PIONEER
ACADEMIC PUBLISHING LIMITED

Journal of Linguistics and
Communication Studies
ISSN 2958-0412
www.pioneerpublisher.com/jlcs
Volume 2 Number 3 September 2023

Interrelation of Speech and Speech Perception and Comprehension of a Teenager with Special Language Development: A Case Study

Mária Laczkó[1,2]

[1] Deák Ferenc High School in Kispest, Hungary
[2] Hungarian Diplomatic Academy LTD, Hungary
Correspondence: Mária Laczkó, Deák Ferenc High School in Kispest, Hungary; Hungarian Diplomatic Academy LTD, Hungary.

doi:10.56397/JLCS.2023.09.06

Abstract

In this paper we analyse and present the experimental results of the speech production and speech perception and understanding process in a case of bilingual teenager who even has the special syndrome (Velocardiofacial syndrome). The results are explained both in the linguistic and pedagogical aspects, so the possible pedagogical activity is also emphasized on the basis of the results.

Keywords: speech production, speech perception and understanding, atypical language development

1. Introduction

The speech can be characterized as the speech production process and the speech perception and comprehension process. In the case of typical language development it is generally thought that speech perception and comprehension processes are better developed than speech production at the same age.

During the mother tongue acquisition the speech production process and the speech perception have close interrelation which is based on age-specific hearing level. If the child's hearing is appropriate tipical language acquisition process and language development are expected to get versus the case of hearing loss when the atipical language dvelopment is characterised including the different speech perception uncertainties and disorders. When the child's speech perception mechanism works without any problems according to the child's age the verbal comprehension of his/her achievement and also his/her communication is without any difficulties (Holt-Lotto, 2008). During the tipical language development it can also occur when the child's speech production is well developed versus his/her speech perception/understanding achievement which has got serious difficulties.

There are a lot of varios types of atipical language development, when the speech production and/or the speech perception and understanding process can contain serious different types of difficulties or disorders. Among the atipical language development it is worth emphasizing the special syndrome called Velocardiofacial Syndrome (VCFS) named after the most common symptoms of the syndrome

(Shprintzen et al, 1981). It is a genetic syndrome that can affect a lot of cognitive processes including speech, hearing, language and learning. It is also mentioned in another terminus technicus called speech-language impairment (Schprintzen, 2008). It can also cause certain physical characteristics and some medical conditions.

It is caused by the micro-deletion on the long arm of chromosome 22, at band q11.2. This means that individuals with 22q11DS have only one copy of the genes lying within the band 22q11, while typically one would have two copies (Shprintzen, 2008; Shaikh et al., 2000). It can occur for the first time in a family for unknown reasons. It includes more symptoms in connection with the name including clinical characteristics (congenital heart disease, palatal abnormalities). As its name says the syndrome involved the soft palate, heart and facial features. Consequently among the symptomes velopharyngeal dysfunction (insufficiency or incompetence) can be emphasized which leads to hypernasal speech. Among the heart problems there are minor cardiac anomalies which includes more types of arteries anomalies (Harris, 2006, Wang et al, 2000).

There are also facial characteristics such as narrow eye openings, a long face bulbous nasal tip, a small jaw, or minor ear anomalies (Wang et al, 2000). Some individuals can also have learning disabilities, or mild to moderate mental retardation (Harris, 2006).

In the communication process the children with this syndrome also have some difficulties. Hypernasality and abnormal voice quality is common with VCFS, and due to a motor speech disorder called 'apraxia' their voice quality is also abnormal and also have language disorder and hearing loss (Golding-Kushner & Weller -Shprintzen, 1985, Solot et al., 2000). Among the language disorders of the VCFS syndrome the interrelation between the receptive and expressive speech was also analysed. Some experts emphasize the reduced expressive vocabulary especially in the case of children between 6 and 11. This symptome was even emphasized among the children older than 11 altogether with immature grammar (Golding-Kushner & Weller-Shprintzen, 1985). The similar results were also observed in the other experiment, where the development of speech and expressive language was more severely delayed than would be expected based on their receptive language abilities (Scherer et al., 1999). Solot and his collegaues also write that speech and language delays are characteristic for the syndrome (Solot et al., 2000), but the other experts, Glaser et al. (2002) reported that the receptive language skills of the children with 22q11DS were significantly lower than the expressive language skills. Glaser et al. emphasize when the children become older, their expressive language abilities also become better, while their receptive language abilities reach a plateau. In another experiment the scholars investigated the ability to retell a narrative, the phonology, syntax and receptive vocabulary of the children with the syndrome. Among the results the shorter sentences of the children than expected according to the population mean were emphasized. Furthermore the low grammatical complexity was also found in most of the cases, but the ratio of the grammatical errors was relatively low (Persson et al., 2006).

These data are observed mainly among the younger children with the syndrome. Among the speech characteristics there are not any data concerning the speech perception process (receptive language) and their spontaneous speech (expressive language) even the interrelation between them regarding the elder children. The aim of this paper to analyse these two kind of processes, their characteristics and the interrelation of them in the case of a bilingual teenage with atipical language development including VCFS syndrome in order to get more data concerning the characteristic feature of the receptive and expressive language development.

Our research questions are:

1) What characteristic features can determine his spontaneous speech in the period of adolescent beside the abnormal voice (hypernasal speech)?
2) What is his speech perception and comprehension process like?

Our hypothesis was:

a) that the speed of his speech is slower and it can be characterized by more/longer pauses.

b) We also thought that his speech can contain less and more simple syntactical/grammatical structures than his mates'spontaneous speech.

c) The third hypothesis was that both of the two processes (i.e., speech and speech understanding

process) are weeker than his mates' with typical language development, but the question is to what extent.

2. The Material, Method and the Participant

In order to discuss the hypothesis the series of experiment was carried out with the participation of a teenage student with VCFS syndome. The examination consisted of three parts.

For the first time his hearing process was controlled by the special Hungarian method called G-O-H apparatus. The device was designed for auditory screening of children from the age of three years. The basic of this Hungarian method is the synthetised speech, which contain words produced by a high-quality formant synthesiser providing the pre-defined data (Olaszy, 1985) and the perceptually confirmed acoustic cues of the target Hungarian speech sounds controlled by a computer. That's why the synthesized speech contains far less acoustic information than natural speech does and it is suitable for the screening of hearing and global speech perception. The speech material of the G-O-H method test consists of four sets of words of one syllable. Each of them contain two or three segments, and one set contains 10 words. Some of the words contain high-frequency bands as acoustic cues like in the word [ʃiː] 'ski'). The other part of the words contain speech sounds that have only low frequency bands like in the word [buː] 'sorrow'. And there are words which contain speech sounds having characteristic frequency bands at both high and low frequencies like in the word [mɛɟː] 'cherry' (Gósy et. al., 1987, Gósy, 2008).

Nowadays the device G-O-H sytem has been developed that contains specifically synthesized monosyllable words in digital form to test the children's hearing/speech perception level. It contains not only touchscreen keyboard and switches for left ear/right ear selection, but two preset intensity values (55 dB and 65 dB). The first one can be used in clinical setting, but the stronger one is in silent but not clinical environment. (For example in the kindergarten is advisable to use the stronger one versus the measurement in the silent room where the weeker one is enough.)

The procedure of the control is the following: the children can hear the words after each other, and there are 5 seconds pause between the words which is enough for the child to repeat the word. The examiner marks his/her responses on the answer sheets. In that sheet there are four columns indicating the different level of the child's hearing and speech perception: (i) normal hearing, typical speech perception, (ii) normal hearing, speech perception deficit, (iii) mild hearing loss, (iv), hearing loss (at about 40 dB or more). In order to check the hearing process of a child on the left and on the right side 10-10 words are used.

The level of speech perception and undestanding process was measured by the Hungarian dyagnostic test called GMP diagnostic package (Gósy, 1995/2006). From these test package there are seven subtest which is available for screening speech perception and comprehension processes. GMP2, 'sentence identification in noise', is designed to control the acoustic level of speech perception. This test material consists of 10 well-formed Hungarian sentences masked by white noise. GMP3, 'word identification in noise', it can also test the acoustic level, but its material consists of isolated words. GMP4, requiring repetition of 10 sentences (pass-band filtered, not masked by noise), assesses the operation of phonetic perception, the recognition of acoustic cues, and their integration in phonetic processing. The control of (morpho)phonological perception is done by having accelerated sentences of a particular structure, word stock, and morphophonological make-up repeated (GMP5). These sentences involve results of phonological coarticulation processes (assimilation, hiatus resolution) partly within words, and partly across word boundaries. These sentences (pronounced a male speaker) were instrumentally speeded up by approximately 25%. Their average tempo thus became 14 sounds/sec, which is above the average tempo of Standard Hungarian. GMP10, 'serial perception', is based on the child having to return the exact order of occurrence of ten nonsense words. Each nonsense item obeys the phonotactic regularities of Hungarian. GMP12 test material consists of a short fable and followed ten comprehension questions. It is suitable to test text comprehension level, based on the correct responses of questions after the listening to the fable (Gósy, 1995/2006).

Thirdly the spontanous speech pattern was recorded digitally and it was analysed in terms of different aspects. We defined the DSS scores

(DSS abbreviation is standing for the developmental sentence score, in Hungarian it is called KFM score), the ratio and types of syntactic structures, and also the temporal features (speech tempo and articulation tempo). In order to define DSS score the use of speech parts, the conjugations and declarations, and also the use of syntactical-grammatical structures are measured. All of them can have the numbers and the DSS score is calculated on the basis of these values, so the results can show the syntactical/grammatical complexity of the child's sentences in his/her spontaneous speech. All his experimental data results were compared to the same aged students' results who have tipical language development.

The student was diagnosed with Velocardiofacial Syndrome. His diagnose was established in 2005. When the experiment was done with his participation he was 17 years old. (Now he is 19 year old). His mother tongue is Hungarian and Turkish, as his mother is Hungarian, his father is Turkish. He also speaks the third language, it is English. He uses English at home as the communication language between his parents in most of the cases is English. At school he also studies English as the second language, but at secondary school the Hungarian is the first language for the child.

Previously this teenage boy was studying in a special class of a Hungarian primary school where he got speech pediatric development because of the symptome of his speech and language difficulties. He also had and has hypernasal speech, and his speech is full of morphological problems. Thats why his spontaneous speech almost cannot be understandable for an average person.

He took part in some examination including the control of his hearing and it showed the hearing loss both in the two ears but the loss is not the same in the two ears. The Figure 1 is showing the audiogram including the hearing loss which is a little bit deeper on the right side.

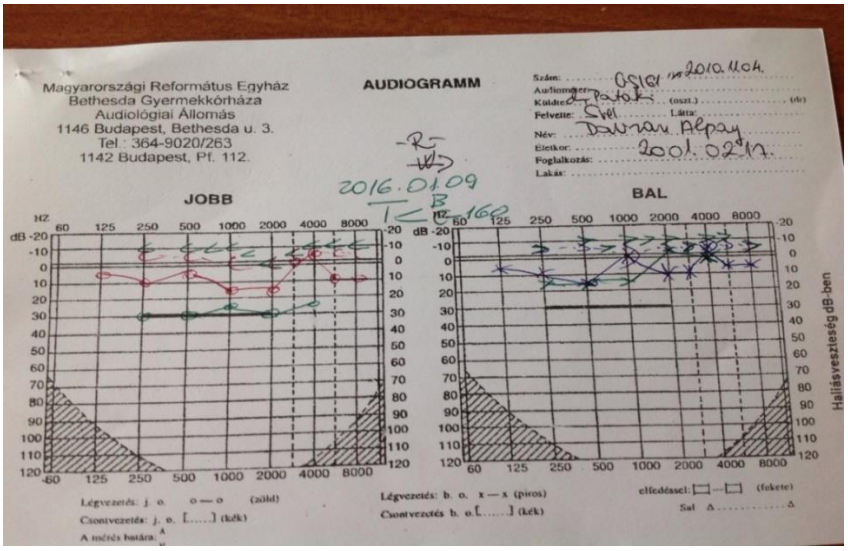

Figure 1. The audiogram os the examined child with VCFS syndrome

3. The Results

3.1 Spontaneous Speech Data Analysis

3.1.1 Temporal Factors

The Figure 2 is showing the student's temporal data including the articulation and speaking rates. Speaking rate refers to the entire speaking phase including pauses versus articulation rate which refers to phases of articulation excluding pauses. Consequently the articulation rate is generally higher than the speaking rate. For the analysis the speech rates (the total number of sounds divided by total speaking time including pauses), articulation rates (the total number of sounds divided by total speaking time without pauses), the ratio of silent/unfilled and filled pauses were calculated.

As the Figure 2 is showing both the articulation and speaking rates of the student with VCFS were much lower comparing the values to the control group's. The differences was also proved by statistical analysis (Paired Samples Test: T(1)=-20,846, p=0,031.) The control group consisted of the same aged teenagers with tipical language development. So the examined

student's speech was much slower than the teenagers' with tipical language development (Laczkó, 2009). The question is whether his low speed can have close interrelation with the number of pauses and/or the duration of pauses.

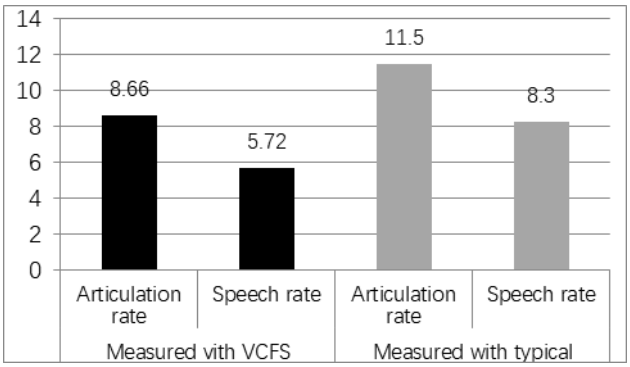

Figure 2. The articulation and speech rates a child with VCFS (sound /s)

The speech of student with VCFS syndrome contained less unfilled pauses (silent pauses) than it was in the speech of the same aged teenagers with tipical language development versus the ratio of filled pauses (hesitation phenomena), which was much more in the speech of the student with VCFS syndrome than it was among the teenagers' speech. The ratio of unfilled pauses in the speech of children with VCFS was 89.2% versus the children'speech with typical language where it was 95.1%. The differences can be followed especially in the case of the filled pauses, as the ratio of it was almost twice (10.8%) than it was in the control group (4.9%). Consequently these data can support that the examined student's slow tempo of his speech is characterised by the less silent pauses and more hesitation phenomena than the same old student's speech.

The duration of the pauses of the student's speech with VCFS syndrome also differed from the duration of pauses of students' speech with tipical development (Figure 3). The duration of the silent pauses (unfilled pauses) were a little bit shorter versus the hesitation phenomena (filled pauses) which were longer than they were among the same old students' speech. The differences can be followed mainly in terms of filled pauses, however they were not proved by the statistical analysis. On the basis of the temporal data regarding the pauses we can conclude that the examined student's pontaneous speech with VCFS syndrome is characterized with more number of filled pauses than the same old student's speech, and they are also longer than the filled pauses in the speech with normal language development.

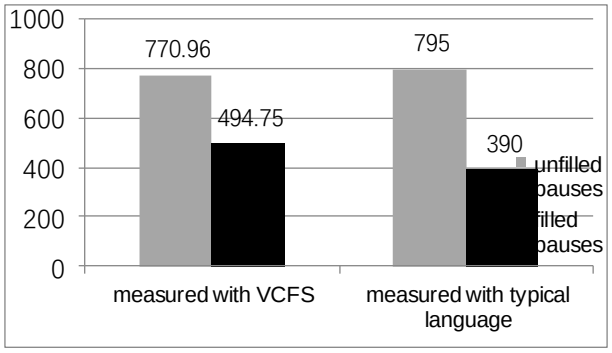

Figure 3. The duration of unfilled and filled pauses (ms)

3.1.2 Segmental Analysis

We analysed the syntactical/morphological structures in the spontaneous speech of the student with VCFS syndrome. In order to get the information about the use of different part of speech and the use of conjugation and declination of them the number of KFM score was calculated. The data obtained was also

compared to the data of spontaneous speech of students with tipical development. The KFM score (the adopted DDS-score (Lee-Canter, 1971)) in Hungarian was very low (14.67), and this low value predicts morphologically and syntactically very simple structures in his spontaneous speech. As the examined student is 17 year old, this value was compared to the value of 15 years old students' and also to 18 years old students'value. The comparison showed that KFM score of the student with VCFS syndrome is much lower than it was among the 15 years old students, whose KFM store was 18.22. The difference can be followed mainly in the case of 18 year old students, whose KFM score was almost twice (25.14) as it was in the case of the examined student with VCFS syndrome.

This very low score means that the examined student's sentences are much more simple than the same old students' and the ratio of those speech parts which can occur later in the mother tongue acquistion process with tipical language development might be less in his sentences. The low value can also mean that the different types of syntactical structures in his sentences are much more simple than they are in the speech of similar aged student.

This was also confirmed in the ratio of syntactical/grammatical syntagms (Figure 4).

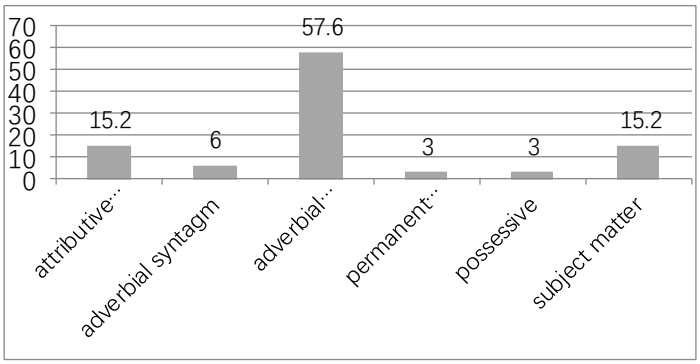

Figure 4. The ratio of syntactical/grammatical structures in the speech of a child with VCFS (%)

Among the types of syntagms there are three types which can define the speech of the examined student. The ratio of the subject matter and attributive syntagm is the same (15.2%), and among the adverbial syntagms more than 50% (almost 60%) is the ratio of adverbial syntagms of place and time which are describing factors of the Hungarian young children's spontaneous speech in mother tongue acquisition process. On the basis of these data it seems to emphasize the examined student's longer level of mother tongue acquisition as it is expected in his age.

3.2 Speech Perception Results

Among the speech perception results of the examined student with VCFS syndrome his hearing was also controlled by the G-O-H system and his hearing loss was confirmed again (Figure 5).

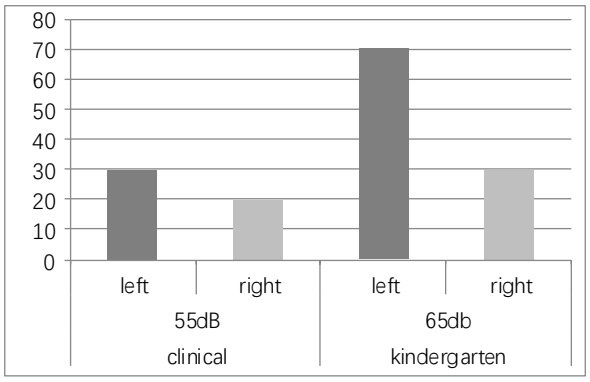

Figure 5. The hearing loss with the G-O-H system (%)

As the figure is showing we used two preset intensity values (65 dB and 55 dB), and the hearing loss was established in his both ears, however in his right ear the hearing loss was deeper. It was measured in both of the clinical an kindergarten examined situations, but the difference was followed especially in the case of the stronger intensity called kindergarten environment.

This hearing loss can predict his lower perception results as well which was also confirmed by the measurement of GMP package. The Figure 6 is showing the examined student's perception results on the different perception levels comparing them to the expected even in the case of 5 years.

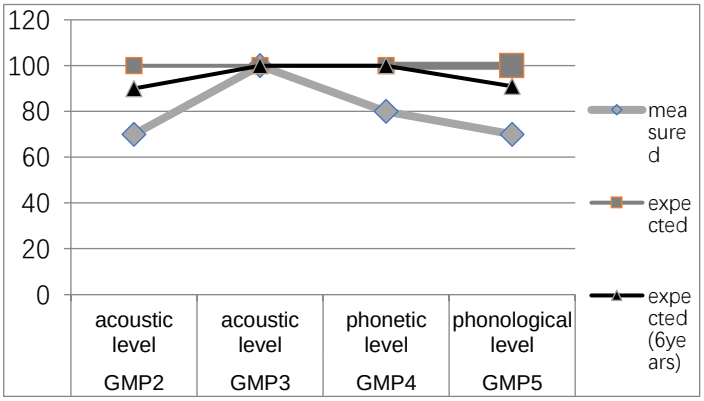

Figure 6. The speech perception results (the results on the different speech perception levels (%)

The results were very low in GMP2, GMP4 and GMP5 subtests. It means that his sentence identification in noise was much lower than it was expected, so the acoustic level of his speech perception does not work apropriately although he could repeat the words in noise. The student's low result in GMP4 subtest is showing the problem of the operation of his phonetic perception, the difficulties of the recognition of acoustic cues, and their integration in phonetic processing. The very low results in GMP5 subtest in repeating of accelerated sentences are showing serious problem of (morpho) phonological perception. On the basis of the results it is worth emphasizing the speech perception difficulties of the examined student with VCFS syndrome which can also occur in his learning difficulties.

The students perception difficulties was also confirmed in other subtests (see Figure 7). Regarding the menaingless soundtracks his result was only 50%, and the same achievement was also measured in terms of his speech understanding test. In the first case it means that he was able to repeat correctly only five from ten nonsense words. In other words he was able to return the exact order of occurrence of only half of nonsense words. In the second case after his listening to the fable its comprehension was checked followed by ten questions and he was able to answer only the half of them. This result is really low for the study in the primary school even in the secondary. His low speech understanding result can explain his low reading comprehension achievement. Summerizing his perception achievement it is also worth emphasizing that 70% of his result is not enough for the studiyng process especially for those exercises which need good listening perception achievement.

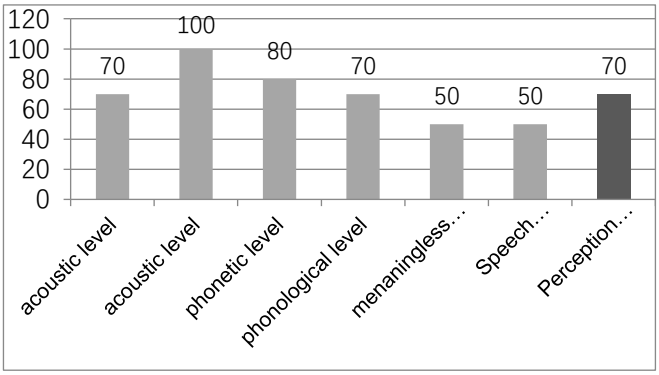

Figure 7. Speech perception achievement (the average and the details, %)

4. Summarize

The aim of this study was to analyse the speech and speech perception and understanding of a teenager student with VCFS syndrome to get more data about the characteristic feature of the mentioned processes.

The first hypothesis was that his spontaneous speech is slower than the same aged adolescents' speech tempo, and it is characterized by more number of various types of pauses or longer duration of them. This hypothesis was proved as his articulation and speech tempo values were less than the same aged students' tempo categories with typical language development especially comparing it to 18 year old teenagers'tempo values. The slower speech of the examined student with VCFS syndrome was also characterized by more number of filled pauses than the speech of teenagers with typical language development, and their duration was also longer than in the control group's speech. The ratio of unfilled pauses and the duration of them was not differ from the ratio and the duration of these types of pauses occuring in children's spontaneous speech with tipical language development.

The second hypothesis was that his spontaneous speech contain less and more simple syntactical/grammatical structures than his mates'spontaneous speech. It was also confirmed as the adopted DDS score (in Hungarian KFM score) in his speech was really low value comparing it to his mates. It means the speech of the examined child can contain grammatically and syntactically simple structures and the simple forms of conjugations and declarations. It was also emphasized in the ratio of different types of syntagms, but his speech was characterized especially by those simple syntagms which are defining factors of speech at the beginning of mother tongue acquistion like adverbial of place and time. On the basis of these data obtained it seemed to conlude that his speech production level is on the lower level of the mother tongue acquisition process.

The third hypothesis was that his spech perception and understanding level is also lower than it can be expected in his age and the weeker results can cause his some learning difficulties. This hypothesis was also confirmed as the speech perception results on the different levels of the process in terms of the hierarchic modell were really low and show more years backwardness from his mates with typical language development. It is especially true in on the phonetic and phonological level of the process. It is also in connection with his hearing loss and his morphological and lexical complexity of spontaneous speech. It is also worth emphasizing the low results in terms of speech understanding level, as it was only 50%,. which means that he could understand only the half of the text. This week achievement has close interrelation with his verbal memory as the student was able to tell back only 3 words from 12 versus the visual memory when he mentioned 11 pictures from 12.

The low perception and understanding results of the examined student with VCFS syndrome can predict and butress his low achievement in different subjects, especially his learning difficulties in terms of his oral results.

In pedagogical aspects it is worth emphasizing both his speech perception and understanding achievement and the skill of spontaneous speech with the extension of his vocabulary and the meaning of the words.

References

Digilio MC, Pacifico C, Tieri L, Marino B, Giannotti A, Dallapiccola B. (1999). Audiological findings in patients with microdeletion 22q11.2 (digeorge/velocardiofacial syndrome) *Br J. Audiol,* 33, 329–334.

Glaser B., Mumme D.L., Blasey, C., Morris M.A., Dahoun S.P., Antonarakis S.E., Eliez S. (2002). Language skills in children with velocardiofacial syndrome (22q11.2.2). *J Pediatrics,* 140, 753-8.

Golding-Kushner, K.J., Weller G., Shprintzen R.J. (1985). Velo-cardiofacial syndrome: Language and psychological profiles. *J Craniofac Genet Dev Biol, 5*, 259-66.

Gósy, M. (1995/2006). *GMP-diagnosztika* [GMP Diagnostics]. Budapest: Nikol.

Gósy, M. (2008). *Synthesized Speech Used for the Evaluation of Children's Hearing and Speech Perception. Human Factors and Voice Interactive Systems*. Eds. Gardner-Bonneau, D., Blanchard, H. E. Springer, New York, pp. 127-139.

Gósy, M., Olaszy, G., Hirschberg, J., Farkas, Z. (1987). Phonetically-based New Method for Audiometry: The G-O-H Measuring System Using Synthetic Speech. *Proceedings of the XIth ICPhS, 4*, Tallinn, 185-189.

Harris J. (2006). *Intellectual disability.* Oxford University Press. New York, 188-260.

Hirschberg, J. (2011). Orrhangzós beszéd *Gyógypedagógia szemle* 2011/1.

Holt, L. L., Lotto, A. J. (2008). Speech Perception within an Auditory Cognitive Science Framework. *Current Directions in Psychological Science*, *17*, 42-46.

Kummer AW, Lee L, Stutz LS, Maroney A, Brandt JW. (2007). The prevalence of apraxia characteristics in patients with velocardiofacial syndrome as compared with other cleft populations. *Cleft Palate Craniofacial J*, 44, 175–181.

Laczkó Mária. (2009). Középiskolai tanulók spontán beszédének temporális jellegzetességei. *Magyar Nyelvőr*, 133, 4. 447-467. [Temporal characteristic of secondary schoolstudents' sontaneous speech].

Lee, L.L. – Canter, S.M. (1971). Developmental sentence scoring: a clinical procedure for estimating syntactic development in children's spontaneous speech. *JSHD, 3663*, 315–340.

Olaszy, G. (1985). *A magyar beszéd leggyakoribb hangsorépítő elemeinek szerkezete és szintézise* [The Most Frequent Building Elements of Hungarian Speech: Acoustic Structure and Synthesis] Budapest, Akadémiai Kiadó. p. 180.

Persson, C., Niklasson, L., Óskardóttir, S., Johansson, S., Jönsson, R., Söderpalm, E. (2006). Language skills in 5-8-year-old children with 22q11.2 deletion syndrome. *Int J Lang Comm Dis*, *3*, 313-3.

Shaikh, T.H, Kurahashi, H., Saitta, S.C., Mizrahy O'Hare, A., Hu, P., Roe, B.A. et al. (2000). Chromosome 22-specific low copy repeats and the 22q11.2 deletion syndrome: genomic organization and deletion endpoint analysis. *Human Molecular Genetics*, *9*(4), 489-501.

Scherer, N.J., D'Antonio, L.L., Kalbfleish, J.H. (1999). Early speech and language development in children with velocardiofacial syndrome. *Am J Med Genet, 88*, 714-723, 31.

Shprintzen RJ, Goldberg R, Young D, Wolford L. (1981). The velocardiofacial syndrome: a clinical and genetic analysis. *Pediatrics, 67*, 167-172.

Shprintzen, R.J. (2008). Velo-cardio-facial syndrome: 30 years of study. *Dev Disabil Res Rev, 14*(1), 3-10.

Solot, C.B., Knightly, C., Handler, S.D., Gerdes, M., McDonald-McGinn, D.M., Moss, E. Driscoll, D.A. (2000). Communication disorders in the 22q11.2.2 microdeletion syndrome. *J Commun Disord, 33*, 187-204.

Wang PP, Woodin MF, Kreps-Falk R, Moss EM . (2000). Research on behavioral phenotypes. Velocardiofacial syndrome (deletion 22q11.2). *Developmental Medicine and Child Neurology, 42*, 422-427.

Woodin M, Wang PP, Aleman D, McDonald-McGinn DM, Zackai E, Moss E. (2001). Neuropsychological profile of children and adolescents with the 22q11.2 microdeletion. *Genet Med*, *3*, 34–39.