

Effects of Peer-mediated Intervention on Social Skills for Children with Autism Spectrum Disorder in Hospital Setting: A Randomized Controlled Trial

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ABSTRACT

Background: Peer-mediated Intervention (PMI) is a treatment approach that engages typically developing peers to teach children with autism social skills and increase their social interactions. However, lack of clinical trials explored the outcome following PMI.

Objectives: The study was to investigate the effectiveness of PMI on social skills for children with ASD and analyze the specific changes in social skills.

Methods: Sample sizes were calculated based on data from previous similar studies. A total of 64 children aged 4-12 years with ASD were randomly allocated to treatment group (n=32, including mild to moderate level n=20, severe level n=12) or control group (n=32, including mild to moderate level n=19, severe level n=13) participated in a 2-month, 20-24-session intervention. 16 typically developing children were chosen and took part in the treatment group. Assessments were completed before and after interventions and included the Social Responsiveness Scale (SRS) and the Childhood Autism Rating Scale (CARS).

Results: Following a 2-month intervention program, there are statistically significant differences between groups (SRS; $p < .05$, CARS; $p < .05$), scores on mild to moderate level (SRS; $p = .013$, CARS; $p = .041$), severe level (SRS; $p = .028$, CARS; $p = .005$), significant differences were found in the mild to moderate autism among groups. Results also showed social cognition ($p = .003$), communication ($p = .001$), motivation ($p = .020$) and autistic mannerisms ($p = .001$) had a different enhanced.

Conclusion: PMI benefits children with autism on social skills and is effective for both mild to moderate and severe level autism

Keywords: Peer-mediated intervention; Autism spectrum disorder; Peers; Social skills

INTRODUCTION

Autism Spectrum Disorder (ASD) has been described in the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) in two main areas: Social interaction-communication disorders and restricted interests/repetitive behaviors [1]. Piece of research found "Autistic individuals have

a higher degree of anxiety as compared to normal population and have a similar level of anxiety as those with the anxious group" [2].

Due to a lack of communication and language skills, they are unable to express their feelings or circumstances, aggression, mood swings, and anxiety are more common among them.

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Research into psychosocial interventions (particularly cognitive-behavior therapies and social skills training) for social-communication deficits among individuals with ASD have proliferated over the past decade [3]. As social deficit creates a negative impact on the development of children with ASD. Many children with ASD frequently experience social isolation from peers and tend not to engage in reciprocal interactions despite being in an inclusive setting. The lack of appropriate social skills further inhibits the development of positive relationships with peers throughout the school years [4]. For example, students with ASD are always immersed in their world, hard to participate in an ordinary study or other activities at school, are unable to understand and follow the requirements of teachers or classmates, and so on. With the continuous development and maturity of rehabilitation therapy, autistic children have improved their sensory, motor, and language abilities, but in the field of social skills, effective social interventions, well-controlled treatment research is lacking [5]. Therefore, the application of scientific and effective treatment methods to improve the social skills of autistic children is an urgent area to be explored in the current pediatric medical and educational areas.

PMI is most commonly defined as a treatment approach that engages typically developing peers to teach children with ASD social skills and increase their social interactions [6]. It is a psychosocial intervention approach to enhance children's social and communication skills. The use of peers to promote interaction for children with ASD is effective and it eases the burden of the teacher as the only source of intervention [7]. Over the past 30 years, PMI had developed many variations from the beginning form of simple free play between autistic children and ordinary children to provide peer interaction opportunities, peer counseling, peer positive reporting, group play, and so on. These variations expand the scope of the PMI. Additionally, recent studies have shown that the application of PMI in the integrated environment can effectively improve the social skills of children with ASD, and has high maintenance and generalization effect [8]. Children were attractive and motivated through interventional games, the social motivation, social behavior, social cognition, and communication skills were enhanced, which were greatly beneficial to their daily participation and quality of life. Carter's research showed that peers without disabilities also benefit from the supporting connections in academic performance [9].

"In the past few decades, there has been an increase in PMI studies for children with ASD. Despite this increase, many studies utilized single-subject design, and relatively few have used large randomized controlled field trials" [10]. Previous kinds of research were also without comparable data on children with ASD who are moderate or low function disability. Additionally, despite lots of researches discussed and described the PMI, specific and detailed intervention components and arrangements are still rare. Efforts might best be aimed at the experimental analysis of specific intervention components and arrangements [11].

This study we did in 2019 was based on two pre-experiments that occurred in 2017 and 2018 which were single-subject designs. This study aims to investigate the effects of the PMI on social skills in children with ASD between two groups as well as the

changes in different levels of ASD among groups. To find the specific improvement of social skills, we also analyzed scores of five subscales extracted from SRS, including social awareness, social cognition, social communication, social motivation, and autistic mannerisms. Specific research questions addressed by this study were:

- 1) Is PMI for children with ASD effective for improving social skills?
- 2) Do the treatment group who participated in PMI for children with ASD make significant differences from the control group who continued with their regular activities and usual care?
- 3) Do PMI demonstrate equivalent effectiveness of social skills in mild to moderate and severe level autism?
- 4) Which aspects of social skills had a significant improvement through PMI for children with ASD?

METHODS

Study design

A single-masked randomized trial was carried out from June 2019 to August 2019 at the outpatient clinics of Shanghai Yangzhi Rehabilitation hospital affiliated with Tongji University. All informed consent and assent procedures were approved by the ethics committee. Parents provided informed written consent on behalf of their children. The trial is registered in the Chinese Clinical Trial Registry, and the registration number is ChiCTR2100049185. The protocol published prior to the study conduction.

Participants

Children with ASD: Shanghai Yangzhi Rehabilitation hospital (Shanghai sunshine rehabilitation center) is a rehabilitation hospital affiliated with Tongji University.

There are a larger number of variously disabled children who achieved treatment in the pediatric rehabilitation department. This study was conducted in this rehabilitation center. It started with 110 sample children who met the criteria for ASD according to the DSM-V [1] by a child neuropsychiatrist of local children's hospital and a pediatrician of our hospital.

The participants met the following inclusion criteria: 1) diagnosed with ASD; 2) aged 4-12 years old; 3) Be able to attend continuously, no more than 4 absences. The exclusion criteria are 1) children with additional disabilities such as emotional disturbances, hearing or vision disabilities, and those who had motor difficulties that would prevent them from participating in social games; 2) frequent uncontrolled aggression behavior which means hurting themselves or others; 3) unable to attend continuous treatment, no less than 20 sessions (Figure 1). At last, 64 children were chosen and randomly allocated to the treatment and control group, including 25 severe levels and 39 mild to moderate level autistic children. Randomization was performed by assigning random numbers from opaque envelopes. One participant failed to complete the measures due to caregiver illness and was dropped from the research protocol post four weeks, three participants dropped out at the end of the last week due to back to hometown, six participants in the control group did not want to assess again in the last assessment and leaving 28 in the treatment group and 26 in the control group at the end of the intervention. Sample characteristics are described in Table 1.

	Training Group (n=29)		Control Group (n=26)	
	N	%	N	%
Gender				
Male	24	82.75	20	76.92
Female	3	10.34	6	23.07
CARS Level				
Mild to moderate	18	62.06	15	57.69
Severe	11	37.93	11	42.31

Table 1: Demographic characteristics.

Through the CARS assessment, both the control group was also divided into mild to moderate and severe groups for different levels of social games. Demographic characteristics were examined for treatment condition comparability using independent samples t-tests. Independent samples t-tests indicated no significant differences in social skills between the groups as well as in the mild to moderate and server groups SRS ($p > .05$), mild to moderate ($p = .254$), severe ($p = .093$) and CARS ($p > .05$), mild to moderate ($p = .561$), severe ($p = .120$).

PMI Peers

At the beginning of the research, social recruitment through the form of posters and web platforms of our hospital was carried out and lasted for one month. A total of 28 children applied to attend this study. Each peer was also assessed with the SRS to provide information on their social skills. Finally, 16 children as PMI peers were selected met the following inclusion criteria: 1) aged 4 to 12 years old; 2) characteristics with enthusiastic, patient, voluntary, and own good pragmatic understanding and social skills based on SRS score. 3) able to attend continuously, no more than 1-week absences. Most of the peers are the child of the hospital faculties and five of them participated in two pre-experiments occurred in 2017 and 2018. They were educated and trained in both group training and individual training by our experimenters for about one week. After they were familiar with the basic knowledge of ASD and defining their role, the PMI got into its stride. There were 8 small groups separated from the treatment group a day and every small group involved one or two ASD with four peers. Every four peers came to the hospital to stay half a day every two days to play with 4 small groups' children with ASD.

Sample size

Since previous studies suggested that PMI is effective for children with ASD to promote social skills. Data for calculating the sample size for this study were obtained from comparable studies. Power Analysis and Sample Size (PASS) software were used for a priori power analysis with a statistical power of 80%, using a two-tailed test at the 5% level of significance, indicating that 60 subjects will be adequate to detect the difference in social skills.

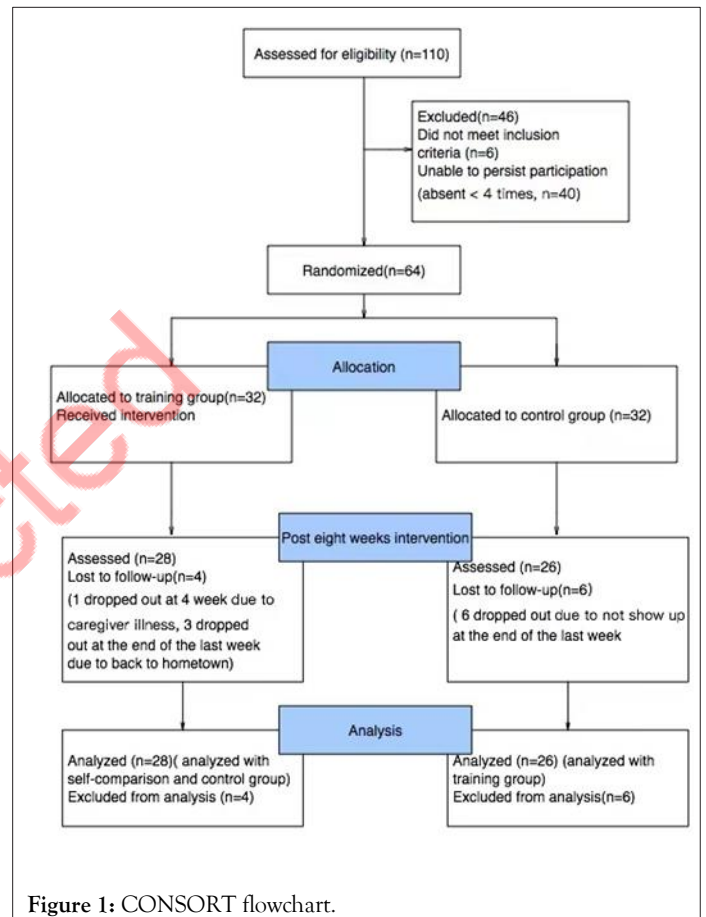


Figure 1: CONSORT flowchart.

Measures

There continues to be a lack of treatment-sensitive measures for ASDs [12]. In this study, we used the Social Responsiveness Scale (SRS) and Childhood Autism Rating Scale with Autistic Adolescents (CARS) to measure their performance before and after intervention both from parent and experimenters' perspectives.

Social Responsiveness Scale (SRS)

The present study used the Chinese SRS version for children aged 4–18 years. The SRS [13] is a 65-item questionnaire. Each item is scored on a Likert scale ranging from 1 (not true) to 4 (almost always true). When completed, a total raw score (ranging from 0 to 195, with higher scores indicating increased social impairment) and five theoretical subscales scores (labeled social awareness, social cognition, social communication, social motivation, and autistic mannerisms) can be generated. SRS focuses on the child's behavior during the past 6 months and can be completed in 15–20 min by a parent, a teacher, or another frequent Caregiver. By investigating the psychometric properties of the Chinese Mandarin version of the SRS when used in Mainland China, the SRS total score has an internal consistency

for total scale (0.871–0.922), test-retest reliability (0.81–0.94), and convergent validity with the Autism Behavior Checklist (ABC) (0.302–0.647) was satisfactory [13]. The study supported the reliability and validity of the parent-report SRS as one ASD screening instrument [13].

Childhood Autism Rating Scale (CARS)

The CARS was designed to assess the presence and severity of autism [14]. The CARS, a 15-item scale, is administered by a trained rater during an observation of the child. Each of the items is scored on a scale from 1 (no abnormality) to 4 (severe abnormality) with half-point scores possible. Scores range from 15 to 30 rate for a diagnosis of mild autism. Scores 30-37 indicate mild to moderate autism, while scores between 38 and 60 are characterized as severe autism [15]. Interrater reliability between the two experimenters for a total score of CARS was 0.98 [16].

PROCEDURES

Pre-intervention peer training

We conducted the pre-intervention training sessions for the 16 participating peers one week before the intervention took place. They attended the lecture on basic ASD symptoms and watched the related video. They all got the training about how to enhance their positive support and reduce the unexpected behavior or words that would appear. They all received the simple game training from the treatment manual. In the social games, the experimenter taught PMI peers how to wait, cooperate, provide visual or physical prompts, coach, give feedback to autistic children. After group training, experimenters gave individual communication about their perception of ASD, explaining their role and solving the questions when they had.

Experimenters training

There were 3 occupational experimenters, 3 speech and language pathologists, and 1 special education teacher, altogether, 7 experimenters from different backgrounds were involved in this study. Before the intervention, experimenters' training also unified all games through the treatment manual to guide the peers during the intervention. Each experimenter participated in 2-3 small groups which included 2-same level ASD children and 4 typical development PMI peers. Based on the two pre-experiments, we concluded a treatment manual including 28 social games based on evidence-based five types of PMI which are presented in Table 2 [17]. We set different goals for mild to moderate and server autism focused on social motivation, social awareness, social cognition, social communication, social behavior to improve their social interaction and initiations. Contents and examples are shown in Table 3.

Intervention

The intervention sessions were conducted in the group training room in the hospital. We purchased and prepared all the materials and tools needed and stored them in the cabinet as well as some reward items. Each intervention session lasted for approximately 40 minutes and was conducted with the following steps [4].

Step 1(5 minutes): self-introduction (name, age), greeting everyone (for the child in the severe group, they had difficulty in verbal communication, they just need to try to greet everyone

through shaking hands). Step2 (5 min): The experimenter talked about the rule of the game and invited two peers to demonstrate how to play; Step 3 (25minutes): game begins: peers helped the children with ASD in the group when need using verbal and gesture cues or hand over hand assist. The experimenter will sit behind or as a judge at the end of games. When a task was completed, the children were excited and celebrated their accomplishment naturally by clapping hands, thumbing up, giving high fives, and verbal praise to each other. Such a celebration was a typical way to make autistic children feel the joy of socializing and improve their social motivation. Step4(5 minutes): After completing the whole session, peers gave positive peer reporting and a warm hug to the autistic children to reinforce their performance [18]. Participants in the control group were instructed not to start any new therapies during the duration of the study but could continue with their regular activities and usual care. An evaluation was conducted at baseline and the end of the 8-week-long intervention.

Type of Peer Intervention	Descriptions
Peer Modeling	Competent peers are paired with students with skills deficits and model/demonstrate the appropriate skill.
Peer Tutoring	Reciprocal peer tutoring format where all students can serve as tutor and tutee. Students review and learn content material with a partner.
Cooperative Learning Strategies	Every group member is responsible for learning the material or skill, and for working cooperatively so that all group members learn. Rather than individuals being rewarded, the group is rewarded according to its success.
Peer Reinforcement	Peers are responsible for reinforcing students for demonstrating an appropriate skill or behavior.
Positive Peer Reporting (PPR)	PPR involves teaching and rewarding peers for providing descriptive praise during structured daily sessions.
Note: Adapted from Dunn et al., 2017; Smith et al., 2009	

Table 2: Types of Peer-mediated intervention.

Data analysis

Data analyses were performed using IBM SPSS Statistics Software Version 23.0 statistical software package for data processing and GraphPad Prism 9 for graph creating. Descriptive statistics were computed and between-group differences were analyzed independent t-tests and paired t-test as appropriate. Data were summarized using mean, standard deviation, median, and f test.

Group comparison Involved all participants who were randomly assigned and completed both their pre-and post-control or intervention assessment using independent sample t-test, $P < 0.05$ was considered as a significant difference, to explore the effect of peer intervention therapy on improving the social skills of autistic children. Effect size estimates were calculated for all mean differences using Cohen's d [19]. All d estimates were standardized using the pooled standard deviation of the conditions involved. In the case of within-subject d estimates, 95% confidence intervals were also reported.

scales used (SRS: $p < .001$, CARS: $p < .001$), as seen in Figure 2.

Levels of ASD	Objects	Type of Peer Intervention	Examples
Mild and moderate	1) Asking for help from peers actively. 2). Observing and imitating others by following game rules. (3). Sharing success with others.	Peer Modeling	Peers demonstrate rules of the game
		Peer Tutoring	Using verbal and gesture cues to assist autistic children
		Cooperative Learning Strategies	Copying games: respond when someone calls, observe and imitate someone's actions/language, then asking the next one actively to demonstrate/ speak to him/her.
		Peer Reinforcement	Verbally praising: "You are doing great! Thanks for being so helpful!"
		Positive Peer Reporting (PPR)	Talking about the detailed good performance in each session and appreciating autistic children's cooperation and effort.
Severe	1) Using AAC device to ask for help or express needs. 2) Completing waiting and taking turns. 3) Sharing food with others.	Peer Modeling	Peers demonstrate rules of game and practice once.
		Peer Tutoring	Hand over hand assist and wait for autistic children's response
		Cooperative Learning Strategies	Passing games: one is drumming while the others pass around a toy/blossom /block to the next one
		Peer Reinforcement	Praising by clapping hands and thumbing up when appropriate behavior occurs
		Positive Peer Reporting (PPR)	Appreciating autistic children's cooperation and effort and giving a warm hug.

Table 3: Contents and examples of PMI.

RESULTS

Within-group differences at posttest

On comparing social skill scores at the time of entry with scores of the same tests after 2 months, the result of paired t-test showed significant improvement in treatment groups in the two

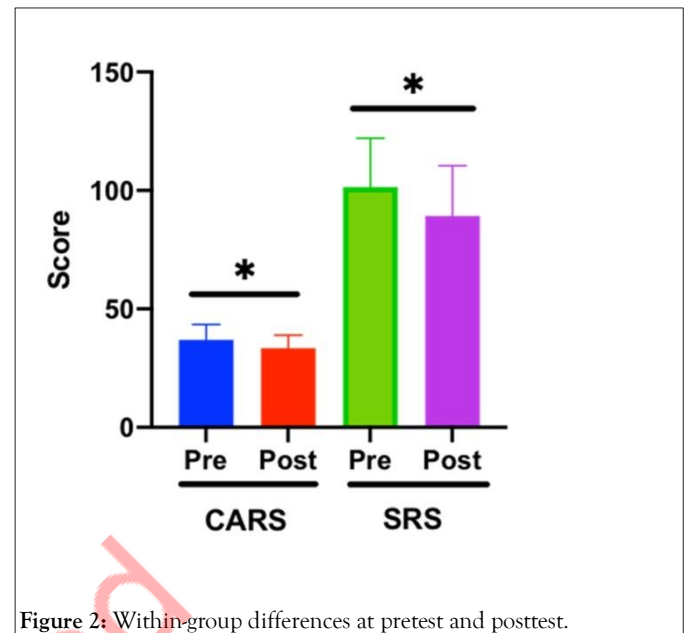


Figure 2: Within-group differences at pretest and posttest.

Results for the CARS and SRS in the treatment groups at the beginning and the end of the study period.

Between-group differences and changes in different levels of ASD

Parent rating scales: Social Responsiveness Scale (SRS): Analyses were conducted for the parent rating scales assessing SRS. Between-groups (treatment vs. control) were conducted on posttest measures, controlling for pretest scores (Table 4). Within Table 4, the posttest reflects the significance of posttest differences after controlling for the pretest scores. Results of the independent t-tests were significant for the total score of SRS: $F(1, 32) = 3.215, p = .002$ (one-tail), $d = 6.18$; mild to moderate SRS $F(1, 32) = 2.694, p = .013$ (one-tail), $d = 8.66$; severe SRS $F(1, 32) = 2.285, p = .028$ (one-tail), $d = 5.15$; Effect size estimates fell in the medium and large ranges [19] and, consistent with the hypothesized direction, favored children in the treatment group.

Staff rating scales: Childhood Autism Rating Scale (CARS): repeated-measures the independent t-tests was used to examine pre-versus post staff ratings for the treatment and control groups on the same scales completed by experimenters (Table 5). Results indicated significant staff-rated pretest to posttest decreases on the total score of CARS: $F(1, 17) = 2.73, p = .0009$ (one-tail), $d = 2$, and mild to moderate CARS $F(1, 32) = 2.14, p = .0041$ (one-tail), $d = 0.96$; severe CARS $F(1, 32) = 3.199, p = .005$ (one-tail), $d = 2.93$; These results were all in the expected direction.

Changes in different aspects of social skills

Independent t-tests were used again to calculate the five subscales of SRS. There were significant differences between the two groups regarding social awareness ($F = .523, P = .025$), social cognition ($F = .104, p = .003$), social communication ($F = 1.618, p = .001$), social motivation ($F = .214, p = .020$) and autistic mannerisms ($F = 1.039, p = .001$), as seen in Figure 3. Yet, on comparing pretest, there was a significant difference between groups in social awareness test.

Scale level SRS	N (Size)	Mean (SD)	F (t) (df)	p	d	Differences of group mean of 95% Conf. int.	
Total							
Trt*Pretest	29	102.07 (20.52)	1.644	0.106	5.94	-21.891	2.183
Ctrl*Pretest	26	111.92 (23.58)					
Trt*Posttest	28	89.72 (21.17)	3.215	0.002*	6.18	-32.26	-7.45
Ctrl*Posttest	26	109.58 (24.28)					
Mild to moderate							
Trt*Pretest	18	94.33 (21.65)	0.734	0.254	8.96	-28.896	7.963
Ctrl*Pretest	15	104.8 (28.534)					
Trt*Posttest	18	79.28 (18.07)	2.694	0.013*	8.66	-23.32	8.65
Ctrl*Posttest	15	102.6 (29.19)					
Severe							
Trt*Pretest	11	114.73 (9.911)	1.087	0.093	3.918	-15.082	1.264
Ctrl*Pretest	11	121.54 (13.497)					
Trt*Posttest	11	106.82 (13.5)	2.285	0.028*	5.15	-12.27	5.142
Ctrl*Posttest	11	119.1 (10.44)					

Table 4: Parent rating of social integration skill, pretest and posttest scores.

Scale level CARS	N (size)	Mean (SD)	F (t) (df)	p	d	Differences of group mean of 95% Conf. int.	
Total							
Trt*Pretest	29	36.96 (6.41)	1.167	0.249	1.89	-6.01	1.61
Ctrl*Pretest	29	39.19 (7.61)					
Trt*Posttest	28	33.36 (5.41)	2.73	0.009*	2	-9.48	-1.45
Ctrl*Posttest	29	38.83 (9.16)					
Mild to moderate							
Trt*Pretest	18	32.97 (2.06)	0.588	0.561	0.82	-2.22	1.23
Ctrl*Pretest	15	33.47 (2.66)					
Trt*Posttest	18	30.56 (2.5)	2.14	0.041*	0.96	-20.4	0.956
Ctrl*Posttest	15	32.6 (2.91)					
Severe							
Trt*Pretest	11	43.5 (5.66)	1.631	0.120	2.15	-8	0.997
Ctrl*Pretest	11	47 (4.31)					

Trt*Posttest	10	37.96 (5.83)	3.199	0.005*	2.93	-15.5	-3.33
Ctrl*Posttest	11	47.32 (7.76)					

Table 5: Staff measures, pretest, and posttest scores.

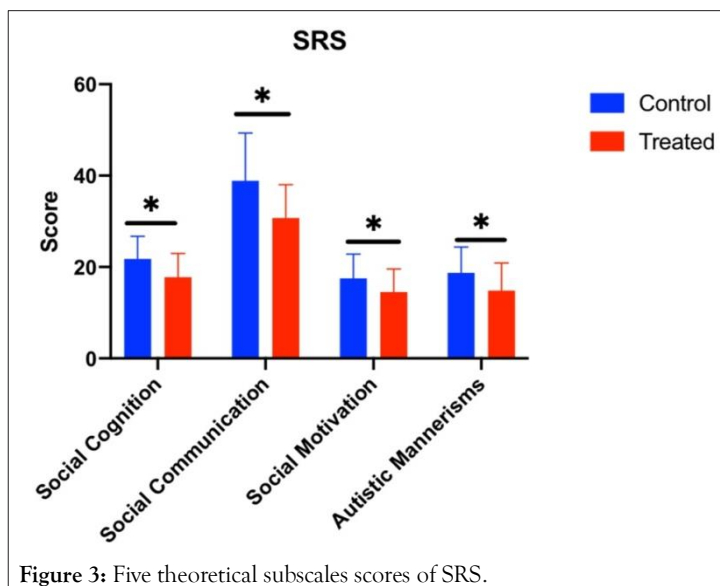


Figure 3: Five theoretical subscales scores of SRS.

DISCUSSION

The purpose of this study was to determine whether the PMI facilitated social skills in children with ASD. Since social skills are defined from an intrapersonal (self-awareness, self-evaluation, self-control) and interpersonal perspective [20], PMI could be the most effective for high functioning children with ASD; However, without comparable data on the majority of children with ASD who are minimally verbal and lower functioning [10]. The results of this study show that statistically significant differences were found in social skills between the treatment group and control group after two-month PMI. Children with ASD in mild to moderate and severe level groups all benefited from this training. Many pieces of research support the use of peers to help teach children with autism has been a commonly used method [21]. In our study, peers were taught how to wait, cooperate, provide visual or physical prompts, coach, give feedback to autistic children, which are presumed to be an active treatment mechanism. Furthermore, children with ASD have opportunities to socially interact with numerous peers in these settings, which may increase the likelihood of children with ASD generalizing the newly acquired social skills across individuals [22].

After analyzing the changes within the group and between groups, we also analyzed scores of five subscales extracted from SRS, significant improvements were seen at least in social cognition, social communication, social motivation, and autistic mannerisms. The interventions of social games we used frequently in the study were “Passing games” and “Copying games”. In the passing games, one child is drumming while the others pass around a toy/blossom/block to the next one or they may compare the speed of passing all items to determine the winners. As they sat at a certain distance, the whole game needs children to be able to respond and ask the name of the child

nearby, it could improve their social initiation and interaction skills. In the copying games, children sat facing one direction one by one and need to observe and imitate someone’s actions/language, then demonstrate/ speak to the next one. According to the study, “a low-intensity, focused intervention targeting imitation can significantly improve autism-specific deficits in social functioning that sustain” [23]. Children with ASD exhibit significant deficits in imitation as well as later emerging social behaviors [24], leading to the proposal that an early deficit in imitation could disrupt the development of intersubjective and lead to broader social impairments in autism. Although it has yet to be established whether imitation deficits are a cause or a consequence of social impairment in autism, several studies have found a significant relationship between imitation and other social behaviors in children with autism, including social reciprocity and initiation of joint attention [23]. Thus, social communication, social initiation, and social interaction could be improved during playing those games. Meanwhile, the more familiar and skillful, the better. Children with ASD can master those social skills after repetition. Home support plays an important role in the interventions. Therefore, we also shared the game manual with autistic children’s parents to facilitate weekly playdates and complete weekly modules as advised by our therapist.

However, we found children in the severe level small groups couldn’t participate well through the same social games used in mild to moderate level groups, they were easy to fail and couldn’t understand the meaning of games, which makes it hard to cooperate and complete the games successfully. Moreover, the PMI peers also felt frustrated and had less positive behavior and emotions toward autistic children. Gunning et al [25] suggested: “currently, a treatment manual is also needed to improve the implementation fidelity”. In this study, we focused on five types of PMI to design and conduct the social games and methods based on different difficulty level social games. Specific arrangements, procedures, and intervention contents were designed from our pre-experiments. Therefore, although PMI could improve children with different levels of ASD which has the same result from previous studies, different difficulty level social games or methods were highly needed to be designed and prepared for different levels of autism while doing PMI.

“There has been an increase in the number of studies evaluating the effectiveness of PMI on children diagnosed with ASD. Most of those studies used a single-subject design with very few studies using a randomized controlled design” [26]. In this study, we involved 55 autistic children and 16 typically developing children to attend the 2-month PMI program in the hospital setting which was the first randomized controlled trial conducted in the hospital setting.

Although most of the researches and cases introduced PMI can be used in inclusive settings or school settings, it is still important and meaningful to explore the effectiveness in a hospital setting due to lots of autistic children receive initial services in hospital or rehabilitation centers. It could be a great foundation to establish basic social skills before entering the school context and promote better performance for school participation and daily life. In some developing countries, such as China, there are few therapists or special education teachers who work in school, children with ASD even can't go to ordinary schools due to a lack of support and effective approach to help them [27]. The improvement of their social skills in the hospital setting will provide more opportunities for them to be admitted to school and performance better.

"Future PMI research should continue to provide detailed information about peers and the peer selection process to allow for further analysis of the impact of peer characteristics on intervention outcomes and to inform the identification of prerequisite skills for peers within PMI" [25]. As we conducted two pre-experiments in 2017 and 2018, we found it is important to assess typically developing peers before intervention. In this study, each peer did the SRS test and parents interview to provide more information on their social skills as well as setting up inclusion criteria. Finally, 16 children who are enthusiastic, patient, voluntary, and have good pragmatic understanding and social skills were selected as PMI peers. After completing the study, they all established good friendships with autistic children. It is a rare experience of volunteer service and growth learning for the ordinary children as companions, which makes them realize the disabled people around them, and enhances their patience, love, and guidance ability. So, we highly recommended PMI can be conducted in various settings to benefit both typically developing children and children with disabilities.

Several possible limitations to this study were noted after the experiment. A larger sample is required to further investigate the influence of PMI in different functions of children with ASD. Although the measurement of SRS total score has satisfied internal consistency, test-retest reliability, and convergent validity with the Autism Behavior Checklist (ABC). The CARS total score has interrater reliability. More standardized measurement tools needed to be identified and quantify the impact of PMI on autistic children. Since the PMI is conducted during the summer holiday of typical children, a longer time is necessary to help achieve better outcomes and performance on social skills in children with ASD. Different arrangements then need to be considered, such as attending every weekend and lasting for one semester. Long-term follow-up assessments are needed to find the generalization and maintenance of PMI after treatment.

CONCLUSION

A two-month social skill treatment for children with ASD using PMI found statistically significant differences in social skills between the treatment group and control group as well as mild to moderate and severe level autistic children. Social cognition, social communication, social motivation, and autistic mannerisms had a different enhancement. This study also highlighted the specific and detailed intervention components that need to be designed based on different difficulty level social

games and recommendation of using home support to conduct the PMI in a hospital setting.

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DECLARATION OF CONFLICTING INTERESTS

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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