

Distribution of Speech Disorders According to Age in Patients Presenting with Speech Problems

Konuşma Problemi ile Başvuran Hastalarda Konuşma Bozukluklarının Yaşa Göre Dağılımı

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ABSTRACT Objective: In this retrospective study, we examined the records of 2,300 individuals who presented to the health board with the complaint of speech disorder between January 2011 and November 2015. The aim of this study is to determine the distribution of speech disorders according to age and to investigate the effects of additional disease/disability conditions on. **Material and Methods:** Of the individuals who presented to the health board with the complaint of speech disorder 1,530 were children and 770 were adults. Individuals were divided into 3 groups according to their age. Group 1 consisted of 700 individuals aged 2 to 6 years. Group 2 included 830 individuals aged between 7 and 18, and Group 3 included 770 individuals aged 19 years or older. Findings from 2,300 individuals' language, articulation, fluency, and voice evaluation tests which were performed by two audiology and speech disorders specialists and 1 educational audiology specialist were recorded. According to the file information, additional diseases/disability conditions accompanying with speech disorder were also investigated. **Results:** A significant difference was found between the groups in terms of the obstacle scores in all the categories of language, articulation, fluency and voice and total speech disability scores ($p<0.05$). It was determined that both the highest total speech obstacle score and the highest rate of additional disease/disability to speech disorder were in the 2-6 age group. In all age groups, it was found that the presence of additional disease/disability to speech disorders increased speech obstacle scores in all areas. **Conclusion:** A comprehensive and standard evaluation should be made in individuals who apply to the health board with speech problems. It is thought to be important to determine the additional disease/disability conditions accompanying speech disorder in individuals. Routine speech and language assessment is recommended for individuals with additional disease/disability accompanying speech impairment.

ÖZET Amaç: Bu retrospektif çalışmada, 2011 Ocak ve 2015 Kasım tarihleri arasında konuşma bozukluğu şikâyeti ile sağlık kuruluna başvuran 2.300 bireyin dosya kayıtları incelendi. Bu çalışmanın amacı, konuşma bozukluklarının yaşa göre dağılımının belirlenmesi ve ek hastalık/engel durumunun; dil, artikülasyon, ses ve akıcılık üzerine etkisinin araştırılmasıdır. **Gereç ve Yöntemler:** Konuşma bozukluğu şikâyeti ile sağlık kuruluna başvuran bireylerin 1.530'u çocuklardan, 770'i ise yetişkinlerden oluşmaktaydı. Bireyler, yaşlarına göre 3 gruba ayrıldı. Birinci gruba, yaşları 2-6 arasında olan 700 birey, 2. gruba yaşları 7-18 arasında olan 830 birey, 3. gruba ise yaşları 19 ve üzerinde olan 770 birey dâhil edildi. İki bin üç yüz bireyin; 2 odyoloji ve konuşma bozuklukları uzmanı ve 1 uzman eğitim odyoloğu tarafından yapılan dil, artikülasyon, akıcılık ve ses değerlendirme bulguları kaydedildi. Dosya bilgilerine bakılarak, konuşma bozukluğuna eşlik eden ek hastalık/engel durumu araştırıldı. **Bulgular:** Dil, artikülasyon, akıcılık ve ses alanlarının tümünde engel puanlarının ve toplam konuşma engeli puanının karşılaştırılması sonucunda gruplar arasında anlamlı fark saptandı ($p<0,05$). Hem en yüksek toplam konuşma engeli puanının hem de konuşma bozukluğuna ek hastalık/engel görülme oranının en fazla 2-6 yaş grubunda olduğu belirlendi. Tüm yaş gruplarında konuşmaya ek hastalık/engel olmasının; tüm alanlarda konuşma engel puanlarını artırdığı saptandı. **Sonuç:** Konuşma problemi ile sağlık kuruluna başvuran bireylerde, kapsamlı ve standart bir değerlendirme yapılmalıdır. Bireylerde, konuşma bozukluğuna eşlik eden ek hastalık/engel durumunun belirlenmesinin önemli olduğu düşünülmektedir. Konuşma bozukluğuna eşlik eden ek hastalık/engeli olan bireylerde, konuşma ve dil değerlendirmesinin de rutin olarak yapılması önerilmektedir.

Keywords: Speech disorder; language disorder; articulation disorder; voice; communication

Anahtar Kelimeler: Konuşma bozukluğu; dil bozukluğu; artikülasyon bozukluğu; ses; iletişim

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Peer review under responsibility of Journal of Ear Nose Throat and Head Neck Surgery.

Received: 01 Oct 2020

Received in revised form: 09 Dec 2020

Accepted: 13 Dec 2020

Available online: 09 Feb 2021

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Speech and language that people use for communication, share their thoughts and ideas is a common code shared by people in a society and that children learn through social interaction and it is integral for human interaction and development.^{1,2} Speech includes articulation, resonance, voice, fluency/rhythm and prosody.³ Language is a social interaction tool used for communication and includes receiving and transmitting messages. Receiving and understanding speech messages is called the receptive language, and communicating speech messages is called the expressive language.⁴ Language development is important for children's success in life.⁵ Language development which requires high cortical function is based on verbal stimuli from the environment in addition to functional anatomical structures.⁶ Language disorders are one of the most common problems in preschool and school age children.⁷

Speech and language disorders which account for about 40% of pediatric cases and are one of the main causes of applications to pediatric services, are also seen in adults and the elderly.^{8,9} It is difficult to determine the exact prevalence of speech and language disorders due to different views on uncertainty in terminology, methodological differences in studies, and researchers' different definitions of normal and abnormal language development. Speech and voice disturbances affect 10% of children and the prevalence of language disorders in preschool children is between 2% and 19%.¹⁰ It is thought that there are individual and multifactorial causes of speech and language disorders in childhood. Among the causes of speech disorder; cleft palate, syndromes, mental retardation, elective mutism, receptive aphasia, cerebral palsy can be given.¹¹ Language disorders can be affected by organic, intellectual/cognitive and emotional factors, and these factors are often associated with each other.¹² Speech and language disorders can cause significant problems for children and their families and may cause long-term adverse effects on the child's development if they are not treated early.¹³ Stroke, Parkinson's disease, stuttering, hearing loss, neurogenic disorders, head trauma, tracheostomy, dementia are among the causes of

speech problems in adults and the elderly.¹⁰ The effect of communication disorders within the adult and the elderly population is similar.¹⁴ Therefore, early and accurate diagnosis of speech disorders is important.

In this retrospective study, patients who applied for a health board report with the complaints of speech disorder between January 2011 and November 2015 were evaluated. Retrospective evaluation of language, articulation, voice and fluency results was planned according to age groups. The effects of additional disease/disability status on language, articulation, voice and fluency were investigated.

MATERIAL AND METHODS

SUBJECTS

In this study, 2,300 individuals' data were examined retrospectively between January 2011 and November 2015 with the complaint of speech disorder (for disabled identity card, using special excise tax, special disability education, 2022 numbered law, disability pension etc.). After the otorhinolaryngologic examination, the results of the speech evaluation of the individuals referred to the Hearing-Speech and Balance Disorders Diagnosis and Treatment Center of Ankara Numune Hospital were recorded respectively.

Of these individuals, 1,530 consisted of children aged between 2-18 years, and 770 were adults aged between 19-80 years. Individuals included in the study were divided into 3 groups according to their age. Group 1 consisted of 700 individuals aged 2 to 6 years. Group 2 included 830 individuals aged between 7 and 18, and Group 3 included 770 individuals aged 19 years or older. In addition, according to the file information, additional disease/disabilities (syndromic and non-syndromic hearing loss, neurological disorders, craniofacial anomalies, developmental retardation, cognitive impairment, etc.) were investigated in all subjects. This study was conducted in accordance with the Declaration of Helsinki Principles. Ethics committee approval was received from Clinical Researches Ethics Committee of Ankara Numune Reserach and Training Hospital (Date: 11.11.2015, Number: 651/2015).

METHOD

In the study, the results of 2,300 individuals who applied to the health board with the complaint of speech disorder; were evaluated by 2 audiology and speech disorders specialists and 1 educational audiology specialist were retrospectively reviewed. The speech obstacle score obtained as a result of the evaluations, which are required to be made in accordance with the 8th article Annex 2 of the regulation on disability criterion, classification and health board reports to be given to disabled people, (language, articulation, fluency and voice) were recorded.¹⁵ Although there are different standard assessment methods in speech, language, and general development assessment, our assessment methods are presented in this study.

Denver II Developmental Screening Test

The results of the Denver II Development Screening Test, which was applied to children aged 0 to 6 years by the educational audiology specialist were evaluated retrospectively. This test was adapted to Turkish children and standardized by Anlar and Yalaz.¹⁶ It provides evaluation of developmental state and developmental deviations in the areas of personal-social, fine motor, language and rough motor in children aged 0-6. In our study, the results of the Denver II Development Screening Test were recorded for the children aged 0-6 years.

Language Assessment

The results of the language assessment using the Turkish Early Language Development Test (TELDT) or the Preschool Language Scale (PLS-4), conducted by the educational audiology specialist were examined. TLDT, is an evaluation scale which is adapted into Turkish by Güven et al. and it is a valid, reliable, normative based assessment scale for receptive and expressive language for children 2 years and 0 month to 7 years and 11 months. PLS-4, adapted to Turkish by Yalçınkaya et al., is a scale used to evaluate language ability in children from birth to 6 years and 11 months. This scale evaluates auditory comprehension and expressive communication parameters.^{17,18}

In addition, the results of the assessment of reading and reading comprehension skills in children and adults who were literate were examined by prompting

them to read a text called “Jale’s World”, In the clinical setting, the observation results were evaluated for natural speech and communication skills of the patient (using toys or picture cards in patients with poor cooperation). In adult subjects, the results of the receptive and expressive language assessment performed with structured approaches (reading, writing, calculation, attention and memory etc.) and with the use of natural speech and language structures. The results of the evaluation of the patient’s communication with his family and other people were analyzed. As a result of all evaluations, the language obstacle score of the individuals was recorded.

Articulation/Phonological Evaluation

In the articulation/phonological evaluation, the results of Ankara Articulation Test (AAT) performed by a audiology and speech disorders specialist or educational audiology specialist were examined. The reading results of “Jale’s World”, which was read by the individual, were recorded. In addition, natural speech findings were also examined.

AAT is a test that evaluates articulation disorder in children aged 2 to 12 years with content and structure validity. In the test, 19 consonants in Turkish are evaluated. It is used to determine the false voice production in the beginning of the word, in and at end of the word, in the beginning and at the end of a syllable or between to vowels.¹⁹ In our study, phonemes which all individuals stated incorrectly were identified and the obstacle score was recorded.

Voice Evaluation

The results of the voice evaluation were evaluated during the reading of the text “Jale’s World”, which was conducted by the audiology and speech disorders specialist for the individuals who have natural speech and are literate. As a result of respiration, phonation, resonance, timbre and loudness evaluation, the obstacle score was recorded

Fluency

For the individuals who have literacy, the results of the fluency assessment performed by the audiology and speech disorders specialist were analyzed by prompting the patient to read the text “Jale’s World”

as well as using the natural speech. The words, syllables and sound repetitions, pauses, syllables and extensions were determined and the obstacle points that the individual took were recorded.

STATISTICAL ANALYSIS

Statistical Package for the Social Sciences (SPSS; Chicago, IL, USA) 24.00 software was used for statistical analysis. Language articulation, voice and fluency obstacle score differences were examined with one way ANOVA test and post hoc Tukey test with Bonferroni correction. Independent samples t test was used in the for the analysis of the difference between the speech obstacle scores between the groups with and without the disease/disability condition accompanying the speech problem. $p < 0.05$ was considered statistically significant.

RESULTS

Of the 1,530 children included in the study, 782 (51%) were female and 748 (49%) were male. Of the 770 adult individuals, 366 (47.5%) were female and 404 (52.5%) were male. The mean age of the children between the ages of 2-6 years was 4.55 (SD=1.26), the mean age was 8.66 (SD=3.99) in the 7-18 age group, and the average age of 770 individuals in the age group of 19 years was 36.18 (SD=16.02).

When comparing between groups in terms of language, articulation, fluency and voice; the highest speech obstacle score belonged to articulation in individuals aged 2-6 and older than 19 years (respectively 8.30 ± 3.21 ; 5.88 ± 4.49). In the 7-18 age group, the highest obstacle score was in the fluency area (6.32 ± 4.30). The highest obstacle score in the area of voice evaluation was obtained from the individuals aged 19 years or older (2.89 ± 3.54). The highest total speech obstacle scores were obtained in the 2-6 age group (21.92 ± 7.96), while the minimum total number of speech obstacle scores was the least in the 7-18 age group (13.16 ± 9.15) (Figure 1). A significant difference was found between the groups in terms of language, articulation, fluency and voice related obstacle scores and the total speech obstacle score ($p < 0.05$).

There were significant differences between all age groups' all pairwise comparisons in terms of obstacle score in language, articulation and total obstacle score ($p < 0.001$). There was a significant difference between the individuals in the 19 years and older group and both individuals between 2-6 years of age group and 7-18 years of age group in terms of obstacle score in voice area ($p < 0.001$). There were no significant differences between the individuals in the 2-6 years age group and 7-18 years of age group in the voice area ($p = 0.025$). There was a significant differ-

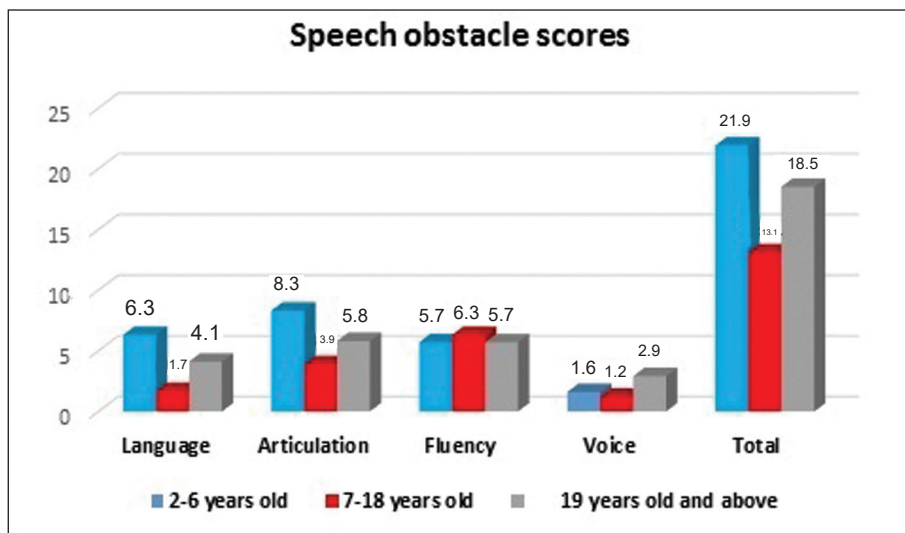


FIGURE 1: Distribution of language, articulation, fluency, voice and total obstacle scores according to groups.

TABLE 1: Post hoc Tukey test results of differences in speech obstacle scores between groups.

(I) Group	(J) Group	Mean differences (I-J)	p value
Language			
2-6 years old	7-18 years old	4.55	0.000
	19 years and above	2.12	0.000
7-18 years old	2-6 years old	-4.55	0.000
	19 years and above	-2.43	0.000
19 years old and above	2-6 years old	-2.12	0.000
	7-18 years and above	2.43	0.000
Articulation			
2-6 years old	7-18 years old	4.36	0.000
	19 years and above	2.41	0.000
7-18 years old	2-6 years old	-4.36	0.000
	19 years and above	-1.95	0.000
19 years old and above	2-6 years old	-2.41	0.000
	7-18 years and above	1.95	0.000
Fluency			
2-6 years old	7-18 years old	-0.61	0.015
	19 years and above	-0.01	0.996
7-18 years old	2-6 years old	0.61	0.015
	19 years and above	0.59	0.016
19 years old and above	2-6 years old	-0.01	0.996
	7-18 years and above	-0.59	0.016
Voice			
2-6 years old	7-18 years old	0.40	0.025
	19 years old and above	-1.23	0.000
7-18 years old	2-6 years old	-0.40	0.025
	19 years and above	-1.63	0.000
19 years old and above	2-6 years old	1.23	0.000
	7-18 years and above	1.63	0.000
Total			
2-6 years old	7-18 years old	8.74	0.000
	19 years and above	3.43	0.000
7-18 years old	2-6 years old	-8.74	0.000
	19 years and above	-5.31	0.000
19 years old and above	2-6 years old	-3.43	0.000
	7-18 years and above	5.31	0.000

ence between the individuals in the 7-18 age group and both individuals between 2-6 years of age group and 19 years and more group in terms of obstacle score in fluency area (respectively $p=0.015$, $p=0.016$). There were no significant differences between the individuals in the 2-6 years age group and 19 years and older group in the fluency area ($p=0.996$) (Table 1).

Of all the subjects included in the study, 1,407 patients (61%) with speech disorder had additional disease/disabilities (hearing loss, neurological disorders, craniofacial anomalies, developmental retardation or

cognitive impairment). In 893 individuals (39%), there was no disease/disability associated with speech disorder. The incidence of additional disease/disability was found to be at most in the 2-6 age group (77%) and to be the least in the 7-18 age group (39%) (Figure 2).

In terms of language, articulation, voice and fluency related obstacle scores, and the total speech obstacle scores, a significant difference was found between the individuals with one or more disease/disability and the ones who did not accompany with

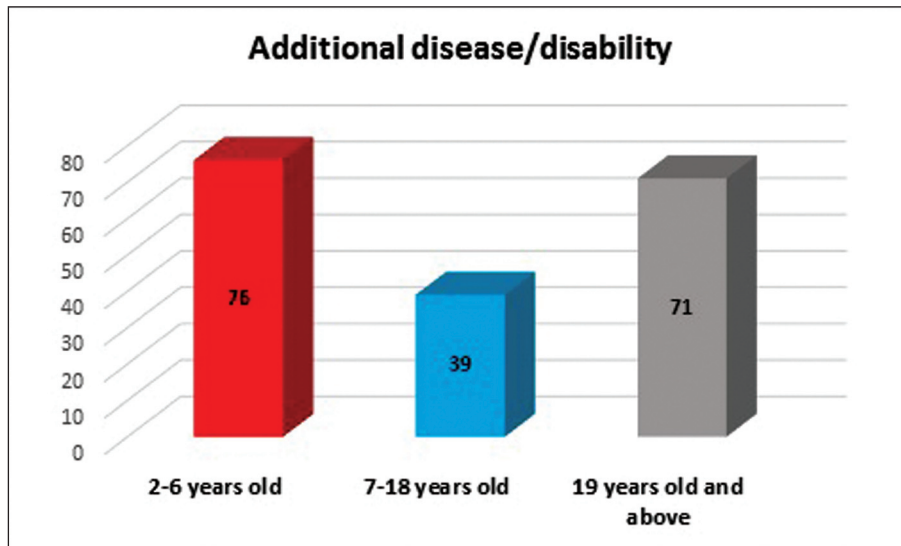


FIGURE 2: Percentage of additional disease/disability in groups.

TABLE 2: Speech obstacle scores based on additional disease/disability.

Speech obstacle scores	Subjects with additional disease/disability (n=1,407)	Subjects without additional disease/disability (n=893)	p* value
Language	5.46±3.08	1.51±3.05	0.000
Articulation	7.81±3.57	2.95±4.22	0.000
Fluency	7.60±3.09	4.63±4.52	0.000
Voice	2.84±3.45	0.47±1.60	0.000
Total	23.54±7.91	9.43±8.01	0.000

*Independent samples t-test.

speech disorder ($p < 0.001$). The language, articulation, voice, fluency, and total speech obstacle score of the individuals with additional disease/disability were higher than those without additional disease/disability (Table 2).

DISCUSSION

Communication disorders can affect both speech and language. Language disorders such as articulation disorder, fluency disorder, voice disorders and aphasia are some of the communication disorders. Language and speech disorders adversely affect the social, emotional and functional well-being of the individual.²⁰

Speech and language disorders are reported to be most prevalent among the childhood disorders, affecting 1 of every 12 children or 5-8% of pre-school children.⁹ Communication disorders affect the inter-

action of individuals with their environment and their formal and informal learning abilities. Evaluation of the effects of communication disorders on individuals and their families is complex.²¹ Careful planning and implementation of language and speech assessment affect the success of diagnosis, prognosis and therapy.²²

In Turkey, there are some factors that make it difficult to apply a standardized approach to speech and language disorders. The first is that speech and language assessment requires a very comprehensive approach and experience. Secondly, it is necessary to have an appropriate environment and adequate time in the evaluation, especially in patients who have difficulty in communication. The third one is the determination of the obstacle score for speech disorders by different experts in public institutions. Therefore, in our study, it was aimed to share our evaluation pro-

tocol in the detection of speech obstacle score, and to share our results of speech, language, articulation and voice evaluation according to both age and additional disease/disability situation. The results will be aimed to share the results with the clinicians working with these patients in our country and to guide studies to be done in this field.

In our study, it was found that the scores of language, articulation, fluency and voice were the different in all three age groups. In the pairwise comparisons, language, articulation related obstacle scores and total speech obstacle scores were different in all three age groups. In our study, there was no difference in terms of fluency between the smallest age group (2-6 years) and the largest age group (19 years and older).

In our study; it was observed that the obstacle score of articulation was the highest for individuals aged 2 to 6 years, and 19 years and above, and the obstacle score of fluency was the highest in the 7-18 age group. The highest obstacle score in the 2-6 age group was obtained from articulation and this was followed by the language obstacle score. The reason for this can be explained by the fact that patients in this age group applied to our center for developmental language disorder, articulation disorder and hearing loss.

Speech and language disorders show a heterogeneous structure.²³ Language disorders are common in young children and affect 5% to 6% of pre-school students.²⁴ Speech and language development are thought to be indicative of the child's general development and cognitive abilities. Good language skills are one of the basic prerequisites for school success. The most intense period of language development in children is between 3-5 years of age and this period is parallel to the maturation of brain structures.²⁵ Early and accurate diagnosis of speech and language disorders, for both general developmental and cognitive skills which is a prerequisite for educational success, could enable experts to determine rehabilitation requirements for these children. As a result, this evaluation will help them to achieve similar development and academic success with their healthy peers.

Applications to our center in the age group of 7-18 years are due to intense articulation disorder, fluency disorder and hearing loss. This confirms that we achieved higher speech obstacle scores in fluency and articulation areas, respectively, in this age group. In patients aged 19 and over, most of applications to our center are due to severe hearing loss (usually not using hearing aids), aphasia and fluency disorder. In our study, we think that this explain the fact that the highest obstacle scores in this age group are from articulation, fluency and language area, respectively. In our study, the increase of voice obstacle score in individuals aged 19 years and older compared to the other two age groups can be explained by the high level of hearing loss and aphasia which may affect the voice in this group. These problems should be detected with correct and early diagnosis in order to minimize the negative effects of speech and language disorders and communication problems for individuals of all ages.

Language and speech assessment should include the child's developmental stages, functional communication history and formal testing. The developmental stages of the child should be well known, their performance and functions should be evaluated and compared with their peers. To know developmental stages could provide guidance to the family and referral to other experts. Comparing the current functional status or cognitive level of the child with what is expected from his age, will provide additional information in determining the need for rehabilitation.²²

Spontaneous language sample analysis is very important in evaluating the functional use of language ability for communication. Functional communication refers to the child's ability to use the language for successful communication in his or her daily experience. Spontaneous language sample analysis can be considered as formal analysis because children's performance can be compared with the healthy children of the same age. During the reception of the language sample, it may be necessary to choose appropriate speaking subjects in the fields of academic, social, hobby, holiday and sports for older children. Formal tests have been developed to inves-

tigate the ability of the child in various areas. While performing formal tests, the clinician determines the level of ability of the child, knows the basic level of performance, and can determine the upper level that the child can achieve.²²

In our study, the highest speech obstacle score in the 2-6 years age group can be explained by the fact that the rate of additional diseases/disability to speech disorder is highest in this group. Additional disease/disability status may have increased obstacle scores in the areas of language, articulation and fluency in these individuals. In our study, additional disease/disability to speech disorder in all age groups increased language, articulation, voice, fluency score and total obstacle scores.

Language disorders are often associated with other developmental problems such as mental disability, autism spectrum disorder, hyperactivity disorder and attention deficit. Miniscalco et al. conducted speech and language assessment at the Child Health Center.²⁶ In a follow-up period of 7 years, a major neuropsychiatric / developmental disorder was diagnosed in 62% of children with a 2.5 year old language delay.

Language disorder in children may be an indicator of various developmental disorders, especially mental disability and autism spectrum disorder. It is not possible for speech and language development to be independent of other areas of development. Similarly, the child, who needs to be supported in terms of other areas of development, may not sufficiently benefit only from speech rehabilitation.

CONCLUSION

We presented our assessment protocol for speech disorders. In the evaluation of speech disorders, we presented our data on the distribution of language, articulation, fluency and voice disorders by age. We

also found the speech disorder profile in individuals with comorbidities with speech disorder. Speech and language disorders should be evaluated by comprehensive and standard methods. It may be useful to include speech and language assessment in routine assessment of children and adults with one or more of the diagnoses of hearing loss, neurological disorder, craniofacial anomalies, developmental retardation and cognitive disorders. This situation can contribute to both the determination of the patient's rehabilitation requirement and the addition of speech obstacle score to the health board report. Similarly, in individuals presenting to the health board with speech disorder, the investigation of the additional disease/disability situation is extremely important in determining the need for rehabilitation in other areas (mental, physical, etc.) in addition to speech.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Banu Mijdeci, Sevginar Önder; **Design:** Banu Mijdeci, Sevginar Önder; **Control/Supervision:** Serdar Ensari, Süleyman Boynueğri; **Data Collection and/or Processing:** Banu Mijdeci, Sevginar Önder, Serpil Alluşoğlu; **Analysis and/or Interpretation:** Banu Mijdeci, Sevginar Önder, Serpil Alluşoğlu; **Literature Review:** Volkan Güngör, Serdar Ensari, Süleyman Boynueğri; **Writing the Article:** Banu Mijdeci, Sevginar Önder; **Critical Review:** Serdar Ensari, Volkan Güngör, Süleyman Boynueğri.

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