© Borgis New Med 2022; 26(1): 16-19 DOI: https://doi.org/10.25121/NewMed.2022.26.1.16

Julia Dwornik[1], Bartosz Rigall[2], *Lidia Zawadzka-Głos[2]

Case study of a 7-years old patient with central auditory processing disorder on the autism spectrum disorder – Department of Pediatric Otolaryngology, Medical University of Warsaw

Studium przypadku 7-letniego pacjenta z centralnymi zaburzeniami przetwarzania słuchowego w spektrum autyzmu – Klinika Otolaryngologii Dziecięcej Warszawskiego Uniwersytetu Medycznego

[1]Student Audiological and Phoniatric Scientific Group in Medical University of Warsaw, Poland
Students scientific group supervisor: Bartosz Rigall
[2]Department of Pediatric Otolaryngology, Medical University of Warsaw, Poland
Head of Department: Associate Professor Lidia Zawadzka-Głos, MD, PhD

Keywords

auditory processing disorders, Neuroflow, active auditory training, autism spectrum disorder, CAPD

Summary

Central Auditory Processing Disorder (CAPD) is a condition in which sounds are not processed well by the auditory cortex. This disorder is often associated with others, such as dyslexia or autism spectrum disorder. Nowadays, there are many therapeutic methods for CAPD. One of them is active auditory training Neuroflow.
Seven-years old boy on the autism spectrum disorder underwent the CAPD diagnostics using Neuroflow tests. He reported troubles with concentration, aural memory, understanding speech and hyperacusis. He also has significant problems in school due to that disturbances. After starting Neuroflow therapy, significant, but gradual progress was noticed in his both everyday and school life. Two more diagnostic sessions were performed and the results were getting better every time.
Neuroflow is a tool used in various therapeutic disciplines. It is distinguished by its versatility, online conducting and parental participation. This type of therapy can be helpful in the treatment of not only CAPD, but also similar disorders, such as ASD.

Słowa kluczowe

zaburzenia przetwarzania słuchowego, Neuroflow, aktywny trening słuchowy, spektrum autyzmu, CAPD

Streszczenie

Centralne zaburzenia przetwarzania słuchowego (CAPD) to stan, w którym przetwarzanie sygnałów dźwiękowych w korze słuchowej nie przebiega prawidłowo. Zaburzenie to jest często sprzężone z innymi dysfunkcjami, takimi jak dysleksja czy spektrum autyzmu. Obecnie istnieje wiele metod terapeutycznych CAPD. Jedną z nich jest aktywny trening słuchowy Neuroflow.
Siedmioletni chłopiec w spektrum autyzmu został poddany diagnozie CAPD za pomocą kompletu testów Neuroflow. Pacjent miał problemy z koncentracją, pamięcią słuchową, rozumieniem mowy i nadwrażliwością na dźwięki. Zgłaszano także narastające trudności w szkole wynikające z powyższych zaburzeń. Kiedy chłopiec rozpoczął terapię Neuroflow, zauważono znaczny, chociaż stopniowy, postęp w jego codziennym funkcjonowaniu i życiu szkolnym. Przeprowadzono jeszcze dwie kolejne serie diagnostyczne, a wyniki każdej z nich były lepsze od poprzedniego podejścia.
Neuroflow to narzędzie używane w różnorodnych dyscyplinach terapeutycznych. Wyróżnia je wszechstronność, możliwość przeprowadzenia terapii przez Internet i udział rodziców w treningu. Terapia ta może być pomocna nie tylko w leczeniu CAPD, ale także w rehabilitacji współistniejących innych zaburzeń, np. spektrum autyzmu.

Introduction

Central Auditory Processing Disorder (CAPD) is a group of disturbances in auditory processing at the neural level which does not result from cognitive and linguistic dysfunctions (1, 2). The brain has difficulties with analyzing sounds, despite no damage to the peripheral hearing organ. CAPD is usually conjugated with SLI (Specific Language Impairment), LD (learning disability), ADHD (Attention Deficit Hyperactivity Disorder), dyslexia or ASD (Autism Spectrum Disorder). This is making the diagnosis very problematic and nonobvious (3, 4). It has not been confirmed unequivocally what causes CAPD, but we can mark out some risk factors. This is for example technological development, which leads to a limitation on direct talks between children, having a really bad influence on speech and auditory attention development. CAPD can reveal too while the patient has auditory deprivation caused by for example conductive hearing loss in chronic otitis media (2). Other contributing factors are preterm birth (before 34. week), perinatal hypoxia, CNS injuries (cancer or trauma), toxemia (especially lead poisoning), delayed and disturbed CNS development and genetic predisposition (5).

People with CAPD have trouble understanding speech in bad acoustic conditions like noise or echo, reading and writing, learning foreign languages, assessing the direction of the sound, keeping auditory attention while long-standing hearing situations and perception of complicated instructions (3, 6). A big issue connected with CAPD is hyperacusis, also known as auditory hypersensitivity. It makes children anxious and apprehensive, that is why they may be perceived as rude, when it is just an exaggerated responses to sound stimuli (7, 8). As a matter of fact, we can say patients with CAPD can hear, but cannot listen.

CAPD is a complex disorder, so the diagnosis has to be multi-specialist. The diagnostic team includes neurologopedists checking active and passive speech, pedagogues giving opinions about the patient's behavior, psychologists studying the patient's emotional functioning, alliance workers describing the development environment and audiologists doing the most important audiological examinations. The basis of the CAPD diagnosis is making sure the peripheral hearing damage does not occur, so a full complement of audiology examinations is strictly required. After collecting all specialistic feedback, the patient is referred for higher auditory functions tests (2, 9, 10). One of the CAPD diagnostic and therapeutic methods is a special group of auditory tests, which analyze the level of sound perception, called Neuroflow. There are eight different tests:

- TRW (visual reaction test) – assessing the reaction time to the visual stimuli,
- TRS (auditory reaction test) – assessing the reaction time to the aural stimuli,
- ASPN-S (adaptive speech in noise test) – the result is a signal-to-noise ratio in which the patient understands half of the presented words,
- ASPN-Z (adaptive speech in noise test-sentences) – the result is a signal-to-noise ratio in which the patient understands half of the presented sentences,
- DDT (dichotic digit test) – assessing the divisibility of auditory attention and the hemisphere domination for speech understanding, the result is the percentage of correctly repeated words for each ear,
- FPT (frequency pattern test) – assessing the ability to differentiate the pitch of sounds and short-term auditory memory, the result is the percentage of correctly repeated sound sequences of different pitches.

After diagnosis, the therapy is planned individually for each patient. It includes mainly training in listening skills (e.g. with active auditory training Neuroflow consists of exercises that are similar to diagnostic tests) and working with a speech therapist. Therapeutic activities are the most effective treatment way. Thanks to them, children with CAPD could be very well rehabilitated (11, 12).

The article aims to present a case report of a 7-years old patient with CAPD on ASD and to underline the coupling of these two disorders, and in consequence, the possibility of their simultaneous therapy using active auditory training Neuroflow.

Case report

Seven-years old boy has been qualified for CAPD diagnosis in April 2021. The patient reported hyperacusis, a problem with maintaining concentration, a trouble understanding verbal messages and a reduced level of aural memory. Previously, he was under psychiatric care, but that therapy did not bring any results.

The boy's difficulties began in kindergarten and were reported by his mother. He had a problem with taking part in group activities, musical classes like rhythmics or activities generating a lot of noise, such as PE. The patient also suffered from bothersome hyperacusis. He was afraid of the bathroom, where the fan and the flush hummed. He could not stand the sound of the dryer and even the talking toys. The boy had trouble in school activities too. Due to bad concentration, he used incomplete, broken sentences and he did not do the tasks in the lessons claiming he could not. He was perceived as rude cause of difficulties with adjusting to the rhythm of classes (table and fun time). He also did not follow the teacher's orders. He probably did not even detect them or he detected them improperly, and required multiple repetitions.

The first Neuroflow examination was difficult to conduct. The patient resisted entering the diagnostic office and wearing headphones, so not all of the tests were carried out. The results are presented in the attached table, column "April 2021 result" (tab. 1).

The boy was qualified for Neuroflow therapy and he started it in June 2021. The patient was in a separate, quiet room. Therapeutic sessions were lasting from 1,5 to 2 hours, but most of that time consisted of encouraging the boy to

Tab. 1. The results of the diagnosis in every stage of the therapy

Test name	April 2021 result	September 2021 result	December 2021 result
TRW (visual reaction test)	Time: 736 ms L	Time: 521 ms	Time: 459 ms
TRS (auditory reaction test)	Time: 624 ms L	Time: 572 ms L	Time: 415 ms
ASPN-S (adaptive speech in noise test)	Threshold: 0.3 dB SNR L	Threshold: -2.0 dB SNR	Threshold: -6.0 dB
ASPN-Z (adaptive speech in noise test-sentences)	Test was not completed.	Threshold: -2.0 dB SNR	Threshold: -3.0 dB SNR
DDT (dichotic digit test)	% of correct answers: Left ear: 85%, Right ear: 15% L	% of correct answers: Left ear: 78%, Right ear: 20% L	% of correct answers: Left ear: 85%, Right ear: 53% L
FPT (frequency sequence test)	Test was not completed.	Answer correctness: 40% L	Answer correctness: 65%

complete auditory tasks. The patient was disturbed by the noise at first, but then he got used to it. Initially, he also asked to increase the volume of the tasks, but towards the end of the first stage of therapy, he began to decrease it. The boy needed his mother to be with him and tell him he was doing well. He had the greatest difficulty finding words in other words and remembering strings of numbers (he was only able to repeat three or four numbers in a string). He also could not answer questions about the story he had just told, but he was good at understanding poems. He often gave up when the task was too difficult for him and then he did not answer the question. Despite the difficulties, the patient tried to listen actively and was very focused.

During processing of the first stage of therapy, changes in the boy's everyday functioning appeared. He started listening to music and using audio guides without anxiety. His fears also diminished.

The second examination had been made in September 2021. The results are presented in the table, column "September 2021 result" (tab. 1). All of the test results from Neuroflow have improved. Active auditory training had been recommended to be continued.

In the second stage of therapy, the boy was more and more willing to join therapeutic sessions and perform exercises. The greatest difficulty, and concurrently, the greatest success of that time was "the naming" of sounds – "loud/quiet", "long/short", "high/low" etc. The patient also started to repeat very long sentences, ceased to be afraid of mistakes and even joked about them. He was already able to repeat six-digit strings and answer some questions about the story.

Most importantly, the boy's functioning at school began to change. He willingly participated in lessons or cooperated with the teacher and other students in group activities. He also started to be open to new challenges, although, he still needed preparation and time to accept them. However, he still reported hyperacusis for certain sounds.

The third examination had been conducted in December 2021. The results of it are presented in the table, column "December 2021 result" (tab. 1). Despite the patient's resistance to entering the office, the diagnosis time went very smoothly. The boy left the office satisfied, because the examining lady praised his progress. All of the test results have improved again and all the positive effects of the therapy on the boy's everyday life have persisted. The patient is still bothered by hyperacusis, so the next stage of therapy in this direction was recommended.

Conclusions

There are many psychological, pedagogical, speech therapy and integration clinics throughout the country or abroad (for the Polish diaspora) that successfully use Neuroflow for diagnosis and therapy of CAPD. It is easy to use, does not require specialized equipment and can be carried out from everywhere via Internet. The last one was of particular importance during the pandemic, when most patients were deprived of the possibility of continuing in person therapy (13).

Active auditory training Neuroflow is aimed at the specific difficulties of the patient. It also makes the possibility to adjust the degree of difficulty and pace of exercises to the needs and abilities of the child. When the patient answers correctly – the system makes the task more difficult, and when incorrectly – it makes it easier. This type of activity creates new neural connections in the auditory system and can contribute to the development of other skills, such as language skills. A characteristic feature of Neuroflow training is the parent's participation in the therapy, who supports and motivates the child during therapy sessions. It makes comfortable mental and social conditions for the development of speech and auditory patterns (11).

Neuroflow therapy proved to be extremely useful in treating CAPD in a cases of a patients on the autism spectrum disorder. Obviously, active auditory training Neuroflow does not cure ASD, but it can help the patient function better in his everyday life. Our case study of a 7-years old patient with central auditory processing disorder on the autism spectrum disorder is a proof of it.

Conflict of interest
Konflikt interesów

None
Brak konfliktu interesów

Correspondence
Adres do korespondencji

*Lidia Zawadzka-Głos
Klinika Otolaryngologii Dziecięcej
Warszawski Uniwersytet Medyczny
ul. Żwirki i Wigury 63A, 02-091 Warszawa
tel.: +48 (22) 317-97-21
laryngologia.dsk@uckwum.pl

submitted/nadesłano:
01.02.2022
accepted/zaakceptowano do druku:
15.02.2022

References/Piśmiennictwo

1. American Speech-Language-Hearing Association: (Central) Auditory Processing Disorders. http://www.asha.org/members/deskref-journals/deskref/default. 2005.
2. Senderski A: Rozpoznawanie i postępowanie w zaburzeniach przetwarzania słuchowego u dzieci. Otolaryngologia 2014; 13(2): 77-81.
3. Majak J: Trudności diagnostyczne w zaburzeniach przetwarzania słuchowego u dzieci. Otolaryngologia 2013; 12(4): 161-168.
4. Dawes P, Bishop D: Auditory processing disorder in relation to developmetal disorders of language, communication and attention: a review and critique. Int J Lang Commun Disord 2009; 44(4): 440-465.
5. Bieńkowska I, Polok K: Centralne zaburzenia przetwarzania słuchowego a nabywanie kompetencji językowych w zakresie języka obcego. Linguodidactica 2018; 22: 23-45.
6. Kruczyńska-Werner A: Centralne zaburzenia przetwarzania słuchowego – aktualne możliwości terapii dostępne w Polsce. Logopedia 2018; 47(1): 231-245.
7. Knychalska-Zbierańska M: Zastosowanie systemów wspomagających słyszenie (FM) w rehabilitacji dzieci z zaburzeniami przetwarzania słuchowego. Otolaryngologia 2016; 15(1): 1-7.
8. Jeger J, Musiek F: Report of the Consensus Conference on the Diagnosis of Auditory Processing Disorders in School-Aged Children. J Am Acad Audiol 2000; 11(9): 467-474.
9. Skoczylas A, Lewandowska M, Pluta A et al.: Ośrodkowe zaburzenia słuchu – wskazówki diagnostyczne i propozycje terapii. Nowa Audiofonologia 2012; 1(1): 11-18.
10. Bellis TJ: Assesment and management of central auditory processing disorders in the educational setting: from science to practise. Cengage Learning 2003.
11. Bieńkowska KI, Zaborniak-Sobczak M, Senderski A, Jurczak P: Terapia centralnych zaburzeń przetwarzania słuchowego – przegląd metof i narzędzi w kontekście wsparcia edukacyjnego uczniów. Niepełnosprawność. Dyskursy pedagogiki specjalnej 2019; (36): 103-124.
12. Senderski A, Iwanicka-Pronicka K, Majak J et al.: Wartości normatywne przesiewowych testów wyższych funkcji słuchowych platformy diagnostyczno-terapeutycznej APD-Medical. Otolaryngologia 2016; 15(2): 99-106.
13. Bogdanowska Z, Borowiecka R, Senderski A: Neuroflow ATS – właściwe rozpoznanie ryzyka CAPD i działania terapeutyczne; https://neuroflow.pl/pl/blog/dla-profesjonalistow 2022.