

# A Randomized Controlled Trial of the Korean Version of the PEERS® Parent-Assisted Social Skills Training Program for Teens With ASD

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Impaired social functioning is a hallmark feature of autism spectrum disorder (ASD), often requiring treatment throughout the life span. PEERS® (Program for the Education and Enrichment of Relational Skills) is a parent-assisted social skills training for teens with ASD. Although PEERS® has an established evidence base in improving the social skills of adolescents and young adults with ASD in North America, the efficacy of this treatment has yet to be established in cross-cultural validation trials. The objective of this study is to examine the feasibility and treatment efficacy of a Korean version of PEERS® for enhancing social skills through a randomized controlled trial (RCT). The English version of the PEERS® Treatment Manual (Laugeson & Frankel, 2010) was translated into Korean and reviewed by 21 child mental health professionals. Items identified as culturally sensitive were surveyed by 447 middle school students, and material was modified accordingly. Participants included 47 teens between 12 and 18 years of age with a diagnosis of ASD and a verbal intelligence quotient (IQ)  $\geq 65$ . Eligible teens were randomly assigned to a treatment group (TG) or delayed treatment control group (CG). Primary outcome measures included questionnaires and direct observations quantifying social ability and problems directly related to ASD. Secondary outcome measures included scales for depressive symptoms, anxiety, and other behavioral problems. Rating scales for parental depressive symptoms and anxiety were examined to detect changes in parental psychosocial functioning throughout the PEERS® treatment. Independent samples *t*-tests revealed no significant differences at baseline across the TG and CG conditions with regard to age ( $14.04 \pm 1.64$  and  $13.54 \pm 1.50$  years), IQ ( $99.39 \pm 18.09$  &  $100.67 \pm 16.97$ ), parental education, socioeconomic status, or ASD symptoms ( $p < 0.05$ ), respectively. Results for treatment outcome suggest that the TG showed significant improvement in communication and social interaction domain scores on the Autism Diagnostic Observation Schedule, interpersonal relationship and play/leisure time on the subdomain scores of the Korean version of the Vineland Adaptive Behavior Scale ( $p$ 's  $< 0.01$ ), social skills knowledge total scores on the Test of Adolescent Social Skills Knowledge—Revised ( $p < 0.01$ ), and decreased depressive symptoms on the Child Depression Inventory following treatment ( $p < 0.05$ ). Analyses of parental outcome reveal a significant decrease in maternal state anxiety in the TG after controlling for potential confounding variables ( $p < 0.05$ ). Despite cultural and linguistic differences, the PEERS® social skills intervention appears to be efficacious for teens with ASD in Korea with modest cultural adjustment. In an RCT, participants receiving the PEERS® treatment showed significant improvement in social skills knowledge, interpersonal skills, and play/leisure skills, as well as a decrease in depressive symptoms and ASD symptoms. This study represents one of only a few cross-cultural validation trials of an established evidence-based treatment for adolescents with ASD. *Autism Res* 2014, ●●: ●●-●●. © 2014 International Society for Autism Research, Wiley Periodicals, Inc.

**Keywords:** social skills intervention; intervention; clinical psychiatry; adolescents; pediatrics

## Introduction

Autism spectrum disorder (ASD) is characterized by abnormalities in social communication and restricted and repetitive patterns of behavior [American Psychiatric

Association, 2013]. Impaired social functioning is a hallmark feature of ASD that often requires treatment throughout the life span. Adolescence is a particularly troubling period for individuals with ASD. This is especially true for high-functioning teens that may be more

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keenly aware of the difficulties they encounter when interacting with peers [Laugeson, Frankel, Mogil, & Dillon, 2009; Ruiz-Robledillo & Moya-Albiol, 2013].

There is evidence that children and adolescents with ASD experience more negative social outcomes (e.g. fewer friends, little support from their classmates, very limited involvement in social activities, and increased peer rejection) than even adolescents with speech/language impairments, learning disabilities, and intellectual disability compared with their typically developing peers [Renno & Wood, 2013; Shattuck, Orsmond, Wagner, & Cooper, 2011]. A recent study indicated that participants with ASD spent more time in solitary behaviors or engaging in reactive aggression toward peers and less time in cooperative interaction with peers compared with typically developing adolescents with dyslexia [Humphrey & Symes, 2011]. Bullying is another significant issue for children and adolescents with ASD, reflected in a higher rate of victimization and perpetration compared with typically developing peers; presumably, a product of deficits in social interaction and communication skills as well as social naivety [Shivers, Deisenroth, & Taylor, 2013; van Steensel, Deutschman, & Bogels, 2012].

Social skills groups are common interventions for people with ASD, especially those with average to above-average cognitive skills [Reaven, Blakeley-Smith, Leuthe, Moody, & Hepburn, 2012]. However, the majority of social skills training programs have focused on children aged 7–12, and few studies have examined the benefit of such groups for adolescents with ASD [Reichow, Steiner, & Volkmar, 2012]. Thus, there is limited information available on the characteristics of effective programs for this age group [Maglione, Gans, Das, Timbie, & Kasari, 2012]. Furthermore, few randomized controlled trials (RCTs) have examined the effectiveness of social skills training for those with ASD [Reichow et al., 2012]. There also may be a high risk of performance and detection bias in such studies, given the nature of the intervention and selected outcome measures [Reaven et al., 2012], making it difficult to detect meaningful changes following treatment.

The Program for the Education and Enrichment of Relational Skills (PEERS®) is a parent-assisted, manualized social skills training program for high-functioning adolescents with ASD, developed at the University of California, Los Angeles (UCLA) [Laugeson & Frankel, 2010]. The PEERS® intervention addresses crucial areas of social functioning for adolescents, including reciprocal conversational skills, choosing appropriate friends, the appropriate use of humor, peer entry skills, and get togethers, as well as handling rejection, disagreements, and rumors or gossip [Laugeson & Frankel, 2010]. Ecologically valid skills for developing and maintaining friends are taught using psychoeducational and cognitive-behavioral treatment techniques. Treatment sessions are composed of homework review, didactic lessons, role-play demonstrations,

behavioral rehearsal exercises, homework assignments, and reunion of the teens and their parents to negotiate homework completion [Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012; Laugeson et al., 2009].

In North America, PEERS® has been evaluated using RCTs, with its efficacy established for improving social skills in adolescents [Laugeson et al., 2009, 2012] and effectiveness for improving the social functioning of young adults [Gantman, Kapp, Orenski, & Laugeson, 2012] with ASD. In particular, adolescents with ASD (aged 12–17) who participated in PEERS® showed significant improvements in a wide range of social abilities (e.g. social skills knowledge, social responsiveness, social communication, social cognition, social awareness, social motivation, assertion, cooperation, and responsibility) as well as decreased autistic mannerisms and increased frequency of peer interactions immediately following treatment and at a 14-week follow-up [Laugeson et al., 2009, 2012]. PEERS® treatment effects have also been replicated and extended in larger groups of teens, in North America, revealing the program's efficacy in ameliorating some of the social problems associated with ASD, including improved social skills knowledge, friendship skills, problem behaviors, and social anxiety [Schohl et al., 2013], as well as changes in the social brain as revealed through biomarkers of treatment outcome using electroencephalogram [Van Hecke et al., 2013]. Additionally, PEERS® has been shown to be effective in helping young adults with ASD, who reported significantly less loneliness and improved social skills knowledge, social responsiveness, empathy, and frequency of get togethers following treatment [Gantman et al., 2012].

In addition to impacting peer relationships, ASD symptoms are also thought to contribute to a decrease in parental well-being and elevated levels of overall mental health problems, especially anxiety and depression, as compared with parents of typically developing children and even those of children with other developmental disabilities [Ekas, Lickenbrock, & Whitman, 2010; Karst & Van Hecke, 2012]. While levels of parental involvement tend to be low in interventions for older children or adolescents with ASD, even in parent-mediated programs, the extent to which treatment effects parental well-being and mental health is often unexplored [Karst & Van Hecke, 2012]. Yet, in order to understand treatment outcome through a developmental context, it is necessary to understand the direct impact on the family as a whole by assessing the symptoms and functioning of both child and parent, the overall functioning of the family, and the systemic interactions of family members [Hoagwood, Jensen, Petti, & Burns, 1996; Karst & Van Hecke, 2012]. Thus, it is advised that intervention outcome research for those with ASD include parent and family assessment measures as a first step to understanding how treatment impacts the family system [Karst &

Van Hecke, 2012]. Therefore, examining how parental anxiety and depressive symptoms among parents participating in the PEERS® treatment intervention with their adolescents would be useful in understanding the full impact of treatment on the family.

Even with a well-established evidence base, the efficacy of PEERS® has yet to be established in cross-cultural validation trials. Research suggests that cultural factors can influence the treatment of those with ASD, including decisions on whether to seek help, treatment selection, available resources, and relationships between families and professionals [Daley, 2002; Ravindran & Meyers, 2012]. Cultural factors also influence beliefs about the causes of ASD, available resources, people or systems families can rely on for support, and even the relationship between parents and professionals [Ravindran & Meyers, 2012]. As a result, it is advisable that treatment approaches developed in the West should not be blindly generalized to children (or adults) with disabilities across the world [Daley, 2002; Ravindran & Meyers, 2012]. Consequently, while many rating scales and diagnostic instruments developed in Western countries have been translated and adapted for use in other countries, this has not typically been the case for ASD treatment programs.

The objectives of this study were to conduct a RCT to examine the feasibility and treatment efficacy of a Korean version of PEERS® for enhancing social skills. Our research questions were as follows: (a) Is the Korean version of PEERS® applicable and feasible for Korean teens with ASD and their parents with some modification of culturally sensitive contents? and (b) Is the Korean version of the PEERS® treatment efficacious in improving social skills and decreasing comorbid psychosocial distress for adolescents with ASD and their parents to the same extent as the original English version of PEERS®?

## Methods

### *Translation and Modification of the PEERS® Treatment Manual*

The English version of the PEERS® Treatment Manual [Laugeson & Frankel, 2010] was translated into Korean and thoroughly reviewed by 21 child mental health professionals, including child psychiatrists, clinical psychologists, special education teachers, and social workers. The overall structure and didactic elements of the original intervention were maintained. However, the authors agreed that some culturally sensitive material, identified by the child mental health professionals, was not thought to coincide with the culture of teens in Korea. In order to better understand the cultural context of this material, 20 items were surveyed by 477 middle school students (287 boys, 190 girls; ages 12–15 years) in the city of Seongnam, Korea. Survey questions were related to previously identified culturally sensitive material and

included: time spent in extracurricular activities, area of interests/hobbies, locations and methods for making friends through common interests, peer groups and crowds inside and outside of school, focus of extracurricular activities with friends, subjects of conversations with friends, and commonly used electronic communication tools, including social networking sites, blogs, and chat rooms. Based on the results of the survey, the most popular examples of social networking sites were added to Session 3, common extracurricular activities were revised in Session 4, and the classification of peer groups and crowds was altered in Session 4.

In addition, several content areas were modified to be more culturally and linguistically appropriate. For example, in *Session 1 (Introduction and Conversational Skills I—Trading Information)*, the eye-color item in the Jeopardy game was not appropriate for Korean teens because Koreans generally have similar eye color. Thus, the following questions were added to help teens improve their listening skills: my favorite animal, the part of my body I like the most, and my favorite food. In *Session 5 (Appropriate Use of Humor)*, information presented about racial, ethnic, or religious jokes was rephrased as “jokes regarding disability, religion, gender, facial/physical appearance, and race,” to reflect the importance of diversity issues in Korean culture. In addition, different examples of silly, childish jokes were added for the behavior rehearsal. One of the steps from the beginning of get togethers was rephrased in *Session 8 (Get-Togethers)* as “give a tour of the house to show interesting things,” because giving a tour of one’s home is uncommon during adolescent get togethers in Korea. In *Session 9 (Good Sportsmanship)*, *Session 10 (Peer Rejection I—Teasing and Embarrassing Feedback)*, and *Session 12 (Handling Disagreements)*, praise given during games was modified, Korean examples of typical teasing comebacks were included, and common topics of disagreement for Korean teens were suggested for behavior rehearsal. An overview of the changes to the Korean translation of the PEERS® Treatment Manual is summarized in Table 1.

### *Recruitment of Participants*

Study participants were enrolled from child and adolescent psychiatric clinics at Seoul National University Hospital, Gil Hospital, Kyung Hee University Medical Center, and from advertisements mailed to child psychiatrists in the Korean Academy of Child and Adolescent Psychiatry, and parents of offspring with ASD who participate in a support group. Inclusion criteria for adolescents included: (a) between 12 and 18 years of age, (b) currently enrolled in school between sixth grade of elementary school to third grade of high school, (c) experiencing social difficulties as recognized by parents, (d) previously diagnosed with ASD by a reliable mental health

**Table 1. Changes to the Korean Version of the PEERS® Treatment Manual**

Session	Topic	Content	Changes to the Korean version of the PEERS® Treatment Manual
1–3	Teen activity: Jeopardy	The “Eyes” Have It: The color of eyes	The eye-color item in Jeopardy is not appropriate for Korean teens because the eye color of Korean people is generally similar (dark brown/black). This question was replaced with the following: “Yummy Foods” (favorite food or snack), “At the Zoo” (favorite animal), and “My Charm” (body part I like the most).
3	Electronic communication	Examples of social networking sites: Facebook and Myspace	Facebook and Myspace are specific social networking sites that are not popular in Korea. Instead, the survey of Korean teens indicated that teens prefer domestic miniblogs or chat rooms instead.
3—Parent session 4—Teen session	Choosing appropriate friends	Identifying different peer groups/crowds	The differentiation of peer group/crowds by name is not as clear for Korean teens as North American teens, nor do they identify “geeks” in their community. Instead, Korean teens tend to divide peer group based on “in-school hobby groups,” “mania groups,” and more informal small groups such as “(teen’s name)’s group” or “delinquent/bullies ( <i>Il-jin</i> ’ in Korean).” Some North American examples of peer groups/crowds not common with Korean teens include: cheerleaders, pep squad, partiers, preppies, goths, emos, hippies, or ROTC. These groups were substituted with popular examples collected and ranked from students’ surveys including: video clip makers, cartoonists, paper folding, craft club, journal decoration club, bakers, fandom of K-pop singers, figure collectors, fantasy novel writers’ club, costume players, Japanese culture manias, and IT products tuning manias.
4—Parent session	Choosing appropriate friends	List of extracurricular activities as a source of friendship	Lists of extracurricular activities based on the results of students’ survey and community resources were modified and made into a table. Substituted items include: examples of popular sports (i.e. soccer, basketball, bowling, Judo, and hiking), Korean drum bands, movie-making club, reading, reporter of school journal, English study, Chinese letters, and model planes.
5	Appropriate use of humor	Description of an insult joke  Example of joke for behavioral rehearsal	The description of an insult joke included the removal of “racial, ethnic, religious joke,” to be rephrased as, “jokes regarding religion, disability, gender, facial/physical appearance and race.”  The “knock-knock joke” used in the behavioral rehearsal exercise was not appropriate for Korean culture and was thus replaced with a culturally appropriate example of a silly, childish, “greeting joke” (i.e. one person says to the other, “Oh look, there’s money on the floor.” When the other person looks down, the first person says, “You just bowed to me!”).
8	Get together	Suggestions for activity-based get togethers  At the beginning of the get together	Based on the Korean teen survey regarding favorite activities for get together, suggestions were modified accordingly. Activities using community resources such as local Youth Centers were emphasized.  The fourth step for beginning a get together was rephrased to include, “tour the house to show interesting things,” because giving a tour of one’s home is uncommon for child or teen get togethers in Korea.
9	Good sportsmanship	Examples of praise	Common Korean examples of praise during a game were added from the Korean survey of teens.
10	Teasing and embarrassing feedback	Examples of teasing comebacks	Korean examples of <i>teasing comebacks</i> were added from the survey of Korean teens.
12	Handling disagreements	Say you are sorry  Examples of typical teen disputes	In Korean, if you say you are sorry, it often means that you admit you did something wrong. In cases when guilt is not being admitted, the phrase “I’m sorry if you feel that way” was added.  Common topics of disagreement for Korean teens were added to the behavioral rehearsal exercise to include: A friend is upset because you teased him about his grades; a friend is angry because you did not go to the PC game café with him as planned; a friend is hurt because you went home early without waiting for him to finish his school work.

professional, or strongly suspected to have ASD at the time of referral by a trained professional, (e) verbally fluent with a verbal intelligence quotient (IQ)  $\geq 65$  according to a standardized intelligence test, (f) substantially motivated to participate in treatment, (g) no history of major mental illness (e.g. schizophrenia, bipolar disorder, severe major depressive disorder with significant suicidal ideation, or other types of psychotic disorders), (h)

no current problems with aggressive behavior or severe oppositional tendency, (i) no hearing, visual, or physical disabilities that would prevent participation in outdoor sports activities, and (j) the absence of other clinically significant physical or neurological illnesses that would inhibit participation in treatment. This study was approved by the Institutional Review Board of each participating hospital. Written informed consent and assent

were obtained from all parents and adolescents who participated in this study.

### *Screening and Randomization Process*

As directed by the PEERS<sup>®</sup> Treatment Manual, teens' eligibility was initially screened by telephone interview using the Phone Screening Script included in the Treatment Manual [Laugeson & Frankel, 2010]. Additionally, social motivation was assessed during a short intake interview for teens using the Teen Intake Interview Checklist in the treatment manual, which includes offering the teen more information about the program, giving the teen a chance to ask questions, and confirming whether the teen is substantially motivated to participate in the PEERS<sup>®</sup> treatment intervention [Laugeson & Frankel, 2010]. After the initial screening and intake interview, a diagnosis of pervasive developmental disorder-not otherwise specified (PDD-NOS), Asperger's disorder, or autistic disorder was made by three board-certified child psychiatrists following the diagnostic criteria of the Diagnostic and Statistical Manual, 4th edition—Text Revision [American Psychiatric Association, 2000] and corroborated by the Autism Diagnostic Observation Schedule [ADOS; Lord, Rutter, DiLavore, & Risi, 2008] and the Autism Diagnostic Interview—Revised [ADI-R; Lord, Rutter, & Le Couteur, 1994]. IQ and adaptive functioning were assessed using the Korean Educational Development Institute-Wechsler Intelligence Scale for Children-Revised [Park, Yoon, & Park, 1991] and the Korean version of the Vineland Adaptive Behavior Scale [EHWA-VABS; Kim, 1993]. The website <http://www.random.org> was used to randomly assign the eligible teens to the treatment group (TG) or the delayed treatment control group (CG). Each group was divided into three separate treatment groups of approximately 6–10 adolescents. The study design is shown in Figure 1.

### *Participants*

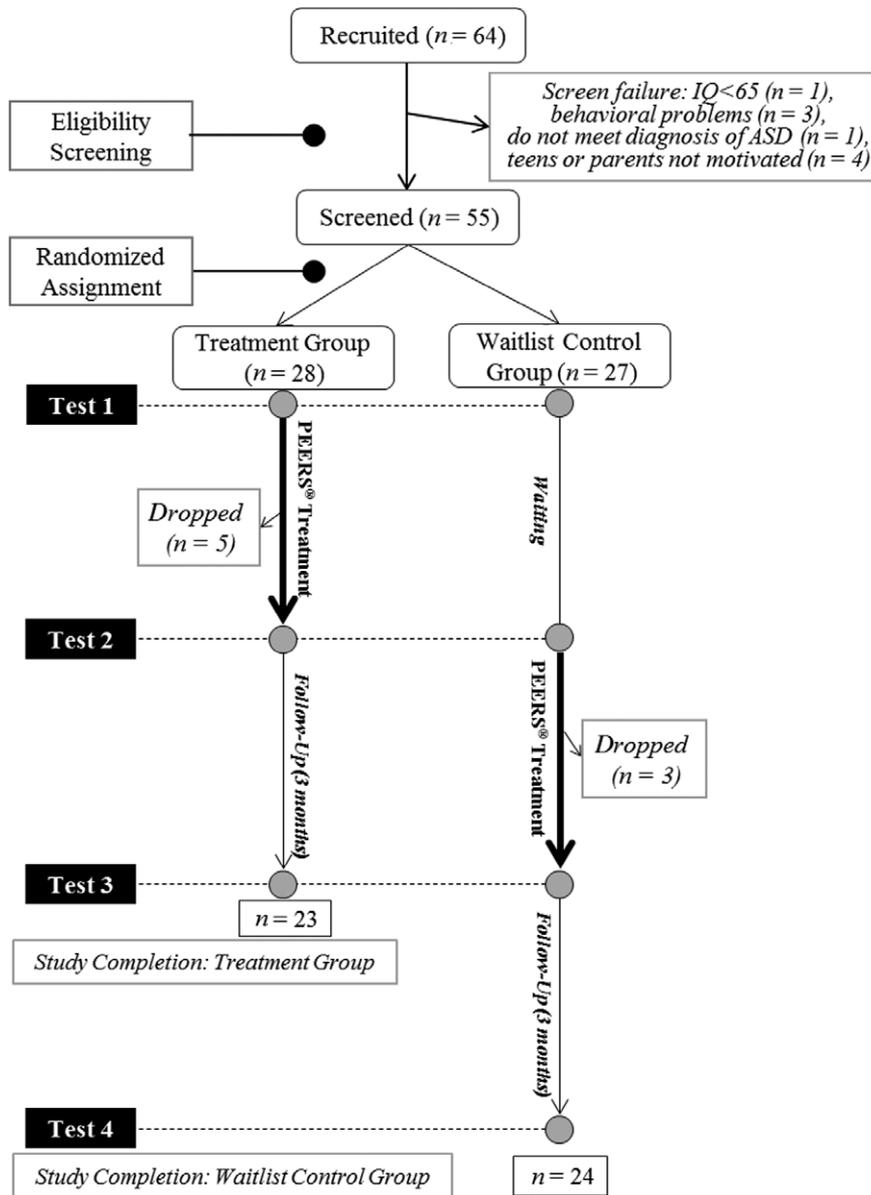
Sixty-four teens between the ages of 12 and 18 years were screened; 55 were considered eligible based on screening interviews and diagnostic procedures. During the randomization procedure, 28 were assigned to the TG and 27 to the CG. During the 14 weeks of treatment, five participants in the TG and three in the CG withdrew because of the teens' lack of motivation, family events, entering college, or moving. A total of 47 adolescents and their parents (TG = 23, CG = 24) completed the treatment program. All but two TG and one CG participants were male. The mean age of participants who completed the treatment was  $14.04 \pm 1.64$  in the TG and  $13.54 \pm 1.50$  years in the CG. Full-scale IQ was  $99.26 \pm 15.37$  in the TG and  $100.46 \pm 16.63$  in the CG. At least one preidentified parent attended the group, although both parents were welcome to attend. In the current study, the parent par-

ticipant was usually the mother (99.5%); both parents attended in 0.5% of cases. Among those completing treatment, the absence rate was 1.82%, and the overall homework completion rate was 43.4%.

### *Korean PEERS<sup>®</sup> Treatment Intervention*

Treatment sessions were conducted as indicated in the original PEERS<sup>®</sup> Treatment Manual [Laugeson & Frankel, 2010]. The PEERS<sup>®</sup> intervention consists of 14 90-min sessions. Sessions were held once a week for 14 weeks. Parents and teens participated in concurrent sessions held in separate rooms. Each session included a targeted lesson, accompanied by a homework assignment to encourage skill generalization to natural settings. Homework was reviewed at the beginning of each session in the parent and adolescent groups, and homework compliance and quality were recorded. After homework review and discussion, participants received didactic lessons on social skills, including role-play demonstrations by trained research staff. Behavioral rehearsal exercises were then conducted in the teen sessions to practice newly learned skills. Research staff monitored treatment fidelity directly from the treatment manual in each session in order to maintain the integrity of the program and ensure that all material was covered. Lessons focused on the skills necessary for developing and maintaining friendships and included: conversational skills, electronic communication, appropriate use of humor, peer entry and exiting strategies, organizing and having successful get-togethers, good sportsmanship, and strategies for handling teasing, embarrassing feedback, physical bullying, rumors and gossip, disagreements, and changing a bad reputation. The detailed process and characteristics of the PEERS<sup>®</sup> intervention are described elsewhere [Laugeson & Frankel, 2010].

The groups were conducted by six trained treatment leaders, one of whom was a PEERS<sup>®</sup> Certified Provider, having received 20 hours of comprehensive training through the UCLA PEERS<sup>®</sup> Clinic by the program developer. The parent and teen group leaders were board-certified child psychiatrists, licensed clinical psychologists, and special education teachers with substantial experience conducting social skills programs for children and adolescents, and parent education groups related to ASD. Three coleaders assisted the group leaders throughout the treatment sessions. The coleaders were psychology or special education graduate students and clinical psychology trainees with experience working with children and adolescents with ASD and other developmental disorders. The treatment leaders were also cotranslators of the Korean version of the PEERS<sup>®</sup> Treatment Manual and received a 2-day training session led by a PEERS<sup>®</sup> Certified Provider, followed by regular meetings (once every 2 weeks for 4 months) until the translation was completed.



**Figure 1.** Subject recruitment, assignment, and assessment procedures.

After completion of the translation, another 3-day training workshop on the implementation of the treatment sessions was provided under the direction of the same PEERS® Certified Provider. As part of this training, treatment leaders then observed each session, modeled the treatment for the PEERS® Certified Provider, and established reliability with the treatment protocol before conducting sessions with participants. Coleaders were fully trained and supervised in all content and intervention processes. They were responsible for assisting with role-play demonstrations, providing performance feedback and prompting during behavioral rehearsal exercises,

and monitoring treatment fidelity and homework compliance. Teen and parent attendance sheets were developed by the treatment team in accordance with the materials provided in the Appendices of the original PEERS® Treatment Manual. Additional materials were developed and translated into Korean including the Planned Absence Sheet, PEERS® Weekly Point Log, PEERS® Good Sportsmanship Point Log, and PEERS® Homework Compliance Sheets, which were used to rate treatment adherence. These materials were reviewed by all members of the treatment team at the end of every treatment session.

## Measures

All TG participants completed outcome measures just before the first and last treatment sessions of the intervention (i.e. test 1 = week 1 and test 2 = week 14). CG participants completed outcome measures upon entering the study (i.e. test 1 (baseline) = week 1), and at the first and last treatment sessions (i.e. test 2 = week 14 and test 3 = week 28). Both groups also completed outcome measures 3 months after completing the last session of PEERS<sup>®</sup> to test the maintenance of treatment effects (TG: test 3 = week 26; CG: test 4 = week 40). Assessment schedules for both groups are depicted in Figure 1. For the CG, formal social skills group therapy was prohibited during the waiting period, but general follow-up visits for counseling and pharmacotherapy were permitted.

Primary outcome measures included self-report and caregiver-rated questionnaires quantifying social ability and problems directly related to ASD. Direct observation of teens using the ADOS was also included as a primary outcome measure. Secondary outcome measures included scales for depressive symptoms, anxiety, and other behavioral problems. Parental depressive symptoms and anxiety were also assessed to examine any changes in these areas during the PEERS<sup>®</sup> treatment.

### Primary Outcome Measures

#### *Autism Diagnostic Observation Schedule (ADOS)*

The ADOS is a play-based, semistructured, standardized assessment of communication, social interaction, and play (i.e. imaginative use of materials) for individuals with a suspected diagnosis of autism or ASD. The ADOS consists of four modules, each of which can be selected on the basis of the participant's expressive language skills and chronological age. Module 4 of the ADOS is designed for adolescents and adults with fluent speech, and includes 10 essential and 5 optional activities. The scores from each activity are coded as well as those for five subdomains: language and communication, reciprocal social interaction, imagination, stereotyped behaviors and restricted interests, and other abnormal behaviors [Lord et al., 2008]. Although the primary purpose of the ADOS is the diagnosis of ASD, the authors suggest that raw scores on individual items and domains can be used to measure changes in participant behavior over time [Lord et al., 2008]. We compared the subdomain scores, including total scores and diagnostic algorithms, to determine changes in communication style and social interaction after the PEERS<sup>®</sup> treatment. The Korean version of the ADOS was translated, back-translated, and approved by the authors [Yoo & Kwak, 2007]. Internal consistency was examined using Cronbach's alpha, with the  $\alpha$  of the ADOS subdomain scores found to be 0.85. The ADOS was administered by a member of the research team who was

trained for research use of the ADOS through a training workshop and established full research reliability on this instrument (G. Bong) prior to the present study.

#### *Korean version of the Vineland Adaptive Behavior Scale (EHWA-VABS)*

The EHWA-VABS is a Korean version of the VABS-Second Edition [interview edition, expanded form; Sparrow & Cicchetti, 1985]. It measures adaptive behaviors including communication, daily living skills, and socialization based on the report of primary caregivers. The current study used only the socialization domain and the T-scores of its three subdomains (interpersonal relationship, play/leisure time, and coping skills) as outcome measures of the treatment intervention. The  $\alpha$  coefficients for each subscale for the EHWA-VABS ranged from 0.60 to 0.98, and the average  $\alpha$  ranged from 0.50 to 0.80 [Kim & Lee, 1992].

#### *Test of Adolescent Social Skills Knowledge—Revised (TASSK-R)*

The TASSK-R is a 26-item measure developed for the original PEERS<sup>®</sup> treatment to assess adolescents' knowledge of the specific social skills taught during the intervention [Laugeson & Frankel, 2010]. The TASSK-R is designed to be completed by the adolescent and includes sentence stems related to the didactic lessons in which adolescents choose the best option from two possible choices. Two items are derived from the didactic contents of each of the 13 didactic lessons; total scores range from 0 to 26. The English version of the TASSK-R was translated into Korean with the authors' permission, back-translated into English by a bilingual translator unrelated to this study, and then reviewed and edited again by the Korean PEERS<sup>®</sup> research group. It showed good internal consistency in our sample, with  $\alpha = 0.85$ .

#### *Quality of Play Questionnaire (QPQ)*

The QPQ consists of 12 items completed by parents and adolescents to assess peer get-togethers, both hosted by the teen and those to which the teen was invited, over the previous month. It also includes 10 items assessing conflict during the last hosted get-together. This scale has been used as an outcome measure in previous PEERS<sup>®</sup> studies [Laugeson et al., 2009, 2012]. Using the same process as with the TASSK-R, the QPQ was translated, back-translated, reviewed, and edited. The  $\alpha$  of the QPQ ranged from 0.845 to 0.849 across subscales.

#### *Korean Version of the Social Skills Rating System (K-SSRS)*

The SSRS is an assessment tool that focuses on adolescent social behavior. The K-SSRS (Secondary Level, Student

form 1) was used in the current study, which standardized and extracted 30 items by factor analysis from the original 39-item version of the SSRS, Student form, Secondary Level [Graham & Elliot, 1990; Moon, 2003]. Adolescents respond with “Never,” “Sometimes,” or “Very Often,” with higher scores on the K-SSRS suggesting better social functioning. Total and subscale scores of K-SRSS factors (i.e. assertion, cooperation, empathy, and self-control) were used as outcome variables following the PEERS® intervention. The  $\alpha$  of the K-SSRS has been reported as 0.84 for the total scale, and between 0.65 and 0.81 for the subscales [Moon, 2003], and is 0.85 for current sample.

#### *Social Communication Questionnaire (SCQ), Current Form*

The SCQ measures ASD symptomatology as rated by the primary caregiver. The SCQ consists of 40 items selected from the ADI-R and has diagnostic validity and interview questions parallel to the ADI-R that cover comprehensive ASD symptom domains [Rutter, Bailey, & Lord, 2003]. Of the 40 items, 39 are rated as “yes” or “no” and scored as 0 or 1, respectively, using SCQ AutoScore forms. Total SCQ scores range from 0 to 78 [Rutter et al., 2003]. The Current Form of the questionnaire to quantify teens’ current ASD-related symptomatology was used. The Korean version was translated, back-translated, and approved by the authors [Yoo, 2008]. The internal consistency of the Korean version of the SCQ in our samples was good ( $\alpha = 0.85$ ) and was significantly correlated with other variables measuring autistic symptoms, including the Social Responsiveness Scale (SRS;  $r = 0.56, P < 0.001$ ), the social domain of the ADOS ( $r = 0.43, P = 0.003$ ), and subscales of the Asperger Syndrome Diagnostic Scale (ASDS;  $r = 0.43\text{--}0.67, P = 0.000\text{--}0.003$ ).

#### *Social Responsiveness Scale (SRS)*

The SRS is a 65-item questionnaire that assesses the various dimensions of interpersonal behavior, communication, and repetitive/stereotypic behavior that are characteristics of ASD [Constantino & Gruber, 2005]. The quantitative nature of the SRS makes it useful for measuring the response to interventions over time, and previous research has revealed it to be sensitive to changes in social functioning among children with ASD [Constantino & Gruber, 2005; Laugeson et al., 2012; Wood et al., 2009]. The parent rating form of the Korean version of the SRS provided by Western Psychological Services was used. While the original version of the SRS is composed of five subscales (e.g. social awareness, social cognition, social communication, social motivation, and autistic mannerisms) represented by T-scores, only total raw scores could be calculated as normative data for the Korean version of the SRS has yet to be standardized. The Korean version of the SRS for this sample has good internal consistency ( $\alpha = 0.84$ ).

#### *Asperger Syndrome Diagnostic Scale (ASDS)*

The ASDS is a 50-item parent rating form that measures observable behavioral characteristics in Asperger’s disorder, including language, social, maladaptive, cognitive, and sensorimotor behaviors [Myles, Bock, & Simpson, 2001]. The Korean version of the ASDS was translated and validated by Kim and Shin [2005]. The  $\alpha$  was shown to be 0.88; the correct classification of Asperger’s disorder from other PDDs and communication disorders was 71% [Kim & Shin, 2005]. The ASDS showed good internal consistency in our sample, with  $\alpha = 0.84$ .

#### **Secondary Outcome Measures**

##### *Child Depression Inventory (CDI)*

The CDI measures depressive symptoms in teens. It consists of 27 self-report questions rated on a Likert-type scale ranging from 0 (not present) to 2 (present and marked) [Kovacs, 1985]. The validity and reliability of the Korean version of the CDI has been well established, with a total score of 29 considered the cutoff for severe depressive symptoms [Cho & Lee, 1990]. Although the CDI was developed for children 8–13 years old, the researchers chose to use the inventory given its applicability to the psychosocial issues and level of comprehension of the meaning of the items for the teens participating in this study. The  $\alpha$  for the CDI was 0.85 in the current sample.

##### *State and Trait Anxiety Inventory for Children (STAIC-T and STAIC-S)*

The STAIC consists of two 20-item scales that measure the level of state and trait anxiety in children, with total scores ranging from 20 to 60 each [Spielberger, 1972]. The State-Anxiety Inventory for Children (STAIC-S) asks respondents to describe how they feel at the present time and how their anxiety increases in response to situational stress and declines under relaxed conditions. The Trait-Anxiety scale for Children (STAIC-T) asks respondents about general feelings and measures stable individual characteristics of anxiety. The Korean version of the STAIC standardized by Cho and Choi [1989] was used in the present study. The  $\alpha$  is 0.85 for both STAIC-T and STAIC-S for this study.

##### *Korean Version of the Child Behavior Checklist (K-CBCL)*

The CBCL [Achenbach, 1991] was used to investigate changes in teen behavioral and emotional problems before and after the PEERS® intervention. The CBCL is a parent-report questionnaire in which parents rate teens on various domains of psychopathology. The reliability and validity of the Korean version of the CBCL (K-CBCL) has been well established in Korean children

and adolescents. The K-CBCL score is computed based on Korean normative samples, with the total problem behavior score calculated by summing the scores obtained for each item [Oh, Lee, Hong, & Ha, 1997]. It assesses internalizing and externalizing behaviors across 16 domain subscales. All data are presented as T-scores, with higher T-scores indicating more problems. The  $\alpha$  ranges from 0.84 to 0.85 for each subscale in the current study.

## Parent Psychosocial Outcome Measures

### *Beck Depression Inventory (BDI)*

The BDI consists of 21 items measuring the severity of subjective symptoms of depression, with emotional, cognitive, motivational, and physiological symptom profiles for adults [Beck, Ward, Mendelson, Mock, & Erbaugh, 1961]. Each question has four possible answer choices, scored from 0 (no symptoms) to 3 (the most severe symptoms). The Korean version was developed by Han et al. [1986] and was administered as an outcome measure of parents' mental health in the present study. The  $\alpha$  was 0.85 for the current sample.

### *State and Trait Anxiety Inventory (STAI-T and STAI-S)*

The STAI-T and STAI-S are two 20-item scales that measure the level of anxiety in adults, with item responses ranging from 1 (no symptoms) to 4 (the most severe symptoms). The STAI-S measures the temporary condition of state anxiety, and the STAI-T measures relatively stable individual levels of anxiety [Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983]. The standardized Korean versions of these inventories were used to measure change in anxiety level of parent participants [Lee, Hahn, & Chon, 1996]. The  $\alpha$  was 0.84 for both STAI-T and STAI-S in the current study.

### *Statistical Analyses*

Differences between pretreatment and posttreatment participant variables were analyzed using paired-sample *t*-tests. Comparisons between the TG and CG and the 3-month maintenance effect were analyzed using repeated measures analysis of variance (ANOVA). Statistical analyses were performed with the PASW Statistics Package, version 18.0 (2009; SPSS Inc., Chicago, IL, USA). Statistical significance was defined as  $P < 0.05$ .

## Results

Independent samples *t*-test revealed no significant differences in age, IQ, years of parental education, socioeconomic status (SES), ASD symptom severity, or baseline social skills profile between the TG and CG participants

( $p$ 's  $> 0.05$ ). Baseline characteristics of both groups are summarized in Table 2.

### *Pretreatment and Posttreatment Comparisons: Whole Group Analysis*

Treatment effects were analyzed by comparing outcome variables tested before and after treatment for the 47 participants who completed the study. Of the primary outcome measures, total current scores of the SCQ, total TASSK scores, number of hosted get-togethers as reported by parents on the QPQ, and the assertion subscale and total scores of the SSRS showed significant differences before and after the PEERS® treatment ( $p$ 's  $< 0.05$ ). On the social skills dimension of the EHWA-VABS, interpersonal relationship, play/leisure time, and coping skills scores showed significant improvement after treatment ( $P$ s  $< 0.05$ ). Direct observation of teens using the ADOS revealed significant changes after the PEERS® treatment for total and algorithm scores in the language and communication and the reciprocal social interaction domains. In addition, the stereotyped behaviors and restricted interests domain scores showed modest but significant changes after treatment ( $p$ 's  $< 0.05$ ).

In addition to improvements in primary outcome variables, we observed significant improvements in teen emotional and behavioral functioning. Specifically, there were significant changes between pretreatment and posttreatment CDI total scores as well as on the externalizing and internalizing subscales of the K-CBCL (anxiety/depression, withdrawal, somatization, social problems, thought problems, inattention, aggressive behavior, and total internalizing and externalizing problems). Changes in the mothers' psychosocial functioning were also observed as reflected by significant changes in maternal BDI and STAI-S scores after the intervention ( $p$ 's  $< 0.05$ ). A summary of pretreatment and posttreatment comparisons is provided in Table 3.

### *Comparisons Between the Treatment and Control Groups*

To evaluate treatment effects in each group, repeated-measures ANOVAs were performed for differences in variables between tests 1 and 2 for the TG and CG, with a condition (TG vs. CG)  $\times$  time (baseline vs. posttest) analysis. The following three models were constructed to control covariates that were potentially affecting treatment outcomes: in model I, there were no covariates; model II controlled for the teens' baseline characteristics, including age, sex, and full-scale IQ; and model III controlled for the variables included in model II and added family characteristics, including SES and maternal education and maternal age. Table 4 shows mean pretreatment and posttreatment scores for statistically significant outcome variables in the TG and CG. The results revealed

**Table 2. Baseline Characteristics of the Treatment and Waitlist Control Groups**

	Treatment group ( <i>n</i> = 23)		Waitlist control group ( <i>n</i> = 24)		<i>P</i>	
	Mean	SD	Mean	SD		
Age (years)	14.04	1.64	13.54	1.50	<i>ns</i>	
Sex (% female)		8.70		4.20	<i>ns</i>	
Intelligence	Verbal IQ	99.39	18.09	100.67	16.97	<i>ns</i>
	Performance IQ	99.09	15.80	100.25	18.19	<i>ns</i>
	Full-scale IQ	99.26	15.37	100.46	16.63	<i>ns</i>
EHWA-VABS	Interpersonal	46.57	8.69	49.54	6.41	<i>ns</i>
	Social ability	53.39	6.83	52.33	8.44	<i>ns</i>
	Play/leisure time	39.22	7.78	36.92	9.54	<i>ns</i>
SCQ, lifetime	Coping skills	18.39	6.69	21.63	7.18	<i>ns</i>
SRS		84.74	25.51	94.25	22.62	<i>ns</i>
SSRS, total		28.43	11.26	31.88	6.91	<i>ns</i>
TASSK-R		13.78	3.26	13.75	2.44	<i>ns</i>
ADOS	Communication	4.57	0.95	4.92	0.97	<i>ns</i>
	Social interaction	8.70	2.34	9.17	2.14	<i>ns</i>
	Stereotyped behaviors and restricted interests	0.96	0.56	1.04	0.46	<i>ns</i>
	Imagination	0.35	0.57	0.88	0.95	0.03*
Socioeconomic status		3.13	0.69	2.96	0.64	<i>ns</i>
Parental age (years)	Father	47.22	3.12	46.13	3.90	<i>ns</i>
	Mother	45.00	3.53	43.42	3.63	<i>ns</i>
Parental education (years)	Father	15.13	2.47	15.00	2.50	<i>ns</i>
	Mother	14.74	2.26	14.57	2.54	<i>ns</i>

Independent samples *t*-test for comparisons of means and chi-square test for frequency variable (% female), \**P* < 0.05; *ns*: nonsignificant. Socioeconomic status: 5 points Likert scale from Child Behavior Checklist; 1: high of high ~ 5: low of low.

ADOS, Autism Diagnostic Observation Schedule; EHWA-VABS, Korean version of Vineland Adaptive Behavior Scale; IQ, intelligence quotient; SCQ, Social Communication Questionnaire; SD, standard deviation; SRS, Social Responsiveness Scale; SSRS, Social Skills Rating System; TASSK-R, Test of Adolescent Social Skills Knowledge—Revised.

that TASSK score, number of hosted get togethers as reported by parents on the QPQ, the interpersonal relationship subscale on the EHWA-VABS, language and communication and reciprocal social interaction scores in ADOS, teen internalizing problems on the K-CBCL, and mothers' state anxiety were the outcome variables most significantly influenced by the PEERS® treatment. Estimated adjusted means for statistically significant outcome variables in the TG (dotted line) and CG (solid line) are depicted in Figure 2. There were no differences in the significant outcomes among groups led by different treatment leaders.

#### Maintenance of Treatment Effects: 3-Month Follow-Up Assessment

Figure 3 shows the treatment outcomes that were maintained three months after the PEERS® treatment. No statistically significant differences were found between posttreatment and 3-month follow-up for current scores of SCQ, SRS, teen's CDI, anxiety/depression as reported by the K-CBCL, and maternal STAI-S. TASSK scores at the 3-month follow-up remained significantly higher than at baseline, but had decreased compared with posttreatment measures (*P*s < 0.05). We did not measure ADOS and EHWA-VABS at the 3-month follow-up.

## Discussion

This study was conducted using a RCT to evaluate the feasibility and treatment efficacy of a Korean version of the PEERS® intervention for enhancing social skills in teens with ASD. While it is common to translate and validate rating scales and diagnostic instruments to other languages, treatment programs have rarely been validated in cross-cultural contexts. In terms of the contents of the treatment material, some specific details were not compatible with Korean teen culture, and certain items or phrases could not be directly translated in the Korean language. To capture a more accurate portrait of Korean teens' everyday social life, we surveyed mental health professionals and middle school students in the community and modified the treatment manual accordingly. Modifications included examples of popular social networking sites, different peer groups or crowds in school, common extracurricular activities, and popular jokes and teasing comebacks. Despite these modifications, the main themes and structure of the treatment were retained without major departures from the original English version of the PEERS® treatment manual [Laugeson & Frankel, 2010]. The overall treatment completion rate was 83.7%, and the most frequent cause of premature withdrawal was not related to the treatment process itself.

**Table 3. Pretreatment and Posttreatment Comparisons of Outcome Variables**

			Before treatment ( <i>n</i> = 47)		After treatment ( <i>n</i> = 47)		<i>T</i>	<i>P</i>	
			Mean	SD	Mean	SD			
SCQ, current			13.45	5.42	10.79	5.54	3.11	0.00**	
SRS			84.35	23.22	74.58	27.68	2.71	0.01*	
TASSK-R			14.22	3.66	19.63	4.52	-6.95	0.00**	
QPQ: Parents	Host		0.31	0.68	0.88	1.38	-2.61	0.01*	
	Guest		0.21	0.61	0.17	0.44	0.47	0.64	
	Conflict		6.83	4.59	6.00	6.26	0.65	0.53	
QPQ: Adolescents	Host		1.00	2.61	2.12	3.53	-1.97	0.06	
	Guest		0.98	3.43	0.81	2.71	0.25	0.80	
	Conflict		9.46	7.92	7.62	5.68	1.19	0.25	
SSRS	Assertion		4.14	3.06	4.95	2.91	-2.60	0.01*	
	Cooperation		6.65	2.16	7.05	1.98	-1.27	0.21	
	Empathy		13.37	5.61	14.47	5.19	-1.71	0.10	
	Self-control		5.91	2.49	6.28	2.19	-1.04	0.30	
Total SSRS score			30.07	11.08	32.74	10.17	-2.30	0.03*	
ASDS	Language		4.77	1.91	4.14	2.22	1.79	0.08	
	Social Interaction		7.44	2.78	6.26	3.08	2.01	0.05	
	Behavioral Problems		3.70	2.55	3.45	2.70	0.74	0.47	
	Cognitive Ability		6.88	2.10	6.78	1.59	0.36	0.72	
	Sensorimotor Problems		1.98	1.54	1.68	1.79	1.45	0.15	
CDI			21.30	9.63	16.81	9.83	2.93	0.01*	
STAIC-T			35.47	8.56	33.65	7.00	1.61	0.12	
STAIC-S			36.89	7.94	35.41	8.64	1.23	0.23	
K-CBCL	Anxiety/depression		64.35	7.73	60.81	7.56	3.32	0.00**	
	Withdrawal		66.28	9.00	63.40	9.24	2.36	0.02*	
	Somatization		58.07	7.39	55.51	7.05	2.98	0.00**	
	Social problems		72.12	6.60	68.37	8.40	3.96	0.00**	
	Thought problems		63.28	8.09	61.16	7.38	2.83	0.01*	
	Inattention		63.42	9.64	59.53	9.00	3.70	0.00**	
	Delinquent behavior		58.07	6.71	57.00	6.44	1.10	0.28	
	Aggressive behavior		59.16	8.37	57.30	7.78	2.29	0.03*	
	Internalizing problems		65.88	9.01	61.23	9.35	4.31	0.00**	
	Externalizing problems		59.05	9.35	56.86	9.44	2.18	0.04*	
	Total problems		66.33	9.16	61.98	10.12	4.43	0.00**	
	EHWA-VABS	Interpersonal relationship		48.72	8.38	56.63	7.10	-6.74	0.00**
		Play/leisure time		53.48	6.01	57.85	4.36	-4.60	0.00**
Coping skills			40.15	8.79	45.65	7.07	-4.48	0.00**	
ADOS	Language and communication	Algorithm	4.77	0.98	4.04	0.81	6.20	0.00**	
		Total	9.96	2.18	8.66	2.14	6.75	0.00**	
	Reciprocal social interaction	Algorithm	9.09	2.33	7.74	2.03	8.29	0.00**	
		Total	14.72	3.32	12.74	2.79	7.16	0.00**	
	Imagination		0.47	0.72	0.34	0.52	1.43	0.16	
Stereotyped behaviors and restricted interests			0.96	0.51	0.85	0.42	2.34	0.02*	
Parental measures	BDI	Father	8.59	8.67	7.67	7.51	0.78	0.44	
		Mother	7.24	6.31	5.17	4.61	2.60	0.01*	
	STAI-T	Father	32.23	7.61	31.10	8.00	1.14	0.26	
		Mother	31.60	6.61	30.64	6.27	1.97	0.06	
	STAI-S	Father	30.64	6.27	36.69	6.89	1.44	0.16	
		Mother	36.90	3.97	32.62	6.88	3.72	0.00**	

Paired samples *t*-test, \**P* < 0.05; \*\**P* < 0.01.

ADOS, Autism Diagnostic Observation Schedule; ASDS, Asperger Syndrome Diagnostic Scale; BDI, Beck's Depression Inventory; CDI, Child Depression Inventory; EHWA-VABS, Korean Version of Vineland Adaptive Behavior Scale; K-CBCL, Korean Version of Child Behavior Checklist; QPQ, Quality of Play Questionnaire; SCQ, Social Communication Questionnaire; SD, standard deviation; SRS, Social Responsiveness Scale; SSRS, Social Skills Rating System; STAI-T and STAI-S, State and Trait Anxiety Inventory; STAIC, State and Trait anxiety Inventory for Children (STAIC-T for trait-anxiety and STAIC-S for state-anxiety); TASSK-R, Test of Adolescent Social Skills Knowledge—Revised.

**Table 4. Mean Pretreatment and Posttreatment Scores for Statistically Significant Outcome Variables in the Treatment Group and Control Group**

Variables	Treatment group (n = 23)				Control group (n = 24)				Model I		Model II		Model III			
	Pre		Post		Pre		Post		F	P	F	P	F	P		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD								
TASSK-R	14.00	3.45	19.95	4.93	13.83	2.46	14.35	3.82	16.32	0.00**	10.87	0.00**	8.10	0.01*		
QPQ	Parents—host		0.14	0.36	1.00	1.55	0.30	0.93	0.43	0.84	3.74	0.06	5.09	0.03*	5.14	0.03*
	Adolescents—host		1.10	3.36	1.95	3.15	1.48	3.53	0.87	1.66	1.61	0.21	2.64	0.11	4.64	0.04*
EHWA-VABS: Interpersonal	46.57	8.69	55.35	7.37	49.43	6.53	50.87	7.64	13.49	0.00**	22.65	0.00**	22.86	0.00**		
ADOS	Language and communication		4.57	0.95	3.96	0.88	4.92	0.97	4.96	1.00	8.46	0.01*	14.20	0.00**	20.42	0.00**
	Social interaction		8.70	2.34	7.91	2.15	9.17	2.14	9.46	2.30	22.70	0.00**	31.95	0.00**	25.79	0.00**
	Total		9.43	2.11	8.57	2.41	10.25	1.87	10.46	2.17	8.46	0.01*	14.82	0.00**	13.54	0.00**
	Algorithm		14.30	3.14	13.26	2.91	14.92	3.30	15.13	3.51	12.38	0.00**	15.36	0.00**	12.85	0.00**
CDI	25.67	4.37	18.14	8.62	18.87	10.28	16.78	11.27	4.36	0.04*	4.80	0.03*	3.76	0.06		
K-CBCL	Anxiety/depression		68.19	6.58	65.50	7.31	62.33	8.53	60.96	7.00	5.14	0.03*	3.64	0.06	6.38	0.02*
	Internalizing problems		69.81	8.82	63.19	11.38	64.22	7.53	62.09	7.45	5.80	0.02*	3.04	0.09	4.84	0.03*
STAI-S: Mother	37.26	4.21	30.53	2.12	38.35	5.58	36.61	3.83	10.31	0.00**	7.32	0.01*	4.77	0.04*		

Repeated-measures analysis of variance (ANOVA), \* $P < 0.05$ ; \*\* $P < 0.01$ .

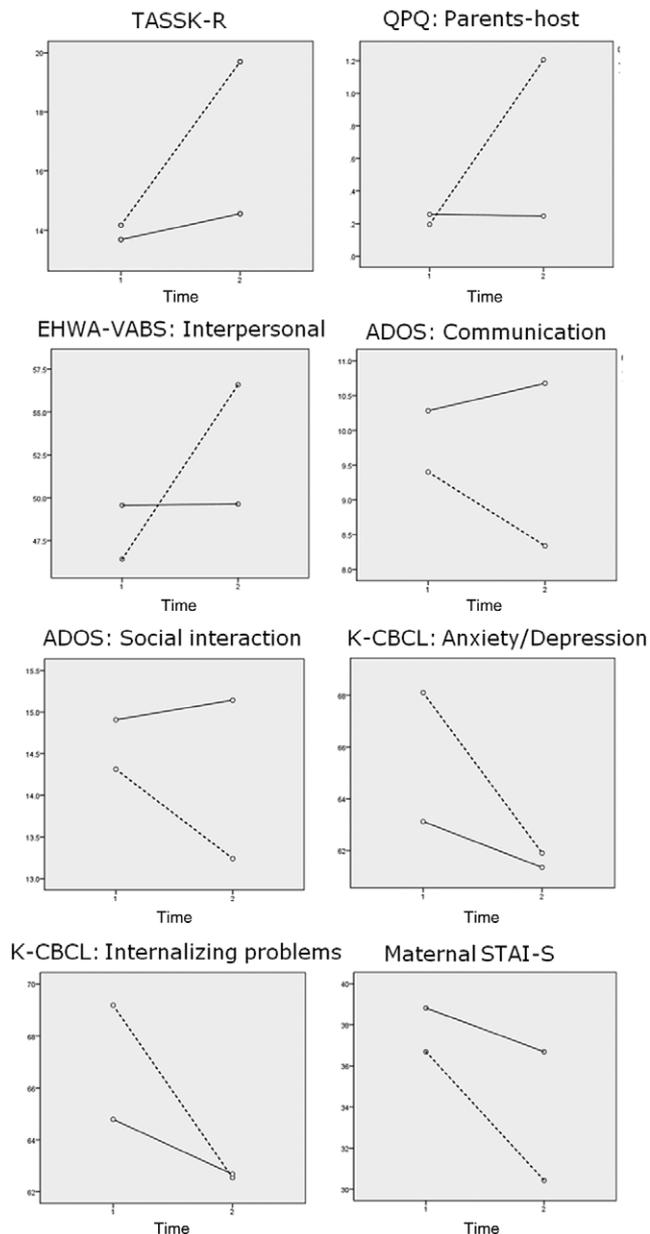
Model I: no covariates are controlled. Model II: Controlled teen's age, sex, IQ, and medication as covariates. Model III: Controlled socioeconomic status, maternal education, and age as well as teen's age, sex, IQ, and medication as covariates. ADOS, Autism Diagnostic Observation Schedule; CDI, Child Depression Inventory; EHWA-VABS, Korean Version of Vineland Adaptive Behavior Scale; K-CBCL, Korean Version of Child Behavior Checklist; QPQ, Quality of Play Questionnaire; STAI-S, State Anxiety Inventory; TASSK-R, Test of Adolescent Social Skills Knowledge—Revised.

This treatment completion rate is slightly higher than that of other RCTs of intervention programs for adolescents [Walkup et al., 2008; White et al., 2013], which supports the feasibility of the Korean version of the PEERS® treatment program. The absentee rate was as low as 1.82%, indicating a satisfactory level of treatment adherence.

The differences between social variables measured before and after treatment strongly suggest that the PEERS® intervention might be helpful in improving teen social skills knowledge, assertiveness and overall social skills, peer engagement through hosted get togethers, social responsiveness, and reducing the overall symptoms of ASD. In addition to improvements in social skills as rated by parents and teens, direct observation (ADOS) and formal assessments (EHWA-VABS) also revealed significant improvements after treatment. Further analysis based on treatment condition (TG vs. CG) and time (baseline and posttreatment) provided more refined data. In models controlling for possible influential baseline characteristics, change of social skills knowledge, interpersonal skills reported by parents on EHWA-VABS, and direct observation of ASD symptoms remained significant. This suggests that the PEERS® intervention might induce more fundamental change in social and communicative behavior and social skills knowledge even after stringent control of related variables. Furthermore, the slight differences in the results between models suggest that baseline characteristics of teens or families do not significantly affect the treatment outcome.

It is noteworthy that the algorithms and total scores of the ADOS revealed strongly significant improvement after treatment in both the language and communication and social interactions domains ( $P < 0.001$ ). As the original authors indicated in their RCTs of PEERS®, behavioral observations would be beneficial to establish the validity of the findings, as parents as well as teens are active participants in the intervention and might be susceptible to bias [Laugeson et al., 2012].

One main difference between the current results and previous work by the UCLA group is that we did not observe significant improvement in SSRS and SRS in the TG compared with the CG when we evaluated the condition  $\times$  time effect [Laugeson et al., 2009, 2012]. This could be attributed to differences in SSRS raters, who were parents in Laugeson's research and teens in the current study. However, it also could be presumed that there are differences in teens' and parents' metacognitive and self-observing abilities regarding culturally based social behaviors or their level of awareness and familiarity with those behaviors. Another explanation might be due to the fact that some teens may have limited insight and self-perception regarding their difficulties [Foley Nicpon, Doobay, & Assouline, 2010]. Thus, direct observation, like those gleaned using the ADOS, could be a complementary measure relatively free of possible biases from perceptual differences or limited insight. However, it is important to interpret the data within the context of multiple instruments as the use of the ADOS as a treatment efficacy measure may be open to practice effects

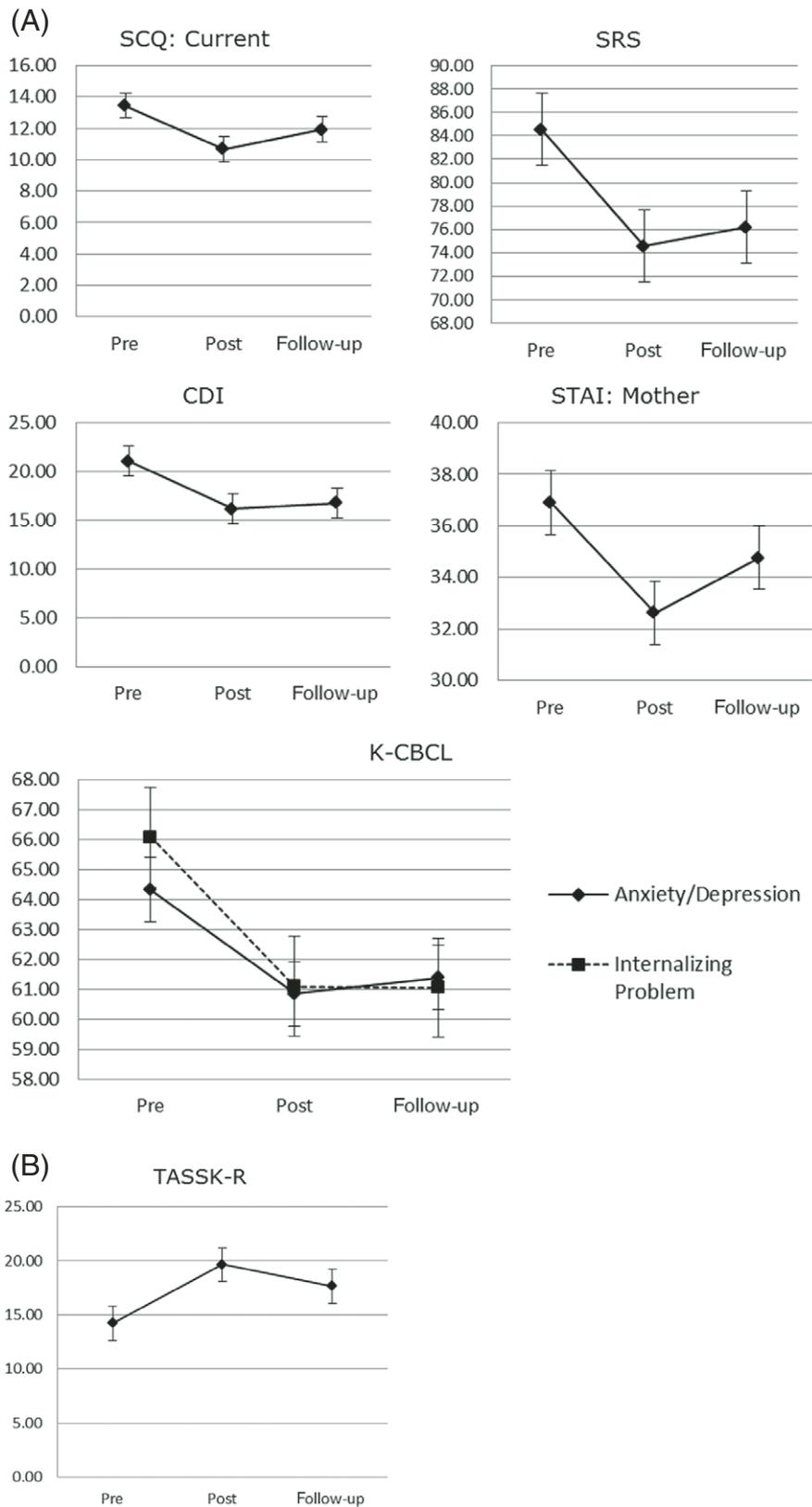


**Figure 2.** Estimated adjusted means for statistically significant outcome variables in the treatment group (dotted line) and control group (solid line). Repeated measure analysis of variance (ANOVA). With model III from Table 2 (controlled socioeconomic status, maternal education and age as well as teen’s age, sex, intelligence quotient [IQ], and medication as covariates). ADOS, Autism Diagnostic Observation Schedule; EHWA-VABS, Korean Version of Vineland Adaptive Behavior Scale; K-CBCL, Korean Version of Child Behavior Checklist; QPQ, Quality of Play Questionnaire; STAI-S, State Anxiety Inventory; TASSK-R, Test of Adolescent Social Skills Knowledge—Revised.

[Lord et al., 2008; Ruiz-Robledillo & Moya-Albiol, 2013; Walkup et al., 2008].

This study found that the PEERS® intervention was effective for improving global emotional/behavioral problems in teens as measured by the K-CBCL, CDI, and STAICs. The most significant change posttreatment was seen in internalizing problems, including anxiety and depression, according to both parental observation and self-report. Anxiety, depression, and even attention deficit/hyperactivity symptoms are known to be common in individuals with ASD [Strang et al., 2012; Taurines et al., 2012]. As comorbid conditions cause increased symptom severity, functional impairment, increased use of psychotropic medication, and higher health expenditures in individuals with ASD [Peacock, Amendah, Ouyang, & Grosse, 2012; Wood et al., 2009], alleviation of these conditions has important clinical implications. The current results revealed that teens’ emotional disturbance, mostly self-reported depressive symptoms, was improved after controlling for the effect of medication. This suggests that those comorbid symptoms associated with ASD might be affected by this intervention even without directly addressing these emotional issues. However, further investigation is needed to understand possible mediating factors leading to symptom improvement (e.g. the nonspecific supportive element of group therapy, more social involvement and acceptance by peers, decreasing or reframing rejection, changes in assertiveness, or family changes).

It has been reported that mothers of adolescents and adult children with ASD have higher levels of stress, anxiety, and depressive symptoms than mothers of typically developing children, or those with children who have other types of disabilities [Abbeduto et al., 2004; Barker et al., 2011; Wang et al., 2013]. In our sample, while levels of maternal anxiety and depressive symptoms did not reach clinical severity, it is noteworthy that PEERS® might be effective for improving mothers’ depressive symptoms and state anxiety. Considering that mothers were the most common parent participants, it is notable to acknowledge the change in mothers’ anxiety as a positive treatment outcome. Evaluating the interaction between parental and teen factors in the current sample is no easy task. However, considering that previous research has shown that lower levels of maternal anxiety and depressive symptoms are associated with child characteristics (e.g. behavior problems or developmental stage) and larger social support networks [Barker et al., 2011], it is likely that improvement in teen functioning after treatment, mothers’ own confidence in social coaching and knowledge obtained from the PEERS® intervention, and group interaction with other parents might mediate a decrease in maternal emotional distress. However, more general therapeutic mediators for cognitive-behavioral psychotherapy, such as expectancy



**Figure 3.** (A) Pretreatment > posttreatment = 3 months after treatment ( $P < .05$ ). (B) Pretreatment > posttreatment > 3 months after treatment ( $P < .05$ ). Variables maintained 3 months following treatment. Repeated-measures analysis of variance (ANOVA),  $P < .05$ . CDI, Child Depression Inventory; K-CBCL, Korean Version of Child Behavior Checklist; SCQ, Social Communication Questionnaire; SRS, Social Responsiveness Scale; STAI-S, State and Trait Anxiety Inventory; TASSK-R, Test of Adolescent Social Skills Knowledge—Revised.

or credibility of treatment, should not be ignored as potential mediators for those changes [Newman & Fisher, 2010]. Evaluating baseline family characteristics, parent and family outcomes, and treatment mediating factors is essential for better understanding of treatment effects as well as the nature of deficits related to ASD [Karst & Van Hecke, 2012]. Therefore, parental outcomes and their mediating factors should be further elucidated in future studies of PEERS®, especially in the context of whole family interaction and system dynamics.

It appears that the treatment effects of PEERS® were largely maintained 3 months after treatment completion, as there were no significant changes in outcome variables between posttreatment and follow-up assessments. Statistically, these improvements were obvious in symptoms of ASD and social responsiveness, as well as secondary outcome variables including anxiety and depressive symptoms, although the level of social skills knowledge was not significantly maintained. It might be interpreted that behavior patterns are somewhat more immune to diminution over time after treatment input has ceased. For practical reasons, we could not conduct direct observations of teens at the 3-month follow-up. Although long-term treatment gains have been established in 1–5 year follow-up assessments with PEERS® participants [Mandelberg et al., 2014], follow-up assessment utilizing direct observational measures might be needed for clarifying the maintenance of long-term treatment effects.

As all participants were enrolled in middle or high school, they could not be free from the cultural environment of the community. Educational strain for high school and college entrance examinations is extremely high in Korea; in fact, this time has been nicknamed “examination hell” [Lee, 2003; Won & Han, 2010]. It is known that South Korean students spend most of their free time completing schoolwork, attending private tutoring institutes, or engaging in passive leisure activities (e.g. watching TV or playing PC games) instead of focusing on active leisure (e.g. sports and socialization activities) after school. It is estimated that Korean teens spend twice as much time as American students on schoolwork [Lee, 2003; Won & Han, 2010]. Further, more than 40% of middle and high school students in Korea report less than 6 hours of daily sleep [Do, Shin, Bautista, & Foo, 2013]. In the current trial, it was unusual for the homework completion rate to be less than 50%. However, the completion rate for the “*source of friends*” assignment declined to 42% when it came to enrollment in an extracurricular activity group and was even less for “*get together*” (as low as 9.5–44.7%) compared with 60–100% for the conversational skills tasks (i.e. *in-group call*, *out-of-group call*, or *practicing conversation with parents*). We assumed that the low homework completion rate for the socialization tasks might be closely related to the teens’

educational environment, shortage of free time, access to extracurricular social groups, and the availability of typically developing peers in the community. This limits the potential for teens to benefit from PEERS®, as the purpose of such homework is to find appropriate sources of friends based on common interests. To maximize the treatment effect of PEERS® while still acknowledging ecological differences among Korean teens, alternative avenues for finding friends should be explored in the future.

This study has a few limitations. First, direct observation data was not available for the maintenance effect. Second, ADOS administration was only partially blinded because of the timing of testing among groups. Third, we did not include ratings from a third party (e.g. teachers). Finally, the study lacked treatment acceptability measures for the participants’ and their families.

## Conclusion

Despite cultural and linguistic differences, the PEERS® social skills intervention appears to be efficacious for teens with ASD in Korea after modest adjustments for cultural differences. In a RCT, participants receiving the PEERS® treatment showed significant improvement in social skills knowledge, interpersonal skills, and state anxiety/depressive symptoms, as well as a decrease in ASD symptoms. This study represents one of only a few cross-cultural validation trials of an established evidence-based treatment for adolescents with ASD.

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