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The Evaluation of Sensory Integration and Partial Pragmatic Communication Abilities in Children with Autism Spectrum Disorder with the Application of a New Evaluation Material Speech-Language Therapy Approach

Abstract: Autism spectrum disorder (ASD) is associated with variable communication difficulties and disorders, mostly detected in pragmatic language abilities, sensory integration, and imitation. These components are important for a comprehensive speech-language therapy (SLT) intervention. This article describes the application of a new evaluation material for assessing imitation abilities, partial pragmatic abilities based on the recognition of graphical visual diagrams, and sensory integration in two boys with ASD (diagnosed with childhood autism in accordance with International Classification of Diseases, 10th Revision, WHO) with sensory integration difficulties, dyspraxia symptoms, and imitation skill disturbances. The main objective is to identify potential obstacles to SLT efficiency and the causes of disturbed pragmatic language abilities. The analysis of the case studies shows some progress in communication ability; however, some of the abilities related to sensory integration have been partially inhibited. In one case, we suggest the possible influence of the individual therapy based on the described detailed assessment.

Key words: autism spectrum disorder, speech-language therapy, sensory integration, sensory processing disorder, communication disorder, special needs education

From a speech-language therapy perspective, autism spectrum disorder (ASD) is a communication disorder classified under the so-called secondary (symptomatic) language disorders or, in line with the current inclusive terminology dominant for example in the UK, North America, or Australia, under a specific category of Speech Language and Communication Needs (SLCN), the prevalence of which is around 7%, or behavioural, emotional and social difficulties (BESD).[1]

[1] E. Meschi, J. Micklewright, A. Vignoles, G. Lindsay: *The transitions between categories of special educational needs of pupils with Speech, Language and Communication Needs (SLCN)*

In addition to verbal development abnormalities, the main symptoms in the area of communication include disorders or differences in imitation facial behaviour and peculiarities of sensory perception and integration accompanied by hypersensitivity or hyposensitivity, which may inhibit adequate development of sensorimotor connections and engagement of executive functions in relation to deviations concerning the so-called theory of the mind and higher cognitive processes (e.g. R. Moseley and P. Pulvermüller[2] or C.M.A, Berenguer et al.[3]). These deviations may further disrupt both perception and production of the non-verbal component of communication affecting the pragmatic level of language and thus impair the social use of speech in children with autism spectrum disorders,[4] noticeable for example in the conversation parameters of a clinical dialogue as demonstrated by Larkin et al.[5]

The mentioned peculiarities may then determine the course and success of speech-language diagnosis, but especially speech-language therapy (for example L. C. Tung et al.[6]). From a comprehensive holistic perspective, it is necessary to take into account familial effects influenced by many etiologically determined clinical and genetic aspects that develop a relatively complex network that variably oscillates between various syndromic and non-syndromic types of defects, as

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and Autism Spectrum Disorder (ASD) as they progress through the education system. 2012 [Research report. Ref.: DFE-RR247-BCRP11]. Available from: 10.13140/2.1.1754.2404 [access: 25.02.2018]; J. E. Dockrell, P. Howell: *Identifying the challenges and opportunities to meet the needs of children with speech, language and communication difficulties*. "British Journal of Special Education" 2015, vol. 42(4), pp. 411–428. Available from: 10.1111/1467-8578.12115. [access: 4.07.2018]; G. Lindsay, J. Dockrell: *The relationship between speech, language and communication needs (SLCN) and behavioural, emotional and social difficulties (BESD).* 2012. [research report Ref: DFE-RR247-BCRP6], Available from: 10.13140/2.1.2540.6721. [access: 23.11.2018].

[2] R. Moseley, F. Pulvermüller: Special issue: Review: *What can autism teach us about the role of sensorimotor systems in higher cognition? New clues from studies on language, action semantics, and abstract emotional concept processing.* "Cortex" 2018; Available from: 10.1016/j.cortex.2017.11.019 [access: 2.02.2018].

[3] C. Berenguer, A. Miranda, B. Rosell., C. Colomer, I. Baixaul: *Contribution of theory of mind, executive functioning, and pragmatics to socialization behaviors of children with high-functioning autism*. "Journal of Autism and Developmental Disorders" 2018, vol. 48, pp. 430–441. Available from: 10.1007/s10803-017-3349-0 [access: 2.02.2018].

[4] D. Keen, H. Meadan, N. Brady, J. Halle: *Prelinguistic and minimally verbal communicators on the autism spectrum* [e-book]. New York, NY, , Springer Science + Business Media, 2016. Available from: PsycINFO, Ipswich, MA [access: 21.01.2018].

[5] F. Larkin, J. A. Hobson, R.P. Hobson, A. Tolmie: *Research paper: Collaborative competence in dialogue: Pragmatic language impairment as a window onto the psychopathology of autism*. "Research in Autism Spectrum Disorders" 2017, 43–44, pp. 27–39. Available from: 10.1016/j.rasd.2017.09.004 [access: 2.02.2018].

[6] L.C. Tung, C. K. Lin, C. L. Hsieh, C. C. Chen, C. T. Huang, C. H. Wang: *Sensory integration dysfunction affects efficacy of speech therapy on children with functional articulation disorders*. "Neuropsychiatric Disease and Treatment" 2013, vol. 9, pp. 87–92. Available from: Science Citation Index, Ipswich, MA [access: 18.03.2018].

suggested in their research studies by for example by V. Ruggieri and C. Arberas[7] or S. Alvarez.[8]

A research team focused on the identification of developmental and behavioural markers of genetic abnormalities in children with autism spectrum disorders led by Bishop[9] confirmed her long-term assumption that the assessment of the differences in communication and other types of behaviour in children with ASD in the key stages of early development, combined with standardized objectively assessable testing may help in tracing probable etiological determinants and also clinical differential diagnoses, but not without primary consideration of developmental and demographic variables. The genetic conditionality of ASD may affect the assessment of communication manifestations associated with autistic behaviour in the context of a narrower social group, especially the family, as suggested for example by Taylor, et al.,[10] as well as the resistance of certain deviations concerning the perception and production of communication behaviour in the context of the reciprocal impact of genetic and endogenous genetic and external factors on the modification of neurodevelopmental disorders (as confirmed e.g. by the results of a cross-diagnostic research study by J. Homberg et al.[11]

Communication behaviour in the area of verbal as well as non-verbal speech production resulting in the functional pragmatic level of language is also affected by a possible comorbidity with the developmental coordination disorder, where one of the clinical symptomatological subtypes is, according to M. Farmer, B. Echenne, & M. Bentourkia,[12] associated not only with language difficulties, but

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[7] V. Ruggieri, C. Arberas: *Trastornos generalizados del desarrollo: Aspectos clínicos y genéticos Pervasive developmental disorders: Clinical and genetics aspects*. "Medicina" 2007, vol. 67(6), pp. 569–585. Available from: http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S0025--76802007000700006&lng=es [access: 25.02.2018].

[8] S. Alvarez: Early *Communication Development in Infants at High and Low Genetic Risk for Autism Spectrum Disorders: an Examination of Communication Spontaneity* [e-book]. ProQuest LLC; 2013. Available from: ERIC, Ipswich, MA. [access: 25.05.2018].

[9] S. L. Bishop, C. Farmer, V. Bal, E. Robinson, A. Willsey, D. Werling, K. Havdahl, S. Sanders, A. Thurm: *Identification of Developmental and Behavioral Markers Associated With Genetic Abnormalities in Autism Spectrum Disorder*. "American Journal Of Psychiatry" 2017, vol. 74(6), p. 576. Available from: 10.1176/appi.ajp.2017.16101115 [access: 25.02.2018].

[10] L. J. Taylor, M. T. Maybery, J. Wray., D. Ravine., A. Hunt, A. O. Whitehouse: *Brief Report: Do the Nature of Communication Impairments in Autism Spectrum Disorders Relate to the Broader Autism Phenotype in Parents?* "Journal of Autism & Developmental Disorders" 2013, vol. 3(12), pp. 2984–2989. Available from: 10.1007/s10803-013-1838-3 [access: 15.06.2018].

[11] J. R. Homberg, E. J. Kyzar, M. L. Scattoni, W. H. Norton, J. Pittman, S. Gaikwad, M. Nguyen, M. K. Poudel, J. F. Ullmann, D. M. Diamond, A. A. Kaluyeva, M. O. Parker, R. E. Brown, C. Song, R. R. Gainetdinov, I. I. Gottesman, A. V. Kalueff: *Review: Genetic and environmental modulation of neurodevelopmental disorders: Translational insights from labs to beds*. "Brain Research Bulletin" 2016, vol. 125, pp. 79–91. Available from: 10.1016/j.brainresbull.2016.04.015 [access: 25.02.2018].

[12] M. Farmer., B. Echenne, M. Bentourkia: *Original article: Study of clinical characteristics in young subjects with Developmental coordination disorder,* "Brain and Development" 2016, vol. 38(6),

also with orofacial dyspraxia. According to M. Miller et al.,[13] dyspraxia (developmental coordination disorder) in autism is conditioned by disrupted cerebellar mechanisms responsible for motor control, and integration of these mechanisms with cortical networks. As a result, motor functions are connected with visual-motor integration. They inform about previously confirmed ideation or bucofacial dyspraxia (compare also e.g. with E. Sharer et al.[14]).

The authors of the present study believe that the assessment of any determining effects on specific components potentially affecting the pragmatic level of language in children with autism spectrum disorders is necessary for the determination of an adequate approximal therapeutic procedure involving etiological preconditions concerning any deviations in facial behaviour (interoception and exteroception, orofacial movements, imitation motor behaviour, etc. – see e.g. K. Vitásková and A. Říhová[15]). In line with the research findings of T. Tavasolli et al.,[16] or P.Posar and P. Visconti,[17] we believe that the atypical sensory reactivity of subjects with autism spectrum disorder may play crucial role in understadning their abnormal behaviours, and keeping that in mind, a formal evaluation of sensory function should be an integral part of the each evaluation, especially in the context of further speech-language therapy intervention.

For these reasons, the authors of the present article/study have for a long time analysed the originally developed tools for the assessment of pragmatic communication behaviour by a speech-language therapist, also in the context of oral praxis and oral sensory skills within sensory integration disorders and imitation behaviour deviations, as well as visual and auditory perception in persons with autism spectrum disorders and related diagnoses (see for example K. Vitásková,

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pp. 538–547. Available from: https://doi.org/10.1016/j.braindev.2015.12.01 [access: 15.05.2018].

[13] M. Miller, L. Chukoskie, M. Zinni, J. Townsend, D. Trauner: *Research report: Dyspraxia, motor function and visual–motor integration in autism*. "Behavioural Brain Research" 2014, vol. 269, pp. 95–102. Avalaible from: 10.1016/j.bbr.2014.04.011 [access: 15.08.2016].

[14] E. Sharer, D. Crocetti, J. Muschelli, A.D. Barber, M. B. Nebel, B.S. Caffo, J.J. Pekar, S.H. Mostofsky *Neural Correlates of Visuomotor Learning in Autism.* "Journal of Child Neurology" 2015, vol. 30(14), pp. 1877–1886. Available from: https://doi.org/10.1177/0883073815600869 [access: 10.06.2018]

[15] K. Vitásková, A. Říhová: *Challenges Resulting from Pragmatic Language Level Difficulties and Their Recognition in Children with Autism Spectrum Disorders.* In: *Teilhabe und Vielfalt: Herausforderungen einer Weltgesellschaft.* Eds. I. Hedderich, R. Zahnd. Bad Heilbrunn, Verlag Julius Klinkhardt 2016, pp. 222–230. Available from: http://www.klinkhardt.de/verlagsprogramm/2059.html [access: 15.06.2018].

[16] T. Tavassoli, L. J. Miller, S. A. Schoen, J. J. Brout, J. Sullivan, S. Baron-Cohen: *Sensory reactivity, empathizing and systemizing in autism spectrum conditions and sensory processing disorder.* "Developmental cognitive neuroscience" 2018, vol. 29, pp. 72–77. Available from: https://doi.org/10.1016/j.dcn.2017.05.005 [access: 14.04.2018].

[17] P. Posar, P. Visconti: *Sensory abnormalities in children with autism spectrum disorder.* "Jornal de Pediatria" (Versão em Português), 2018, vol. 94(4), pp. 342–350. Available from: https://doi.org/10.1016/j.jped.2017.08.008 [access: 29.11.2018].

A. Říhová, & J. Dostálová,[18] or K. Vitásková, M. Málková and A. Hlavinková[19]). In most cases, a mixed methodological design is used, as it shows to be the most suitable for individualized assessment of real abilities of the child, the results of which are then directly implemented in the development of a comprehensive speech-language therapy intervention in order to increase its quality and efficiency. The mixed research study described below is linked with the results of the authors' previous research studies.

Research methodology – description of the objectives and methods

To demonstrate the use of the screening tool, a case study of two children is provided – a boy (B1) aged 5 years and 5 months diagnosed with childhood autism, tactile and auditory hyposensitivity, and a boy (B2) aged 3 years and 11 months diagnosed with childhood autism, disrupted perception and sensory integration, and difficulties in the receptive and expressive language component.

To assess the current pragmatic level of language and perception, the authors used the following record sheets, which are part of the originally developed assessment tool verified on children with ASD, specific language impairment (developmental dysphasia), mild intellectual disability, and a typical population of peers (partial result of a GACR project "Assessment of the pragmatic language level in children with autism spectrum disorders" – GA14-31457S, 2014/2016, Investigator: Vitásková) complemented with sensory integration assessment (for details about the assessment tool, see publication by Vitásková and Kytnarová[20]): Record sheet A – Assessment of pragmatic level of language (based on observation and assessment of graphical visual diagrams of pragmatic communication situations of the child's everyday life), and Record sheet C – Screening assessment of perception-sensory integration. The data collection was performed from September 2017 to

[18] K. Vitásková, A. Říhová, L. Dostálová: *The Consequences of Pragmatic Language Level Impairment and Auditory Agnosia in Individuals with Autism Spectrum Disorder.* In: EDULEARN14 Proceedings. Madrid, IATED 2014, pp. 7432–7440.

[19] K. Vitásková, M. Málková, A. Hlavinková: *Ověřování výzkumných možností diagnostiky orální stereognozie v oblasti symptomatických poruch řeči u dětí – význam pro interdisciplinární praxi.* In: *PhD existence 2016 Česko-slovenská psychologická konference (nejen) pro doktorandy a o doktorandech. Sborník odborných příspěvků.* Olomouc, Univerzita Palackého v Olomouci 2016, pp. 124–131. Available from: http://contexo.cz/files/other/filemanager/Files/PHD%20VI/phdexistence2016_web2.pdf [access: 14.04.2018].

[20] K. Vitásková, L. Kytnarová: *Pragmatická jazyková rovina u osob s poruchami autistického spektra. (Hodnocení pragmatické jazykové roviny u osob s poruchami autistického spektra z pohledu logopeda).* Olomouc, Univerzita Palackého 2017.

February 2018. In September 2017, the primary assessment was performed, based on which an individual therapeutic plan was developed. From September 2017 to February 2018 a targeted therapeutic intervention was performed and in 2018 a verification procedure was carried out.

Record sheet A – Assessment of pragmatic level of language consists of two parts – observation (O) and testing (T). The two components are assessed in the following areas: problem behaviour, visual contact, sensory integration, social interaction and abilities (addressing, greeting another person); social interaction and abilities (changing communication roles, communication rules); motor imitation, facial expressions. In the area of observation the scoring range is 0–4 points (0 – no symptoms, 4 – severe symptoms). During the testing procedure a participant is presented with a series of pictures and asked to choose one that according to the participant corresponds with the respective social situation. No points are awarded for a correct answer; 1 point is awarded for an incorrect answer. Record sheet C – Screening assessment of perception-sensory integration is based on observation. The following areas are assessed: touch, proprioception, vestibular system, auditory perception, visual perception, taste and smell. The severity of the problem is expressed on a scale from 0 to 4 (0 – no problem, 4 – severe disorder; learning and social interaction almost impossible).

Results of the research – description of a case report and partial discussion

The following section describes two case reports including boys with childhood autism, where the assessment tool mentioned above and developed under a GACR project (see above) was applied together with an assessment of sensory integration and comparison of the findings, which not only enrich the current knowledge in terms of speech-language therapy diagnostics and intervention, but also demonstrate possible application of the developed assessment tool in the context of assessing pragmatic aspects of communication.

Case 1

B1 was born from second normal pregnancy without any recorded complications. The delivery took place after due date, was induced, a caesarean section was performed as a result of non-progressing delivery and weak blood flow in the umbilical cord. Apgar score: 9-10-10, values at birth 52 cm, 3680 g. Mild neonatal jaundice (*icterus neonatorum*). Breastfed for 3 months, breastfeeding being

very painful for the mother due to strong suckling, later she was diagnosed with extensive mastitis; then the boy was fed from a bottle until almost 18 months of age. Motor development was normal, first words were pronounced at the age of 8 to 9 months, at around 18 months of age the boy ceased to communicate verbally. He started to communicate verbally again before 4 years of age. His vocabulary is expanding, but remains limited in comparison with his peers, passive vocabulary exceeds active vocabulary. The morphological-syntactical level of language is undeveloped, the boy is unable to decline words, constructing a sentence is performed by mechanical ordering of words, they are mostly nouns, the boy seldom uses verbs spontaneously, the number of adjectives is very limited. He rarely achieves the communication intent, in case of a failure the boy shows defiance, aggression – throwing objects, hitting things and people around. B1 is tactually hyposensitive – he has a tendency to put various objects in his mouth, discovers the properties of objects through oral perception, requires a tight tactile contact with objects and people, requires tight clothes, firmly attached shoes, strong tactile stimuli (directed at both, himself and other people and things), searches for distinct surface texture, vibrations etc. His auditory perception is also hyposensitive, requires higher sound intensity, likes loud music, constantly produces loud sounds, enjoys shopping centres, public spaces, all noisy and vibrant places.

The speech-language therapy focuses on the development of communication skills – verbal and non-verbal. A communication handbook was provided – communication takes place through pictures and pictograms, sometimes the boy tends to react to a symbol verbally. He uses words from the book in verbal communication but always with a two- to three-month delay. The therapy further focuses on the training of self-care activities and understanding of social situations (the therapy uses training situations and diagrams from publications focused on the development of these areas). An integral part of the therapy is improving tactile perception, boy's awareness of his body, and improving auditory perception.

Assessment of the pragmatic level of language: initial assessment was performed in September 2017 when the boy was five years old (see Table 1). In areas assessed by means of observation the boy scored 17 points and in areas assessed through testing the boy scored 20 points. The best results were achieved in the category of visual contact, where the boy analysed correctly two out of three visual diagrams representing pragmatic communication situations (visual contact, parting). Based on observation the boy was classified in category 1 – occasional problems, visual contact may differ from other children. The greatest difficulties were observed in the area of sensory integration; in the test the boy scored the maximum number of 2 points. Incorrect analysis of the diagram in the area of proxemics and greeting. Based on observation the boy was included in category 3 – persisting symptoms of a serious nature that have a negative effect on the learning process and everyday activities. The maximum number of points was also scored in the area of social interaction 2 (ability to change communica-

tion roles and observe communication rules). Incorrect analysis of the situation aimed at waiting for communication and changing communication roles. Based on observation the boy was included in category 3 – almost does not change communication roles, does not observe communication rules, only after being notified or rewarded. The last very problematic area is motor imitation, where the boy is capable of imitation involving an object in the categories of drinking from a cup and combing. In terms of imitation without an object the boy is capable of clapping and waving. As far as oromotor communication is concerned the boy is unable to imitate any motor operation. The observed manifestations fall within category 3 – persisting problems of a serious nature, negative impact on learning and social interaction, performs after notification or reward. The results in individual areas are shown in Table 1.

Table 1. Assessment 1 – Record sheet A

Area	Observation (points)	Testing (n/N)
Problem behaviour	3	4/6
Eye contact	1	1/3
Sensory integration	3	2/2
Social interaction	2	3/5
Social interaction 2	3	2/2
Motor imitation	3	8/12
Facial expression	2	–

A repeated assessment was performed in February 2018 (see Table 2). The boy achieved only slightly better results in observation (15 points), but significantly better results in testing (13 points). The results in individual areas are shown in Table 2. Observation suggested improvement in problem behaviour and sensory integration; in both cases B1 was included in category 2 – frequent symptoms with mild manifestations that have an effect on the process of learning and everyday activities. Deterioration was not observed in any of the monitored areas. Testing suggested improvement in problem behaviour, where the therapy had a positive effect on communication behaviour and correct analyses of situations when the boy wanted something. No improvement was observed in the area of identification of a correct diagram expressing displeasure. B1 failed to understand the purpose of the diagram during the first or second testing and was unable to resolve the social situation. However, in real training and application of this social behaviour a significant improvement was observed. He no longer expresses his displeasure, neither towards himself nor towards other people and objects in an aggressive way; the boy's behaviour in general improved. The boy identified the diagram aimed at a reaction to loss correctly, but understood the picture as

correct because children played together. The boy was unable to understand the principle of the diagram.

The targeted therapy improved the boy's identification of the correct diagram which represented the act of greeting. Practical training of greeting including a handshake was performed as part of the speech-language therapy but also in kindergarten. In the area of social interaction and the ability to address and greet another person, the boy achieved better results in greeting and saying that he wanted something. In terms of imitation, an improvement was observed in imitating tongue protrusion and kissing a toy.

Table 2. Assessment 2 – Record sheet A

Area	Observation (points)	Testing (n/N)
Problem behaviour	2	3/6
Eye contact	1	0/3
Sensory integration	2	1/2
Social interaction	2	1/5
Social interaction 2	3	2/2
Motor imitation	3	6/12
Facial expression	2	–

Screening assessment of perception-sensory integration: Record sheet C was completed on the basis of direct observation by the speech-language therapist and an interview with the child's parent always after testing of the pragmatic level of language by graphical visual diagrams. B1 achieved 49 of the total of 140 points. The number of points scored in individual areas is shown in Table 3. The greatest difficulties were manifested in the area of tactile perception. B1 is hyposensitive and requires a firmer touch on various body parts, requires a strong hold during hugging. Requires tight clothes, his shoes must be firm and heavy, and at the same time firmly attached. During washing the boy prefers a facecloth with a coarse structure or a brush with stiff hairs. Food texture must be lumpy, food ought to be highly seasoned (salty, sweet, spicy), either hot or cold. The boy does not respect personal space, needs to be close to other people. No difficulties were observed in the area of walking, there are no signs of broad base or tiptoe gait. The other significantly impaired area is auditory perception, the boy again shows signs of hyposensitivity. He searches for loud music, loud noises, likes to watch an ambulance or a fire fighting vehicle go by. He is attracted by the source of the sound and runs towards it. He likes to visit shopping centres, shops, all places that are busy and noisy. If there is no source of a loud sound around the boy, he tries to produce it himself. He does not like silence, if the boy is in a calm environment and has no opportunity to produce a loud sound, he shows signs of

bruxism (grinding teeth). He likes to sing, but again it has to be loud. He does not like games with rapidly changing verbal instructions. He is unable to follow a quick series of instructions. These games induce fits of aggression directed at himself, other people or surrounding objects. Virtually only difficulties pertaining to vestibular system were associated with activities requiring balance. B1 is unable to ride a bicycle, ski or skate. In the area of proprioception, differences were observed in high-risk activities, where the boy is not aware of the risk. The boy jumps from height, climbs to high places, leans from windows, etc. Another noticeable aspect is food texture, which needs to be strong, the same applies to taste and temperature. The boy does not prefer fine food texture, but accepts yoghurt or pudding when fed. The area of visual perception is unbalanced. The greatest difficulties were observed during activities that require eye-hand coordination. B1 is unable to catch a ball, not even with both hands, has difficulty drawing and solving a jigsaw puzzle. No difficulties were observed with transition from light to dark and vice versa. B1 has no difficulties with olfaction, except for checking unusual bad or nice smells. Greater difficulties were observed in the area of gustation.

Table 3. Assessment 1 – Record sheet C

	Touch	Proprioception	Vestibular system	Auditory perception	Visual perception	Gustation and olfaction
Points	14	8	2	12	7	6

A re-assessment of sensory integration was performed in February, during which his parents together with the speech-language therapist completed Record sheet C. In the repeated assessment B1 scored 42 points, which is 7 points less compared to the first assessment. The results in individual areas are shown in Table 4. Following the targeted therapy, the greatest progress was observed in the area of tactile perception. The boy no longer searches for a strong hold or a strong hug, his clothing does not have to be tight, the boy now accepts slightly loose clothes, he is able to remove his shoes for a while during the day. There has been an improvement in the boy's perception in the oral cavity, food temperature was decreased from hot to warm, burns in the oral cavity are less frequent. A higher score was observed in proprioception. One point less was scored in the area of food texture, B1 improved in fine motor activities (drawing, building blocks, handling objects, etc.) The last area where improvement was observed is visual perception. The boy improved in activities requiring eye-hand coordination. The boy was motivated for activities requiring eye-hand coordination by a bubble blower. During the therapeutic sessions he started to search for activities with a bubble blower and improved in motor-visual hand-eye coordination and later

also in eye-hand coordination. No improvement was observed in the area of the vestibular system, gustation and olfaction, or one of the most impaired areas – auditory perception.

Table 4. Assessment 2 – Record sheet C

	Touch	Proprioception	Vestibular system	Auditory perception	Visual perception	Gustation and olfaction
Points	10	6	2	12	6	6

Case study 2

Boy (B2) aged 3 years and 11 months diagnosed with childhood autism, impaired perception-sensory integration, and difficulties in the receptive as well as expressive language component. Regarding the boy's age, only Record sheet C was used – Screening assessment of perception-sensory integration. The collection of primary data was performed in November 2018. The initial information was used to produce a therapeutic plan, which will be implemented and regularly assessed in the following months.

B2 was born from a first, high-risk pregnancy. The mother suffered from gestation diabetes, which was compensated by diet. The delivery was induced in due date, there were concerns about larger size of the new-born. Head first presentation, adequate postpartum adaptation (Apgar score 10-10-10), mild neonatal jaundice. The values at birth were 51 cm, 3700 g. The boy received standard vaccination, at around 6 years of age showed signs of sleep disorders. The boy was referred to a neurologist, where he was diagnosed with hyperexcitability. The boy's sleep normalized at the age of 2.5 years, currently the boy does not sleep during the day, at night sleeps for a maximum of 6–7 hours without interruption. Difficulties while breastfeeding, weak suckling, problems with coordination. Fed from a bottle, from 6 months of age provided complementary feeding. Without dietary restrictions, he eats almost every type of food but must be at home or without the presence of unknown people, otherwise refuses to eat. Early development of gross motor skills was normal – head raised with forearm support at the age of 4 months, rolled from back to belly and vice versa at the age of 6 months, crawling on all four from 9 months of age, began to sit independently at the same age. Independent walking from 14 months of age. Started to walk on foot soles at the age of 17 months – 50% (50% tiptoe walking). During a repeated examination by a neurologist at the age of 3 years an improvement was observed, only 30% of tiptoe walking, but now tiptoe walking prevails again (up to 70%). Changes between child sitting and W-sitting. In case

of positive emotions stands on tiptoes and flaps his hands in front of the face. In comparison with his peers there is a noticeable delay in walking upstairs and downstairs and running, does not use a riding toy or a bicycle. Prefers his right upper extremity, for writing utensils uses palmar grasp or pincer grasp. The boy does not favour drawing activities. According to the boy's parents, pre-speech development was normal (gurgling, babbling at the age of 6 months, between 9 and 12 months he began to reduplicate syllables, but without functional use). Began to use first words at the age of two years – *mom*, *dad*, *no-no*, *yeah-yeah*. Speech development stagnates, when the boy learns a new word, he ceases to use it after a few days. The parents estimate the boy's current vocabulary to include 20 words that vary. The boy uses gestures and pointing to communicate. The boy's appetence for communication varies, if he wants or needs something he tries to communicate. He usually fails to achieve the communication intent. His speech is dominated by babble, but tries to maintain word melody. In terms of morphology and syntax the boy uses single-word expressions, also uses two-word units including gesture + word, gesture + gesture. Declines the words mom and dad. The boy's comprehension is lowered, a clear example must be provided, but even in that case comprehension tends to remain insufficient. He understands only trained phrases and activities. Targeted therapy is further complicated by significant emotional instability – sorrowfulness, tearfulness, defiance, angriness. When the boy does not agree he runs to the corner or hides, starts crying and becomes angry. Obvious frustration as a result of his failure to achieve the communication intent, when the intent is achieved or the boy is praised he shows very positive emotions. Insufficient visual contact from the age of 6 months, when the boy wants something he looks at his communication partner but visual contact is very short.

In terms of tactile perception (Table 1), B2 achieved 12 of the total of 24 points. There is a clear imbalance between individual items; some areas are not difficult at all for the boy, while in others the boy shows severe impairment. Therefore, the boy is assessed to be of a tactile-mixed type. He requires physical contact with a close person, he likes touching, tickling and cuddling. As far as clothes are concerned, there are no problems with clothing preferences. He has considerable difficulty washing his hair, face, nail cutting and combing. He refuses to brush his teeth, is willing to take a bath only if he sees his younger sister taking a bath. He does not like to have his hair washed. He likes to play with water, he has no problems with textures such as sand, stones, etc. He has difficulties with food intake. He refuses to eat in an unfamiliar environment or in kindergarten, or when unknown people are present. His food must be cut into pieces so that he does not have to bite off for example a roll or a slice of bread. He moves his food to the molars, is sensitive in the area of the upper as well as lower incisors. Has drunk through a straw since 6 months of age. B2 does not respect personal zones (assessed as moderate disorder), gets too close to other people or maintains

an excessive distance from a communication partner. He has considerable difficulty walking, he usually walks on tiptoes when he puts on his socks, when he walks barefoot the proportion between tiptoe and foot sole walking is balanced. When he puts on his shoes the type of walking varies.

In the area of proprioception the score was 8 points in the first three monitored items that seem the most problematic. Specifically, these include searching for activities such as swinging, jumping, climbing, very active games, constant need to be in motion and change body position. The boy also searches for high-risk activities such as jumping from higher places, climbing in height, etc. The most problematic area includes fine motor activities, which the boy does not like at all and when offered, the boy acts in the heat of passion. On the contrary, food intake in terms of texture appears to be easy. The boy does not tend to hide or close his eyes.

There are also differences in the area of the vestibular system. At least a slight difference was observed in all items monitored in the present study. The most significant disorder was observed in activities that require balance such as cycling, skiing or skating. B2 does not search for these activities and again when offered he shows negative behaviour or anger. When the boy stands on a less stable surface, he gets angry. The boy searches for toys that spin or tries to spin objects that are not primarily designed for it. However, this area is assessed as a moderate disorder. The boy showed slight or occasional problems in activities that require a change in head position, when travelling by car and going down the slide, in the lift or on the escalator. In the area of the vestibular system, 12 points were scored of the total of 24.

The most impaired area is auditory perception. Here the boy shows the greatest difficulties and the score is 18 points of the total of 24. The boy is impaired in the sense of hypersensitivity. Regarding the specificities of the disorder the boy's parents were recommended the BERA examination in order to identify which levels of sound intensity are impaired. In four items out of six, a score of 4 was ticked, which suggests a severe disorder. These areas include listening to loud sounds (hooting, washing machine, drilling), problems with remaining in a noisy environment (shop, public events such as funfair, public celebrations, etc.), shows anger in case of unfamiliar and feared noises. B2 is unable to play games with rapidly changing sounds, but is able to listen to rapidly changing sounds. A moderate impairment was observed in the area of audio background; the boy's reactions to this type of sound varied. No difficulties were observed in listening to someone else singing. B2 prefers pop songs to children's songs.

In the area of visual perception, 9 points were scored of the total 24. Again, a considerable disharmony was observed between the items. Two items were observed not to have any difficulties. Specifically, these included watching television, transition to dark or dim light. Slight difficulties were observed in watching glittering or moving objects; the boy rarely watches those with excessive inter-

est. B2 does not search for bright light or sunlight. On a very sunny day the boy would hide in a dark corner and would not go out. Sunglasses do not help, the boy refuses to have them on his face and removes them.

Gustation and olfaction seemed to be the least impaired areas. The boy has difficulties only with new food, which he carefully examines. If the food is cut so that he can move it right to his molars, he tastes the food but needs to watch somebody else eating. He will not bite a large chunk of food. If the food has unnatural colour or consistency, the boy refuses to taste it. In case of new food it very much depends on the environment where the boy tastes it. He is willing to taste new food only at home and if people he is familiar with are present.

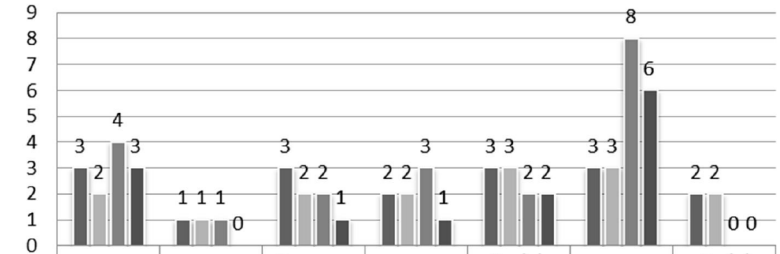
Table 5. Assessment 1 – Record sheet C

	Touch	Proprioception	Vestibular system	Auditory perception	Visual perception	Gustation and olfaction
Points	12	8	12	18	9	2

Discussion and conclusion

The case studies describe two boys with autism spectrum disorders – childhood autism. The effectiveness of the selected speech-language therapy was assessed by means of Record sheet A Assessment of pragmatic level of language in the case of B1, and Record sheet C Screening assessment of perception-sensory integration in both cases.

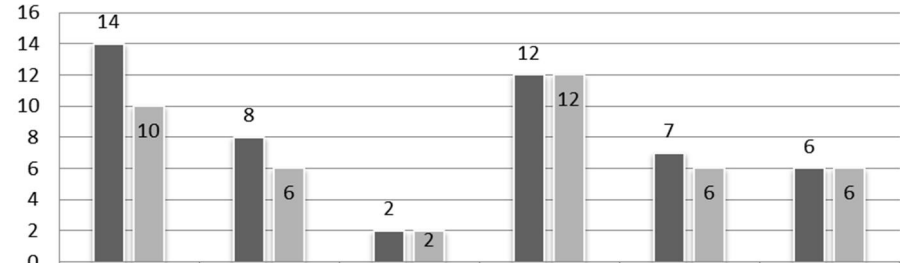
A comparison of the results achieved by B1 in the assessment of the pragmatic level of language (Figure 1) suggests no improvement in the area of facial expression and social interaction 2 assessed by means of testing. As far as observation is concerned, there was no change in the area of social interaction or motor imitation. In the identification of a correct reaction to waiting for communication, B1 responded in the same way during the first and second testing. He searched for differences in the pictures but did not pay attention to the situation itself. In both cases the best reaction was observed in behaviour in a shop; the boy explained that he does the shopping with his mother in this way. He identified visual contact correctly in both cases but was unable to explain why. It took the longest time to examine visual diagrams aimed at the assessment of proxemics. He was unable to understand the situation and asked for explanation several times. During the second testing a clear improvement was observed in cooperation and attention. B1 remembered some pictures and responded in a joyful way by shaking his hands in front of the face.



	Problem behaviour	Visual contact	Sensory integration	Social interaction	Social interaction 2	Motor imitation	Facial expressions
P1	3	1	3	2	3	3	2
P2	2	1	2	2	3	3	2
T1	4	1	2	3	2	8	0
T2	3	0	1	1	2	6	0

Figure 1. Comparison of the results of the first and second assessment B1 – Record sheet A

A repeated assessment of perception-sensory integration in B1 (Figure 2) revealed an improvement by 7 points in the area of touch and visual perception. The results suggest that the therapy aimed at tactile perception is effective, but it will be further necessary to focus on the area of auditory perception, where no improvement has been observed so far. However, a positive fact is that no deterioration has been observed in any of the monitored areas.



	Touch	Proprioception	Vestibular system	Auditory perception	Visual perception	Gustation and olfaction
H1	14	8	2	12	7	6
H2	10	6	2	12	6	6

Figure 2. Comparison of the results of assessment 1 and assessment 2 – Record sheet C

The primary assessment of Boy 2 using Record sheet C – Screening assessment of perception-sensory integration focused on the areas in which the boy has serious difficulties. This assessment allows the therapy to be targeted directly at the problematic areas. The most significant aspect in speech development appears to be the area of auditory perception. The parents have already arranged a hearing

examination (BERA). Before the results of the examination are available, the boy will be stimulated by means of increasing sound intensity. He will also practice sound localization, sound identification and linking sounds with objects. They will record all sounds that will induce the boy's negative reaction. On the basis of the results of the hearing examination, the content of the hearing therapy will be specified. To improve tactile skills the parents were trained in therapeutic brushing and stimulation of acupressure points on the foot sole. They borrowed a set of tactile squares, which will be used to stimulate the boy's soles. To increase the boy's interest in activities that involve visuomotor coordination, the following will be used: bubble blower (catching bubbles with both hands, one hand, fingers), regular obstacle courses to support crawling on all four, climbing on a climbing wall. In terms of speech development it is desirable to improve sensory integration and build high-quality comprehension supported by the PECS alternative communication system, structure, and visualization.

Conclusions

The record sheets may be very beneficial not only in the assessment of the effectiveness of therapeutic approaches but also in the assessment of the client's progress. When the information is recorded, it is then possible to target the therapy at areas where stagnation or deterioration occurs. The development of graphs is beneficial not only for the speech-language therapist but also for the parents who sometimes do not notice the progress of their child and may lose motivation for further therapy. Some of the results (for example in the assessment of the proxemics visual diagram) are consistent with the conclusions of the authors' comparative GACR research study, where the assessment of proxemics showed to be the most difficult across all groups of the research sample (see above; for further reference, see e.g. in K. Vitásková, & L. Kytnarová.[21]

[21] K. Vitásková, L. Kytnarová: *The evaluation of pragmatic level of language in children with autism spectrum disorder.* Olomouc, Univerzita Palackého 2018; K. Vitásková, L. Kytnarová: *The Role of Speech and Language Therapist in Autism Spectrum Disorders Intervention – An Inclusive Approach*. In: Advances in Speech-language Pathology. Ed. F. D. M. Fernandes. Rijeka, InTech 2017, pp. 355–370. Available from: 10.5772/intechopen.70235. [access: 15.06.2018].

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