pii: jc-19-00222 https://dx.doi.org/10.5664/jcsm.8158

JCSM | Journal of Clinical Sleep Medicine

SCIENTIFIC INVESTIGATIONS

Evaluation of the validity of psychological preparation for children undergoing polysomnography

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Study Objectives: Nocturnal polysomnography (PSG) is an essential diagnostic technique to assess sleep abnormalities, including sleep-disordered breathing (SDB). Although low in invasiveness, it is extremely difficult to conduct PSG with children who are not cooperative with wearing electrodes and sensors. Particularly, it is difficult to conduct PSG on children with autism spectrum disorder (ASD) because they have poor predictive ability, exhibit extreme anxiety about novel and unfamiliar things, and have difficulty understanding verbal instructions. Recently, the usefulness of psychological preparation was reported. The primary aim of this study was to assess the usefulness of psychological preparation for PSG.

Methods: The goal of our study was to assess the usefulness of psychological preparation for PSG. A total of 253 children were enrolled in the study: 131 in the control group (19 with ASD) and 122 selected for psychological preparation (51 with ASD).

Results: In the preparation group, 110 of 122 (90.2%) could undergo regular PSG, a significantly higher percentage than the control group at 104 of 131 (79.4%), $P = .018$. Regarding hypnotic drugs, in the preparation group 111 of 122 (91.0%) underwent PSG without hypnotic drugs, which was a significantly higher percentage than in the control group at 107 of 131 (81.7%), $P = .032$. Additionally, 45 of 51 children with ASD in the preparation group (88.2%) could undergo PSG without hypnotic drugs.

Conclusions: This study indicated that psychological preparation was effective in facilitating PSG without hypnotic drugs in children who have difficulty cooperating with PSG, including those with ASD.

Keywords: autism spectrum disorder, children, polysomnography, psychological preparation

Citation: Murata E, Kato-Nishimura K, Taniike M, Mohri I. Evaluation of the validity of psychological preparation for children undergoing polysomnography. *J Clin Sleep Med*. 2020;16(2):167–174.

BRIEF SUMMARY

Current Knowledge/Study Rationale: Although nocturnal polysomnography (PSG) is an essential diagnostic technique for assessing sleep abnormalities including sleep-disordered breathing, children who refuse to wear electrodes and sensors have extreme difficulty undergoing PSG. This study described a psychological preparation method to improve the number of children who are cooperative with and can complete PSG.

Study Impact: This study found that psychological preparation was effective in helping children to uneventfully complete PSG without hypnotic drugs, who would otherwise be uncooperative, including those with autism spectrum disorders. Psychological preparation may help to reduce the burden for children, pediatricians, and laboratory technicians.

INTRODUCTION

Sleep-related disorders are not rare in children.[1] Owens et al[2] reported that more than 37% of children had sleep problems. The prevalence of sleep-related disorders in children is estimated to be 6% with sleep-disordered breathing (SDB), 2% to 4% with restless legs syndrome,[3–5] 90% with parasomnias,[6] and 0.002% to 0.18% with narcolepsy.[7–9] Nocturnal polysomnography (PSG) is an essential diagnostic technique to assess sleep abnormalities, including SDB.[10–12]

Our own experience prior to the introduction of psychological preparation showed that performing PSG was extremely difficult in children younger than 4 years or in those with developmental disorders. Even for skilled laboratory technicians, attaching the electrodes and sensors in children takes at least half an hour, which is too long for children to remain still. We often gave up the full monitoring and chose cardiorespiratory monitoring after holding out for the setup until 11:00 PM. Actually, most pediatric sleep clinics in Japan see only typically developing children older than 6 years. In general, medical examination of children is more difficult than that in adults because of anxiety and noncooperativeness. Therefore, diagnostic and therapeutic procedures in children frequently require the administration of drugs with sedative properties,[13–15] and guidelines for sedation/analgesia in children have been formulated.[16] PSG is not invasive but it takes some time to set up the electrodes and sensors. In the United States, there are relatively few sleep laboratories around the country; most of these are located in academic centers and in large urban areas,[17] adding to the difficulty of conducting PSG in children.

Furthermore, it was reported that electroencephalography (EEG) alone often provoked distress in children with developmental

disabilities because of anxiety with unfamiliar equipment, difficulty inhibiting motion, and tactile defensiveness.[18] Several studies have achieved success with in-laboratory PSG by omitting the number of recording channels, or excluded the thermistor and cannula for assessment of SDB.[19,20] As mentioned previously, for children, hypnotic drugs are often used for medical examinations, such as an EEG; however, the use of hypnotic drugs should be avoided for PSG because it affects sleep structure as well as muscular tone and respiratory effort. Especially in childhood obstructive sleep apnea (OSA), which is one type of SDB, in which apnea and hypopnea usually occur immediately after sleep onset,[21,22] it is recommended to start PSG recording before sleep onset. It is common knowledge that children with developmental disorders have more comorbid sleep problems, such as unstable sleep with excessive body motion and frequent nocturnal awakening, than typically developing children.[23–25]

Our hospital is a tertiary medical care center; we conducted PSG on children with sleep problems, and in more than 20% of them developmental disorders such as autism spectrum disorder (ASD), attention-deficit hyperactivity disorder (ADHD), or intellectual disability (ID) were diagnosed.[26] Particularly, it is extremely difficult to conduct PSG on children with ASD because they have poor predictive ability, they exhibit extreme anxiety about novel and unfamiliar things, and have difficulty understanding verbal instructions. Furthermore, they often are hypersensitive to touch.[27] Alternatively, PSG has to be discontinued because the children remove almost all of the electrodes and sensors when they experience panic upon nocturnal awakening.

Recently, the usefulness of psychological preparation has been reported.[28–33] Psychological preparation means arranging the environment to increase the ability of children and their parents to cope with hospitalization and medical examinations that can cause psychological confusion. Psychological preparation was suitable for any medical examination or procedures.[28–33] For example, Cuzzocrea et al[31] reported that a group that underwent psychological preparation activities using puppets and had a psychologist's support during all phases of the procedure was less anxious and more cooperative in the preoperative period and during anesthesia induction than another group that lacked psychological preparation activities and a psychologist's support. William et al[32] reported that an experimental group that engaged in therapeutic play using a doll and went on a hospital tour approximately 1 week before their surgery had significantly lower scores in the Chinese version of the state anxiety scale for children in the preoperative and postoperative periods and exhibited fewer negative emotions at induction of anesthesia than children in the control group. de Amorim e Silva et al[33] reported that 134 children who were 4 to 16 years old undertook practice magnetic resonance using a practice unit from 0 to 196 days (median 6 days) before the clinical magnetic resonance imaging (MRI). As a result, 110 of 134 underwent clinical MRI without general anesthesia or sedation.[33]

There are three key elements of the psychological preparation process: (1) the provision of developmentally appropriate information; (2) the encouragement of questions and emotional expression; and (3) the formation of trusting relationships with health care professionals.[34] Patients with ASD predominantly use visual information processing,[35–37] so psychological preparation using visual aids before PSG can be expected reduce anxiety and increase cooperation.

The aim of our study was to assess the usefulness of psychological preparation for PSG.

METHODS

Study design and participants

Enrolled participants included 253 children (aged 2 to 11 years) who visited the Pediatric Sleep Clinic at Osaka University Hospital and underwent PSG from October 2008 to March 2015. One hundred twenty-two children underwent psychological preparation (preparation group), whereas 131 children did not undergo psychological preparation (control group) because their parents did not request it or pediatric neurologists judged psychological preparation unnecessary because the children seemed to be cooperative with PSG. This study was not a randomized study. Participants who were thought to have difficulty with PSG were enrolled in the preparation group because of ethical issue. Some of the children had anxiety, had complications such as achondroplasia, heart disease, or epilepsy, or had social/family issues such as single-parent household or a parent with mental disorders, factors believed to affect PSG. We analyzed the coexistence of these factors between the two groups and clarified whether these factors affect the efficacy of psychological preparation using Pearson chi-square tests to compare differences in the rate of success of regular PSG and usage rate of hypnotic drugs with or without the background conditions. The exclusion criteria were as follows: children had already experienced PSG at our department, pediatric neurologists had already prescribed sedatives to the relevant child because of severe ID, and children with cerebral palsy. All participants were seen by pediatric neurologists who were also sleep doctors at an outpatient department prior to the PSG. At that time the participant and their caregivers received information about PSG using the illustrations and photos of the children wearing the sensors. The doctors took about 10 minutes to explain each procedure to the children and their caregivers. The information provided included discussion about the noninvasiveness but possible uncomfortableness of the procedure and the time required depending on cooperation. The patients did not attend the tour of the sleep laboratory nor did they watch videos about the PSG before the hospitalization. The clinical diagnosis for ASD was reassessed by three pediatric neurologists according to the Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition (DSM-5)[38] after it had already been established.

The implementation method of psychological preparation

The participants of the preparation group were hospitalized at approximately 3:00 PM on the day of PSG. Approximately

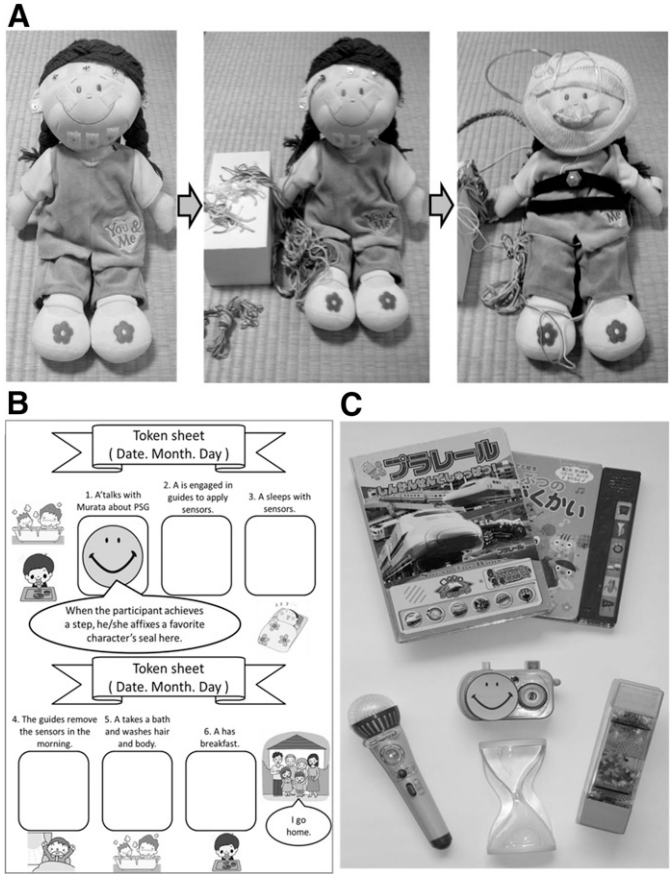
30 minutes to 1 hour before PSG, psychological preparation of a child and his/her caregiver was conducted using photos (a process of PSG), a doll, a model of the electrodes and sensors (**Figure 1A**), and a token sheet[39] (a sheet of a token economy system indicating an approximate procedure leading to the goal of PSG with illustrations and letters; **Figure 1B**) at the participant's hospital room. During rehearsal, the psychologist pretended to put the models of the electrodes and sensors on the doll, while showing the photos with simple words about the process of PSG, feel of the instruments, and the purpose of the instruments. The psychologist demonstrated the procedure with dolls, and the child repeated the procedure (PSG play; **Figure 1A**). The psychologist praised the child's performance. To make the child feel safer, the psychologist told the child that he or she could read books and/or talk with the psychologist while in bed preparing for PSG. The psychologist asked the child and his/her caregiver if there are any remaining concerns that can be alleviated. This process took approximately 30 minutes. Additionally, the psychologist provided distraction (a support methodology to divert the child's attention during uncomfortable medical examinations and procedures) by talking with the patient about his or her interests and using picture books, light and sound toys, and a liquid motion toy (**Figure 1C**) while the sensors were being attached. For the child with hypersensitivity, the psychologist consciously attracted the child's attention to his or her interest items and light and sound toys just before and while the sensors were attached.

The "pearls" of behavioral management is to grasp what the child prefers and interesting topics by communication with the caregiver and the child at the start of the psychological preparation.

Outcome index

To estimate the outcome of PSG, we divided participants into two groups: the regular PSG group and the failed PSG group. The following definition of the regular PSG group was used: without sedatives, and PSG recording was started in wakefulness without trouble. The following definition of the failed PSG group was used: we had to change the examination to cardiorespiratory monitoring without EEG, or we had to abort PSG for any reason. When the patient was showing extreme anxiety and it appeared impossible to attach the sensors and/or because the patient refused to attach the sensors, we tried to attach the sensors after natural falling asleep. However, in the case the patient could not sleep and refused attachment of the sensors after approximately 60 minutes, the pediatricians decided to administer a hypnotic drug such as triclofos sodium. That case was considered "failed." Once leads were placed on the children without sedative drugs, children sometimes removed the leads upon awakening. In such a case, the technicians tried to reposition the leads again and again, but if the children could not withstand the placement of the EEG electrodes, the ordering doctor decided to switch to cardiorespiratory monitoring by 1:00 AM. This case was also judged to be failed. When any electrodes are displaced and unable to be repositioned because of the uncooperativeness thereafter, the cases were judged to be failed retrospectively.

Figure 1—Psychological preparation items and a token sheet.



The procedure of psychological preparation. **(A)** First, a psychologist explains to the study participant and his/her parents the polysomnography (PSG) procedure using photos. Second, the psychologist pretends to put sensors on a doll. Third, the participant pretends to do the same as the psychologist. **(B)** Before the explanation using the doll and so on, the psychologist explains to the participant and his/her parents the approximate procedure to the goal of PSG by using a sheet of the token economy system. When the study participant achieves a step, he/she affixes a favorite character's seal to the sheet. **(C)** While the study participant is putting on sensors, the psychologist attempts distraction by communication and using toys. The toys include books with sound, a microphone with light and sound, a talking camera, an oil glass, and a swimming fish bottle.

We compared sleep onset latency and sleep efficiency for the sleep period as a PSG parameter between the preparation and control groups. In our centers, lights-off time was at the patients' usual bedtime; the latest was 9:00 PM.

In the preparation group, we evaluated acceptance of psychological preparation using three levels: (1) well understood: children positively engaged in PSG play and asked the psychologist about PSG, (2) moderately understood: children interested in the doll and related materials and could understand visually patterned information about PSG, and (3) poorly understood: children played using a doll or other items by themselves and paid little attention to the psychologist. A pediatrician and the psychologist who attended to prepare PSG discussed behavior of the patient and assigned one of the three levels of psychological preparation.

Table 1—Demographic data of all participants.

	Preparation Group (n = 122)	Control Group (n = 131)	*P*	Statistical Analysis
Age				
Mean ± SD (years:months)	5:9 ± 2:2	6:4 ± 2:10	.057	*t* test
Range (years)	2–11	2–11		
Sex, n (%)				
Boys	89 (72.9)	81 (61.8)	.060	χ^2 test
Girls	33 (27.1)	50 (38.2)		
ASD, n				
With ASD	51	19	< .001	χ^2 test
Without ASD	71	122		
Coexisting issues, n				
Anxiety	14	2	.013	χ^2 test
Achondroplasia, heart disease, epilepsy	20	24		
Social family issues	7	4		

ASD = autism spectrum disorder, SD = standard deviation.

Table 2—Demographic data of participants with ASD.

	Preparation Group (n = 51)	Control Group (n = 19)	*P*	Statistical Analysis
Age				
Mean ± SD (years:months)	6:4 ± 2:2	7:5 ± 2:7	.112	*t* test
Range (years)	3–11	3–11		
Sex, n (%)				
Boys	38 (74.5)	15 (78.9)	.700	χ^2 test
Girls	13 (25.5)	4 (21.1)		

ASD = autism spectrum disorder, SD = standard deviation.

In the preparation group, we evaluated cooperation with psychological preparation using two levels: (1) cooperated: children did not refuse putting on sensors or did not remove sensors later, and (2) did not cooperate: children refused placement of sensors.

Statistical analysis

Pearson chi-square tests were used to compare differences in sex, number of children with ASD, perfectness of PSG, and use of hypnotic drugs between the preparation and control groups. In addition, independent two-tailed *t* tests were used to compare age, sleep onset latency, and sleep efficiency (for sleep period time) between the preparation and control groups.

Pearson chi-square tests were used to compare differences in cooperation by putting on sensors, the perfectness of PSG, and using hypnotic drugs in those with different degrees of understanding of psychological preparation.

All data analyses were performed using SPSS for Windows software, version 20.0 (IBM Corp, Armonk, New York, United States), and the significance level was set at $P < .05$.

This study was approved by the Institutional Review Board of Osaka University Hospital.

RESULTS

Participants' demographic data

The preparation group enrolled 122 children. Their mean age was 5 years 9 months ± 2 years 2 months (range: 2 to 11 years). The control group enrolled 131 children. Their mean age was 6 years 4 months ± 2 years 10 months (range: 2 to 11 years). Mean age and sex did not significantly differ between the two groups (Table 1).

Seventy children had ASD. The preparation group enrolled 51 children (72.9%) and the control group enrolled 19 children (27.1%). The number of children with ASD in the preparation group was larger than in the control group ($P < .001$; Table 1).

Table 2 outlines the details of children with ASD. The mean age of participants in the preparation group was 6 years 4 months ± 2 years 2 months (range: 3 to 11 years). The mean age of participants in the control group was 7 years 5 months ± 2 years 7 months (range: 3 to 11 years). Mean age did not significantly differ between the two groups (Table 2).

One hundred eighty-three children were without ASD. The preparation group enrolled 71 children (38.8%) and the control group enrolled 112 children (61.2%). The mean age of

participants in the preparation group was 5 years 4 months ± 2 years 0 months (range: 2 to 11 years). The mean age of participants in the control group was 6 years 2 months ± 2 years 10 months (range: 2 to 11 years). The preparation group was significantly younger than the control group (**Table S1** in the supplemental material).

The effect of psychological preparation on PSG

To clarify the efficacy of psychological preparation on PSG, we compared the outcomes of PSG, such as no cessation of the procedure, no shift to cardiorespiratory monitoring, or no hypnotic drug usage between the preparation and control groups (**Table 3**). In the preparation group, 110 of 122 (90.2%) could undergo regular PSG, a significantly higher percentage of children than in the control group 104 of 131 (79.4%), $P = .018$ (**Table 3**). Regarding hypnotic drugs, in the preparation group, 111 of 122 (91.0%) completed PSG without the use of hypnotic drugs, and this rate was significantly higher than in the control group of 107 of 131 (81.7%), $P = .032$ (**Table 3**).

Considering medical/psychiatric or social differences, the coexistence of anxiety, medical conditions, and social/family issues was significantly higher in the preparation group ($P = .013$) than in the control group (**Table 1**). To clarify whether this adverse bias affects the efficacy of psychological preparation, we performed Pearson chi-square tests to compare differences in the rate of success of regular PSG and usage rate of hypnotic drugs with or without the background conditions. The results showed that the rate of success of regular PSG was significantly higher ($P = .047$) and usage rate of hypnotic drugs was lower ($P = .080$) in the preparation group than in the control group. Sleep onset latency and sleep efficiency were not significantly different between the two groups (**Table 3**). In the preparation group, the lights-out time was 8:58 PM, and this time was not significantly different from that of the control group 8:59 PM ($P = .746$). Even if we compared the two groups of participants who fell sleep within 5 minutes, there was no significant difference between two groups ($P = .536$).

Acceptance of psychological preparation and cooperativeness with PSG

To determine the factors related to perfectness of PSG, we estimated the degree of acceptance of psychological preparation and participants' cooperativeness with PSG. In the well-understood group, the rate of children who cooperated with PGS was significantly higher ($P < .001$; **Table 4**) than in the

Table 3—Effects of psychological preparation on polysomnography.

	Preparation Group (n = 122)	Control Group (n = 131)	*P*	Statistical Analysis
Completion of full PSG, n (%)				
Yes	110 (90.2)	104 (79.4)	.018	χ^2 test
No	12 (9.8)	27 (20.6)		
Usage of hypnotic drugs, n (%)				
No	111 (91.0)	107 (81.7)	.032	χ^2 test
Yes	11 (9.0)	24 (18.3)		
Sleep onset latency (minutes), mean ± SD	19.8 ± 20.2	26.7 ± 34.9	.054	*t* test
Sleep efficiency (%), mean ± SD	91.2 ± 7.3	90.6 ± 10.0	.581	*t* test

PSG = polysomnography, SD = standard deviation.

Table 4—Acceptance of psychological preparation and cooperativeness with polysomnography.

	Well Understood (n = 87)	Moderately Understood (n = 28)	Poorly Understood (n = 7)	*P*	Statistical Analysis
Cooperativeness, n (%)					
Cooperated	87 (71.3)	24 (19.7)	1 (0.8)	< .001	χ^2 test
Did not cooperate	0 (0.0)	4 (3.3)	6 (4.9)		
Completion of full PSG, n (%)					
Yes	83 (68.0)	24 (19.7)	3 (2.5)	< .001	χ^2 test
No	4 (3.3)	4 (3.3)	4 (3.3)		
Usage of hypnotic drugs, n (%)					
No	84 (68.9)	24 (19.7)	3 (2.5)	< .001	χ^2 test
Yes	3 (2.5)	4 (3.3)	4 (3.3)		

PSG = polysomnography.

moderately or poorly understood group. Furthermore, in the well-understood group, the rate of children in whom PSG was performed without hypnotic drugs was 68.9%, which was significantly higher than in the other groups ($P < .001$; **Table 4**).

Effects of psychological preparation on PSG in children with ASD

To clarify the effects of psychological preparation on PSG in children with ASD, we compared the perfectness of PSG and hypnotic drug usage between the preparation and control groups. In the preparation group, 45 of 51 (88.2%) could undergo regular PSG and complete it without hypnotic drugs. Although this completion rate is higher than in the control group, the difference was not significant (**Table S2** in the supplemental material). Moreover, although the children in the preparation group were younger than in the control group, the difference was not significant (**Table S2**).

Acceptance of psychological preparation and cooperation with PSG in children with ASD

In the children with ASD who understood the preparation well, the rate of cooperation with PSG was significantly higher ($P < .001$) than in the moderately or poorly understood groups. The rates of regular PSG ($P < .001$) and without hypnotic drugs ($P < .001$) were also significantly higher in the well-understood group than in other groups with ASD.

Effects of psychological preparation on PSG in children without ASD

In children without ASD, we compared the perfectness of PSG and hypnotic drug usage between the preparation and control groups. In the preparation group, 65 of 71 (91.5%) could undergo regular PSG, and this rate was significantly higher than that in the control group of 90 of 112 (80.4%); $P = .040$. Regarding hypnotic drugs, in the preparation group, 66 of 71 (93.0%) underwent PSG without hypnotic drugs, and this rate was significantly higher than that in the control group of 93 of 112 (83.0%); $P = .053$ (**Table S3**). Moreover, the children in the preparation group were significantly younger than those in the control group (**Table S3**).

DISCUSSION

The effect of psychological Preparation on PSG

In Japan, referral of children for PSG is limited by the difficulty of placing the sensors and electrodes and the amount of time required. Very few institutions or hospitals in Japan can conduct PSG in children.[40] Therefore, there have been no reports describing the success rates or use of hypnotics drugs in pediatric patients undergoing PSG.

Primeau et al explained PSG using a book and also used a PSG kit for desensitization at the participants' home more than 1 week before PSG.[41] This was the first report about psychological preparation for PSG. The authors showed that there was nothing different about a successful PSG depending on the diagnosis, but desensitization required more time in participants with ASD than in typically developing patients.[41] In our study, unlike in this previous report, psychological preparation was conducted 30 minutes to 1 hour before PSG at the hospital. The current study is the first to report the effectiveness of psychological preparation on the same day for children taking PSG. Moreover, the success rate of regular PSG was 90.2%. Our hospital is a tertiary hospital in Osaka Prefecture. As indicated in **Table 1**, we assessed very young children (beginning from age 2 years). This study was not a randomized study. Coexistence of the factors thought to affect PSG such as anxiety, medical complications, or social/family issues is significantly higher in the preparation group ($P = .013$) than in the control group (**Table 1**). Despite these adverse bias situations, the rate of success of regular PSG was significant higher and hypnotic drug usage rate was lower in the preparation group than in the control group. Therefore, although our study was not a randomized controlled trial, strong bias between the two groups strengthens the efficacy of psychological preparation.

In our study, in the control group, 79.4% participants completed PSG and 18.3% of participants used hypnotic drugs. In recent years, psychological preparation has been conducted in children at various medical examinations and treatment sites.[28–33] The psychological preparation raised the ratio of completed PSG and lowered the ratio of the use of hypnotic drugs.

More specifically, acceptance of psychological preparation affected the cooperativeness and perfectness of PSG. Children who understood the psychological preparation well could cooperate with putting on sensors and subsequently the rate of regular PSG increased, whereas the rate of hypnotic drug usage decreased.

Effects of psychological preparation on PSG in children with ASD

In our study, there were more boys than girls. This reflected that ASD predominantly occurs in males, as reported previously.[42]

A randomized controlled trial was not possible because of ethical considerations. In this clinical research, the control group consisted of children whose parents did not request psychological preparation or their pediatric neurologists judged it to be unnecessary because they seemed to be cooperative with PSG. However, children who were anticipated to have difficulty undergoing PSG were placed into the preparation group. Therefore, there was a large bias regarding the difficulty of conducting PSG between the two groups with ASD. However, in children with ASD, psychological preparation raised the ratio of completed PSG and completion without hypnotic drugs as well, although there was no obvious difference between the preparation and control groups in ASD in this research. However, as shown in **Table S1**, there was no obvious difference in the ratio of completed PSG and usage of hypnotic drugs between the two groups. From these results, at least, psychological preparation is worth trying.

The results of our study indicated that psychological preparation was not very effective for children who were not interested in psychological preparation (**Table 4**). However, psychological preparation was effective for children who understood and were interested in psychological preparation. The children simulated the experience of PSG with photos, a doll, and a model of the apparatus, and the children themselves

were able to actively participate in PSG play by putting sensors on a doll. As a result, PSG was effectively completed by introducing it to children, who could independently act in the inspection scene, which otherwise would usually be a passive experience, and the children had a sense of accomplishment and self-efficacy. Moreover, although Weiner et al reported that sleep onset latency was longer for children who had high anxiety sensitivity,[43] it was reported that psychological preparation decreased anxiety.[31,32] In our study, the sleep onset latency of the preparation group was shorter than in the control group. This result may indicate that psychological preparation reduced the children's anxiety.

In addition, in the preparation group, children had decreased use of hypnotic drugs, which suggests that psychological preparation was effective not only for reducing children's mental burdens but also their physical burdens. Furthermore, in the preparation group, there were fewer cases in which PSG had to be terminated midway through or the examination had to continue without an EEG, which meant that psychological preparation reduced the burden on clinical technologists who observed the state of children's sleep all night. Moreover, the group who underwent psychological preparation had significantly more children with ASD than in the control group. This result indicated that psychological preparation effectively increased the number of children who could undergo regular PSG and decreased use of hypnotic drugs in children with ASD.

Limitations and future directions

This study has several limitations. The first limitation is that diagnosis of ASD was made solely by DSM-5, and structured diagnostic interviews and observation for assessment for ASD were not performed.

The second limitation is that although a sufficient intelligence quotient or developmental quotient is necessary to understand the psychological preparation, the current study did not investigate them.

Third, and most importantly, this study was not a randomized controlled trial because of ethical considerations. However, the resulting selection bias, such as having more uncooperative children in the preparation group, may have strengthened our results.

Finally, the psychological preparation was performed in the sleep laboratory; therefore, the technicians were not blinded to the procedure. However, this clinical study was a retrospective review and the technicians were not informed of this study at the time of the PSG. Therefore, we do not think that this knowledge has an effect on the decision to terminate the study.

CONCLUSIONS

This study was a single hospital experience but indicated that psychological preparation was effective in allowing children to complete PSG without hypnotic drugs, shortening sleep onset latency in children who have difficulty cooperating with PSG. We hope that psychological preparation, which can be adjusted to the degree of children's understanding, will not only decrease children's negative experiences caused by PSG but also ensure that correct data are obtained about children's sleep.

ABBREVIATIONS

ADHD, attention-deficit hyperactivity disorder
ASD, autism spectrum disorder
DSM, Diagnostic and Statistical Manual of Mental Disorders
EEG, electroencephalogram
ID, intellectual disability
MRI, magnetic resonance imaging
OSA, obstructive sleep apnea
PSG, polysomnography
SDB, sleep-disordered breathing

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ACKNOWLEDGMENTS

The authors gratefully acknowledge all participants and their parents. We also thank Ms. Ayumi Sangawa, Sayako Teraoka, Satomi Nobuhara, Ayako Ehara, Naoko Miyamoto, and Shoko Yuta for their excellent technical assistance. And we are grateful to Dr. Kenji J. Tsuchiya, Professor of Hamamatsu University School of Medicine Research Center for Child Mental Development, for advice regarding statistics and Dr. Masaya Tachibana, Assistant Professor of United Graduate School of Child Development, Osaka University, Kanazawa University, Hamamatsu University School of Medicine, Chiba University and University of Fukui, for provide information about doctors' decisions about administration of hypnotic drug and/or switch full PSG to cardiorespiratory monitoring the criteria.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication April 3, 2019
Submitted in final revised form September 13, 2019
Accepted for publication September 13, 2019
Address correspondence to: Ikuko Mohri: 2-2 Yamadaoka, Suita City, Osaka 565-0871, Japan; Email: ikuko@kokoro.med.osaka-u.ac.jp

DISCLOSURE STATEMENT

All authors approved the manuscript as submitted and agree to be accountable for all aspects of the work. Work for this study was performed at Department of Child Development, United Graduate School of Child Development, Osaka University, Osaka, Japan. This work was supported in part by research grants from the Ministry of Education, Culture, Sports, Science and Technology of Japan (15K12721 and 16H03273to M.T), the Takeda Science Foundation (to M.T), the Center of Innovation Program from the Japan Science and Technology Agency, JST, Japan (to M.T), and by the Osaka University Program for the Support of Networking among Present and Future Women Researchers (to M.I). The authors report no conflicts of interest.