加者が各試行でこれらのどの課題解決方略をどの程度とったかは明らかではない。表2のデータは（2）の可能性が少ないことを示しているものの，（1）と（3）のいずれかであるかははっきりしない。この点については，今回の課題状況においてビデオA1の視覚情報を遮断し聴覚情報のみが利用可能な条件，そして音声をすべて消して視覚情報のみが利用可能な条件で，同調傾向の知覚が成立するか否かをPDD群と対照群で調べてみる必要がある。また，本研究は非言語コミュニケーションの領域に焦点を当てて実験を構成したが，ビデオA1の聴覚情報は言語内容を含んでいた。この点についても，音声を加工して発話のプロソディ情報だけを残した実験事態での遂行を確認するなどの必要がある。これらについては，今後の検討課題である。

次に今回の動画刺激では，3つのビデオが比較的小さいために，参加者がビデオのどこを注視しているかについての詳細な分析ができなかった。この分析が可能となれば，ビデオB1やB2の視覚情報について，唇の動きを読んでいるのか，うなずきや表情変化，口の動きといった多様なジェスチャー情報を手がかりにしているのかを検討することができるかもしれない。この点については，動画刺激を3画面の構成とするのではなく，二人の会話者の一方の顔の動画と他方の発話音声を一つの動画に組み合わせた刺激を構成して，同調傾向の知覚を検討することでアプローチできると思われるが，これも今後の課題である。

さらに，今回の実験では，課題状況が自然な会話場面であったために，本研究で示唆された，PDDの困難さにかかわる基礎的な認知過程を直接検討できていない。考察の中で概観した，PDDの時間経過の知覚困難は機械音を用いた実験で明らかにされている。このことはPDDの社会性障害の基底に，社会性とは直接関係のない認知活動の機能不全が存在している可能性を示唆する。一方，異なる感覚モダリティの情報統合の困難さはコミュニケーションやジェスチャーなど社会的な刺激を用いた研究から導出されている。しかしこの困難さについても，異なる空間位置に異なるタイミングで生起する異なる感覚様式の刺激を全体的に統合する実験パラダイムを考案することで，PDDの社会性障害の基底に社会性とは直接関係のない認知活動の機能不全が存在している可能性を見いだせるかもしれない。今後の課題としては，社会的な刺激を用いた実験パラダイムでPDDの認知的困難さを把握しつつ物理的な刺激を用いた実験パラダイムを考案してその認知的困難さを検討し，社会性の認知を支えるより基礎的な認知過程を明らかにしていくことであろう。

最後に，本研究では，PDD群と対照群を比較検討しただけであり，非PDD臨床群との比較検討を行っていない。本研究が示唆した2つの認知的な困難さの要因がPDDに特有のものであるか否かを検討していくことも，今後の課題として残されている。

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EYE-TRACKING EXPERIMENT ON PERCEPTION OF INTERACTIONAL SYNCHRONY IN TWO-PERSON DIALOGUES IN SUBJECTS WITH HIGH-FUNCTIONING PERVASIVE DEVELOPMENTAL DISORDERS

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The study was designed to examine whether there are any differences in perception of interactional synchrony between pervasive developmental disorder (PDD) and control groups.

Fourteen PDD subjects with typical IQ (13 adults and 1 high school student) and 12 controls were shown sets of movie stimuli assembled as three sectional video stimuli each, two of which were synchronized. Movies constructed for the experimental condition were two-person dialogue scenes with each sectional video stimulus being video records of a speaker's face. Movies for the control condition were constructed of physical event scenes. In both conditions, the task was to identify the two video segments that were synchronized. Percentage of correct responses, reaction time, and eye movements were recorded.

The two groups were not significantly different regarding the percentage of correct responses and the mean fixation durations in both conditions. The mean reaction time was longer and the mean number of fixations per trial was higher in the PDD group compared to the control group in the experimental condition. In the control condition, the two groups were not significantly different in either the mean reaction time or the mean number of fixations per trial.

The findings suggested lowered perception of interactional synchrony in two-person dialogue situations in the PDD group than in the control group. The results were discussed from the view points of time perception and cross-modal integration.

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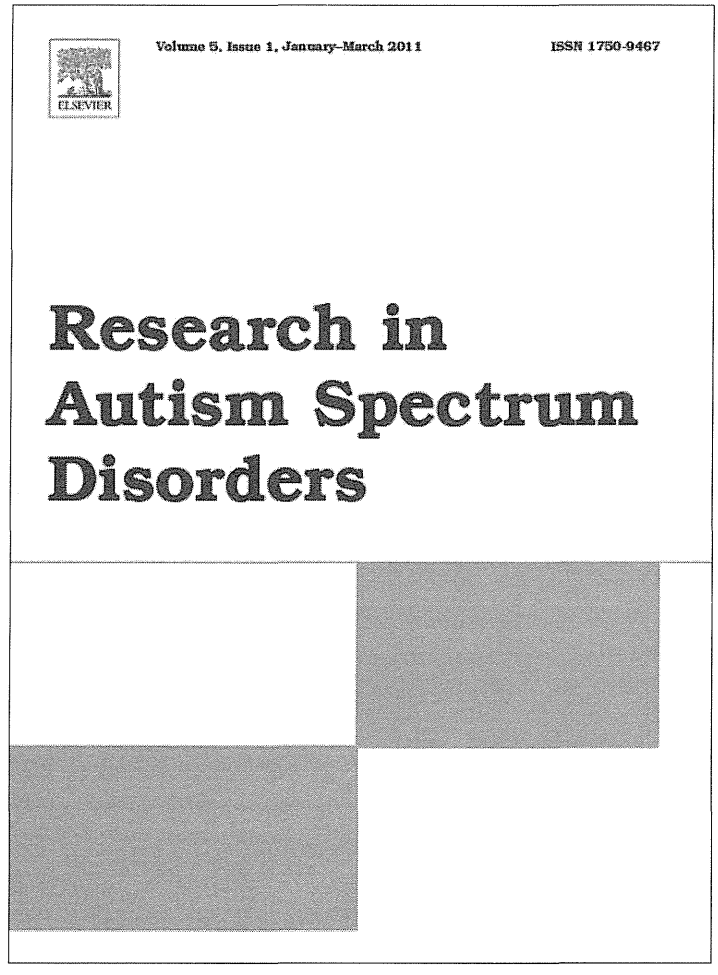

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Determining differences in social cognition between high-functioning autistic disorder and other pervasive developmental disorders using new advanced "mind-reading" tasks

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ABSTRACT

Deficits in understanding the mental state of others ("mind-reading") have been well documented in individuals with pervasive developmental disorders (PDD). However, it is unclear whether this deficit in social cognition differs between the subgroups of PDD defined by the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. In this study, PDD was divided into high-functioning autistic disorder (HFA) ($n = 17$) and other PDD ($n = 11$) consisting of Asperger's disorder ($n = 8$) and PDD-NOS ($n = 3$), and differences in mind-reading ability was examined between the two clinical groups and controls ($n = 50$) using a new advanced naturalistic task consisting of short scenes from a TV drama showing communication in social situations. The task was divided into visual and auditory tasks to investigate which modality was more valuable for individuals with PDD to understand the mental state of others. The results suggest that social cognition differs significantly between individuals with HFA and those with other PDD, with no difference being found between those with other PDD and controls. Neither the auditory or visual modality was found to be dominant in subjects with PDD in the mind-reading task. Taken together, complex mind-reading tasks appear to be effective for distinguishing individuals with HFA from those with other PDD.

1. Introduction

The term "theory of mind (ToM)", which describe the ability to attribute mental states to oneself or another person, was introduced in psychology by Premack and Woodruff (1978). Since Baron-Cohen, Leslie, and Frith (1985) first reported "deficit of ToM" in which the autistic condition is seen as a failure to attribute mental states to others, much work has been conducted on ToM in pervasive developmental disorders (PDD). The ability to understand the mental state of others, which underlies fundamental social skills, is also referred to as "mind-reading" (Baron-Cohen et al., 1985). The basic ToM test,

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usually consisting of the first and the second-order false belief tasks, is not sufficiently complex to detect deficits in adults with high-functioning PDD (HFPDD) (Bowler, 1992; Happé, 1994; Ozonoff, Pennington, & Rogers, 1991). Thus, an advanced ToM test, the Strange Situation Test, was devised by Happé (1994) in which participants are asked to provide an explanation for non-literal statements (e.g. irony or lie) made by story characters. Happé's study demonstrated that participants with PDD who passed the first and second-order false belief tasks did show specific deficits in ToM on this more complex test.

Many advanced ToM studies were subsequently conducted with adults with HFPDD in order to investigate subtle deficits of "mind-reading" ability. The Eyes Test was created for adults with HFPDD as a mind-reading task that uses information from the visual modality alone (Baron-Cohen, Wheelwright, & Jolliffe, 1997; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). In the task, participants are shown photographs in which only the areas of the eyes are cut out from a person's face, and they are asked to identify the person's mental state. Researchers have revealed that individuals with PDD provide less correct justifications of mental state than controls, indicating that the Eyes Test is highly accurate in measuring mind-reading ability. However, in the real world, in order to integrate all of the information which people express, we look not only at the eyes of others, but also at their facial expressions, body language, posture and so forth. Moreover, we do not look at a static face and body in the real world, but at a moving face and body. Thus, a task that presents dynamic information in both the visual and auditory modality, such as video, was deemed to be more realistic and was expected to measure the ability to understand others' mental states in daily life. Accordingly, Heavey, Phillips, Baron-Cohen, and Rutter (2000) developed the "Awkward Moments Test" which uses scenes taken from TV programs and commercials and Roeyers, Buysee, Ponnet, and Pichal (2001) devised the "Empathic Accuracy Task" which uses recordings of real communicative interactions. In their studies, participants viewed moving images (video) and tried to determine the mental states of the characters. Participants with PDD provided less correct justifications of mental state than typically developing subjects.

More recently, a question has been raised about which of the auditory and visual modality is more valuable for adults with PDD to understand the mental state of others. A task that extends the abovementioned advanced tasks into the auditory modality was created by Rutherford, Baron-Cohen, and Wheelwright (2002), and a study employing this task with adults with Asperger's disorder (AS) and high-functioning autistic disorder (HFA) revealed that both groups had difficulty extracting mental state information from vocalizations (Golan, Baron-Cohen, Hill, & Rutherford, 2007). In addition, use of the Cambridge "Mind-Reading" (CAM) Face-Voice Battery in adults with AS to test their cognition of 20 complex emotions and mental states from faces or voices (Golan, Baron-Cohen, & Hill, 2006) showed that although the participants showed deficits in social cognition when relying on either facial or vocal information alone, they could understand others' mental state better from the voices than from the faces. Given this finding among individuals with AS, one of the objectives of the present study is to identify which modality—visual (facial expression, gesture and posture) or auditory (pitch, intonation and tone of speech)—is more valuable for adults with PDD to understand the complex emotions of others.

Most recent studies using the advanced mind-reading tasks with moving stimuli have treated adults with PDD as one group. Some earlier studies, however, investigated the difference in mind-reading ability between the subgroups of PDD, especially between HFA and AS, but still today it is unclear whether in fact the two disorders differ in degree of impairment of mind-reading ability (Dahleger & Trillingsgaard, 1996; Ozonoff, Rogers, & Pennington, 1991; Ozonoff, South, & Miller, 2000; Zaitai, Durkin, & Pratt, 2003). A recent study that compared the subgroups of HFA and AS with typically developing adults was conducted by Spek, Scholte, and Van Berckelaer-Onnes (2010), who used the Eyes Test (Baron-Cohen et al., 1997), the Faux Pas Recognition Test (Stone, Baron-Cohen, & Knight, 1998) and the Strange Stories Test (Happé, 1994). The findings suggested that there was no significant difference in mind reading ability between individuals with HFA and AS on any of the tasks. However, since Spek et al. did not employ the CAM or moving images in their mind-reading task, it remains to be determined whether mind-reading ability differs on a more complex, moving mind-reading task between the PDD subgroups.

Thus, the second objective of the present study was to clarify whether any differences exist in mind-reading ability between HFA, a typical PDD, and other PDD consisting of AS and pervasive developmental disorder not otherwise specified (PDD-NOS). We hypothesized that individuals with HFA would show greater deficits in mind-reading ability than those with other PDD.

2. Methods

2.1. Participants

The clinical group comprised 28 male adolescents and adults with PDD (mean age 24.5 years, SD = 7.7 years, range = 16–45 years). Participants were recruited from a private child psychiatric clinic specializing in PDD or a research volunteer pool of the PDD research group at the National Institute of Mental Health. All participants were diagnosed by experienced child psychiatrists. The diagnostic process was conducted by a team of one child psychiatrist and one or two clinical psychologists. The psychiatrist interviewed the parents about their child's developmental history and daily behaviors. In parallel, in another room, the clinical psychologist observed the social behavior and communication of each participant during the IQ test and in conversation which included questions about daily life, their community and interpersonal relationships. Based on the data obtained, the participants were diagnosed according to the established criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) (APA, 2000): 17 were diagnosed with HFA (showing qualitative impairment in social interaction, qualitative impairment in communication, and restricted repetitive and stereotyped patterns of behavior, interests, and activities), and 11 were diagnosed with other PDD, which combined 8 participants with

Table 1
Descriptive characteristic of participants.

	HFA[a] ($n = 17$)			Other PDD[b] ($n = 11$)			Control ($n = 50$)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Chronological age	24.2	8.5	16–45	25.0	6.6	17–35	19.3	1.7	18–22
Full Scale IQ	103.2	13.5	87–132	108.2	9.7	88–119			
Verbal IQ	103.9	14.5	80–136	109.4	10.1	83–120			
Performance IQ	100.3	16.7	72–126	106.5	16.4	66–127			
AQ[c]	33.3	6.5	24–44	33.6	6.3	28–44			

[a] High-functioning autistic disorder.
[b] Pervasive developmental disorders.
[c] Autism Spectrum Quotient.

AS and 3 participants with PDD-NOS (showing atypical autistic symptoms that are relatively mild and do not meet the diagnostic criteria of the main symptoms of Autistic disorder). Also, 14 participants were tested using the Wechsler Adult Intelligence Scale Reversed (WAIS-R), 3 were tested using the WAIS-Third Edition (WAIS-III), and 11 were tested using the Wechsler Intelligence Scale for Children-Third Edition (WISC-III) (Wechsler, 1981, 1991, 1997). The characteristics of the participants with PDD are shown in Table 1. All participants had a full intelligence quotient (FIQ) of at least 85. In addition, all participants except one were administered the Autism Spectrum Quotient (AQ)-Japanese version (Wakabayashi, Baron-Cohen, Wheelwright, & Tojo, 2005). No significant differences in FIQ ($t = 1.1$, $p = .30$), the verbal intelligence quotient (VIQ) ($t = 1.1$, $p = .29$), the performance intelligence quotient (PIQ) ($t = 1.0$, $p = .35$) and AQ ($t = .18$, $p = .90$) scores were found between the HFA group and other PDD group. The participants had no other psychological diagnosis.

The control group consisted of 50 male students recruited from the University of Chiba (mean age 19.3 years, SD = 1.74). They were no administered IQ tests, but on the basis of their grade level it was assumed that they had normal intelligence.

Written informed consent to participate in the study was obtained in advance from all participants and from their parents when the participants were minors (<20 years of age), and the study protocol was approved by the Ethics Committee of the National Institute of Neurology and Psychiatry.

2.2. Instruments

2.2.1. Visual and auditory tasks

We administered the Motion Picture Mind-Reading (MPMR) Task, which was originally designed to measure individual differences among adults in the general population (Wakabayashi & Katsumata, in press). The MPMR consists of short clips from the TV drama "*Shiroi Kyotou*" (Kobayashi, 1978), which was famous in the 1970s but would not be well known to the younger participants in this study. The storyline concerns malpractice at a famous medical school in Japan. The drama was edited into clips using DVRaptor software (Canopus Company, Japan). The length of each of the 41 scenes ranged from 3 s to 11 s (mean 5.2 s). The MPMR Task thus contained more realistic material than the ToM tasks used in previous studies because it contained scenes from dramatized real life. Moreover, the content was highly complex, including many non-literal scenes with incongruent dialogue and mental states conveying, for example, characters who were lying or being ironic. The participants were asked to understand the hidden intent, masked behind incongruent visual information (facial expression, gesture and posture) and auditory information (the non-literal aspects of speech of pitch, intonation and tone).

In order to identify whether the visual or auditory modality was more valuable for adults with PDD to understand the complex mental states of others, we modified the 41 clips of the MPMR to create one visual task and one corresponding auditory task for each clip. For the visual task, the sound was edited out of each scene. For the auditory task, no picture was displayed on the PC monitor and only the auditory stimuli composed of segments of the one character's speech was heard (see Fig. 1). In each of the visual and auditory trials, participants had to decide whether a label appearing on the PC monitor described the character's mental state (intent) appropriately or not. Of the 41 clips, 27 were labeled correctly and 14 incorrectly (Table 2).

2.2.2. Autism Spectrum Quotient-Japanese version (AQ-Japanese version)

The AQ is a self-report questionnaire which measures the degree to which any adult of normal IQ possesses traits related to the autism spectrum (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). The AQ-Japanese version (Wakabayashi et al., 2005) was used in this study.

2.3. Procedure

The participants were tested individually in a quiet room at the clinic or university. Both the visual and auditory task stimuli were presented to the participants while were wearing headphones. The clinical groups viewed the stimuli on a 13.3-in. monitor of a laptop computer running Windows XP (Dynabook SS MX/190DR, Toshiba), while the control group viewed them on a 17-in. PC monitor (Dimension XP 4400, Dell). The participants' response to each item was recorded by computer. Each task began with the message "To start, press the space key". After 1 s, the stimuli were presented in either the visual or

Fig. 1. Example of the test stimuli used in the visual task without auditory information (Scene 1, Feigning). In the auditory task which presented the dialogue, "Um, I just feel like seeing you, big brother" there was no picture of the character displayed on the screen. In each of the visual and auditory trials, participants had to decide whether the label appearing on the screen described the character's mental state (intent) appropriately or not.

auditory modality scene accompanied by the word or phrase describing a mental state. The participant was asked to judge whether the word or phrase presented on the screen described the person in each scene appropriately or not. To record their judgment, they pressed the F key to which was attached a small label saying "appropriate" or the J key to which was attached the label "inappropriate". One second after participants pressed a key, a message appeared saying "Next scene, press the space key", and as a participant pressed it, the next trial started. The presentation order of the 41 clips was randomized for each participant.

Participants completed one practice trial for one visual and one auditory task before the experiment started. The order of the visual and auditory tasks was counterbalanced. Throughout the entire test, a task requiring the participants to determine the camera angle from which a photo was taken was inserted between the Visual tasks and the Auditory tasks to serve as interference stimuli.

3. Results

3.1. Comparison of groups by diagnosis

Accuracy rate was determined by two-way repeated measures ANOVA. The main effect of Group was significant: the HFA group had a lower accuracy rate than the other PDD and control groups. The main effect of Task was also significant in all three groups. The interaction between Group and Task was not significant ($F(2,75) = 0.2$, $P = 0.80$).

The accuracy rate for each task modality is shown in Fig. 2. ANOVA revealed significant main effects for Task ($F(1,75) = 19.0$, $P < 0.01$) and Group ($F(2.75) = 7.9$, $P < 0.01$). The accuracy rate was higher on the visual task than on the auditory task in all groups. The interaction between Task and Group was not significant ($F(2,75) = 0.2$, $P = 0.80$). Results of Bonferroni multiple-comparison tests showed that the accuracy rate of the HFA group was lower than that of the control group ($P < 0.01$) and the other PDD group ($P < 0.05$). No significant difference was found between the other PDD and control groups.

3.2. Within-group comparisons of accuracy rate

No correlations were found for the HFA group and other PDD group with respect to the accuracy rates on the visual task and auditory task, and FIQ, VIQ, PIQ and AQ scores.

3.3. Between-group comparisons of accuracy rate

The accuracy rates on the visual task and auditory task (41 items each) were compared between the HFA, other PDD, and control groups using Fisher's exact test. As shown in Table 2, significant differences were observed for some items on the Visual and Auditory task.

4. Discussion

This study investigated differences in mind-reading performance among PDD subgroups by using advanced mind-reading tasks comprised of clips from a TV drama that included social context in the form of another character appearing and

Table 2
Accuracy rate for determining the character's mental state among the three subgroups of PDD.

Scene	Duration (s)	Word/phase shown on screen	Visual				Auditory			
			HFA[a] ($n=17$)	Other PDD[b] ($n=11$)	Control ($n=50$)	p	HFA ($n=17$)	Other PDD ($n=11$)	Control ($n=50$)	p
1	3	Feigning	53	64	72	.35	94	82	82	.47
2	3	***Respectful***	35	73	82	.00**	65	64	76	.54
3	6	Sarcastic	71	73	82	.55	59	55	52	.89
4	7	Ironic	82	100	88	.36	71	46	46	.20
5	6	***Pleased***	30	64	48	.19	38	30	14	.10
6	3	Disbelieving	65	82	60	.39	65	82	70	.62
7	4	***Convinced***	47	73	80	.03*	82	91	92	.52
8	9	***Confident***	35	55	74	.01*	29	55	70	.01*
9	6	Bluffing	82	82	72	.61	77	82	82	.88
10	3	Ingratiating	65	64	62	.98	71	80	74	.87
11	6	Astonished	88	82	74	.45	71	73	48	.13
12	3	Feigning	82	91	76	.51	63	100	76	.08
13	4	Pretending not to want	77	82	64	.39	12	27	28	.39
14	9	Ironic	77	90	86	.56	65	73	72	.84
15	9	Sarcastic	59	73	92	.01*	53	55	66	.56
16	4	Playing down	82	82	58	.10	53	91	86	.01*
17	5	Coercive	65	73	68	.91	56	64	88	.01*
18	9	***Worried***	82	100	82	.31	65	46	62	.55
19	6	Lying	41	64	72	.07	71	55	72	.52
20	4	Ironic	88	64	74	.30	59	64	84	.07
21	4	Guilty	41	91	86	.00**	41	91	62	.03*
22	3	Sarcastic	41	64	64	.24	47	82	68	.14
23	9	Ingratiating	41	64	52	.50	81	91	88	.72
24	3	***Appreciative***	29	91	84	.00**	35	73	62	.09
25	4	Feigning	53	73	82	.60	88	82	88	.85
26	5	***Wondering***	77	64	82	.40	18	36	50	.06
27	9	***Praising***	24	27	46	.18	29	36	38	.82
28	3	Angry	82	73	90	.29	59	73	86	.06
29	5	***Mocking***	24	18	30	.68	12	10	32	.13
30	3	***Disappointed***	77	46	68	.22	47	55	60	.64
31	11	Figuring someone out	41	91	46	.02*	53	82	68	.27
32	4	***Unsure how to react***	47	55	78	.04*	35	36	48	.58
33	3	Employing tactics	82	73	86	.56	69	100	78	.14
34	7	Flattering	82	82	92	.43	59	55	40	.34
35	7	Teasing	65	73	46	.16	77	64	70	.76
36	6	***Apologetic***	77	73	96	.02*	29	72	78	.00**
37	5	Covering up Embarrassed	71	100	82	.14	53	64	68	.54
38	7	***Not liking***	65	73	86	.14	41	36	58	.28
39	5	Modest	88	91	92	.90	71	90	84	.36
40	7	Sarcastic	77	46	56	.21	59	73	78	.31
41	9	***Ashamed***	31	36	62	.05*	47	80	86	.00**

Note: Words/phrases not appropriate to the scene are shown in bold italics. Items shown in yellow highlight are under chance level of the control group. Fisher's exact test, $^{*}p < .05$, $^{**}p < .01$.

[a] High-functioning autistic disorder.

[b] Pervasive developmental disorders.

background scenery being visible. According to Adolphs, Sears, and Piven (2001) and Golan et al. (2006), compared to recognizing general emotions, it is difficult for adults with PDD to recognize the intentions and emotions underlying facial expressions that do not correspond with speech. All of the task items in the present study were designed to assess participants' understanding of hidden emotions and mental states that do not concord with the language heard, and these items were thus expected to present some difficulty for adults with PDD. While differences were observed between the HFA group and control group and between the HFA group and other PDD group, no differences were observed between the other PDD group and control group. This finding suggests that a close relationship exists between cognitive ability, which is closely connected with social communication such as mind-reading ability, and the behavioral characteristics of PDD as laid out in the DSM diagnostic criteria. These findings replicate those of previous ToM research studies which showed that the differential abilities in ToM may help to distinguish AS from autism (Ozonoff, Rogers, et al., 1991; Zaitai et al., 2003).

As to differences in mind-reading ability between the subgroups of PDD, Spek et al. (2010) previously reported no such difference between subjects with HFA and AS. The contradictory results of our study and theirs might be due to the different format of the tasks used. More specifically, the tasks used in their study might not be able to detect the subtle differences in mind-reading performance between the HFA and AS subgroups. Golan et al.'s (2006) comparative study of individuals with AS and those with typical development which used the CAM reported significant differences in performance on both the

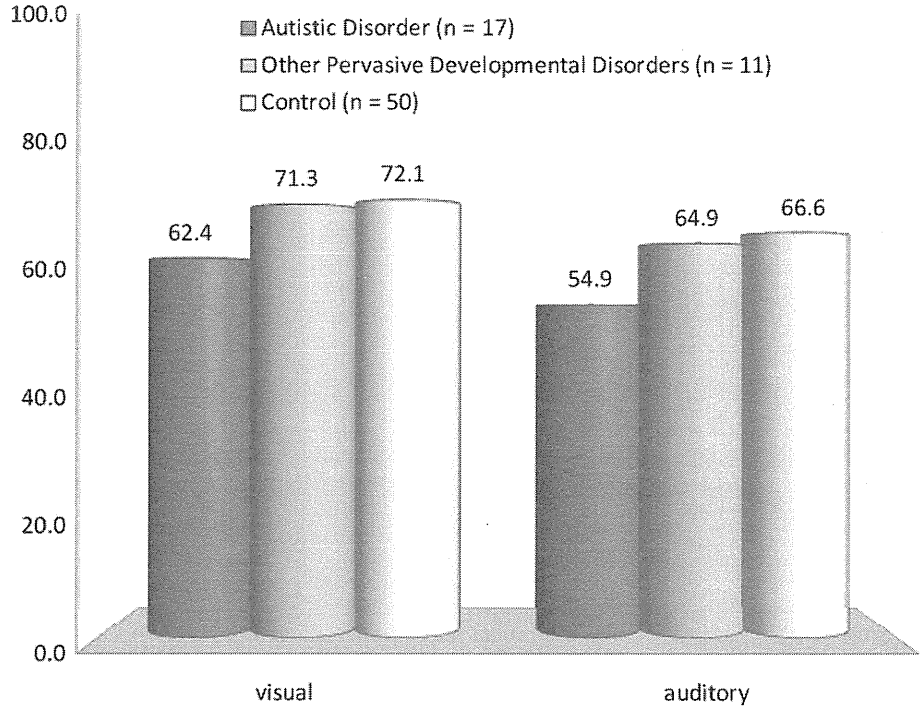

Fig. 2. Mean accuracy rate on the visual and auditory tasks for each group.

visual and auditory tasks, findings which do not accord with those of the present study. The reason for the discrepancy might be attributable to the inclusion of social context in the MPMR clips, where, for example, two characters can appear together on screen or background scenery can be visible. Also the participants' response method differed between the two studies: while Golan et al. (2006) asked participants to select a word from 4 alternatives to describe an appropriate mental state matching facial expression and voice, we asked them to judge whether a word describing a mental state was appropriate or not to the scene.

The present finding that individuals with other PDD showed accuracy rates close to those of the control group suggests that adults with other PDD might understand other people's minds to some extent. However, in everyday life, their social communication is often not successful, which could suggest that even though they may understand other people's mental states, they might experience difficulties responding to them. Moreover, previous studies have shown that individuals with PDD rely on strategies different from those of the general population when trying to understand others' thoughts and emotions (Baron-Cohen et al., 1999; Castelli, Frith, Happé, & Frith 2002; Happé et al., 1996). Future studies of the brain by, for example, functional magnetic resonance imaging might reveal the difference in strategies adopted by individuals with other PDD and controls.

The present study found no correlation between FIQ, VIQ and PIQ scores and task performance in the HFA and other PDD groups. A previous study by Happé (1995) showed that VIQ score was correlated with mind-reading ability, whereas in the present study there was no such relation between VIQ score and performance. This is because all participants had an IQ $\geq$80, and therefore differences in VIQ score were small among the PDD subgroups. Moreover, there was no correlation between AQ score and task performance. A high AQ score indicates serious symptoms of autism, alongside which lower mind-reading task performance would be expected. The finding therefore suggests that mind-reading ability might be associated with symptom profiles that are in accordance with the diagnostic criteria of DSM-IV-TR, rather than degrees of autism as assessed by AQ scores.

Regarding test items that showed significant differences in accuracy rate between the three groups, the HFA group had lower accuracy on most of the visual and auditory tasks than the other PDD and control groups. Contrary to expectation, the accuracy rate of the HFA group for some items was under the chance level (50%) of the control group, and the other PDD group showed a higher accuracy rate than the control group on several items, including "figuring someone out" on the visual task and "guilty" on the auditory task. Moreover, the HFA group showed a higher accuracy rate than the control group on a few items. We suspect that some emotions and mental states are relatively easier for adults with PDD to understand, based on their previous experiences. This remains a subject for further investigation.

With respect to the objective of determining whether there exist differences in the mind-reading performance according to whether the visual or auditory modality is used, we found no such differences. These findings are contrary to those of Golan et al. (2006) who found that males with AS perform better on the auditory task than on the visual task, which suggests that there may be no difference in understanding of others' mind by modality. The reason for this may be attributable to the complexity of the tasks and language used, or cultural differences between the two experimental settings. In general, Japanese people make less obvious facial expressions than Western people, and as such, cultural differences might have produced differences in the results.

A limitation of this study is that the group of PDD participants was small, as then was the two subgroups. Therefore, future study should involve a larger number of participants. In addition, the profiles of the control group participants lacked important information. For example, no accurate IQ information was available, although because the average IQ of the PDD group participants was higher than 100 and no correlation was found between IQ and mind-reading performance, the influence of IQ appears to be limited. In future studies, the IQ, age and education level of the control group should be matched to those of the PDD group. Moreover, the participants in this study were all male. Given that gender differences on mind-reading tasks have been reported (Baron-Cohen, Wheelwright, Skinner, et al., 2001; Baron-Cohen, 2003; Golan et al., 2006; Rutherford et al., 2002; Wakabayashi & Katsumata, in press), future work should include female participants. Finally, the tasks used in this study were created from clips from a TV drama, which resulted in somewhat uncontrolled categories of emotions. Thus, future use of controlled categories of emotions to examine performance differences among groups divided by diagnosis should contribute to identifying those emotions and mental states that are relatively easier for adults with HFA to recognize.

5. Conclusions

Using the new visual and auditory tasks, this study compared the performance of subgroups of PDD divided according to DSM-IV-TR diagnostic criteria in order to clarify the difference in mind-reading abilities among the subgroups. The results demonstrated that on both the visual and auditory tasks, individuals with HFA experienced the greatest difficulty in understanding the complicated emotions and mental states of others. In contrast, the results suggest that the mind-reading abilities of adults with AS and PDD-NOS did not differ much from those without PDD. Taken together, complex mind-reading tasks appear to be effective for distinguishing individuals with HFA from those with AS or PDD-NOS. Clinically, adults with HFA who are not able to understand easily others' thoughts and emotions will likely encounter problems in social relationships. Individuals with AS or PDD-NOS will likewise experience such problems, but for different reasons: although they might well be able to understand others' emotions and thoughts, they will likely have difficulty knowing how to adapt their own social behavior. The support offered to individuals of different PDD subgroups may need to be differentiated accordingly.

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Q 広汎性発達障害疑い例へのプライマリケアでの対応

内科開業医であるが，アスペルガー症候群，広汎性発達障害が疑われる患者がしばしば来院する．高学歴者が多く，その一部は精神科で，うつ病，統合失調症として治療を受けている．精神科で治療されている人以外で精神科的にやや問題のある場合，内科診療所でどのように対応すればよいか．治療・指導することは可能か．

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（東京都　H）

A 発達の凸凹を本人の問題点に絞って指摘することが重要．うつ病が併存する場合は投薬量に注意．抗不安薬はなるべく投与しない

現在，未診断の高機能（知的な遅れのない）広汎性発達障害（自閉症をはじめとする生来の社会性のハンディキャップを抱える発達障害）が一般内科を受診することは，まったく珍しくなくなった．大きな社会的な不適応を生じているわけではないが，周囲との若干の軋轢やトラブルを抱えるといった状況が多く認められる．よく見られる問題とその対応を紹介し，一般のクリニックで可能なことをまとめてみたいと思う．

キーワードは代償である．つまり，こうした患者は障害というほどの強い問題レベルでなくとも，健常な人々とは異なった戦略で，いわば脳の中にバイパスを作って，適応を図っている．この時にしばしば誤学習が入り込み，本人はそれに気づかないといったことがよく起きてくる．

さらに陥りやすいのは過剰代償である．つまり，こうした患者は自分の欠点を補おうとするあまり，逆に自分の首を絞めてしまうというパターンである．例えば，整理整頓が非常に苦手な人がしばしば整理魔に転ずる．整理ができないという自覚から，少しでも余計なものがある状態をなくしてしまうという方略に固執するわけである．すると，これが巻き込みを作る．本来，物を散らかす存在である子どもに辛く当たったり，子どもを見ているだけで苛々し，自室に閉じこもり，立ち入り禁止区域を作ったりといった具合である．

それ以外によく聞く問題としては，2つのことを一度にできない，予定の変更に柔軟に対応できない，スケジュール管理ができない，細かなことにこだわりやすい，うつになりやすい，などがしばしば認められる特徴である．

このような状況にどう対応したら良いだろうか．何よりも，自分の持っている凸凹を理解し，受け入れることが重要である．曖昧な言い方は避け，「広い意味での発達障害，正確に言えば発達の凸凹がある」ということを本人に，ピシッと言うことが重要である．次いで，本人の抱えている凸凹部分に関して，本人の状態を具体的に示すことである．一般論ではなく，あくまでその本人の問題点に絞って指摘することが重要である．

その先はどうしたら良いだろうか．日常生活に困っているレベルであれば，カウンセリングを受けることを勧める必要がある．この時に，本人に次のようなアドバイスをしていただきたい．「今のあなたの状態は，日常生活で支障が出ているので，カウンセリングを

受けてください．その時に，認知行動療法ができるかどうか，尋ねてください．できると答えたところを受診してください」．最近，認知行動療法が可能な心理クリニックは少しずつ増えてきている．なぜ認知行動療法なのかといえば，一般的なカウンセリングで広まっている受容的方法および分析的解釈はまったく役に立たないからである．

よく認められるのがうつ病の併存である．この場合には，服薬が必要であるが，内科医としては精神科の薬物を出すことには抵抗があるのではないかと思う．ご自分で出されるのであるなら，次の注意が必要である．

①非常に少量でよいこと．最低量の錠剤の半錠からスタートするようにしていただきたい．

②しばしば双極性障害が隠れていて，抗うつ薬だけ処方すると躁転があること．年に何度かすごく元気になるといったエピソードがある場合には，感情調整薬の処方が無難である．

③抗不安薬はなるべく用いないこと．抑制が外れたようになることがしばしばあるからである．

ご自分で処方をしたくない場合には，精神科クリニックへの受診を勧め，「クリニックを受診した時に，自分は薬にとても敏感なので，最低の錠剤の半量から薬を下さいとお願いをしてください」と言うように勧めていただきたい．

▶文　献

1）杉山登志郎：発達障害から発達凸凹へ，講談社，東京（近日刊）．

▶回　答

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杉山登志郎

特集

連合小児発達学研究科開設記念特集

広汎性発達障害の現在

杉山登志郎
あいち小児保健医療総合センター

1. 広汎性発達障害：問題の整理

21世紀は脳の世紀になることは，1980年代後半，分子生物学の進歩に引き続き，脳画像の著しい進歩が確実になった時点から既に約束されていた．自閉症は，1943年のその最初の記述（Kanner, 1943）以来，一貫して膨大な研究が継続されてきたにもかかわらず，その病因は謎として残されたままわれわれは21世紀を迎えることになった．しかしミレニアムから10年，病因に非常に近い部分ではないかと考えられる重要な発見が相次いで報告された．これらの発見の重要な所は，臨床的所見との整合性が存在することである．連合小児発達学研究科の開設を記念するこの特集において，筆者は主として臨床的な立場から，新たに提起された問題について鳥瞰を試みたい．

冒頭に用語について言及しておきたい．アメリカ精神医学会のDSMをはじめとする国際的診断基準において，自閉症を中核とする社会性の障害を持つ発達障害は広汎性発達障害と呼ばれている．それに対し，Wingら（1996）を中心とするロンドン大学の研究グループは，このグループが，最重度の症例から正常の性格の偏奇をも一連の連続体（スペクトル）を形成するという事実から，自閉症スペクトルという呼称を提案している．筆者としては，後述するように，今後は適応障害を伴わないグループをも視野に入れた臨床と研究が行われる必要があり，自閉症スペクトルという立場が正しいと考える．ただし，先に述べたように広汎性発達障害という呼称がこのグループの正式な名称であるので，連続体という状況を含め，広汎性発達障害の呼称を用い，この小論では従来の診断名に合致しない場合には，その点を明確にして用いることとする．

さて，膨大な広汎性発達障害研究において，重要と考えられる新しい所見の整理をしてみよう．

第一に，このグループの広がりである．知的能力から言えば，正常以上の高知能から最重度知的障害まで存在する．そもそも精神遅滞において知的障害が重度であるほど自閉症の併存は多く，IQ30以下の場合，自閉症の併存率7割を超える（Happé, 1994）．そして，基礎疾患として数百以上存在することが明らかになっている．正に「全ての障害は自閉に通じる」のである．何故か？筆者の答えは「人間は社会的存在だから」である．後述する

ように，病因につながる新しい所見は，単一の脳の部位の問題ではなく，全ていくつかの領域にまたがる複合系である．脳のどの部位がダメージを受けたとしても，そのダメージが重度かつ広範であれば知的障害が生じるように，脳のどの複合系が障害を生じたとしても，それが社会的機能に関われば，自閉症スペクトルを生じざるを得ない．知的障害が重ければ重いほど自閉症の併存が生じるのはこの視点に立てば当然であり，また例えばいわゆるチャウチェスク・ベビーの様に極端なネグレクトによる最重度の愛着障害によって社会的機能に重度の問題が生じる状況があれば，後天性の広汎性発達障害が生じることも起こり得る（Rutter ら, 1999；Rutter ら, 2007）．

第二に，病因として最も確実なものは，遺伝的な素因であるが，多因子遺伝（polygenetic）モデルが適合することである（Sumi ら, 2006）．つまり，一つの遺伝子が原因となって疾患をつくるのではなく，沢山の遺伝的な素因が関与し，またそれらの発現においてはepigeneticとよばれる，遺伝情報の発現に環境因の干渉を受ける現象が大きな影響を与える（Marcus, 2004）．これは，一般の慢性疾患と同じである．一般の慢性疾患において，素因レベルは少なくとも罹病率の５倍程度は存在する．すると，素因レベルと障害レベルとを分ける必要がある．最新の調査による広汎性発達障害の罹病率は1～2%程度を示ししており（Boron-Cohen ら, 2009；鷲見ら, 2006），素因レベルは約１割前後ということになる．この所見の重要さは，素因レベルであっても障害に至らないつまり予防が可能である，さらに障害レベルであっても適応障害の重症度を軽減させることは十分に可能であることにある．その一方で，スペクトルとして，障害レベルではない膨大なグループが存在することが示唆される．遺伝学者から，自閉症あるいは広汎性発達障害の近親者によく似た認知傾向を持つ者が少なくないことはかねてから指摘されてきており，広範な自閉症特性（the broad autism phenotype；Sung ら, 2005）という呼称が提唱されている．筆者は臨床において，広汎性発達障害の親に，適応障害が軽微ではあるが，類縁の認知の問題と社会性のハンディキャップを抱えるものが数多く存在し，臨床の上で看過できない様々な問題を生じていることを経験するようになった（杉山ら, 2009）．これは実は広汎性発達障害に限らない．このグループを命名する必要があり，あれこれ愚考を重ねる中で，独特の認知特性はマイナスとは限らないという意味を込めて単純に発達凸凹と呼べばよいのではないかと筆者は結論した．発達凸凹に適応障害を伴った状態が発達障害である．広汎性発達障害が1～2%の罹病率であるので，先述のように広汎性発達凸凹は少なくとも5～10%存在することになる．実は，世の天才や偉人として後世において顕彰された人の中にこのタイプは多いことが近年明らかになった（Fitzgerald, 2005；James, 2006）．

第三に，この視点で広汎性発達障害を捉えたとき，生来の認知特性によって生じる一次的問題と，その結果生じる二次的な問題とを分ける必要が生じる．特に二次的問題によって形成される症状の部分は，自閉症グループの中核と考えられている問題にまで広がる．先取りをして述べれば，迫害体験などトラウマの与える影響は取り分け無視できない重みを持っている（杉山, 2008）．

2. 最新の脳研究所見の検討

さて，最新の脳研究で示されたいくつかの有力な所見に対して臨床サイドからコメントを述べ，再考を試みてみたい．

まず，扁桃体の異常を中心とする小脳の機能障害までを含めた大脳辺縁系の病因仮説である．大脳辺縁系，特に扁桃体の異常と小脳の異常は，既に80年代後半剖検による脳の比較研究から指摘をされてきた問題である（Bauman ら, 1985）．最近の Endo ら（2007）による MRS を用いた研究でも扁桃体の機能異常が示され，しかも自閉症において最も強く，Asperger 障害では健常者と自閉症との中間的な値が示された．この様に，器質的な所見の裏付けがあることが大きな強みであり，また自律神経系の不安定さや知覚過敏性の問題といった中核的な症状に関して説明が可能である．しかし一方で，扁桃体の機能障害はトラウマ関連障害においても原因結果がどちらに向くのか未だに決着がつかないものの，指摘をされており（笠井ら, 2006），後述する，広汎性発達障害におけるトラウマの問題を考慮に入れる必要があると考えられる．

次に，ミラーニューロン系の障害である（Depretto ら, 2006）．逆転バイバイといったごく幼児期から認められる，社会性の障害の中核に位置する問題に関して説明が可能であり，0歳から認められる障害であること，またミラーニューロン系がヒトだけでなく，サルにも認められることが大きな強みである．以前から論争になっていた，感情理解に関するシミュレーション仮説を支持する所見であり，最近われわれが行った研究でもミラーニューロンシステムの異常が示された（図1）．一方この所見からは，知覚過敏性などの問題は説明が困難である．

神経科学者から最近提示されているのが，環境ホルモンの影響による神経接合不全仮説である（黒田, 2008）．脳の後半に位置する知覚入力情報と前頭前野とを繋ぐ神経経路は，

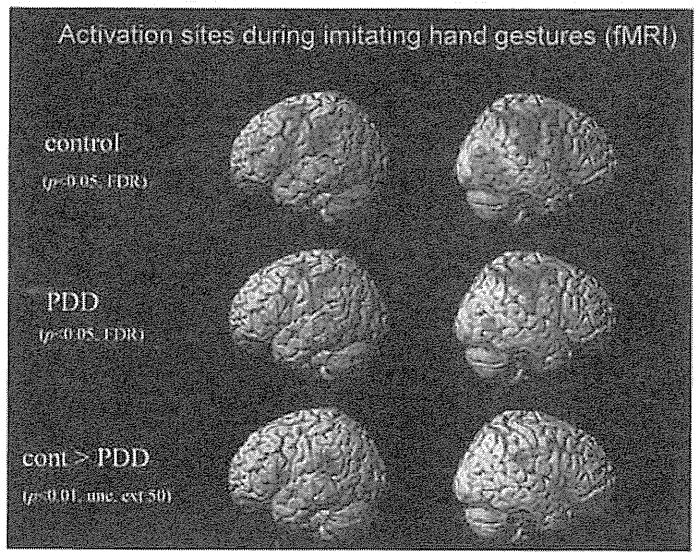

図1　fMRI による模倣時の所見
ミラーニューロンシステムの部位に異常が認められる

いくつかのシナプスを経て，距離にして10cm以上を正確に繋がなくてはならない．環境ホルモンの影響によってその接合不全が生じると仮定すると，広汎性発達障害に認められる実行機能不全や，連合野の機能不全に関する説明が可能になる．この仮説は，知的に正常な年長者における中心的機能不全を最もよく説明するが，一方，広汎性発達障害に見られる広範な生理学的異常を説明することは困難であり，また連合野の形成そのものが，最も遅く20歳代まで至って完成する系であることを考えると，幼児期の自閉症症状を全てこれで説明することは困難であると考えられる．

抑制系のニューロンであるセロトニン系の問題も，既に1980年代に提示され，周知のように，セロトニン系の賦活薬フェンフルラミンの服用というトライアルも既に行われてきた（Ritvoら, 1984）．しかしこの問題の決定的な証拠は，Nakamuraら（2010）によるPET研究まで示されなかった．Nakamuraらの研究の大きな意義は，社会的機能が必ずしも不良ではない高機能群において，セロトニン系の機能低下のみならず，同時に賦活系であるドパミン系の代償的な機能亢進が示されたことである．これは自閉症圏の発達障害者および，のみならずその親族にも気分障害が極めて多いという臨床的な所見や，易興奮を示す広汎性発達障害児，者に比較的少量の抗精神病薬の服用が著効を示すという臨床的な所見に合致する．この部分に，広汎性発達障害の異常が存在することは確かな事実になった．

自閉症における男女差に注目し，認知に影響を与えるホルモン系の検討から浮上したのがオキシトシン系の問題である（Yamasueら, 2009）．かねてからオキシトシンは共感性を支えるホルモン系であることが示されており，自閉症における愛着障害がオキシトシンの低下によって説明が可能となる．この所見の重要さは，社会的な行動が出来ない自閉症のモデルマウスによる裏付けが存在すること（Liuら, 2008），オキシトシンの点鼻によって自閉症ハイリスク児に自閉症症状の軽減が出来ないかというパイロットスタディーが開始されており（Guastellaら, 2009），障害の予防，あるいは軽減の道を開く可能性を持つ点である．臨床サイドからの疑問点は，オキシトシンもまたトラウマとの関連があることが指摘されてきたことである．

必須脂肪酸の問題は，当初，うつ病女性の研究から始まった．非常に単純化した説明を行えば，植物油のとりすぎによって，オメガ6の過剰摂取となり，オメガ3の相対的欠乏が生じ，その一部がうつ病，また発達障害に関連を持つという指摘である．いくつかの治療研究がADHDを中心に既に行われてきた（Johnsonら, 2009）．全員ではないが一部には有効性が示されており，広汎性発達障害においても今後，この問題への検討が必要であろう．

さて，問題はこれらの脳の所見は一つの輪になるかという点である．脳の発達の機能分化を胎生期から発達的に見ること，つまり一次的問題と二次的問題，また0歳から認められるものとその後に生じるものを分けることが必要であると考えられる．

筆者の見解としては，最も基盤と考えられるものは，ミラーニューロンの機能不全ではないかと考える．その理由として，0歳において既に認められる問題であり，またサルに

も存在が確認されている問題だからである．そうすると，サルの自閉症モデルというものをつくることが可能であるなら，大きな進展が得られる可能性がある．セロトニン系は愛着形成との関連で次に生じる問題ではないか．オメガ3など脂肪酸の欠乏は恐らくここに関連するのであろう．ミラーニューロン系が言語機能にどのような役割を果たすのか，この点に関して十分な研究がまだない．恐らく他者と自己との重なり体験そのものが，言語の概念化形成や，曖昧概念の許容能力，さらには抑制系の神経発達そのものに決定的な影響を与えるのではないかと推察され，今後の研究が待たれる．さらに，ミラーニューロン系と，連合野および前頭前野の機能の障害との関連を見る必要がある．一方，オキシトシンや扁桃体はトラウマとの関係で再検討が必要である（Chamey, 2004）．後述するように，筆者はトラウマ臨床の経験から発達障害においてトラウマという問題が，かつて考えていた以上に大きな影響を持ち，発達障害の二次障害を形成する要因であることに思い至った．神経接合不全仮説は，自閉症に限らずいわゆる軽度発達障害の近年の著しい増加や，高次脳機能における認知の凸凹を説明することが可能であり，また実行機能や連合野の機能不全を説明できる．しかし，むしろ青年期以後の後年の障害において大きな影響を与えるのではないだろうか．

このような雑な説明では非常に不十分であるが，もとより広汎性発達障害は臨床症候群である．今後は各々の所見を結ぶ統合的仮説と，さらに生物学的データを個々の症例の臨床所見に繋げ，生物学的な視点からサブグループを再検討することが必要になろう．

3．広汎性発達障害とトラウマ

筆者は，子ども虐待の臨床に従事する中で，発達障害と子ども虐待との複雑な絡み合いに驚かされた（杉山, 2007）．この問題に関してはいくつかの報告を既に行ってきたが，トラウマ臨床を経験し，その視点で発達障害の体験世界を見直したとき，特に広汎性発達障害において，トラウマの影響というものは，看過できない重みをもつことに思い至らざるを得なかった（杉山, 2008）．

特に自閉症である．知覚過敏性の中に生きる世界がいかに彼らにとって脅威となっているのか，彼らの自伝は余すところなく語っている（Grandin, 1986；Williams, 1992）．また狭く深い認知機能によって，広い視野を持つことが出来ず，予定の変更に著しく脆弱であるということは，翻れば全ての事象が不意打ちで襲ってくる秩序無き世界に置かれていることに他ならない．愛着の形成が遅れることは，愛着というレジリエンシー機能の不全によって，トラウマの侵襲に対し，保護機能の脆弱な自我構造がつくられる．さらに愛着形成の遅れは，養育者側に強い欲求不満を生じさせ，過度の叱責やはたまた子ども虐待の高リスクになるのである．これらの家庭での生育におけるリスクのみならず，集団教育においても激しいいじめを受けることは稀ではない．筆者は自閉症独自の記憶の障害をタイムスリップ現象（杉山, 1994）として記述したが，これはチックとフラッシュバックに関連を持つ独自の病理であり，トラウマに類縁の現象である．

広汎性発達障害とトラウマの関係は，これまで正面から論じられることが乏しかった．しかし，強度行動障害として知られる最も対応が困難な自閉症の二次障害とは，他者の存在が全て悪性の刺激になった状態に他ならず，トラウマが大きな要因になっていると考えられる（杉山ら，in press）．つまり発達障害臨床においても，可能であればトラウマへの治療を行うことが必要である．これまでトラウマ処理においてエビデンスを持って有効性が証明されている治療技法は認知行動療法による遷延暴露療法（prolonged exposure：PE）（Marks ら，1998）　と，EMDR（eye movement desensitization and reprocessing 眼球運動による脱感作と再処理）（Shapiro, 2001）である．われわれは児童や発達障害への使用が可能という点から EMDR を用いてトラウマ処理をしてきた．この領域は世界レベルで未開拓であるので，われわれの実践を紹介する．

4．高機能広汎性発達障害への EMDR

過去１年間に主として外来で EMDR を実施した高機能広汎性発達障害の一覧を表１に示す．この一覧を見ると３群に分けられることに気付く．第一群は，小学校年代の児童に，現在進行形のトラウマ記憶の処理を行ったもので，ターゲットはいじめのトラウマ記憶が大多数を占めており，多忙な外来でわずか数分間の EMDR を行うという場合が多い．このような面接の中でトラウマの訴えが表出された時に直ちに短時間に行う EMDR をわれわれはチャンス EMDR とよんでいる．第二群は，青年期の患者に，過去の迫害体験（主としていじめ）の処理が必要となり実施したものである．EMDR のプロトコールに忠実なセッションから，短時間のものまで様々なレベルの介入がある．第三群は，既に成人になった患者に，過去の被虐待（一部は現在の加虐）への処理が必要となり実施したもので

表1　外来でEMDR を実施した高機能広汎性発達障害一覧

#	年齢	性別	診断	IQ	トラウマの内容
1	6	m	Au	80	学校での友人とのトラブル
2	8	f	As	92	いじめのフラッシュバック
3	11	m	Au	73	以前の抜毛していた状況
4	11	f	Au	82	苦手な男の子への過剰反応
5	12	m	Au	77	嫌いな歌の記憶
6	14	m	As	99	小6の時のいじめ
7	14	f	As	86	小学校のいじめ
8	23	m	Au	78	過去の自分のいやな記憶
9	24	m	Au	101	過去の様々なトラウマ記憶
10	29	m	As	112	小中学校で無視をされた記憶
11	32	f	NOS		祖母に噛みつかれた
12	36	m	NOS		母親からの激しい虐待
13	38	f	NOS		父のDV，学校でのいじめ、夫の自殺
14	43	f	NOS		娘への虐待，過去の性被害