ORIGINAL

Effects of group therapy on jumping to conclusion bias in adolescents with autism spectrum disorder : An exploratory study

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Abstract : Background and Purpose: Jumping to conclusion (JTC)—a cognitive bias in thinking processes—leads to drawing conclusions based on little information, and could be related to psychosis and paranoia. While it has recently been pointed out that it could accompany the autism spectrum disorder (ASD), no interventions targeting this bias in adolescents with ASD have been reported. Therefore, this exploratory study investigated the effects of a group social cognition program on JTC bias in adolescents with ASD. Patients and Methods : Group rehabilitation using social cognition and interaction training (SCIT) was conducted for 12- to 18-year-old adolescents with ASD. An SCIT program comprehensively targets social cognitive functions, including interventions for JTC bias, and examines changes before and after the SCIT intervention, social cognitive functioning tasks, and subjective quality of life (QOL). Results : Thirteen adolescents with ASD participated in this program ; 10 (76.9%) stayed through it. The proportion of participants with JTC bias decreased significantly before and after SCIT (before : 7/10 ; after : 1/10 ; p = 0.041), and subjective QOL increased significantly (p = 0.014). Conclusion : The results show that a group social cognition program with a JTC bias approach improves the JTC bias and increases subjective QOL in adolescents with ASD. J. Med. Invest. 70 : 115-122, February, 2023

Keywords **:** *jumping to conclusion, adolescent, autism spectrum disorder, social cognition and interaction training*

INTRODUCTION

"Jumping to conclusion" (JTC) is a cognitive bias that leads to judgments and strong beliefs based on little information. Its possible involvement in the generation and maintenance of delusions in psychosis, and as a cognitive characteristic of schizophrenia spectrum disorders (SSD) has been reported (1). The bias is present in a high proportion of individuals with psychosis, as well as among those without psychosis, but with paranoid ideas, and experiences of perceptual anomalies being significantly associated with JTC are seen even in healthy individuals (2). A recent meta-analysis examining the JTC bias reported that its prevalence was 60% among those with psychosis, compared with approximately 29% for healthy participants, and 38% for those with nonpsychotic mental health problems (1). Patients with high delusional tendencies, regardless of diagnosis, have also been reported to have a persistent JTC bias, not only in the acute phase but also in the decompensation phase (3). Furthermore, a longitudinal study of SSD similarly found that the JTC bias persisted in both the acute and remission phases, with little change in response to medication or psychotherapy (4). In a longitudinal study that followed clinical high risk for psychosis (CHR) for 2 years, no association was found between reasoning bias at baseline and the subsequent onset of psychosis. However, a significant association was found between JTC at baseline and a reduced level of functioning at 2-year follow-up in the CHR group after adjusting for transition, gender, ethnicity, age, and intelligence quotient (IQ) (5). These findings show that the JTC bias is a cognitive trait that is widely found in individuals with delusional ideation—from schizophrenia to healthy controls—and persists even when the expressed symptoms are in remission. In addition, it worsens levels of social, occupational, and cognitive functioning.

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by core symptoms of repetitive behaviors, cognitive rigidity/inflexibility, and social-emotional disturbances. Individuals with ASD are more likely to make assumptions (6) and have a higher tendency for paranoia than the general population (7). As per reports, ASD coexists with SSD in as many as 34.8% cases ; even more reports state that it coexists with SSD in as many as 60% cases (8). Individuals with ASD have an eight-fold higher risk of developing SSD than the general population (8). Many similarities exist between ASD and schizophrenia, and commonalities have been reported in social cognitive dysfunctions (9). As compared to the general population, while no JTC was reported in adolescents with ASD (10) by one study, others reported a higher tendency toward paranoia and JTC in those with Asperger's syndrome (11). Studies have also reported that children with ASD are more likely than the general population to demonstrate mistaken overconfidence in their answers and JTC (12). Based on these results, the JTC bias may not be a cognitive trait common to all ASD patients, but those with ASD may be more prone to paranoia because they have a background of JTC bias.

The JTC bias as well as other social cognitive abilities, such as reading people's facial expressions and intentions, have also been the subject of therapeutic interventions and programs. Social cognition and interaction training (SCIT) comprehensively covers not only one type of social cognition but a wide range of social cognitive functions, including emotion perception and theory of mind as well as low tolerance for ambiguity and JTC (13).

Received for publication July 5, 2022 ; accepted November 14, 2022.

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SCIT is the most widely practiced program reported to improve social cognitive functioning in psychiatric disorders (14). Patients with schizophrenia and bipolar disorder, who attended the SCIT program, have shown improved social cognitive functioning, including in problems related to decision-making (13, 15). Recently, the SCIT program's Japanese version was prepared, and its effectiveness in improving social cognitive functioning and motivation in schizophrenic patients was reported (16). The SCIT-Autism (SCIT-A) program was created by modifying the SCIT ; as per some reports, it has also been implemented for ASD (17-19). However, the SCIT-A program was structured to modify the contents, assuming that those with ASD do not necessarily have a JTC bias but focus more on irrelevant than socially relevant facts (17). In the first stage, the focus was shifted from the emotion of paranoia to interest/disinterest, and participants were taught to be more aware of social cues (17). In the second stage, they shifted the focus from distinguishing facts and guesses to distinguishing socially relevant facts from socially irrelevant facts (17).

Several intervention practices have been reported that may have positive effects on those with autism, such as those described below (20, 21). Behavioral approaches such as behavior therapy, Applied Behavior Analysis (ABA), and Pivotal Response Treatment (PRT) analyze behavior and try to increase adaptive behavior and decrease nonadaptive behavior by using prompts, reinforcers, and situation regulation. Some types of interventions, such as the Picture Exchange Communication System (PECS), teach the use of assistive communication systems (e.g., devices, communication cards) other than oral/vocal communication. There are also interventions such as the Parent-Child Interaction Therapy (PCIT), in which the therapist directly instructs and supports the caregiver on the spot by observing the caregiver's interaction with the young child. Some types of interventions, such as Social Skill Training (SST), use modeling and role-playing techniques based on real-life situations to teach basic skills for coping with social life. In addition, the Program for Education and Enrichment of Relational Skills (PEERS), which is included in SST in the broadest sense, helps students make friends of the same age. Sensory integration therapy (SIT) is used to compensate for the frequent co-occurrence of sensory difficulties and clumsiness. Interventions such as FaceSay also directly train social cognitive functions such as facial expression recognition. However, the Treatment and Education of Autistic and Communication handicapped Children (TEACCH) methodology is a barrier-free conception of intervention that respects the cognitive characteristics of autism in each child and creates an environment that does not target changes in surface characteristics or language and behavior. In addition, comprehensive approaches have emerged that combine the best parts of intensive intervention practices. Typical examples are the SCERTS model and Early Start Denver Model (ESDM). They are practiced over an extended period, on a yearly basis, targeting a wide range of learning or developmental problems related to the core characteristics of autism. As described above, many useful autism intervention programs have emerged, but they are still in their infancy and do not yet cover all ASD characteristics and social adjustment issues.

Interventions that focus on social cognitive functions include interventions that focus on specific social cognitions in addition to the previously mentioned facial expression recognition. The ones most reported are the theory of mind and emotional processing interventions, with a limited number of attributional biases and social perception interventions (14). Meta-analyses of randomized controlled trials of behavioral interventions targeting these social functions and social cognition have reported significant gains in social functioning and social cognition among children and adolescents, who received behavioral interventions for social deficits, compared with control participants across diagnoses (22). This demonstrates the effectiveness and importance of a nonpharmacological approach to social cognition for children and adolescents. However, there are no reported intervention programs for children and adolescents with ASD, that target decision-making and reasoning processes, such as the JTC. As previously mentioned, those with ASD are at a high risk of psychosis and paranoia-prone thinking. Similarly, one of the risk factors for the formation of delusional and paranoia-prone thinking is a JTC bias ; hence, improving their quality of life (QOL), an intervention for JTC bias, may be useful.

For adolescents with ASD, this study implemented an SCIT program, including intervention for JTC bias. It assessed the program's feasibility, social cognitive functioning, and QOL, including assessment of the JTC bias, before and after the SCIT program.

PATIENTS AND METHODS

Participants

Adolescents aged 12-18 years, who are in the transitional period from child to adult, in junior high school, and high school in Japan, and who attended the Department of Psychiatry and Pediatrics of Tokushima University Hospital, were recruited as participants. Two child and adolescent psychiatrists used the DSM-5 for diagnoses. Participants' comorbidities included attention-deficit/hyperactivity, generalized anxiety, social anxiety, conduct disorders, and epilepsy. Of all participants, seven were on medication. The IQ for children aged 16 and below was measured using the Wechsler Intelligence Scale for Children-IV (WISC-IV) ; whereas the Wechsler Adult Intelligence Scale-III (WAIS-III) was used for participants aged 17 years and above. As the program was adapted from an adult program for adolescents, a certain level of intellectual ability was considered necessary for the comprehension of its contents. Therefore, those falling below 70 on total IQ were excluded.

Interventions

SCIT is a manual-guide group intervention, wherein participants meet up to 20 times (once a week, for approximately an hour). Its Japanese version was translated by Nakagome *et al*. (23). The SCIT is divided into three modules. The first stage (sessions 1 to 7) comprised an introduction (therapeutic alliance) and emotion-perception training. The second stage (sessions 8 to 15) covered an approach to thinking processes and decision-making, such as JTC, attributional styles, and tolerance for ambiguity. Finally, in the third stage (sessions 16 to 20), the techniques learned up to that point were reinforced and generalized to daily life. The third stage consisted of repeating the same procedure, dealing with the participants' own experiences. This stage was changed from sessions 16-20 to sessions 16-17 because the experiences of all participants could be adequately dealt with in two sessions.

The program was conducted by a treatment team consisting of one or two psychiatrists and a clinical psychologist, and three to five patients. All sessions had the same set of participants. The therapists were trained extensively in a two-day hands-on training session by the developers of the SCIT Japanese version.

Slides were created for all sessions to make it easier for the adolescents with ASD to understand and visualize the program's contents. Based on the participants' experiences during the first half of their adolescence, some content was added to the case study on SCIT (Table 1). Additionally, suspiciousness, JTC, and distinguishing facts and guesses were not removed, and

the general themes of SCIT were not changed. However, using the same material in SCIT, training was conducted to not only distinguish facts and guesses but also to distinguish socially relevant facts from socially irrelevant facts. The first, second, and third phases : 1-7, 8-15, and 16-17, respectively, spanned 17 hours.

Table 1. In sessions 9–10, participants would use some scenarios to practice producing other guesses to avoid jumping to conclusions.

1	You sent a message to your friends around 16:00 hours to play with you this weekend. However, the next morning, you still had not heard back from your friends.
2	You lent your comic book to your classmates. A few days later, you got it back. As you read it, you noticed that your favorite page was torn.
3	Two of your classmates, who are not very close to you, talked happily to each other, "Are you stupid?" Then, when you said to your classmate, "Are you stupid?" he was really angry, "Why can't you say that?"
4	The other day you took a test. Its results were not very good. You shared the results only with one of your close classmates. At a later date, the results of your test were known to other classmates.

Measures

SCIT comprehensively covers a wide range of social cognitive functions including emotion perception and theory of mind as well as low tolerance for ambiguity and JTC. To assess the impact of SCIT on social cognitive functioning and social skills for children with autism, we felt it necessary to assess the theory of mind and interpersonal skills as well as JTC bias. The beads task was used to assess JTC bias. The social cognition screening questionnaire (SCSQ) and hint task, which were used to determine the effectiveness of the Japanese version of the SCIT, were used to assess the theory of mind. The social responsiveness scale second edition (SRS-2) was also used to assess whether improvements in social cognitive function resulted in objectively observed improvements in autistic social skills. Subjective QOL was then measured using the QOL questionnaire because even if cognitive function improved if subjective QOL worsened, the intervention program would be of less therapeutic significance. Subjective QOL was assessed using a QOL questionnaire for primary school children in the third grade and above, as well as junior high school students.

Beads task (24,25) : This task assesses the JTC bias and consists of 1) two versions of the 85 : 15 (easy), in which participants were presented with two jars—one containing 85 brown beads and 15 white beads and the other containing 15 brown beads and 85 white beads, and 2) the 60 : 40 ratio (more difficult task). The contents of both jars were then hidden from view, and participants were shown that individual beads were drawn from one jar in succession. The beads were presented in a prespecified order. Thereafter, the participants were asked to decide which jar they were being drawn from. The fewer the beads that participants had while answering, the higher was the JTC bias. If they decided to have less than three beads, they were assessed to have a high JTC bias (1,2). Draws to decision were highly correlated between three trial repetitions, with Pearson's r ranging from 0.71-0.77 and 0.78-0.85 in the easy and difficult, respectively (26).

SCSQ (27) : This task consists of five subscales (verbal memory, contextual reasoning, theory of mind, metacognition, and hostility bias). The examiner reads sentences describing conflict situations found in everyday life situations and asks participants three questions on verbal memory, inference from context, theory of mind (including causal attribution style hostility bias), and confidence in the last question (metacognition). The 10 items in each domain are graded on a 10-point scale, with higher scores indicating better functioning. Hostility bias was graded on a 5-point scale, with higher scores indicating greater hostility bias. The theory of mind, metacognition, and hostility bias were used as social cognition. The Japanese version has been validated and is reliable in adults (28). Cronbach's alpha for the SCSQ total score was 0.72 (28).

Hinting Task (29) : This task assesses the theory of mind. It consists of 10 stories about two characters. The participants are asked to answer about character A's intention based on the ambiguous words and actions of character A toward character B. The correct answers can be given in multiple ways, as there are multiple correct answers. Participants are assigned two points if they get one correct answer from the question text alone, and 1 point if the clue given is not enough to get the correct answer. The total score is 20. The higher the score, the better the theory of mind. Cronbach's alpha in adults with autism and typically developing were 0.74 and 0.40, respectively (30).

SRS-2 (31) : This task comprises a questionnaire rating scale that asks caregivers about objective ASD characteristics. It consists of six subscales : social awareness, social cognition, social communication, social motivation, interest restriction, and repetitive behavior. The severity of ASD is calculated from the overall T-score ; the higher the score, the more severe the social impairment. T scores of 60-75 and ≥76 were associated with mild-to-moderate and severe symptomatology, respectively. A Japanese version has been created and standardized (32). Cronbach's alpha was in the range of 0.92 to 0.95 (32).

QOL questionnaire (33) : It is a comprehensive questionnaire designed for Japanese elementary and junior high school students considering developmental issues. It consists of 37 items and six subscales : "F1 : No worries and anxieties," "F2 : Home and family satisfaction," "F3 : Friends satisfaction," "F4 : School and teachers' satisfaction," "F5 : Overall health satisfaction," and "F6 : Fitness, diligence, and self-esteem." The scores ranged from 37 to 185, with higher scores indicating a higher subjective QOL. It was standardized for 1,106 and 1,004 elementary and junior high school students, respectively, throughout Japan. Cronbach's alpha was 0.93 for the total score and 0.69-0.84 for the subscales (33).

Trial Design

The study used a before-after design, with tests conducted before and after (6 months later) SCIT. The program's duration was one hour, and was conducted weekly, around 17 times. If the participants missed a class, they were asked to come early for the next class, and before the start of the program were given an individual lecture with a recap of the previous session's content. Participants continued to receive their usual treatment during the program, but the medication content was not controlled for those receiving medications. The implementation period was from May 2018 to March 2022.

Statistical Analysis

Data were expressed as median (interquartile range [IQR]). As some continuous measures were not normally distributed ($p < 0.05$) with the Shapiro-Wilk test, the Wilcoxon signed-rank test was used to compare the corresponding test result scores before and after SCIT. Differences, with $p < 0.05$, were considered statistically significant in all cases. The effect size was measured using Cliff's Δ, whose index of effect size was considered negligible if ≤ .15, small if .16-.33, medium if .34-.47, and large if ≥.47

(34).

The presence or absence of JTC was based on the cutoffs of previous studies (2,35). Those having two or fewer bead balls, and three or more bead balls, were defined as having and not having a JTC bias, respectively. The change in those with JTC before and after SCIT was determined using McNemer's test. The R version 4.1.2 was used as the analysis software.

Ethical Considerations

Ethical approval was obtained for the study (Ethics Committee of Tokushima University Hospital) and the trial was registered with the University Hospital Medical Information Network (UMIN000030140). Written consent was obtained from all the participants and their caregivers. When obtaining participants' consent, they were informed that they could withdraw from the study at any time, and the interruption would not usually affect their treatment.

RESULTS

Participants' Backgrounds and Attendance Rates

Fourteen adolescents with ASD participated in the SCIT. One participant, who met the diagnosis of intellectual disability (IQ <70) was excluded from the analysis. Of the 13 adolescent participants with ASD, 10 (76.9%) participated until the end, and their attendance averaged 13.9 times throughout the 17 sessions, although some were absent during the study. The age, sex, attendance, comorbidity, and oral medication of the 13 participants are shown in Table 2. No specific characteristics were found in three participants who dropped out.

The analysis of this study was conducted with 10 participants (five males and five females) aged between 12 and 18 years, whose demographic data are shown in Table 3.

The median [IQR] of the participants' age was 14.00 [13.00, 14.75]. The median SRS total score for participants was 70.50, which was within the moderate range for the severity of ASD characteristics. The distribution of severity of ASD characteristics among the participants comprised three with severe and seven with moderate characteristics. The median total IQ in the WISC-IV was 99.00, within the level range of the mean. The 17-year-old participants had a total IQ of 117, which was considered as high functioning.

The Changes in Outcomes Between Before and After SCIT

The changes in outcomes among adolescents with ASD before and after SCIT are shown in Table 4. The 60 : 40 beads task (difficult) showed the following results : the number of beads (tendency to gather information) significantly increased with a high effect size (before SCIT : 1.50 [1.00, 2.75], after SCIT : 4.00 [3.00, 4.75], effect size (Cliff's Δ) = 0.64, p-value = 0.041) ; proportion of participants with a JTC bias decreased significantly before and after SCIT (before SCIT : 7 out of 10, after SCIT : 1 out of 10, McNemar's chi-squared = 4.17, df = 1, p-value = 0.41) and confidence levels did not change before and after SCIT. However, in the 85 : 15 bead ball task (easy), the number of beads did not change before and after SCIT (before SCIT : 3.00 [2.00, 3.75], after SCIT : 3.00 [3.00, 4.00], effect size (Cliff's Δ) = 0.18, p = 0.64) ; proportion of participants with JTC bias decreased but did not change significantly (before SCIT : 4 of 10, after SCIT : 2 of 10, McNemar's chi-squared = 0.25, df = 1, p = 0.617) ; confidence levels increased significantly before and after SCIT (50.00 [42.50, 57.50] before SCIT, 55.00 [50.00, 77.50] after SCIT) ; and effect size (Cliff's Δ) = 0.32, p = 0.022).

The results of the SCSQ showed that the theory of mind, hostility bias, and metacognition showed a trend toward improvement with small to medium effect sizes, although not significant (effect size (Cliff's) $\geq$ 0.16, P > 0.05).

The results of the QOL questionnaire showed that the subjective QOL increased with a weak effect size (before SCIT : 76.00 [72.25, 92.50], after SCIT : 98.50 [76.25, 116.50], effect size (Cliff's Δ) = 0.26, p = 0.014). The results of the subscales : "F1 : No worries and anxieties" (before SCIT : 19.00 [15.25, 25.00], after SCIT : 24.00 [20.25, 31.50], effect size (Cliff's Δ) = 0.35, p = 0.008) ; "F3 : Friends satisfaction" (before SCIT : 13.50 [8.75, 15.00], after SCIT : 15.50 [12.75, 17.00], effect

Table 2. Participants' age, sex, attendance, comorbidity and oral medication

No	Age	Sex	Attendance	Comorbidity	Oral medication
1	13	Female	12	ADHD	Methylphenidate 54mg
2	14	Male	15	Epilepsy	Sodium valproate 800mg
3	14	Male	17	ADHD, Conduct disorder	Aripiprazole 6mg Guanfacine 2mg
4	12	Male	13	-	-
5	13	Female	16	Epilepsy, ADHD	Sodium valproate 400mg Guanfacine 2mg
6	14	Male	17	ADHD	Olanzapine 5mg Methylphenidate 27mg
7	13	Female	11	General anxiety disorder, Insomnia Disorder	Fluvoxamine 125mg Suvorexant 15mg
8	18	Male	10	ADHD	-
9	16	Female	15	Social anxiety disorder	Mirtazapine 15mg
10	12	Male	14	ADHD	-
11	13	Female	3	Anorexia Nervosa	-
12	14	Male	7	-	-
13	14	Male	1	Tics	Haloperidol 1.5mg

ADHD : attention-deficit/hyperactivity disorder

Table 3. Demographic and clinical characteristics of participants (n = 10)

Age, years		10
Sex (%)	Male	5 (50)
	Female	5 (50)
Age, years		14.00 [13.00, 14.75]
SRS-2	Total	70.50 [66.25, 81.50]
	Social communication	72.50 [67.75, 82.25]
	Social awareness	67.00 [58.25, 69.75]
	Social motivation	65.50 [56.75, 77.50]
	Social cognition	68.00 [62.50, 75.00]
	Restricted interests and repetitive behavior	70.00 [65.75, 84.75]
WISC- Ⅳ	N	9
	FSIQ	99.00 [83.00, 113.00]
	PRI	102.00 [76.00, 127.00]
	PSI	91.00 [67.00, 110.00]
	VCI	101.00 [88.00, 121.00]
	WMI	88.00 [73.00, 120.00]
WAIS- Ⅲ	N	1
	FIQ	117
	PO	128
	PS	114
	VC	108
	WM	106

Data for measures are number or Median or Interquartile Range in brackets. SRS-2 : Social Responsivity Scale-2, WISC-Ⅳ : Wechsler Intelligence Scale for Children-IV, WAIS-Ⅲ : Wechsler Adult Intelligence Scale-III,VCI : Verbal Comprehension Index ; PRI : Perceptual Reasoning Index ; WMI : Working Memory Index; PSI : Processing Speed Index ; FSIQ : Full Scale Intelligence Quotient, PO : Perceptual Organization, PS : Processing Speed, VC : Verbal Comprehension, WM : Working Memory

size (Cliff's Δ) = 0.38, p = 0.041) and "F6 : Fitness, diligence and self-esteem" (before SCIT : 12.00 [5.50, 14.50], after SCIT : 14.50 [10.50, 18.75], effect size (Cliff's Δ) = 0.31, p = 0.047) showed significant increases with moderate effect sizes ; "F4 : School and teachers satisfaction"(before SCIT : 9.50 [8.25, 10.00], after SCIT : 11.50 [8.00, 13.50], effect size (Cliff's Δ) = 0.26, p = 0.112) and "F5 : Overall health satisfaction" (before SCIT : 10.50 [9.25, 11.75], after SCIT : 12.00 [11.00, 14.50], effect size (Cliff's Δ) = 0.31, p = 0.122) increased with weak to moderate effect sizes, although not significantly. Because the QOL scale is primarily intended for elementary and middle school students, the analysis was also conducted with only eight middle school students, excluding two high school students. The QOL results for those 8 students were similar to the results of the QOL analysis conducted with 10 students ("total scores" (before SCIT : 73.50 [69.25, 79.00], after SCIT : 95.50 [66.75, 105.75], effect size (Cliff's Δ) = 0.25, p = 0.042) ; " "F1 : No worries and anxieties" (before SCIT : 17.50 [14.75, 19.75], after SCIT : 21.50 [18.75, 27.50], effect size (Cliff's Δ) = 0.43, p = 0.02) ; "F2 : Home and family satisfaction," (before SCIT : 17.00 [12.50, 21.50], after SCIT : 18.00 [11.00, 24.00], effect size (Cliff's Δ) = 0.13, p = 0.527) ; "F3 : Friends satisfaction" (before SCIT : 13.50 [7.25, 15.25], after SCIT : 15.50 [14.25, 17.00], effect size (Cliff's Δ) = 0.38, p = 0.076) ; "F4 : School and teachers satisfaction ; " (before SCIT : 9.50 [8.00, 10.00], after SCIT : 11.00 [7.00, 12.50], effect size (Cliff's Δ) = 0.19, p = 0.29) "F5 : Overall health satisfaction ; " (before SCIT : 10.50 [9.50, 11.25], after SCIT : 12.00 [9.75, 15.50], effect size (Cliff's Δ) = 0.27, p = 0.27) "F6 : Fitness, diligence and self-esteem" (before SCIT : 9.50 [5.00, 13.50], after SCIT : 12.50 [9.75, 19.75], effect size (Cliff's Δ) = 0.27, p = 0.068).

Objective social impairment ratings from caregivers on the SRS-2 showed little change before and after SCIT (before SCIT : 70.50 [66.25, 81.50], after SCIT : 73.00 [55.00, 78.00], effect size (Cliff's Δ) = 0.12, p = 0.15), but among the subscales, only social awareness showed improvement with moderate effect sizes (before SCIT : 67.00 [58.25, 69.75], after SCIT : 55.50 [44.50, 64.25], effect size (Cliff's Δ) = 0.37, p = 0.052).

DISCUSSION

This exploratory study examined the effectiveness and feasibility of an intervention for the JTC bias in adolescents with ASD. To date, there have been no reports of group psychotherapy targeting the JTC bias in adolescents with ASD. Participants in this study increased the number of beads collected before and after SCIT in the 60 : 40 beads task (difficult). While 7 of the 10 participants had JTC bias before SCIT, the number

Table 4. The changes in outcomes between before and after SCIT

			before SCIT (N=10)	after SCIT (N=10)		
			median Q1-Q3	median Q1-Q3	P value	Effect size
SCSQ		Theory of mind	6.50 [6.00, 7.75]	8.00 [7.25, 8.75]	0.190	0.38
		Hostility bias	2.00 [1.00, 2.75]	1.00 [1.00, 1.00]	0.270	0.26
		Metacognition	9.33 [8.75, 9.92]	9.66 [9.33, 10.00]	0.580	0.21
Beads task	85:15	Number of draws	3.00 [2.00, 3.75]	3.00 [3.00, 4.00]	0.666	0.18
		Decision confidence	50.00 [42.50, 57.50]	55.00 [50.00, 77.50]	0.022	0.32
		Number of JTC	4	2	0.617	
	60:40	Number of draws	1.50 [1.00, 2.75]	4.00 [3.00, 4.75]	0.013	0.64
		Decision confidence	50.00 [16.75, 58.75]	50.00 [50.00, 65.00]	0.233	0.16
		Number of JTC	7	1	0.041	
Hinting Task			11.00 [10.00, 15.00]	14.00 [13.00, 16.00]	0.204	0.3
QOL questionnaire		total	76.00 [72.25, 92.50]	98.50 [76.25, 116.50]	0.014	0.26
		F1 : No worries and anxieties	19.00 [15.25, 25.00]	24.00 [20.25, 31.50]	0.008	0.35
		F2 : Home and family satisfaction	20.00 [13.50, 22.50]	21.50 [12.00, 24.00]	0.356	0.14
		F3 : Friends satisfaction	13.50 [8.75, 15.00]	15.50 [12.75, 17.00]	0.041	0.38
		F4 : School and teachers satisfaction	9.50 [8.25, 10.00]	11.50 [8.00, 13.50]	0.112	0.26
		F5 : Overall health satisfaction	10.50 [9.25, 11.75]	12.00 [11.00, 14.50]	0.122	0.31
		F6 : Fitness, diligence and self-esteem	12.00 [5.50, 14.50]	14.50 [10.50, 18.75]	0.047	0.31
SRS-2		total	70.50 [66.25, 81.50]	73.00 [55.00, 78.00]	0.153	-0.12
		Social communication	72.50 [67.75, 82.25]	74.00 [55.00, 80.75]	0.406	-0.07
		Social awareness	67.00 [58.25, 69.75]	55.50 [44.50, 64.25]	0.052	-0.37
		Social motivation	65.50 [56.75, 77.50]	65.50 [57.25, 70.00]	0.677	-0.03
		Social cognition	68.00 [62.50, 75.00]	72.00 [55.75, 77.75]	1.000	0.04
		Restricted interests and repetitive behavior	70.00 [65.75, 84.75]	65.00 [54.25, 78.50]	0.262	-0.22

Q1-Q3 : Interquartile Range
P value were calculated from Wilcoxon signed-rank test and McNemer test
Effect size were calculated from Cliff's Δ ; negligible: ≤ .15, small : .16-.33, medium : .34-.47, large : ≥.47
SCIT : Social Cognition and Interaction Training, SCSQ : Social Cognition Screening Questionnaire, QOL : quality of life, SRS-2 : Social Responsivity Scale-2

significantly decreased to 1 out of 10 after SCIT. The results of our exploratory intervention study showed that SCIT may improve bead tasks, which may reflect JTC bias in adolescents with ASD. However, we cannot rule out the possibility that the participants in this study happened to be a group with high JTC bias, leading to an effect size of significant change in JTC bias. Prior research has reported that 38% of those with nonpsychotic mental health problems have JTC bias, as assessed by the beads task (1). For the participants in this study, the percentage was comparable at 40% for the 85 : 15 beads task (easy), but clearly higher at 70% for the 60 : 40 beads task (difficult). This may have been because of this study having many adolescents with the JTC bias. Previous studies do not agree on whether those with ASD are more likely to have JTC bias (10-12). Therefore, it is impossible to determine whether this study's participants represent a population that can be generalized to adolescents with ASD.

In this study, a higher percentage of participants had a JTC bias in the 60 : 40 bead task (difficult) than in the 85 : 15 bead task (easy). This may have been because the 85 : 15 task clearly showed which bead count was higher, whereas the 60 : 40 task made it difficult to determine which bead count was higher, and participants had to answer based on ambiguous information. Although ambiguity avoidance, in which people avoid uncertain situations and act cautiously when facts are ambiguous, is generally observed, ambiguity avoidance is weaker in those with ASD (36).

This study found an increase in subjective QOL measures before and after the SCIT intervention, approaching the mean value of the standardized total QOL scale (129.7 ± 21.3) (33). The subjective QOL subscale showed various improvements in "F1 : No worries and anxieties," "F3 : Friends satisfaction," "F4 : School and teachers' satisfaction," "F5 : Overall health satisfaction," and "F6 : Fitness, diligence, and self-esteem," but only "F2 : Home and family satisfaction" remained almost unchanged. However, there was little improvement in social impairment, as assessed by caregivers using the SRS-2. Thus, even though the participants' JTC bias and subjective QOL had improved, as evaluation of improvement from the family's viewpoint had been scant, the participants did not show any improvement in QOL in terms of family relationships. This could suggest the importance of family interventions during adolescence, as well as intervention for the persons themselves. However,

among the SRS-2 scales that showed little improvement, only the subscale of social awareness showed a moderate potential for improvement. Social awareness is an item that specifically assesses social cognition, such as paying attention to persons who are watching or listening, noticing how loud they are, interrupting suddenly when people are talking, and matching topics and facial expressions.

The original SCIT program was designed for adults. Therefore, we thought that implementing it as it is for adolescents would not have a sufficient effect on their understanding and persistence rates. We created slides for all sessions, that were visually informative, with examples that were relevant to the adolescent age group. Additionally, we tried maintaining adolescents' motivation to participate in SCIT by incorporating commercially available board games during the sessions. In a previous study using the Japanese version of the SCIT in adults, the persistence rate was 88.9% (32/36) (16). In our adolescent SCIT study, the persistence rate was slightly lower at 76.9% (10/13). However, we believe we obtained some persistent rates. Two patients withdrew after : first and third sessions, respectively. Another withdrew after the seventh session. The two who withdrew after the first and third sessions were not motivated to continue, whereas the one who withdrew after the seventh session was unable to keep up with the schedule during the long program.

The problems with this program are : it is too long (17 sessions) for adolescents, and its contents are too varied and voluminous for them to understand and retain. Although all the contents of SCIT are critical and relevant, it is considered too much for children to understand and retain. Based on the results of implementing the SCIT program, we shall consider creating a new program that reduces the number of times, focuses on content, such as balanced information gathering and unbiased thinking, like JTC.

LIMITATIONS

This study had three limitations. First, its sample size was small ; the program was a long-term intervention with 17 sessions ; and there were limitations in gathering many participants in a short time at only one facility. Being an exploratory study, its effectiveness could not be determined, though its feasibility has been demonstrated. Second, as this is a before-and-after study without a control group, the possibility of age-related changes in natural growth cannot be ruled out in the SCIT non-intervention group. In particular, the social cognitive tasks used in this study (bead task, SCSQ, and hinting task) were not sufficiently standardized for children and adolescents, whereas with regard to the QOL measures, the standardized results indicated that the average QOL scores for each age group decreased slightly as age increased (33). This suggests that factors other than age-related changes may have contributed to the increase in subjective QOL for the participants in this study, and that participation in the SCIT program may have been partially responsible for it. However, this study did not measure changes in factors other than SCIT that might affect QOL, so caution should be exercised in determining the effect of SCIT on improving QOL. Furthermore, it should be noted that the Cronbach's alpha coefficient for the hinting task in typically developing was low (Cronbach's alpha = 0.40). However, the participants in the current study were ASD, and the hinting task in ASD met fair reliability (Cronbach's alpha = 0.72) (30). Third, its participants received the usual medical care and medication, and were not controlled for drug treatment. Therefore, the influence of medications cannot be excluded. However, in a longitudinal study of SSD, JTC bias persisted in both the acute and remission phases, with little change in response to medication or psychotherapy (4). Thus, the decrease in the proportion of those with JTC in this study may be an effect of the study's program.

CONCLUSION

This exploratory study demonstrates the feasibility of a group cognitive program for JTC bias in adolescents with ASD. JTC bias is often discussed in relation to SSD, and only a few studies have focused on JTC bias in ASD, which has received little attention. However, the comorbidity of ASD and psychosis is high, and psychotropic medications have been reported to be less beneficial for psychotic symptoms in children with ASD (37). It may be worthwhile to evaluate the presence of JTC bias in ASD as well, and to implement non-pharmacologic therapy against JTC bias, such as the program in this study.

CONFLICT OF INTERESTS DISCLOSURE

There is no conflict of interests to disclose in relation to this paper.

ACKNOWLEDGEMENTS

This work was supported by JSPS KAKENHI (Grant Number JP21K15714).

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