

Original article

Analysis of the Synthetic-HTP drawing test about Developmental Disorders

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Abstract

Background

Some patients cannot draw three subjects on the same page during the Synthetic House-Tree-Person drawing test (S-HTP). We call this phenomenon “no synthetic sign”.

We tried to clarify the pathological meaning of “no synthetic sign” and use it for the early detection of developmental disorders at a pediatric primary care center.

Methods

We administered the S-HTP to 283 people who consulted the child psychosomatic medical clinic of Okayama University Hospital in 2007-2012. We diagnosed developmental disability based on Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) criteria and compared findings between different diagnostic groups.

Results

A total of 241 patients completed the S-HTP (S-HTP group) and 22 patients who could not complete the S-HTP, but completed the HTP (an original version of the S-HTP) or tree test (HTP group). Significantly more people in the HTP group had autism spectrum disorders (ASD) compared with the S-HTP group. The Full scale Intelligence Quotient was significantly lower in the HTP group compared with the S-HTP group.

Conclusions

There were two types of patients with “no synthetic sign”. The first type was patients whose mental ages were suspected to be younger than 5 years and 11 months . The second type included patients with ASD. Although drawing ability reflects multiple domains, it may help in early identification of children with developmental problems and allow interventions to begin sooner.

Introduction

Because drawing a picture is a natural activity for children, drawing tests are useful psychological tests for children. Drawing tests can be easily administered in the office. However, evaluation of these tests is difficult for general pediatricians. As a result, most publications only consist of case reports and discussions of disease characteristics^{1,2}. Autism spectrum disorders (ASD), which include autism, Asperger's disorder, and pervasive developmental disorder-not otherwise specified (PDD-NOS), are disorders of social communication in which patients have difficulties with social interactions, repetitive behavior patterns, and restricted interests and activities³. The children with ASD are suggested to draw a characteristic drawing from awkwardness and characteristic cognitive. There are some reports that child with ASD draw the original composition and shape at the drawing test^{4,5}. The children with ASD are thought that they are not good at drawing human figure, because of less time looking at people or less motivation to generate accurate and detailed drawing when given the instruction to draw a person⁶. But, there are no reports of simple and clear signs of ASD that can be assessed by the general pediatrician at drawing test.

The original House-Tree-Person test (HTP) is a drawing test that requires participants

to draw three subjects on three pages. The Synthetic House-Tree-Person drawing test (S-HTP) is a drawing test that requires participants to draw three subjects on one page. The S-HTP is less of a burden because one can draw all objects at the same time. However, it requires the ability to integrate the objects; thus, synthetic drawing is suspected to be related to the strength of the self. Mikami reported that the S-HTP can be used as an intelligence test, a personality test, a detector of mental disorders, and for behavior observation⁷. Thus, it may be a useful test in pediatric primary care clinics. However, some participants cannot draw three subjects on one page, and we name this phenomenon “no synthetic sign”. We examined the use of the S-HTP, the HTP, and the tree test for patients at the child psychosomatic medical clinic at Okayama University Hospital. The purpose of this study was to identify the pathological meaning of “no synthetic sign” among these children.

Methods

Patients

We tested 283 patients who visited the child psychosomatic medical clinic of Okayama University Hospital from April 2007 to March 2013. This clinic is the special clinic for the patient with psychosomatic disease. The major chief complaints of them

were physical symptoms and/or no attendance at school. They sometime had developmental problem but almost of them were not diagnosed. This clinic isn't the special clinic for developmental disorder. There is the special clinic for developmental disorder in this hospital separately from this clinic. All children who visit the clinic at the first time are performed S-HTP. This study was approved by the Okayama University Hospital Ethical Review Board.

A diagnosis was made according to the text revision of the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) criteria⁸. We defined Mental Retardation(MR) as children with an intelligence quotient (IQ) under 70 and border intelligence (BIQ) as those with an IQ of 71-84. Children were also divided into groups according to their diagnosis: attention-deficit/hyperactivity disorder (AD/HD), learning disorder(LD), Asperger's disorder, and PDD-NOS. Asperger's disorder and PDD-NOS were classified as ASD. Because we diagnosed children according to DSM-IV-TR, which allows for overlap between disorders, some patients were considered to have comorbidities. We determined four groups according to developmental disorder (ASD, MR and BIQ, AD/HD, LD) and a non-developmental disorder group. We compared the diagnoses of these five groups in terms of the HTP and S-HTP groups (Table 1).

Procedure

All patients were instructed to complete the S-HTP first. The S-HTP was done with a pencil, an eraser, and a piece of A4 paper (210 mm × 297 mm) according to Mikami's methods. Children were instructed as follows: "Please draw a house, a tree, a person and anything you want to draw in one picture"⁷. If the patient spent more than several minutes without starting to draw or refused to draw, we instructed them to complete the HTP or tree test. The HTP was conducted using Buck's method, except we used 210 mm × 297 mm paper, and included the following directions: "Please draw a house", "Please draw a tree," and "Please draw a person."⁹ Instructions for the tree test were given according to Takahashi's method: patients were given a piece of paper and told "Please draw a tree"¹⁰. The tester determined whether the child was reinstructed with the HTP or tree test depending on the patient's age and psychological condition. There was no change in terms of paper or writing instruments; we only changed the type of test. We defined the patients who completed the HTP or tree test as the HTP group and patients who completed the S-HTP as the S-HTP group. Most patients were given this test at their first visit with us, and each patient completed the test individually. Although some patients took the drawing test more than twice, only data from the first test was used in this analysis.

Statistical analysis

Mann-Whitney U tests were used to assess differences between group means on continuous variables. Fisher's exact tests were used to assess differences between groups on categorical variables. The results of the statistical tests were considered significant at a level of $p < 0.05$.

All statistical analysis was tested by SPSS software (SPSS Inc. Chicago, IL, USA).

Results

A total of 283 patients (104 boys and 179 girls) were asked to complete the S-HTP. Ages ranged from 4 to 17 years. 243 patients could draw S-HTP and 27 patients could draw HTP. Thirteen patients refused or were not able to do any of the drawing tests. These 13 patients were excluded from this study. The youngest patient who could draw S-HTP was 5 years and 2 months old. The youngest patient who drew HTP was 4 years and 1 month old. Children who were younger than 5 years and 2 months could not complete the S-HTP in this study. Mikami reported that most children are able to complete the S-HTP after the age of 5 years and 11 months¹¹. More than 90% of the children whose age was older than 5 years and 11 months could draw S-HTP in the report. So, Mikami told that it is suitable to use for a child 5 years and 11 months or

older. Thus, we chose to examine only patients older than 6 years (Figure 1). The S-HTP group consisted of 241 patients and the HTP group consisted of 22 patients. Details of the HTP group are provided in Table 2. The HTP group included a significantly higher number of patients with ASD than the S-HTP group ($p=0.0093$). The odds ratio of ASD is 3.26. (The 95% confidence interval is 1.22-9.01.) The rates of the other diagnoses except MR/BIQ were not significantly different between groups. The number of subjects who took or completed the enforcement IQ test in the HTP group was 72.7% (16 cases), and the rate in the S-HTP group was 56.0% (135 cases). In the HTP group, 11 patients took the Wechsler Intelligence Scales for Children-III (WISC-III) and five patients took the Wechsler Intelligence Scales for Children-IV (WISC-IV). In the S-HTP group, 63 patients took the WISC-III, 65 patients took the WISC-IV, four patients took the Wechsler Adult Intelligence Scale-III (WAIS-III), one patient took Wechsler Preschool and Primary Scale of Intelligence (WPPSI), and two patients took the Tanaka-Binet Intelligence Scale V. Table 3 shows comparisons of IQ scores by the Wechsler test between the HTP group and S-HTP group. Full scale Intelligence Quotient (FSIQ) was significantly lower in the HTP group (mean FSIQ=83.18) compared with the S-HTP group (mean FIQ=96.05) ($p=0.0024$). In particular, the profile score of the HTP group for vocabulary ($p=0.004$), comprehension

($p=0.008$), and coding ($p=0.008$) were significantly lower than in the S-HTP group.

Next, we compared the diagnosis of patients who took IQ test (Table 4). The HTP group of the patient who took IQ test included a significantly higher rate of patients with ASD than the S-HTP group ($p= 0.015$). The rates of the other diagnoses were not significantly different between groups. Furthermore, “no synthetic sign” was noted significantly more often in ASD patients, although not all ASD patients had this sign.

We compared the ASD patients’ WISC scores between the HTP group and the S-HTP group to investigate what type of ASD patients could not complete the S-HTP (Table 5).

For ASD patients, there were significantly more males in the HTP group ($p=0.0023$), and the HTP group’s score on the FSIQ ($p=0.0019$), Verbal Comprehension Index (VCI) ($p=0.001$), Working Memory Index (WMI)/ Freedom from Distractibility Index (FDI) ($p=0.042$), Vocabulary ($p=0.003$), Comprehension ($p=0.0025$), Information ($p=0.021$) and Coding ($p=0.036$) were significantly lower in the HTP group than in S-HTP group.

The attitude of the HTP group during the drawing test was sometimes characteristic of factors other than “no synthetic sign”. Some patients could not say anything and froze; these were considered states of catatonia accompanying ASD. Some patients complained that they could not draw the person in the S-HTP. When they were

reinstructed to complete the HTP or tree test, they drew eagerly, and some children continued free drawing after completing the test. Some patients said “It is hard for me to draw from my imagination. I would like to draw with a sample.”

We instructed some patients in the S-HTP again who could not complete this test at first visit. For example, Case 14 was 9 years old at the first examination. His chief complaints were school refusal, difficulty waking up early in the morning, general fatigue, and abdominal pain. He was diagnosed with PDD-NOS (ASD) and Orthostatic Dysregulation. He could not complete the S-HTP and could draw only a tree and house (Figure 2). We started medication and life guidance, and his symptoms improved. We performed environmental manipulation and his school attendance improved. He could attend school almost every day at the second S-HTP test. He was able to complete the S-HTP at the time of the reexamination 2 years later (Figure 3). The size of each object in the S-HTP was very small compared with the paper, and the shape of the person was immature. However, he could draw a person without a sample at the age of 11. His WISC-IV scores at two time periods are shown Figure 4. The first WISC was done soon after he consulted us, and the second WISC was done at the second S-HTP.

Discussion

Significance of “no synthetic sign”

There were two types of patients with “no synthetic sign”. One was patients whose mental ages were suspected to be younger than 5 years and 11 months. The result that patients with a young mental age cannot complete the S-HTP is thought to be valid, as some papers showed that S-HTP can be used as an IQ test.⁷ However, there is no report about relation between S-HTP and intelligent test and the correlation with IQ is not clarified, especially about synthesis. Misawa mentioned the synthesis is related with age, but what are developmental factors didn't become clear¹¹. There are a few reports about drawing test mentioned that scoring of shape about person like Goodenough draw-a-man intelligence test is correlated significantly with WISC score^{4, 12, 13}. In our study, there were three cases in the HTP group who were 7 years old with an IQ in the 70s, and 5 cases under 5years 11months could not draw S-HTP test. The mental age of these cases, estimated from the WISC and their life history, was younger than 6 years. Misawa also reported that the child older than 5years 11months can draw S-HTP¹¹. We should not conclude the patient's mental age with “no synthetic sign” to be younger than 6 years old, from this few cases. But this sign can lead to realize the necessary of further evaluation. By a feature as an IQ test of S-HTP, we think it useful to perform an evaluation of intellectual ability once when we encounter “no synthetic sign” in a child

who is older than about 6 years, even if it is necessary to consider that a psychological influence. The drawing test can be used easily in comparison with an IQ test, and it is very useful as a screening test or assessment.

The second type of cases with “no synthetic sign” had ASD. ASD is a deficit in social interaction and “no synthetic sign” represents a deficit of relation with objects. We noted that this sign had some correlations with IQ on the WISC and subtest scores. The profile scores of Vocabulary and Comprehension differed significantly between the HTP group and S-HTP group. We suspect that weakness in following instructions depends on the situation and the lack of ability to understand instructions rather than poor drawing and visual constitution revealed by the sign that the patient cannot draw three subjects on one page. This view is connected with an ASD characteristic in which it is hard to draw and capture key points about something but it is easy to describe it in detail. It is not clear whether this sign expresses information about characteristic actions or brain function from this study, but the fact that children with “no synthetic sign” tend to be diagnosed with ASD is worthy of attention.

Usefulness and limitations of “no synthetic sign”

S-HTP is a variation of original HTP of Buck. House symbolically expresses the relation of family, tree does the unconscious self-image, and person does conscious

self-image in S-HTP⁷. So, S-HTP reflects a basic relationship of environment projectively¹⁴. Furthermore this drawing test can evaluate the greatest in ability of drawing more and measure the mental maturity more finely than original HTP. Because the drawing test can be taken in a relatively short time, and the drawing act itself is very familiar to a child, the S-HTP is easy to administer to a child. There are few children refusing S-HTP at our clinic. S-HTP has a possibility that can be used for various medical examinations and treatment of children¹⁵. In addition, we think that S-HTP is easy to adopt for general practice in various situations, as it does not need special equipment and is not associated with any costs. However, evaluating the attitude of the child, the contents of the drawing, and interpreting the findings requires extensive experience. It is not good to pay attention to only contents analysis and pattern analysis. So, despite its ease of administration, the drawing test appears difficult for the general pediatrician to assess. Thus a test that is easy to analyze in general practice needs to be developed. There were no reports on analytical findings of the S-HTP within the range of our search in PubMed. Furthermore, there were no reports on “no synthetic sign”; thus, this is the first report to address this issue. The finding that a child who does not refuse a drawing test but cannot complete the S-HTP may provide some objective information regarding the potential presence of a developmental disorder. This inability

is simple for doctors to recognize, even if they are not familiar with the drawing test. Thus, administration of the drawing test may be effective to help general practitioners identify a potential developmental disorder early on and recommend additional testing.

Among patients with “no synthetic sign”, 13 of 22 had ASD. On the other hand, we found “no synthetic sign” in 13 of 77 ASD patients, indicating a low sensitivity of this test. Thus, the S-HTP cannot be used as a screening test, because of the high number of false-negative findings, but it can provide information on the potential presence of ASD, particularly in children with a low ability to understand speech. This sign maybe reflect their weakness of communication, and we need more research about this. These children experience real-life difficulties and early detection would help in the provision of early intervention. Thus, it may be effective to use the S-HTP in the evaluation of development in pediatric practices.

Child growth and disappearance of “no synthetic sign”

Some children who could not complete the S-HTP at first were able to complete it later. We presume that the disappearance of “no synthetic sign” reflects the development of abilities. The ability to understand instructions increases with social experience and the power to make concrete drawings may also increase over time. Additional studies are needed to assess the disappearance of “no synthetic sign”.

Conclusion

There were two types of patients with “no synthetic sign”. The first type was patients whose mental ages were suspected to be younger than 5 years and 11 months. The second type included patients with ASD. Additional studies are needed regarding the presence of “no synthetic sign” because drawing ability reflects multiple domains. The incidence of “no synthetic sign” was low in this study, but because this test is simple and easy to administer, it may help in early identification of children with developmental problems and allow interventions to begin sooner.

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Table 1. Diagnosis of patients in the HTP and S-HTP groups

	HTP Group (n=22)	S-HTP Group (n=241)	P value
ASD	13	74	0.0093*
MR · BIQ	8	35	0.0144*
AD/HD	1	18	0.078
LD	0	2	1.0
Non- developmental disorder	8	141	0.0701

* : $p < 0.05$

ASD: Autism spectrum disorders

MR: Mental Retardation

BIQ: border intelligence

AD/HD: attention-deficit/hyperactivity disorder

LD: learning disorder

Table 2. Details of patients in the HTP group

No	Age, yr	Gender	Chief complaint	Diagnosis	IQ
1	6	M	School refusal	Adjustment Disorder	
2	6	M	Nail biting, hyperactivity	Reservation of diagnosis	
3	6	F	Sensitivity to noise	AD/HD, BIQ	81
4	6	M	Stuttering	PDD-NOS	86
5	7	M	Rotating one's neck	Tic Disorder	
6	7	M	Enuresis, encopresis	PDD-NOS, BIQ	74
7	8	M	Stuttering, collectionism	Reservation of diagnosis	94
8	8	M	Encopresis	PDD-NOS	90
9	8	M	Panic at school	PDD-NOS	93
10	8	F	Trouble with communication	PDD-NOS	96
11	9	M	Trouble with the opposite sex	Precocious puberty	107
12	9	F	Telling lies, hiding things	Consultation and introduction to another clinic	
13	9	M	Sleep disorder, School refusal	PDD-NOS, BIQ	76
14	9	M	Difficulty waking up in morning, School refusal	PDD-NOS, Orthostatic dysregulation	86
15	10	M	School refusal	PDD-NOS, BIQ	84
16	11	F	School refusal	PDD-NOS, BIQ	84
17	12	F	Visual and hearing impairment	Conversion Disorder	
18	13	M	School refusal, self-injurious behavior	PDD-NOS, MR	45
19	13	M	School refusal	PDD-NOS, BIQ	84
20	13	M	Nausea	PDD-NOS, Conversion Disorder	90
21	13	M	School refusal	PDD-NOS, BIQ	81
22	14	F	Low back pain, School refusal	Social Anxiety Disorder	

PDD-NOS: pervasive developmental disorder-not otherwise specified MR: Mental

Retardation

BIQ: border intelligence

AD/HD: attention-deficit/hyperactivity disorder

LD: learning disorder

Table 3. Wechsler IQ index and subtest mean scores using descriptive statistics in the HTP and S-HTP groups

	HTP Group (n=16)	S-HTP Group (n=133)	P value
FSIQ	83.18	96.05	0.0024*
VCI	85.18	97.36	0.004*
PRI/POI	87.06	96.21	0.028*
WMI/FDI	88.77	95.99	0.037*
PSI	90.24	97.35	0.021*
Similarities	8.1	9.6	0.12
Vocabulary	7.5	9.7	0.004*
Comprehension	7.5	9.9	0.008*
Information	7.6	9.1	0.17
Block Design	8.5	9.4	0.21
Picture concept	8.4	8.6	0.91
Digit Span	8.4	9.2	0.28
Arithmetic	8.0	8.9	0.061
Coding	8.2	9.7	0.008*
Symbol Search	8.5	9.5	0.13

* : $p < 0.05$

FSIQ: Full scale Intelligence Quotient

VCI: Verbal Comprehension Index

PRI/POI: Perceptual Reasoning Index /Perceptual Organization Index

WMI/FDI: Working Memory Index / Freedom from Distractibility Index

PSI: Processing Speed Index

Table 4. Diagnosis of patients in the HTP and S-HTP groups (the patients took IQ test)

	HTP Group (n=16)	S-HTP Group (n=135)	P value
ASD	13	64	0.0154*
MR · BIQ	8	35	0.0743
AD/HD	1	16	1.0
LD	0	2	1.0
Non-development disorder	3	47	0.2658

* : $p < 0.05$

ASD: Autism spectrum disorders

MR: Mental Retardation

BIQ: border intelligence

AD/HD: attention-deficit/hyperactivity disorder

LD: learning disorder

Table 5. Comparative study of ASD patients in the HTP and S-HTP groups

	HTP Group (n=13)	S-HTP Group (n=64)	P value
Male:Female	11:2	24:40	0.0023*
Age, y	9.90	11.1	0.13
FSIQ	82.6	97.1	0.0019*
VCI	83.0	100.0	0.001*
PR/POI	88.4	97.9	0.028*
WMI/FDI	88.1	96.3	0.0042*
PSI	91.5	95.9	0.22
Similarities	8.0	10.0	0.11
Vocabulary	6.7	10.2	0.003*
Comprehension	6.9	10.2	0.0025*
Information	7.2	9.7	0.021*
Block Design	8.8	9.6	0.22
Picture Completion	8.4	8.8	0.59
Digit Span	8.5	9.3	0.42
Arithmetic	7.5	9.0	0.12
Coding	7.9	9.6	0.036*

Symbol Search	9.1	9.1	0.97
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* : $p < 0.05$

FSIQ: Full scale Intelligence Quotient

VCI: Verbal Comprehension Index

PRI/POI: Perceptual Reasoning Index / Perceptual Organization Index

WMI/FDI: Working Memory Index / Freedom from Distractibility Index

PSI: Processing Speed Index

Figure 1. Study patients

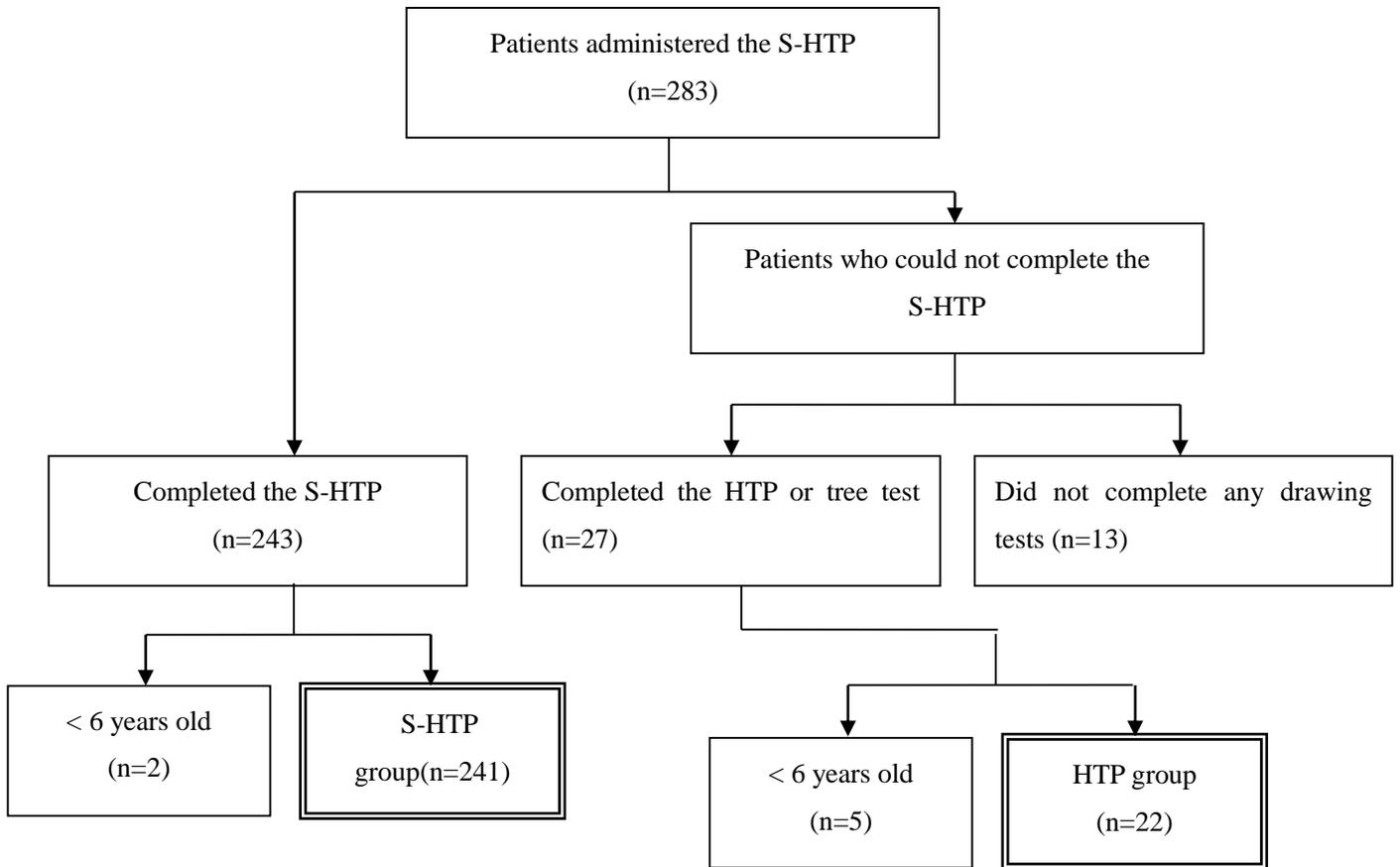


Figure 2. Case 14, first drawing test (HTP) at the first visit

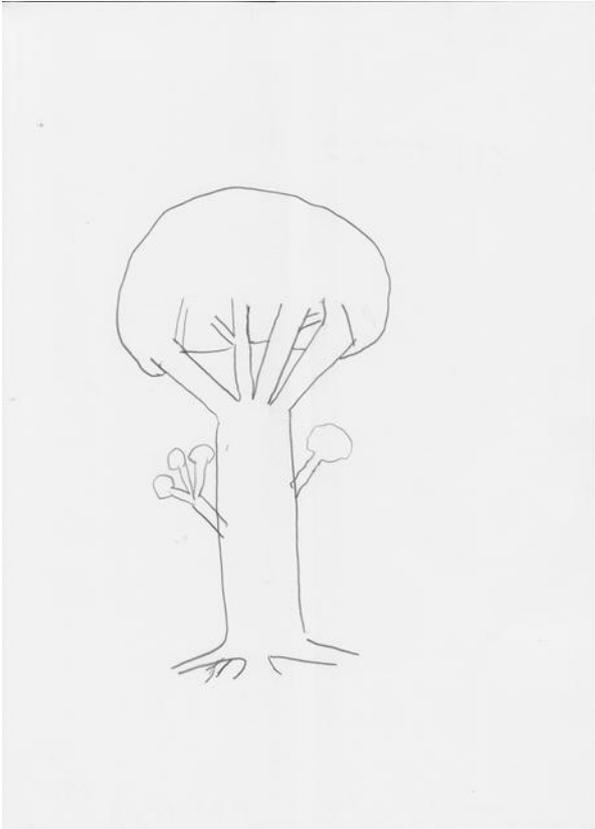
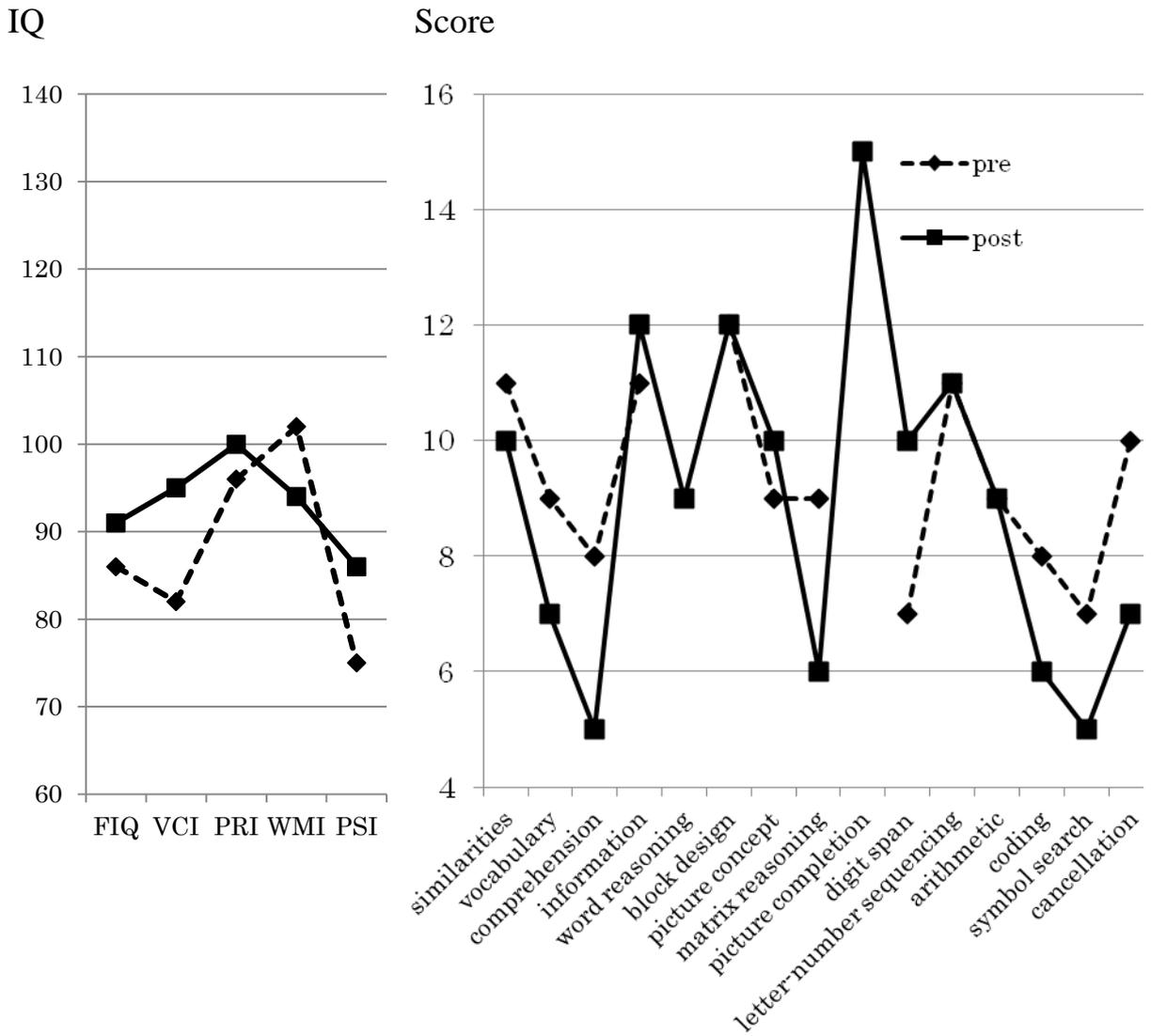


Figure 3. Case 14, second drawing test (S-HTP), 2 years after the first visit



Figure 4. WISCIV scores of case 14



FSIQ: Full scale Intelligence Quotient

VCI: Verbal Comprehension Index

PRI: Perceptual Reasoning Index

WMI: Working Memory Index

PSI: Processing Speed Index