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Psychogenic voice disorders

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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ABSTRACT:

Introduction: Voice express the psyche and personality of a person. Psychogenic dysphonia is called Phononeurosis. Neurosis, depression or family, occupational and social conflicts are the cause of voice disturbances. The most frequent type of dysphonia is hyperfunctional dysphonia, rarer – hypofunctional type.

Aim: The aim of this study is an analysis of voice quality and diagnosis of clinical type of psychogenic dysphonia.

Material and methods: The analyzed group consisted of 50 patients with voice disorders treated in 2017 and the control group – 30 people with physiological voice. In the diagnosed group 60% of patients were treated for neurosis, 12% due to depression, the others reported conflict situations. In the diagnosis of clinical type of psychogenic dysphonia GRBAS scale was used, maximum phonation time (MPT) and type of breathing were assessed. The visualisation of the larynx was performed using High Speed Digital Imaging (HSDI) technique. The parametric acoustic evaluation of voice was conducted.

Results: The most often clinical type of psychogenic dysphonia was hyperfunctional dysphonia, rarer hypofunctional type and vestibular voice. Dysphonia occurred the most often in women during the highest professional activity period. In the diagnosis of clinical type HSDI technique was especially useful allowing to visualization of the real vocal fold vibration and objective differentiation of hyper- and hypofunctional dysphonia. The acoustic analysis of the voice objectively confirmed the presence non-harmonic components – noise generated in the glottis in hypofunctional dysphonia. Disturbances in the way and breathing type caused irregularities in respiratory-phonic and articulation coordination.

KEYWORDS: functional dysphonia, psychogenic dysphonia, visualisation of the larynx, acoustic evaluation of voice

INTRODUCTION

The voice and speech express the psyche and personality of a human. According to Perello [19[, psychogenic voice disorders are determined as phononeurosis. Behlau [6] believes that voice quality also depends from social and professional conditions. A common cause of psychogenic disorders of the voice and speech are family and professional conflicts. Phononeurosis usually appears in women aged 30-50 years and affects people who are introvert, with a strong reaction to stress, alienated and unhappy. These conditions often coexist with neurosis and depression. Most frequently, they take the form of functional dysphonia that is hyperfunctional, and more rarely hypofunctional.

PURPOSE OF WORK

The purpose of this work is to analyze voice quality and diagnose the clinical form of psychogenic dysphonia.

MATERIAL AND METHOD

The study comprised a group of 50 patients with psychogenic-related disorders of the voice and speech diagnosed in the Department of Clinical Phonoaudiology and Speech Therapy of the Medical University of Bialystok and treated at the Phoniatric Clinic of University Clinical Hospital in Bialystok in 2017. The group comprised 41 (82%) women and 9 (18%) men. Patients ranged in age from 26 to 59 and with an average age of 44 years. In the diagnosed group, 30 (60%) of patients were treated for neurosis, 6 (12%) for depression; 24 (28%) reported family, professional and social conflicts. These were persons without signs of pathology of the upper respiratory tract, non-smokers, professionally active (60% using voice professionally).

Facial expression, tension of the musculature of the neck were assessed, with endoscopic examination of the mouth and throat performed.

Perceptual assessment of voice quality was done using the standardized GRBAS scale according to the Japan Society of Logopedics and Phoniatrics. On a scale from 0 to 3, it defines the degree of hoarse throat intensity - G (grade), voice hoarseness – R (rough), puffing character of voice – B (breathiness), asthenicity of the voice – A (asthenia) and voice tension – S (strain).

To visualize real vocal fold vibrations, High Speed Digital Imaging (HSDI) technique was used. Research was done using a rigid endoscope with a 90o viewing angle and a video camera for fast imaging in the HRES ENDOCAM 5562 system produced by Richard Wolf GmbH. During phonation of vowel "i", the High-Speed (HS) camera allowed to register a 2-second image with a speed of 4000 frames per second. The playback function allowed to replay the recorded sequence at 8.88 min. Regularity, symmetry and synchrony of vocal fold vibrations, morphology of mucosal wave (MW) and phonatory glottis were analyzed.

Acoustic examination of the voice was performed during phonation of the vowel "a" uttered in isolation and phonation of a continuous linguistic text: "Dziś jest ładna pogoda.." Jitter (%), shimmer (%), NHR (%) parameters were analyzed using DiagNova Technologies Diagnoscope Specialist software. During acoustic evaluation of the voice, spectroscopic analysis of the "a" sound uttered in isolation was also performed, illustrating the distribution of harmonic and nonharmonic components of recorded voice samples.

Maximum phonation time (MPT) during three-fold phonation of the vowel "a" was analyzed. Time was measured in seconds and the mean of three voice samples was calculated.

All patients were evaluated in terms of breathing patterns, classifying it as costoclavicular, phrenocostal or abdominal.

The control group of 30 persons comprised persons with physiological (euphonic) voice, where 24 women (80%) were the majority. Mean age of respondents was 42 years and ranged from 26 to 57 years. The control group included people without pathological lesions of the larynx and upper respiratory tract.

The study and control group did not differ significantly in terms of age and gender. In the statistical analysis of objective values, a one-way analysis of variance was used.

RESULTS

In 48 (96%) patients, excessive tension of the neck and facial muscles was found during phonation, while endoscopic examination showed excessive tension of the mesopharynx , laryngopharynx and articulators. In the remaining 2 (4%), these symptoms were not found. Perceptual evaluation of voice quality using GRBAS scale (Fig. 1) showed hoarseness in 48 (96%) patients, voice strain in 47 (94%), asthenia in 4 (8%) patients, and breathiness in 3 (6%).

The GRBAS control group included certain physiological parameters in the form of G-0, R-1, B-1, A-1, S-1 results.

Visualization of the larynx using HSDI showed epiglottis prolapse in 44 (88%) respondents, reduction of vibration amplitude, reduction of mucosal waves (MW), excessive and prolonged phonetic phase of phonatory contraction along the entire rima. Four (9%) patients of this group also had a small triangle of regurgitation in the posterior glottic segment (Fig. 2).

In 5 (10%) subjects, an increase in vibration amplitude, mucosal wave limitation (MW), incomplete phonatory contraction of the glottis in the mid- and posterior segment were found (Fig. 3).

In 1 (2%) patient, there were retroflexion of the epiglottis, excessive tension of supraglottic structures of the larynx and phonic contraction of the vestibular folds, which made it difficult to examine vocal folds during phonation (Fig. 4).

In the control group, vibrations of the vocal folds were regular, symmetrical, synchronous with preserved normal mucosal wave (MW). Full, physiological closure of the glottis was noted along the entire length of the rima during phonation (Fig. 5).

In patients with euphonic voice, the average MPT was 23 seconds, with hyperfunctional dysphonia - 5.16 sec, with hypofunctional dysphonia - 6.86 sec. Average time of phonation in apparent vestibular voice was 4.98 sec. (Fig. 6).

Parametric acoustic analysis of the voice in patients with psychogenic dysphonia, using Diagnoscope Specialist software by DiagNova Technologies, showed an increase in jitter, shimmer and NHR parameter in relation to the normative value. Mean value of jitter parameter in hyperfunctional dysphonia was 0.61%, shimmer 12.78%, NHR 6.75%. In hypofunctional dysphony, value of jitter parameter is 0.82%, shimmer - 9.62%, NHR - 8.44%. Mean value of jitter parameter for vestibular voice was 0.93%, shimmer 16.21%, and NHR 5.56% (Table I).

Parametric analysis of the voice in patients with psychogenic dysphonia (Fig. 9, 11, 13) shows values of acoustic parameters and determines those coefficients whose values have exceeded the normative level. Figure 7 shows result of parametric analysis in a person with euphonic voice.

Tab. I. The average values of parameters jitter, shimmer and NHR in patients with psychogenic dysphonia and euphonic voice.

PARAMETR	JITTER [%]		SHIMMER [%]		NHR [%]	
	ŚREDNIA	ODCHYLENIE STANDARDOWE	ŚREDNIA	ODCHYLENIE STANDARDOWE	ŚREDNIA	ODCHYLENIE STANDARDOWE
Głos eufoniczny	0,42	2,33	4,1	11,12	3,4	4,22
Dysfonia hiperfunkcjonalna	0,61	4,88	12,78	13,04	6,75	7,89
Dysfonia hipofunkcjonalna	0,82	5,38	9,62	12,45	8,44	9,61
Głos przedsionkowy	0,93	6,21	16,21	14,46	5,56	7,01

Spectrographic analysis of the voice in 44 (88%) patients with hyperfunctional dysphonia showed, in addition to harmonic components, especially in the low frequency of formants, existence of nonharmonic components in the high frequency range. In 5 (10%) respondents with hypofunctional dysphonia, there were nonharmonic components generated in the glottis region in the high frequency range. In 1 (2%) patient, presence of nonharmonic components in the low and high frequencies was noted. The control group showed harmonic components within all frequency levels of formants and a small number of nonharmonic components (Fig. 8).

Fourt-two (84%) patients showed respiratory disorders in the form of shallow, peak breath (costoclavicular pattern), in 7 (14%) the breathing pattern was normal phrenocostal and in 1 (2%) patient, the breathing pattern was abdominal. All 50 (100%) patients in the study group had impaired respiratory--phonic coordination.

The control group comprised 27 (90%) people with a correct breathing pattern, and 2 (7%) with phrenocostal breathing pattern. Only 1 (3%) people showed an abdominal breathing pattern (Fig. 15).

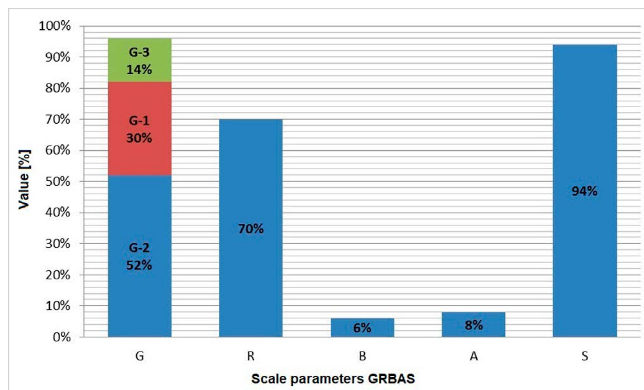

Fig. 1. The values of GRBAS parameters in the analyzed group.

DISCUSSION

Physiological-euphonic voice is the result of efficient cooperation of many organs. It depends from correct vibration of vocal folds, efficiently functioning respiratory organs, correct function of articulators and resonating cavities. Vocal organ is subject to CNS control, which Husson emphasizes in the theory of neurotaxis [20]. According to Behlau et al. [6], voice quality also depends from psychological characteristics and social and professional conditions. A sick psyche and personality significantly disturb the quality of voice and speech. Perello described the psychogenically conditioned functional disorder as phononeurosis [19]. According to Andersson et al., Baker, Nemr et al., Shalén et al. [1,5,17,23] laryngeal pathology with a psychogenic basis is functional, not organic, which is confirmed by the study results in the analyzed group of patients. Andersson et al., Baker, Behlau et al. [1,5,6] argue that family and professional conflicts are a frequent cause of phononeurosis. The examined group of patients comprised a majority of women whose average age was 44 years, which falls in the period of their peak professional activity. Similar results were presented by Baker in the group of people who use their voice for their professional [4]. According to Roy et al. [21] people with psychogenic voice disorders are introverted, vulnerable and strongly responsive to stress, alienated and unhappy, as opposed to patients with vocal cords who are socially dominant, aggressive and impulsive. In the study group, 60% of people were treated for neurosis, 12% for depression, and others reported family and social conflicts. The most common clinical form of psychogenic dysphonia is hyperfunctional. Hyperfunctional dysfunction in the literature is also called Muscle Tension Dysphonia (MTD) [6,12,14]. It is characterized by a hoarse voice with an admixture of roughness, with a certain strain, created with tension, which is illustrated by the results obtained in the analyzed group using GRBAS scale. Endo-

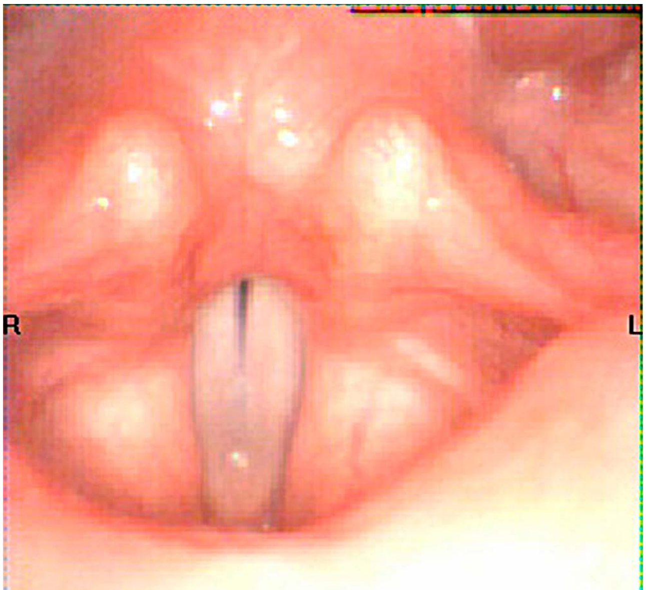

Fig. 2. HSDI – hyperfunctional dysphonia.

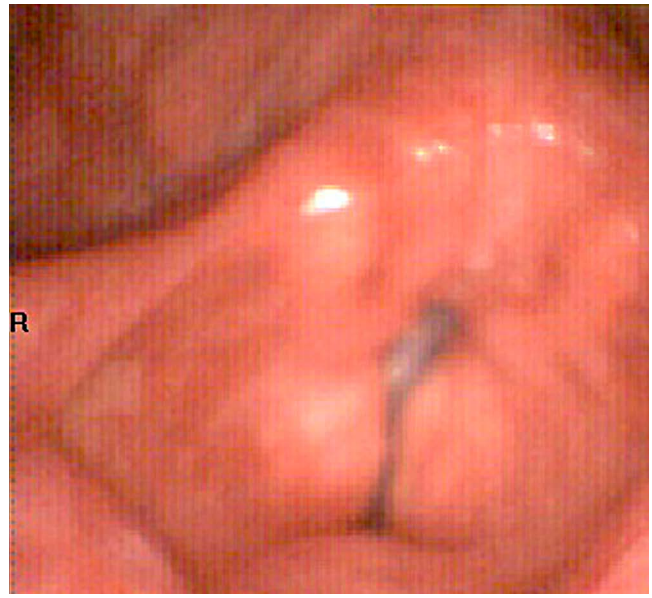

Fig. 4. HSDI – vestibular voice.

Fig. 3. HSDI – hypofunctional dysphonia.

Fig. 5. HSDI – euphonic voice.

scopy shows the phenomenon of supraglottic hyperfunction, whereas the intensified form has a sphincter mechanism of phonation. [20, 28]. According to Martins et al. [15] severe hyperfunctional dysphony can cause voice nodules or lead to vestibular phonology, which was observed in 2% of patients. Another clinical form of psychogenic dysphonia is hypofunctional dysphonia. Vibrant voice is preserved during coughing, laughing and crying.

Perceptual GRBAS scale is useful in assessing the quality and severity of dysphonia. In the analyzed group of patients, the second most common type of G-2 hoarseness (mild hoarseness) was found in 26 (52%) patients. G-0 normal voice was recorded in 2 patients, which accounted for 4% of the respondents. Strained voice classified as S-2 on the GRBAS scale was the most frequent in the analyzed group, as much as 94% of cases, which indicates the existence of hyperfunctional dys-

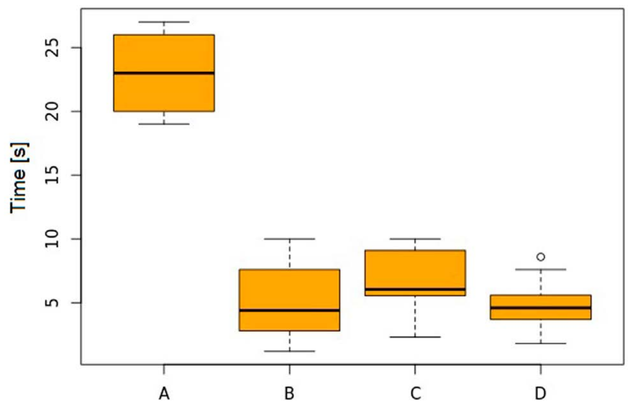

Fig. 6. Analysis of MPT parameter in patients with euphonic voice(A), hiperfunctional dysphonia(B), hipofunctional dysphonia (C), vestibular voice(D).

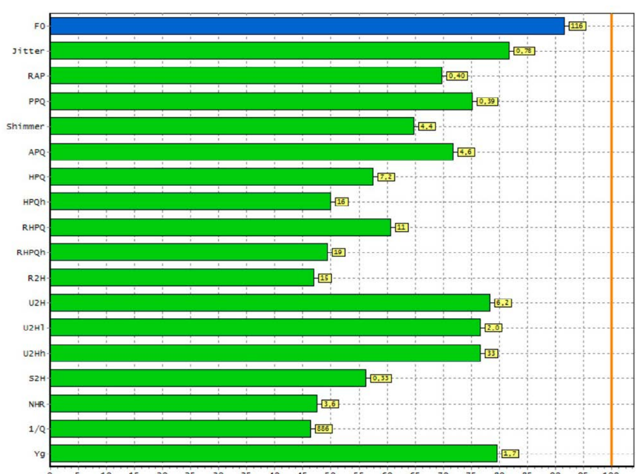

Fig. 7. Parametric analysis of voice – euphonic voice.

phonia. Voice classified as B-1 and A-1 was found only in 6% and 8% of the respondents.

Visualization techniques are particularly useful in the assessment of mobility of vocal folds [8, 16]. The most precise diagnostic tool is High Speed Digital Imaging (HSDI), which allows imaging of real vocal fold vibrations [10,11,18,24,29].

Morphology of the Mucosal Wave (MW) allows for objective differentiation of the clinical form of functional dysphonia into hyper- and hypofunctional form. Use of this unique technique allowed to recognize the hyperfunctional form in 88% and hypofunctional form in 10% of the examined patients. Vestibular phonation was noted in 2% of diagnosed patients. A special form of functional disorders of the voice is spastic dysphonia [19]. This pathology is caused by neurological disorders in the

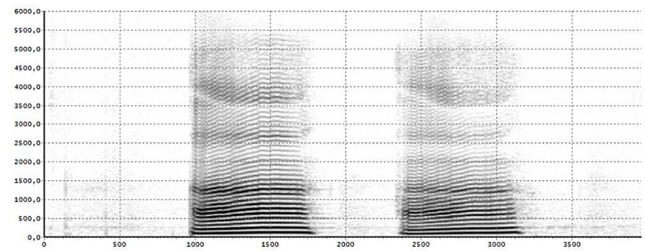

Fig. 8. Narrow-band spectrogram of „a" vowel in isolation in patient with euphonic voice.

Fig. 9. Parametric analysis of voice – hiperfunctional dysphonia.

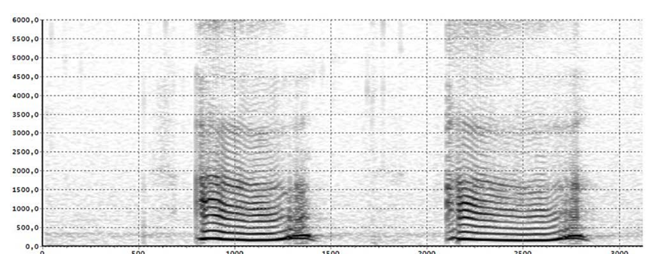

Fig. 10. Narrow-band spectrogram of „a" vowel in isolation in person with hyperfunctional dysphonia.

pyramidal pathways or psychogenic changes [20]. No spastic dysphonia was found in the analyzed group. The most severe form of psychogenic dysphonia is psychogenic aphonia, characterized by the lack of vibrant voice without organic changes in the larynx. Inflammatory traits or traumatic symptoms were not present in laryngeal examination. Respiratory and defensive function of the larynx is preserved, while no phonatory contraction of the glottis is recorded along the whole length when forming a whisper [2,7,13]. No psychogenic aphonia was found in the group of diagnosed patients. According to

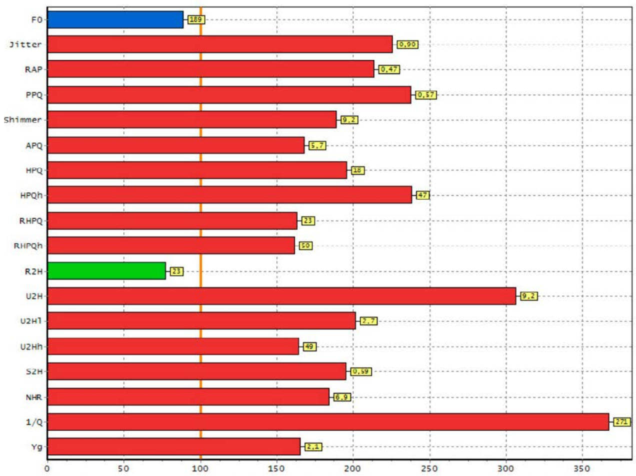

Fig. 11. Parametric analysis of voice – hipofunctional dysphonia.

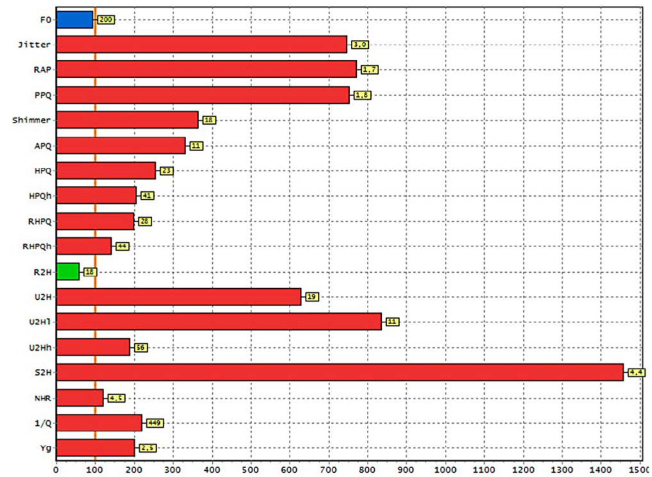

Fig. 13. Parametric analysis of voice – vestibular voice.

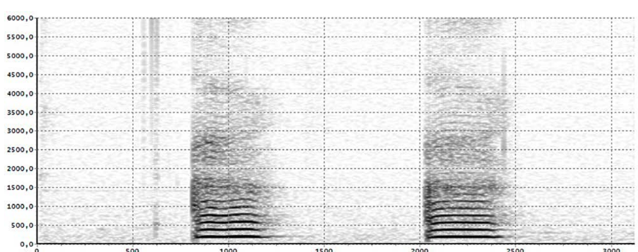

Fig. 12. Narrow-band spectrogram of „a" vowel in isolation in person with hypofunctional dysphonia.

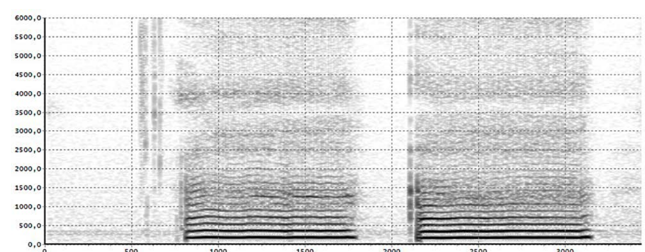

Fig. 14. Narrow-band spectrogram of „a" vowel in isolation in person with vestibular voice.

Maniecka-Aleksandrowicz et al. [13], it is important to assess tension and mobility of the soft palate, tongue, palatopharyngeal reflex and swallow efficiency in laryngological examination in psychogenic aphonia. In the analyzed material, 96% of patients recorded an increase in muscle tone in the mesopharynx and laryngopharynx as well as articulatory organs. No inflammatory or traumatic symptoms are recorded in laryngeal examination in psychogenic dysphonia, and defensive and respiratory function of the larynx is unaffected. In the analyzed group of patients, 88% had vivid facial expressions, excessive tension of the neck muscles, increased palatopharyngeal reflex and epiglottic retroflection, which confirms the existence of hyperfunctional dysphonia diagnosed in visualization (HSDI).

An important aerodynamic parameter of the voice, which should not be omitted, is maximum phonation time - MPT, which specifies the phonation time of vowel "a" during complete exhalation [28]. It is a simple, rapid to perform and noninvasive for the patient. The analyzed material showed statistically significant shortening of MPT in all diagnosed clinical forms of psychogenic dysphonia. The control group showed an average MPT value of 23 seconds and was close to normal.

The topic of many scientific publications is use of acoustic voice testing in diagnosing the clinical form of psychogenic dysphonia. Parametric analysis is most commonly used, showing percentage changes in fundamental F0 frequency in two periods (jitter), amplitude changes from period to period (shimmer), presence of noise component in the Harmonic-To-Noise Ratio (HNR). Teixeira et al. [26] analyzed values of the above-mentioned parameters in sounds isolated in psychogenic dysphonia, considering this method to be diagnostically useful. Sudhir et al. [25] used the "Vaghmi" software for acoustic voice analysis to determine fundamental F0 frequency and maximum time of phonation (MPT). They found significant shortening of MPT values to the average value of 4 seconds in the group of patients with psychogenic dysphonia. The analyzed group of patients showed pathological values of jitter and shimmer parameters, and especially significant differences in the NHR parameter range in patients with symptoms of hypofunctional dysphonia. Obtained results were confirmed by narrowband spectrographic, where in the group of patients with hypofunctional dysphonia there were numerous nonharmonic components in the high frequency scope of formants - noise component generated in the glottis region, which indicates

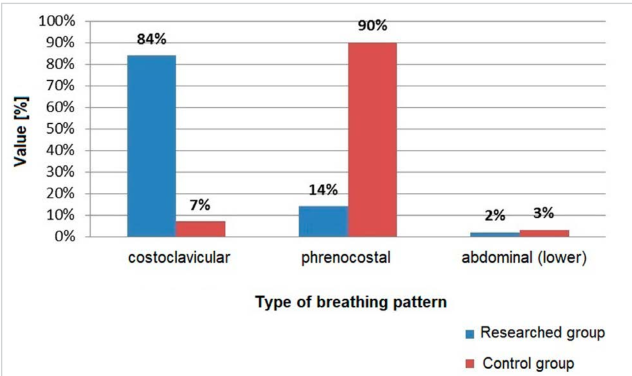

Fig. 15. The comparison of the way of breathing in patients with psychogenic dysphonia and euphonic voice.

lack of a full phonatory contraction in the glottis. Presence of the noise component in the glottis in patients with hypofunctional dysphonia correlated with clear excess of the normative value of NHR parameter, which confirmed existence of a rima in the glottal area in patients with hypofunctional dysphonia.

Fast and accurate diagnosis of the clinical form in psychogenic dysphonia makes it possible to implement an adequate treatment regimen. Bader and Schick [3] emphasize that often patients with psychogenic dysphonia are unnecessarily treated with antibiotics, which delays diagnostics.

According to Mathieson et al. [14], increased muscle tension of the larynx and neck may be the main symptom of psychogenic voice disorders and cause pain during phonation. Often times, voice therapy or vibration massage is not very effective. According to the author, in such a case, manual therapy should be used, which is particularly useful in treatment of hyper-functional dysphony, as confirmed by acoustic analysis of voice [14].

Historical treatment of functional dysphonia included the use of "stimulating" sprays on vocal folds, oral administration of quinine, arsenic or strychnine. The modern form of treatment is voice therapy and relaxation techniques [27].

Contemporary treatment of psychogenic dysphonia requires a multi-specialist approach that includes causative treatment, pharmacology, psychotherapy, voice rehabilitation and physiotherapy [4,9,22,25]. According to Martins et al. [15], interdisciplinary treatment of psychogenic dysphonia forms is the key to success.

CONCLUSIONS

Psychogenic dysfunction most often affects women in the period of peak professional activity.

The most common clinical form of psychogenic dysphonia is hyperfunctional dysphonia, a lesser form is hypofunctional or false vestibular voice.

HSDI allows for assessment of actual vibration in vocal folds and objective differentiation of the clinical form of hyperfunctional and hypofunctional dysphonia.

Acoustic analysis of the voice objectively confirms presence of nonharmonic components generated in the glottis (noise component) in hypofunctional dysphonia.

Abnormal breathing method and pattern cause significant shortening of the maximum time of phonation, disrupt respiratory, phonatory and articulatory coordination, which affects voice quality.

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