), but a moderate negative effect was obtained for the SRS-A T3-T2 (d = −0.53; Table 4).

4. Discussion

This study was the first to compare the efficacy of combined therapy of SST and PT plus TAU (training group; TG) and TAU alone in patients with ASD and their parents in Japan. The purpose of this study was to examine two hypotheses: the Japanese version of an SST program for Japanese children with HFASD to enhance social interaction skills, and the program combining SST for children with HFASD and parent training for their parents to enrich relational skills to improve their relationships with their peers and parents and finally, decreasing parenting stress.

The results demonstrated a significant tendency for the positive differences obtained for the SRS-Mot T3-T2 (Z = −1.681, p < .10), SRS-Man T3-T2 (Z = −1.879, p < .10) and SRS-SUM T3-T2 (Z = −1.711, p < .10) regarding the differences between the TG vs. the TAU group in terms of treatment effects as measured by the change in scores in the parent evaluation. It suggests the possibility of showing that the TG showed more significant changes regarding autistic symptomatology, such as social cognition, social motivation and autistic manners than the TAU group in the PT session. The present findings show that social skills were significantly improved in the TG group compared to participants on the waitlist, which supports the results of previous studies [31,32], but findings were less significant in this study. Unfortunately, these differences were a significant tendency and not significant at all in terms T3-T1. At the three-month follow-up test (T4), however, the results showed that the TG obtained positive moderate ES of SRS-A T4-T1 (d = 0.51), SRS-Mot T4-T1 (d = 0.61) and SRS-total T4-T1 (d = 0.51). In other words, the findings suggest that the SST and PT program might not only maintain the effect but also lead to further improvement and that further study is required. Previous studies have found that positive effects are maintained at the three-month follow-up and support the findings of this study [32,33,17].

On the one hand, the generalization effect was negative. No significant difference was found regarding the
|                  | Pre-test | Mid-test | Post-test | FU-test | Pre-test | Mid-test | Post-test | T2-T1 | T3-T2 | T3-T1 |
|------------------|----------|----------|-----------|---------|----------|----------|-----------|-------|-------|-------|
| **Parent measures** |          |          |           |         |          |          |           |       |       |       |
| GHQ              | 13.55 (7.01) | 9.85 (6.18) | 9.00 (6.27) | 9.63 (6.46) | 10.67 (4.94) | 11.65 (5.10) | 9.90 (7.62) | <0.05 | n.s.  | n.s.  |
| PSI C-total      | 112.56 (17.00) | 119.36 (10.94) | 111.36 (12.40) | 107.73 (16.53) | 110.73 (15.48) | 109.82 (13.83) | 110.69 (19.23) | n.s.  | <0.10 | n.s.  |
| PSI total        | 120.99 (26.93) | 117.36 (24.29) | 110.24 (28.35) | 116.10 (28.50) | 119.82 (26.48) | 119.10 (21.34) | 120.58 (23.94) | n.s.  | n.s.  | n.s.  |
| PSI              | 233.55 (35.78) | 236.67 (29.33) | 221.60 (35.80) | 219.45 (40.52) | 230.55 (41.64) | 228.92 (33.26) | 231.27 (41.27) | n.s.  | <0.05 | n.s.  |
| SRS-A            | 66.00 (12.62) | 58.55 (17.20) | 62.18 (14.07) | 59.27 (13.97) | 66.64 (14.49) | 63.27 (10.91) | 69.09 (10.88) | n.s.  | n.s.  | n.s.  |
| SRS-Cog          | 67.27 (11.82) | 68.91 (8.89) | 66.36 (12.36) | 64.36 (10.01) | 72.73 (14.23) | 65.73 (11.86) | 68.91 (12.42) | <0.05 | n.s.  | n.s.  |
| SRS-Com          | 73.00 (13.96) | 71.91 (16.96) | 71.18 (15.95) | 67.54 (13.78) | 73.73 (18.66) | 69.64 (12.64) | 71.73 (14.70) | n.s.  | n.s.  | n.s.  |
| SRS-Mot          | 61.73 (7.95) | 62.36 (10.83) | 58.27 (10.86) | 56.36 (9.46) | 61.45 (18.51) | 58.64 (15.75) | 61.36 (15.08) | n.s.  | n.s.  | n.s.  |
| SRS-Man          | 81.09 (12.37) | 81.27 (14.44) | 74.00 (14.06) | 76.90 (14.02) | 79.00 (18.90) | 74.55 (16.10) | 79.00 (16.70) | n.s.  | <0.10 | <0.10 |
| SRS-total        | 74.00 (10.71) | 75.00 (12.95) | 70.55 (14.17) | 68.18 (11.95) | 75.18 (17.64) | 70.73 (13.73) | 73.73 (12.45) | n.s.  | <0.10 | n.s.  |
| **Teacher measures** |          |          |           |         |          |          |           |       |       |       |
| SRS-A            | 59.30 (7.10) | –         | 56.70 (10.34) | 60.50 (11.36) | 60.18 (13.27) | –         | 58.73 (12.52) | –     | –     | n.s.  |
| SRS-Cog          | 60.20 (8.75) | –         | 57.00 (8.34) | 60.40 (6.40) | 63.09 (16.68) | –         | 59.36 (14.89) | –     | –     | n.s.  |
| SRS-Com          | 63.20 (7.89) | –         | 59.00 (9.49) | 62.80 (7.21) | 62.73 (17.42) | –         | 61.64 (13.16) | –     | –     | n.s.  |
| SRS-Mot          | 55.30 (7.18) | –         | 52.70 (11.26) | 52.70 (5.96) | 57.45 (20.12) | –         | 55.55 (16.22) | –     | –     | n.s.  |
| SRS-Man          | 65.90 (10.10) | –         | 63.60 (10.48) | 68.60 (10.25) | 66.67 (21.29) | –         | 64.36 (21.28) | –     | –     | n.s.  |
| SRS-total        | 62.70 (7.80) | –         | 59.60 (9.01) | 63.10 (6.87) | 64.00 (19.21) | –         | 61.64 (16.69) | –     | –     | n.s.  |

GHQ: General Health Questionnaire, PSI: Parenting Stress Index, SRS-A: social responsiveness scale in the area of awareness, SRS-Cog: social responsiveness scale in the area of cognition, SRS-Com: social responsiveness scale in the area of communication, SRS-Mot: social responsiveness scale in the area of motivation, SRS-Man: social responsiveness scale in the area of mannerism, SRS-total: total score of social responsiveness scale.
The effect size of treatment and treatment as usual groups at pre-test, middle-test, post-test and follow-up-test.

|                        | Treatment group (n = 11) | Treatment as usual group (n = 11) |
|------------------------|--------------------------|----------------------------------|
|                        | T2-T1                    | T3-T2                           | T4-T1                           | T2-T1 | T3-T2 | T3-T1 |
| **Parent measures**    |                          |                                 |                                 |       |       |       |
| GHQ                    | 0.55                     | 0.13                            | 0.68                            | 0.58  | –0.20 | 0.27  | 0.77  |
| PSI C-total            | –0.47                    | 0.68                            | 0.08                            | 0.29  | 0.06  | –0.05 | 0.00  |
| PSI P-total            | 0.14                     | 0.27                            | 0.39                            | 0.18  | 0.03  | –0.07 | –0.03 |
| PSI total              | –0.10                    | 0.46                            | 0.33                            | 0.37  | 0.04  | –0.06 | –0.02 |
| SRS-A                  | 0.49                     | –0.23                           | 0.29                            | 0.51  | 0.26  | –0.53 | –0.19 |
| SRS-Cog                | –0.15                    | –0.16                           | 0.08                            | 0.27  | 0.53  | 0.29  | –0.22 |
| SRS-Com                | 0.07                     | 0.04                            | 0.12                            | 0.39  | 0.26  | –0.15 | 0.12  |
| SRS-Mot                | –0.07                    | 0.38                            | 0.36                            | 0.61  | 0.16  | –0.40 | 0.01  |
| SRS-Man                | –0.01                    | 0.51                            | 0.54                            | 0.32  | 0.25  | –0.27 | 0.00  |
| SRS-total              | –0.08                    | 0.33                            | 0.27                            | 0.51  | 0.28  | –0.23 | 0.09  |
| **Teacher measures**   |                          |                                 |                                 |       |       |       |
| SRS-A                  | –                        | –                               | 0.29                            | –0.12 | –      | –      | 0.11  |
| SRS-Cog                | –                        | –                               | 0.37                            | –0.03 | –      | –      | 0.24  |
| SRS-Com                | –                        | –                               | 0.48                            | 0.05  | –      | –      | 0.07  |
| SRS-Mot                | –                        | –                               | 0.27                            | 0.39  | –      | –      | 0.10  |
| SRS-Man                | –                        | –                               | 0.22                            | –0.27 | –      | –      | 0.11  |
| SRS-total              | –                        | –                               | 0.37                            | –0.05 | –      | –      | 0.13  |

GHQ: General Health Questionnaire, PSI: Parenting Stress Index, SRS-A: social responsiveness scale in the area of awareness, SRS-Cog: social responsiveness scale in the area of cognition, SRS-Com: social responsiveness scale in the area of communication, SRS-Mot: social responsiveness scale in the area of motivation, SRS-Man: social responsiveness scale in the area of mannerism, SRS-total: total score of social responsiveness scale.

differences between the TG and the TAU group in the teacher evaluation (p > .31). The results support Frankel et al.’s previous study, which found that teachers did not report significant findings for aggression and withdrawal [17]. Furthermore, the meta-analysis results showed that teacher reports were nonsignificant [34]. On the other hand, Deckers et al. were successful at demonstrating a positive generalization effect in the teacher rating [32]. They investigated the effectiveness of a 15-session SST with and without parent and teacher involvement (PTI) in a randomized controlled trial with three conditions: SST, SST-PTI and care as usual. Children in the SST-PTI group improved significantly more on the teacher social skill scale than those in the care as usual group [32]. The SST-PTI program contents are comprised of SST and an additional parent and teacher involvement, parent-participated psycho-education and interventions for enhancing desired behaviors and teacher-participated teacher-therapist meetings before the SST, as well as five telephone meetings with the therapist during the SST. Basically, for improving maintained effects in the teacher rating, it is necessary that teacher and therapist discuss the training and the skills to be addressed, as well as opportunities to support the child in practicing skills at school. The content of the program in this study also needs to be further examined.

We found that the SST intervention, including the PT group, was more effective for both parental mental health and parenting stress at the end of treatment than the TAU alone, given the result of GHQ T2-T1 (Z = −2.006, p < .05) and PSI-P total T3-T2 (Z = −2.102, p < .05). In addition, the positive moderate ES was stronger in the TG, GHQ T2-T1 (d = 0.55), T3-T1 (d = 0.68) and PSI C-total T3-T2 (d = 0.68). Furthermore, the three-month follow-up test showed that psychological symptoms were significantly improved only in the TG, as had also been found in previous studies [19]. It would be important to also include PT rather than just SST. There is no study that has examined SST interventions for children with ASD to reduce parenting stress. The participants in PEERS were tested, and parenting stress decreased, so parents also reported lower levels of parenting stress associated with adolescent mood and social isolation, but no childhood ASD [35]. In the PT intervention study, parents who received parenting training and participated in a support program for children with ASD, reported a reduction in parenting stress and an increase in parenting competence [36]. Based on this, though little research has tested how to reduce the parenting stress in SST interventions for children with ASD, this study worked on investigating this issue. SST interventions, including a PT program, have the potential for decreasing parenting stress for parents caring for children with ASD. We suggest that SST, combined with a PT program, may not only increase social skills for children with ASD but also reduce parenting stress for parents who have children with ASD.

Our study has several limitations. First, the present study was conducted as a quasi-experimentally designed open trial, not as a randomized controlled trial (RCT).
Furthermore, a research design that compares the SST group with the SST + PT group is needed to clarify the effect of adding PT to SST.

Second, limitations were evident in the outcomes reported by teachers. Teacher outcome variables failed to reach significance (p’s > 0.31) in our study. In a recent meta-analysis, Reichow, Steiner & Volkmar encountered the same limitation. Better results could be achieved by including discussions with teachers [13].

Third, this study obtained slightly lower effects than the previous study. Further research on the effectiveness of a program regarding the content, term and amount of time, for SST and PT patients with ASD and their parents is desirable.

Fourth, the number of participants and their parents was relatively small, and all participants were drawn from one clinical location (a university hospital). Therefore, the participants and their parents might not be representative of all patients and their parents with different economic situations and motivations for participating in this training.

Finally, there was a lack of control over the participants’ medical history and medication status. In particular, since this was not a randomized trial, these conditions would have a significant impact on the results. Therefore, it is necessary to include conditions such as stable medication treatment in the selection of participants.

In summary, the results of the present study revealed that the combination of SST and PT plus TAU in a clinical setting is effective for improving both social competencies and parental mental health. Future research should be conducted to evaluate the long-term effects of the combination of SST and PT programs and should add samples in a high-evidence level-study design.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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