

Literature Review on Sensory Abnormality in Children with Disposition of Developmental Disorder

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I . Issue in question and purpose

Autism spectrum disorder (“ASD”) is a neurodevelopmental disorder, which core symptoms include persistent impairment in social communications and interpersonal reactions, and having a restricted and repetitive pattern in behaviors, interests, and activities (American Psychiatric Association 2013) . Diagnostic and Statistical Manual of Mental Disorders, 5th Edition: DSM-5 (DSM-5) was revised in 2013, to which “hypersensitivity or insensitivity to sensory input, or above-normal interest in the sensational environment” was added to the existing diagnostic items for ASD.

Chonan (2014) predicts that studies for sensory characteristics of children with ASD will increase because of this incorporation of hypersensitivity and insensitivity into medical diagnostic criteria. That may possibly be the reason why the interest in sensory abnormality for people with disposition of developmental disorder is drawing increasing attention now to raise the number of study cases.

The newly added sensory abnormality is recognized in more than 80% of ASD patients (Geschwind 2009). Some people with disposition of developmental disorder, who may not necessarily have been diagnosed as

ASD, are hypersensitive or insensitive (Mizuguchi 2020). In view of these facts, one could argue that sensory abnormality is a common characteristic of the people with disposition of developmental disorder.

Nakashima & Kaneko & Nakamura (2020) listed seven notable behaviors of children having the characteristics of ASD by reference to some of the professional literature and applied behavior analytical perspective, and reflected potential background and contributing factors for each behavior. The forementioned notable behaviors include; being restless, having difficulty in following instructions, having difficulty in communication, being unable to get involved appropriately with other children, being unable to act in a group, losing his/her temper easily, and being violent. The author points out the hypersensitivity to sensory stimulation as one of the causes for these seven behaviors.

Furthermore, sensory factors are in large part responsible for the food preferences of children with ASD, thus texture, taste and flavor of the food tend to be a cause of unbalanced diet (Tateyama & Miyajima & Shimizu 2013, Mizuno et al. 2014). Kojima (2015) conducted a questionnaire survey of parents/guardians of typically developing

children, of children with ASD, and of children with other developmental disorder to find out about problems in eating behavior of children with ASD. As a result, it was found that children with ASD stick with familiar food, have limited preference and choices of food, and are unable to eat some food with variation of taste, compared to typically developing children. It is presumed that the sensory abnormality in taste and vision, etc. may be relevant to these behaviors. As such it is suggested that children with ASD may have extremely unbalanced diet and strong attachment to particular food that may be associated with sensory abnormality, that makes their behavior a standout feature.

Also, in the scene of medical examination, children with ASD may have a difficulty having an examination due to the hypersensitivity as a background factor (Tsubomi & Mizuno & Tokuda 2020). More specifically, they may get into a panic by feeling offended at a smell of disinfectant, a sensation of coldness of medical equipment directly touching their skin, speaking voice of the people in the waiting room and crying babies.

As seen above, behind all kinds of behaviors of the children with the characteristic of ASD is the fact that they have a sensory abnormality, thus, it is presumed that a sensory abnormality is a problem all too common for children with ASD.

The children with ASD are likely to develop psychosomatic symptoms as a stress reaction to maladjustment to the environment, which may lead to susceptibility to secondary disability in their adolescence if the symptoms are not handled properly (Okamoto & Miyake & Nagasawa 2017). The author

thinks it is important to establish an adequate support procedure in order for the children with disposition of developmental disorder and sensory abnormality to receive proper support without developing secondary disability.

Based on the above, this study aims to conduct a literature review on studies of characteristics of the people with sensory abnormality attributable to disposition of developmental disorder, to find out the current status of the study on the characteristics of sensory abnormality in children and the support procedure, and to review further research agenda.

II. Method

Using CiNii Research and Igaku Chuo Zasshi (Ichushi)-Web, keyword searches were conducted with “developmental disorder” + “senses” + “support”, and “developmental disorder” + “senses” + “characteristics” without placing a restriction on the year of publishment. The period of search and literature collection was June of 2023.

A total of 77 articles were extracted from CiNii Research and 106 from Igaku Chuo Zasshi (Ichushi)-Web, and 166 articles were obtained after excluding 17 duplicates. Out of the 166 articles, 62 articles including interpretive articles, feature stories and literature review were excluded.

Out of the remaining 104 articles, 53 were excluded based on their titles as being irrelevant to this study. Specifically, 28 articles related to the development of scales or systems, and 25 articles discussing sensory issues unrelated to developmental disorders, such as hearing-impaired infants or irritable bowel syndrome, were excluded. After reading

the abstracts or main texts of the remaining 51 articles, 30 articles were excluded. These included 4 articles that focused on typical development without addressing sensory abnormalities related to developmental disorders, 8 articles that were limited to sensory integration focusing on

proprioceptive and vestibular senses, and 18 articles that did not discuss the characteristics or support methods for sensory abnormalities. In consequence, as it turned out that 21 articles became the subject of this analysis (Fig. 1).

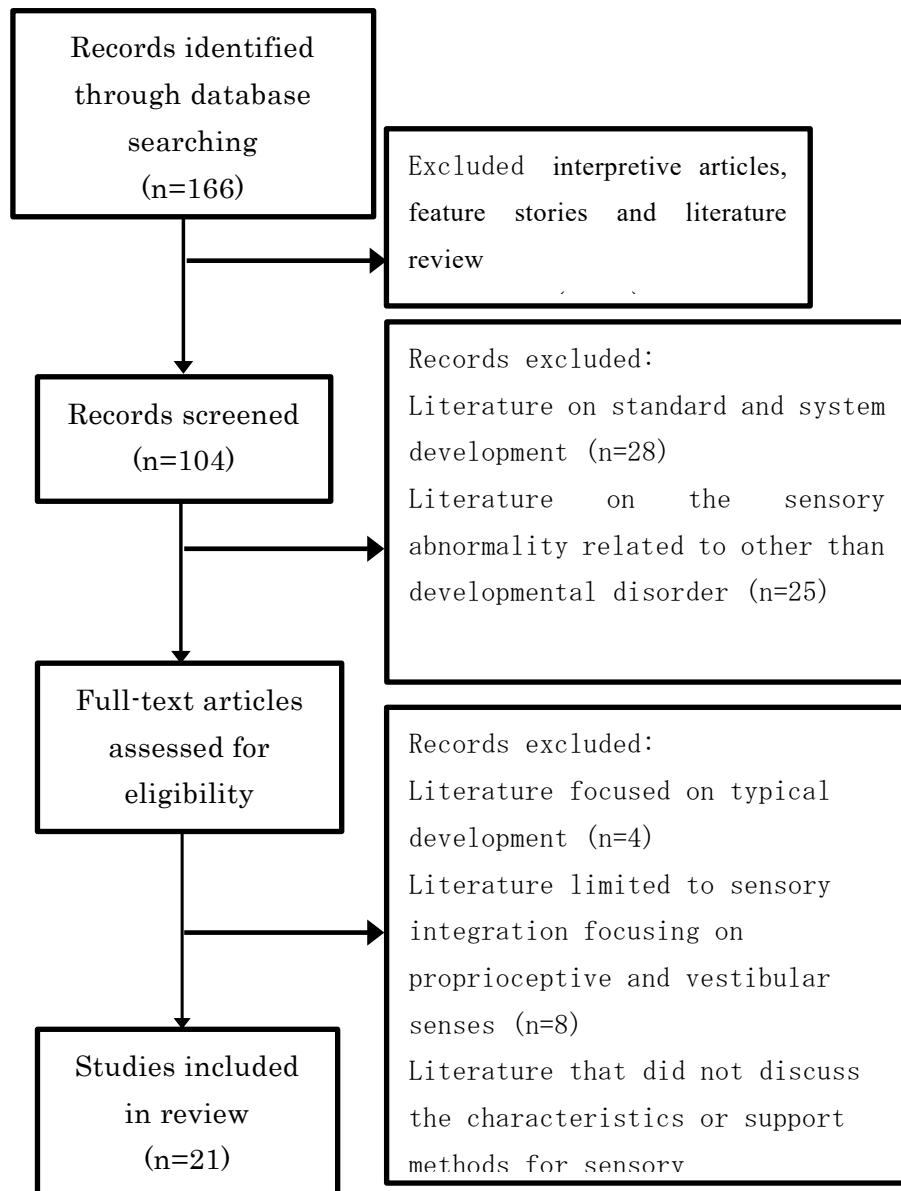


Fig. 1. Flow diagram depicting the studies identified and selected for review

III. Results and considerations

1. Annual transition of the literature

Looking at the 21 subjects of analysis by year, one article was published in 2005, another one was published in 2008, two were published in 2011, another two were published in 2012, one was published in 2013, two were published in 2018, three were published in 2019, three were published in 2020, four were published in 2022, and two were published in 2023. Since sensory abnormality was added to the existing diagnostic items for ASD due to the revision of DSM-5 in 2013, studies on the characteristics of sensory abnormality and the support procedure had been on the increase during the period of 10 years after the revision compared to the period of 10 years before the revision.

2. Subject for the study and the study methods

In 6 out of 21 articles, adult patients of developmental disorder are the subject of the study while the people around the children with developmental disorder, such as the parents, guardians, childcare workers and teachers are the subject of the study in 15 articles.

For the study method, out of the articles targeting adult patients with development disorder, questionnaire surveys were conducted in 3 cases, questionnaires combined with assignment evaluation were conducted in one case, while hearing surveys were conducted in 2 cases. In contrast, out of the articles targeting the people around a child with developmental disorder, such as the parents, guardians, childcare workers and teachers, observation of the patients' sensory perception by the people other than the

patients themselves were collected in a form of questionnaire (9 cases), hearing survey (2 cases), case report (3 cases) or a combination of case report and hearing (1 case).

For the articles about surveys on minor children's sensory perception, the respondents include grown-up patients themselves responding to the survey by recalling their childhood memories, and the people around a child, such as parents and guardians, childcare workers and teachers. There were no articles in which minor children themselves responded to the survey.

3. Type of senses

There are 13 articles discussing five senses; a "sense of touch", a "sense of vision", a "sense of hearing", a "sense of smell", and a "sense of taste". In addition to the five senses, a "vestibular sense" and a "proprioceptive sense" are discussed in 8 articles.

There are 13 articles demonstrating that ASD patients may be suffering from multiple characteristics of sensory abnormality. From this, it is indicated that people with developmental disorder, suffering from sensory abnormality often have sensory abnormalities in two or more sensory functions.

For 6 articles targeting ASD patients themselves, a "sense of touch" is discussed in all articles, while a "sense of hearing" or "taste," and a "sense of smell" or "vision" are discussed in 83.3% and 66.7% of the articles, respectively. Moreover, for 15 articles prepared by referencing to the responses to a questionnaire from the people other than the patients themselves, a "sense of hearing" is discussed in 93.3% of the articles, while a "sense of touch" or "vision," a "sense of taste," and a "sense of smell" are discussed in 86.7%,

66.7% and 60.0% of the articles, respectively (multiple number count). It appears that patients themselves are more sensitive about abnormalities in all five senses while other people are less likely to notice abnormalities in a sense of test and a sense of smell of the patients, which may be reflected in a percentage of the coverage for these two senses that is lower in the articles targeting at the people other than the patients, compared to the articles targeting at the patients themselves.

4. Support procedure

There are 9 articles discussing some procedures of supporting the children with sensory abnormality. The procedures currently used (multiple number count) may be roughly divided into four categories; “avoidance” (discussed in 7 articles), “practice/acclimation” (6 articles), “reminding/giving advance notice” (3 articles), and “transition to alternative action” (4 articles).

“Avoidance” means to avoid stimulating the sensory function in question. More specifically, it means to give ear muffs and sunglasses to a child so as to block the stimulus, or to avoid sending a child to an area where he/she may be exposed to unpleasant stimulus. “Practice/acclimation” means to have a child gradually getting used to the sensation by practice in a step-by-step manner. “Reminding/giving advance notice” means to warn about uncomfortable sensation that a child is about to encounter, or to comfort the child so as not to make him/her anxious about that sensation. “Transition to alternative action” means to distract the child from an uncomfortable sensation by giving something with his/her favorite texture to wear or to cuddle to calm down the child.

“Avoidance” and “Practice/acclimation” are discussed in many of the articles as a support procedure. “Avoiding” uncomfortable sensation may be a relatively easy step as a starting point to support a child with ASD. Mizuno & Tokuda (2017) mentions that he tries to get a child used to uncomfortable stimulus patiently in a step-by-step manner in his practice if there is no way to avoid it. It implies that they try to have a child used to the sensation by “practice/acclimation” if the sensory stimulation is “unavoidable”. In addition, even if we are talking about the same sensory abnormality, the responses to uncomfortable sensation may vary depending on a child, therefore, it is considered necessary to choose an appropriate support procedure tailored to a child.

5. A child’s reaction to sensory stimulus

Among the articles discussing the results of a questionnaire about reactions of a child with ASD to stimulus, observed by someone other than the child, there are 9 articles about the reactions to stimulus of a child with sensory abnormality. Some reactions of a child with sensory abnormality to unfavorable stimulus include; “running away” (discussed in 8 articles), “becoming panicky” (6 articles), “getting angry” (3 articles), “crying” (2 articles), “developing physical symptoms, such as sweating and vomiting” (2 articles), and “covering his/her ears” (2 articles). It demonstrates that the people around a child with sensory abnormality, including parents and guardians, childcare workers and teachers, determine the unfavorable stimulus for that child from those reactions.

In the meantime, there are 5 articles about the reactions of grown-up patients to sensory stimuli. In 3 articles, “feeling fatigue” is

discussed although that was not found as a reaction of a child patient. Younger patients must feel fatigue as well from sensory abnormalities, but it is possible that the people around the child may not recognize the child's fatigue as a consequence of the sensory abnormality. Also, a child's sense of fatigue may be expressed in a form of "getting angry" or "crying". It is considered necessary to pay attention in an evaluation, not only to direct reactions to stimulus, but also a child's fatigue condition.

In comparison to reactions of a child, the articles targeting grown-up patients demonstrates that adult patients may express what is unfavorable for them specifically and may verbalize by saying, for example, "I cannot stand scratchy texture like a knitted sweater." It is presumed that a child patient may get panicky because of his/her inability to verbalize unfavorable sensation. Instead, they express their feelings with an attitude while feeling a sense of frustration of not being able to explain their feelings to the people around them.

6 . Needs of care and understanding of sensory abnormality that a child is suffering

There are 10 articles discussing that the people around a child need to care and understand the characteristics of sensory abnormality and to provide the support for the child.

The needs of care and understanding are discussed in about half of a total 21 articles, indicating that in the current situation, there is a lack of understanding about the sensory abnormality attributable to a disposition of developmental disorder, and that knowing as much about the sensory abnormality is of high

importance. It is considered that promoting proper understanding of the characteristics of sensory abnormality and the support procedures to the people around the patients is one of the important perspectives to be adopted in order to provide improved support for the patients of ASD.

7 . Difficulty for strangers to understand the sensory abnormality

There are 4 articles discussing the difficulty of understanding the sensory abnormality. For example, Takahashi & Masubuchi (2009) conducted a survey on the patients' frustrations attributed to hypersensitivity or insensitivity caused by Asperger syndrome, etc., and their needs. He suggested from the survey result that the patients with sensory abnormality appear to struggle with some activities while the people around them take it for granted that the patients perform these activities normally. The researcher argues that it is a peculiar feeling that is difficult for the people around a patient to understand. Moreover, according to Machida & Hashimoto & Doyama & Fuchigami (2020), the result of a questionnaire survey on childcare involving hypersensitivity revealed that it is hard for childcare workers to picture which sensation is unpleasant for a particular child. Two articles shed light on the difficulty for a child to explain his/her own sensation as a possible factor to make it difficult for other people to understand the child's problem. It is discussed in other 2 articles that there is a difficulty of imagining what is bothering a child, thus the supporters are unable to understand. It became apparent from this that the characteristics of a child's sensory abnormality are hard to understand because the people around the child have difficulties

understanding the unpleasant sensation that the child may feel while the child has difficulties explaining their own sensation.

In addition to the situation described above, it is revealed from 3 articles that a lack of understanding of sensory abnormality may contribute to lowering of self-esteem or to cause secondary disability for a child with developmental disorder, suffering from sensory abnormality. More specifically, it was found from an interview survey, conducted as part of a study by Mizuno & Tokuda (2022), of grown-up patients who are aware of their own sensory abnormality that more than 60% of the survey subjects have experienced a rough time because of a lack of understanding from their parents, guardians, childcare workers and teachers who casted blame on their alleged lack of motivation for their problem. Moreover, Takahashi & Masubuchi (2009) suggested as follows. The patients of Asperger syndrome experience body sensation that is different from normal sensation. Because of that, their attitudes that have been misunderstood as being “small-minded” or “selfish” could be significantly attributable to hypersensitivity or insensitivity, and that may cause secondary disabilities, such as maladaptation and problematic behavior. In addition, Maeda & Ogasawara (2011) stated in his study that if a child may not have sufficient successful experiences, and recognize himself/herself as a “failure” from their clumsy bodily manipulation due to a peculiarity of the body sensation, that could cause the child lowering of a sense of competence and self-esteem.

8. When sensory abnormality is recognized by the people around the patient

There are 2 articles discussing when

sensory abnormality may be recognized by the people around a child. Some specificities of sensory abnormality rise to the surface when a child joins communal life (Kato & Matsumoto 2018) at “a place where many people meet together at the age of 2 to 5” (Tsuji 2018). Also, these two articles revealed that sensory abnormality for hearing is relatively easy to be recognized by the people around the child. In communal life, there is a variety of sonic stimulation and a child’s reaction to noise, such as “covering his/her ears” against unpleasant noise is relatively noticeable. It is found that sensory abnormality often rises to the surface in communal life, such as in daycare, kindergarten or school to become noticeable. Therefore, it is considered necessary to encourage a greater number of parents, guardians, and childcare workers to become aware of a child’s sensory abnormality.

9. Procedures and creative ideas to improve problematic behaviors attributable to sensory abnormality

There are 2 articles reporting on the case examples where some characteristics of the disorder were well understood and a support procedure was successfully implemented. It is stated in Kato and Matsumoto’s article (Kato & Matsumoto 2018) that provision of the support to improve the child’s problematic behavior only became feasible because some supporters of the child (with disposition of developmental disorder) started questioning the specificity of the child’s sensory perception as a possible cause of his problematic behavior. Moreover, it is reported in Komatsu et al.’s article (Komatsu & Kitajima & Takeda & Konno 2005) that a supporter watched a video describing an inner

world of a patient of high functional autism, and felt strong sympathy for the agony that a person having hypersensitivity may be suffering from and was convinced that more attention needs to be paid. That in turn changed the video viewer's consciousness, resulting in a more helpful environment for younger patients to live with a peace of mind. These 2 articles demonstrate that it is necessary for supporters who are close to the patients to think of a possibility that sensory abnormality may be related to the patient's problematic behavior, and to understand the need of attention to sensory abnormality in order to deliver the support to improve the patient's problematic behavior.

IV. Summary and future prospects

The volume of literature on the characteristics of and support procedure for sensory abnormality has been on the increase since sensory abnormality was added to the existing diagnostic items for ASD. Thus, it is safe to say that the interest in some characteristics of and support procedures for sensory abnormality in the people with disposition of developmental disorder is increasing after the revision of DSM-5. On the other hand, the literature related to the research of sensory abnormality for minor children with disposition of developmental disorder includes no articles discussing survey responses from minor children themselves. This may hint a possibility that the needs of support felt by the children themselves may not become visible. While a child may be aware of the abnormality in all five senses of his/her own, the people around him/her may have a hard time noticing any abnormality in the child's sense of taste or a

sense of smell, or even the child's fatigue from the sensory abnormality. As such, there is a gap between the child's awareness of his/her own sensory abnormality and the knowledge of the people around the child about the clumsiness he/she may feel, indicating a lack of understanding of the child's frustration. Furthermore, a questionnaire survey was conducted as part of a study by Matsuda & Ichikado & Wada (2019) targeting the parents/guardians of young ASD patients about the children's behavioral characteristics. Meanwhile, Matsuda pointed out that the evaluations by the parents/guardians on the patient's hypersensitivity and insensitivity may differ from how the patients themselves perceive their sensory abnormality.

The mental states of children with disposition of developmental disorder, including "feeling awkward", "being anxious", and "feeling frightened" are expressed in nonverbal manner, such as facial expression, postures, body language, movement and position. With these nonverbal expressions, the adults around them notice that the child may have some issues on his/her hands or feeling challenges (Noi 2021). Therefore, in studies associated with behavioral characteristics of the children with disposition of developmental disorder, questionnaire survey of childcare workers is conducted for review (Kuboyama & Saito & Nishimaki & Touda & Fujii S & Takigawa 2009, Tamai & Horie & Terawaki & Muramatsu 2011, Imanaka & Takahashi & Izawa & Nakamura 2013). Also, to give a support for the behavioral characteristics, the support procedures are reviewed by case study (Akahoshi & Fukuda 2023, Tanba &

Ohnishi & Bito 2012). In addition, the studies regarding children with impulsive or hyperactive tendency focus on the frustration felt by childcare workers and parents/guardians (Wada 2021).

In the light of this study, in order to close the gap between the sensory perception of the child with ASD and an evaluation by the people around him/her, it is considered necessary to examine a child's sensory abnormality both by interviewing the people around the child and by observing the child.

While it may not be easy to recognize a child's sensory abnormality, if a child is blamed on his/her attitudes, that could be attributable to hypersensitivity or insensitivity, as being "small-minded" or "selfish" without receiving appropriate support, that may cause lowering of self-esteem or secondary disability for that child. It became apparent that in order for many children in question to reduce their frustration from sensory abnormality and receive appropriate support without triggering secondary disability, it is necessary for more parents/guardians and childcare workers to realize that sensory abnormality may be one of the causes of problematic behavior and to realize the significance of paying attention to the child. In addition, it is considered that knowing some characteristics of sensory abnormality and how one can support a child, could lead to appropriate support in consideration of the background factors of a child's behavior.

Based on the above, it is considered necessary, as future prospects, to establish a system that promotes better understanding and knowledge that the supporters around a patient should have about sensory

abnormality and to provides conscious support for a child. Yamashita (2015) argues that if a child with ASD has an opportunity to receive appropriate support, that child becomes to show growth during the process and the characteristic of sensory abnormality gradually becomes less obvious. In order to achieve that, the author desires to develop training programs and provide information regarding problematic behaviors attributable to disposition of developmental disorder, and the support available for these children for many parents/guardians and childcare workers.

The first thing for us to do is to find out the current status of the knowledge and awareness, that parents/guardians and childcare workers may have for sensory abnormality attributable to disposition of developmental disorder, and then to look into what should be implemented to cause changes in the realization and awareness of problematic behaviors of a child with sensory abnormality attributable to disposition of developmental disorder.

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This study aims to examine the characteristics of sensory abnormalities and support methods for individuals with developmental disorders. Using CiNii Research and Igaku Chuo Zasshi (Ichushi)-Web, keyword searches were conducted, yielding a total of 166 articles after excluding duplicates. Of these, 62 interpretative articles were excluded, and another 53 were eliminated based on relevance, leaving 21 articles for analysis.

The literature trends show an increase in research on sensory abnormalities following the DSM-5 revision in 2013, which added sensory abnormalities as diagnostic criteria for ASD. Six studies focused on adult patients, while 15 involved the people around children with developmental disorders, such as parents, teachers, and childcare workers. The studies used questionnaires, interviews, and case reports to gather data on sensory perceptions.

Of the 21 articles, 13 discussed abnormalities in the five primary senses (touch, vision, hearing, taste, smell), with many patients experiencing abnormalities in multiple sensory functions. Four key support methods were identified: “avoidance,” “practice/acclimation,” “reminding/giving advance notice,” and “transition to alternative action,” with the first two being the most frequently discussed.

Children's reactions to sensory stimuli included behaviors like “running away” and “panic,” which were often observed by those around them. In contrast, adult patients could better articulate their sensory challenges, which suggests communication difficulties in children lead to frustration.

The study highlights the need for greater awareness and understanding of sensory abnormalities among parents, teachers, and caregivers to provide appropriate support. The research suggests that developing training programs and providing information on sensory issues is crucial for improving care for children with developmental disorders.