



## **Hyperlexia in a Child with Autism Spectrum Disorder: A Case Report**

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DOI: <https://doi.org/10.55248/gengpi.4.1223.0120>

### **ABSTRACT**

**Introduction.** Hyperlexia is a condition where preschool children display an intense early interest in letters in a way that is very advanced for their age. They can decode words accurately, but without understanding their meaning. It is most common among children with autism spectrum disorder (ASD), but also occurs in neurotypical children and children with sensory dysfunctions.

**Subject.** The subject of this paper is the occurrence of hyperlexia in a child with ASD and its impact on the speech-language development of the child. This report is a result of five-year longitudinal follow-up referring to the child's speech-language development conducted during the speech therapy treatments.

**Results.** The findings of this report indicate that the child with ASD and hyperlexia does not follow the same pathway to literacy which is common in typically developing children.

**Conclusion.** Reading comprehension skills of a child with hyperlexia are poor relative to the great ability to start early reading. However, the unique ability to read should be taken into account during the rehabilitation process and used as a powerful tool for the development of verbal and social communication.

**Key words:** hyperlexia, autism spectrum disorder, speech-language development.

### **1. Introduction**

Language is one of the most powerful tools used by humans to communicate with the environment (Filipova, 2013). On the other hand, language development can sometimes be affected for various reasons, including hyperlexia. Hyperlexia is defined by a precocious and spontaneously acquired ability to read at preschool age. Children with hyperlexia are often self-taught readers who can read well above what is expected at their age but struggle to understand what they are reading, exhibit receptive language difficulties and delay in the development of speech and social skills. They are often obsessed with numbers and letters, preferring books (Siegel, 1984). The reading ability of children with hyperlexia is surprisingly beyond their expected ability relative to their age (Sparks & Artzer, 2000). They start reading at a remarkably young age, even before the age of three, and even without any reading instruction. Children with hyperlexia have a very good auditory and visual memory, they can accurately remember the things that they have seen without trying too hard, but this does not help them in speech understanding and expression (Cobrinik, 1982). Despite being able to read well, the encounter poor vocabulary and limited communication skills (Richman & Kitchell, 1981). The speech development in children with hyperlexia does not follow the same pattern as the other children (Nation, 1999). They start speaking by using whole phrases or sentences (Castles & Nation, 2006). These children rarely engage in interaction with others, and even more rarely initiate a conversation. They become compulsive readers to the detriment of other forms of communication (Filipova & Krstevska-Kokormanova, 2022). Children with hyperlexia have difficulty with who, what, why, where, and how questions. Echolalia (immediate and delayed) is often present in their speech (Filipova and Krstevska-Kokormanova, 2022). They encounter problems in social interaction. Their thinking is concrete and very literal and they have difficulty understanding abstract concepts. Sensory integration dysfunctions are often present as well (Savić, 2014). Due to the selective hearing they may appear to be deaf (Golubović, 2018). Children with hyperlexia may not understand everything they read, but reading tends to become an important avenue through which they communicate, because their attention to text is greater than to speech (Aram 1997; Kistner et al. 1988). Verbal ability level and IQ scores were found to be higher in children with ASD and hyperlexia than in those with ASD without hyperlexia (Burd et al. 1986; Fisher et al. 1988). It is assumed that this is due to the fact that reading provides a greater opportunity for communication and socialization (Kistner et al. 1988). According to some authors, hyperlexia is due to the high phonological ability for decoding and transformation of graphemes into phonemes, instead of using the direct lexical approach (Welsh et al., 1987). According to recent functional magnetic resonance imaging (fMRI) research, in children with hyperlexia there is a greater activity observed in the left inferior and superior temporal cortices, as well as in the right inferior temporal sulcus. This study suggests simultaneous hyperactivation of left hemisphere phonological decoding systems (mainly the left superior temporal cortex), as well as right hemisphere visual form recognition systems (mainly the right inferior temporal sulcus). This evidence seems to suggest that very skilled word reading in the context of ASD is supported by both elevated phonological and visual processes. However, hyperlexia in children with ASD is still not a phenomenon widely studied (Ostrolenk et al., 2017; Turkeltaub, et al., 2004).

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## 2. Methodology

### 2.1. Methods

This paper presents a clinical case of a child diagnosed with an autism spectrum disorder, manifesting a precocious and spontaneous ability to read. The report is a result of a longitudinal follow-up referring to the child's speech-language development conducted during the speech therapy treatments.

### 2.2. Instruments

The Test Lingvogram (Vladisavljević et al., 1983) was used for assessment of speech and language skills of the child. This test examines single-word understanding, independent picture naming, immediate word repetition and quality of spoken voices, reading abilities and writing abilities. The test consists of 80 pictures and an examination form composed of six columns. In the first column there are words and sounds represented by pictures. In the second column includes pictures intended for examination of understanding of the words represented by pictures is checked. The third column is intended for examination of the independent naming of the displayed images. The fourth column notes the ability of repetition. The fifth column is intended for assessing the accuracy of the words reading. In the sixth column the respondent writes words by dictation.

The semantic test (Vladisavljević et al., 1983) was also used in the study, intended to examine the child's semantic development. This test contains 40 words divided into four categories (homonyms, antonyms, synonyms, metonyms) with 10 words in each category.

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## 3. Case report

The subject of this paper is the occurrence of hyperlexia in a child with ASD and its impact on the speech-language development of the child.

**Anamnestic Data.** L. A. is a seven-and-a-half-year-old child. He goes to the first grade. According to the mother's report, the overall development of the child went normally until the second year, and then stagnation in overall development and speech regression was noticed. Child's first meaningful word appeared around the age of one. By the age of two, the child had had at least 50 words, but they were then lost. The child had been examined by a paediatric psychiatrist. Based on the Statistical Manual of Mental Disorders DSM-5, the child was given F84.0 diagnosis. Speech and language therapy was recommended.

**First examination.** Child's first assessment due to delayed speech development was done at the age of two-and-a-half. During the first examination, the child seemed disconnected, calm, not interested to engage, didn't explore the environment. He didn't respond his name when called, and didn't make eye contact. His play was functional. He didn't experience any sensory integration issues. Gross motor skills were age-appropriate and the fine motor skills were delayed. The dominant lateralization of the upper limbs was not differentiated. Self-care skills were not learned yet. There were no problems in child's feeding and sleeping noticed. The child went to kindergarten, but he wasn't interested to interact and preferred to stand aside and only watch other children.

**Lingvogram test** was administered in order to assess child's speech and language developmental status. It indicated that child's comprehension was situational (speech comprehension depends a lot on the situation itself). The child doesn't identify and point to/show a named object. He is not able to repeat a two-syllable word, to label a shown object, to sing songs, and to match same objects. He is not able to recognize letters. Child's usual forms of communication are crying, shouting, hand taking and hand leading gestures. Symbolic gestures are not present. According to mother's report, the child has a vocabulary of 10-20 words and he uses them when he wants to.

**Therapy and progress.** Implemented therapy included exercises for fine motor skills and dexterity, visuo-motor coordination, gross motor skills, psycho-motor re-education, as well as stimulation of receptive language through play and using pictures.

After 3 months of intensive work the child has started to recognize and pronounce initial sounds of words presented on a picture. He was able to understand simple commands and repeats words he hears.

After 6 months, the child has begun to make associations between the initial letter and the word, as if reading them (B-balloon, S-snake). When pronouncing the word, the child was always pointing to the letters below the word. The speed of mastering the phonetic and phonemic structure of words, i.e. the correct pronunciation of each word and the correct organization of the sounds in the word, regardless of its length, was amazing. Understanding was at the level of simple statements. When it comes to the verbal expression, the child used a sentence made up of one word and labels objects.

After 10 months of work, the child has begun to recognize a large number of written words, that is, to read them as a picture. He has also begun to write letters and shows an obsessive interest in letters and books. In addition to reading words, he has begun to use them in communication, that is, to boost his vocabulary and use a sentence composed of two to three words. As the lexicon increases, the presence of delayed echolalia has increased as well. Speech comprehension was at the level of understanding complex commands, usually those used and repeated in daily life. Child has learned to write the names of his family members and to copy words on his own, and words copying has become his preoccupation.

After one year of intensive work with a speech therapist and a special educator, there was a re-evaluation done. Lingvogram test indicated understanding of complex spoken commands and adequate naming of all items within the test (77 in total). Referring to immediate repetition, the child could repeat a

sentence of 4 words without error. He could read and copy all 77 words included in the test. In the dictation section, he could write 60 words. In verbal communication, he used complex but agrammatical sentence.

At the age of four, the child began to read whole sentences and the reading became his main preoccupation. He mostly liked to play with picture books and magazines for kids, especially those with letters. The child mastered the language combinatorics in a short time, with the exception of the correct use of pronouns. When it comes to the speech understanding, he had difficulties to understand complex and newly encountered words. The child didn't feel comfortable enough to join in group activities in kindergarten, he used to passively watch other children while playing, he sometimes made attempts to initiate interaction, but he wasn't able to maintain it within a longer period.

At the age of five, the child was able to read short texts fluently and write short sentences. In his verbal communication he used grammatically correct sentences. The applied semantic test indicated difficulties in the metonyms subtest, which implied a lack of figurative thinking and generalization which would allow him to discover the associated words.

He started school at the age of six-and-a-half, with no need of an educational assistant. The first two-three months were difficult for him, but then it went generally well. He read the texts in books fluently and accurately, much better compared to his peers, but not always comprehended what was being read. He wrote by dictation well. His obsession with books was reduced, but still dominated in his preferred activities. The child engaged in verbal communication only when absolutely necessary, but didn't initiate communication himself. Delayed echolalia occurred occasionally as well. He was selective in his play referring to the friends to interact with, choosing those who were more flexible. The speech therapy was reduced to giving instructions to the family members. Neurofeedback was also introduced.

At the age of seven-and-a-half, when the child went to second grade, his reading skills were at the same level as his typically-developing peers, but the comprehension was poorer compared to them. The child read for the sake of reading, not of learning. He was able to write by dictate, but not to compose written text himself. He had difficulties to understand figurative meaning of words. He felt much more comfortable to engage in verbal communication and often asked adequate questions. He also engaged in peers' play activities more often. The delayed echolalia was still present when the child stand alone.

Discussion. This case report of a child with hyperlexia, as well as the review of the relevant literature dealing with this problem, indicate that in children with hyperlexia there is an extensive self-exposure to printed materials which results in acquiring of a vast catalogue of orthographic representations virtually mapped with phonological representations, bypassing the lexical-semantic route (Kelić, 2015, Kuvać, Palmovič, 2007). They are able to successfully couple written words with their corresponding sounds. The first two logical steps of reading (word recognition and grapheme-to-phoneme conversion) are functional in hyperlexia, but the third (semantic access) does not seem to be achieved *prima facie* (Sparks & Artzer, 2000).

Although visual word recognition in hyperlexia is performed as fast as for any fluent reader, it is not known whether it is achieved in the same way, or goes through a different route (Cobrinik, 1982). It is assumed that there must be another system, or a different use of the same system in hyperlexia, to explain such fast decoding without access to meaning. The question remains as to whether the development of reading in hyperlexia is truncated (i.e. the third step is missing altogether while the first two are intact), inverted (i.e. the three steps do not come in the same chronological order), or altered (i.e. there are fundamental differences at every stage). (Grigorenko et al., 2003).

The evidence showing differences in brain activity in autism in general, and hyperlexia in particular, suggests that hyperlexic reading is a substantially different process from typical reading (Fletcher-Flinn, Thompson, 2000). Autistic strengths in visual tasks may be an asset in the processing of written strings of letters as the visual cortex is highly involved in visual word form recognition (Dehaene, Cohen, 2011). The very first step of reading, visual word form recognition, may therefore be achieved faster and/or earlier than by typical children. Autistic children may be attracted to words and letters at a young age because written material is particularly adapted to autistic neurocognitive abilities. (Henderson et al., 1993, Huttenlocher & Huttenlocher 1973).

Hyperlexia is a combination of precocious reading skills accompanied by significant problems with learning and language (Treffert, 2011). Hyperlexia relatively rare occurs in neurotypical children who simply read early (Golubović, 2018, Golubović, 2000). Hyperlexia occurs in 6-14% of children with ASD (Burd, & Kerbeshian 1985, Wei et al., 2015, Jones et al., 2009, Grigorenko et al. 2002). Hyperlexia can also occur in children with sensory dysfunctions who are misdiagnosed as autistic. However, not all autistic individuals present hyperlexia and not all children with hyperlexia present autism.

There are many limitations in research due to the inconsistency of the criteria to define hyperlexia (Åsberg Johnels et al., 2019). No meta-analytic studies are available and study populations are still too heterogeneous to derive consistent data (Zhang et al., 2018). Treffert's classification of hyperlexia into three types has not gained consensus (Mammarella et al., 2022). The establishment of clear population criteria is essential to better understand how to focus research. If we consider hyperlexia as occurring only in atypically developing populations, it is necessary to determine whether it represents a comorbidity or a feature of a specific subtype of disorder in order to customize the intervention. If hyperlexia, in its classical meaning, is also accepted in typically developing populations, it might be useful to investigate the root of the discrepancy between reading and other competencies.

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#### 4. Conclusion

Spontaneous and early acquisition of reading skills should not be considered as a problem, because children with hyperlexia will benefit from learning the skills they need through the written language. The problem arises when the precocious ability to read leads to difficulties in comprehension of what is being read and behaviour issues when the hyperlexic child is being obsessed with numbers and letters, alongside difficulties in understanding and using

spoken language. Children with hyperlexia do not learn to speak the way other children do. They retain words, phrases, or even entire conversations through what they perceive from the environment every day. Hyperlexic children rarely take part in interactive conversations or initiate conversation. In order to express what they have in their mind, to create original expressions, the child must be able to dissect what they have previously memorized, which hyperlexic children find it really hard to do.

The early acquisition of reading skills is usually without explicit teaching, and as a result of children's strong orientation toward written material. Kids with hyperlexia will like books and other reading materials more than playing with other toys and games. They also have difficulties with conversational speech, exhibit echolalia, pronoun reversals, idiosyncratic use of words or phrases, and delays in using single words. Speech and language therapy is extremely beneficial for individuals with hyperlexia. It aims to develop and improve communication and social skills. The therapist will utilize the individual's strengths i.e. their visual and advance reading abilities, to help develop and support their areas of weakness which may include areas of comprehension and social interaction.

Hyperlexia is a complex condition and it requires individualized approach in its treatment.

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