International Journal of Occupational Medicine and Environmental Health, 2004; 17(2): 273—278

AN ANALYSIS OF OCCUPATIONAL DYSPHONIA DIAGNOSED IN THE NORTH-EAST OF POLAND

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Abstract.
Objective: The objective of the study was to evaluate factors predisposing to occupational dysphonia in a group of professional voice users. **Material and Methods:** The study involved 374 patients treated in the Clinic of Otolaryngology and the Phoniatric Outpatient Clinic, Department of Otolaryngology, Medical University of Białystok in 1999–2001. Group I consisted of 309 patients qualified as professional voice users. The obtained results were compared with those yielded in a group of 65 persons of other occupations (group II). All the diagnosed patients neither smoked nor abused alcohol. Tobacco smokers, patients with chronic diseases of the respiratory system or individuals exposed to irritating vapors were excluded from the study. The clinical evaluation included phoniatric examinations with use of videoendoscopy (VIS) and videolaryngostroboscopy (VLSS) of the larynx. Based on the larynx endoscopic image the voice organ pathology was diagnosed in the patients as functional and/or organic dysphonia. The former comprised hyperfunctional or hypofunctional dysphonia and insufficiency of the glottis and the latter other laryngeal disturbances. In the statistical analysis $\chi 2$ parametric test of independence for two averages was used. **Results and Conclusions:** Female teachers of primary and lower secondary schools, mean age 43 years, prevailed in the group of professional voice users, in which functional dysphonia was more common. In this group, the onset of organic changes was earlier than that of functional changes and was manifested by soft vocal nodules, edematous and inflammatory changes in the vocal fold mucosa. Functional dysphonia of 3°, 4° and even 5° predominated in the group of professional voice users in the course of their employment.

Key words:
Voice quality, Occupational diseases, Teachers, Voice function, Laryngeal diseases

INTRODUCTION

According to the Union of European Phoniatricians, occupations with vocal engagement are classified into three categories: those requiring a high quality voice (actors, professional singers, presenters), those requiring a high efficiency voice (teachers) and those requiring an above-average efficiency voice (lawyers, attorneys, interpreters) [1,2]. Teachers make the largest group of professional voice users. In Poland, this group numbered about 512 000 in 2001, including 226 400 primary and 79 900 high school teachers [2]. The data of the Nofer Institute of Occupational Medicine in Łódź show that the voice organ disorders related to voice overuse form the group of the most common occupational diseases in Poland. A con-

Received: February 3, 2003. Accepted: April 5, 2004.
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stant increase in the incidence of this disease is now being observed [2–7] (3521 and 2479 cases in 1999 and 2000, respectively) [2].

Pruszewicz [8] distinguished intrinsic and extrinsic etiologic factors of occupational dysphonia. Among the extrinsic factors, employment duration is of particular importance [2,8,9]. According to Pruszewicz [8] and Zalesska-Kręcicka et al. [7], voice disturbances begin to occur mostly in the second year of occupational activity, reflecting occupational adaptation, then after 10 years of employment resulting from voice overuse, and finally after 20 years due to hormonal menopausal changes in women. Occupational dysphonia may have an organic and/or a functional background. Intensified pathologic changes in the voice organ affect the voice quality that may be expressed on a six-grade scale according to the Union of European Phoniatricians [8].

The objective of the study was to evaluate factors predisposing to occupational dysphonia in a group of professional voice users.

MATERIALS AND METHODS

The study involved 374 patients treated in the Clinic of Otolaryngology and the Phoniatric Outpatient Clinic, Department of Otolaryngology, Medical University of Białystok in 1999–2001. Group I comprised 309 professional voice users, including 164 teachers of primary and lower secondary schools (53%), 62 high school teachers (20%), 25 kindergarten teachers (8%), 18 attorneys, judges or prosecutors (6%) and 40 actors, telephone operators or interpreters (13%). Group II comprised 65 patients of different occupations. The mean age of the patients in group I was 45 years for women and 43 years for men, in

Table 1. The voice organ pathology diagnosed in professional voice users (group I) and in persons of other occupations (group II)

No.	Diagnosis	Women n		Men n		Total n (%)		Mean age ($\bar{\chi}$)			
								Women		Men	
		I	II	I	II	I	II	I	II	I	II
1	Soft vocal fold nodules	40	9	4	1	44 (14.0)	10 (15.3)	30.6	31.3	30.0	32.0
2	Hard vocal fold nodules	14	0	3	1	17 (5.5)	1 (1.5)	46.2	–	48.0	42.0
3	Chronic proliferative laryngitis	15	1	15	1	30 (9.7)	2 (3.0)	46.3	43.0	51.7	52.0
4	Laryngeal polyps	6	1	13	2	19 (6.1)	3 (4.6)	45.7	45.0	46.7	54.0
5	Edema of the larynx mucosa	51	2	12	0	63 (20.4)	2 (3.0)	45.5	65.0	50.0	–
6	Pachydermia	1	0	16	1	17 (5.5)	1 (1.5)	45.0	–	55.7	59.0
7	Acute laryngitis	24	3	11	1	35 (11.3)	4 (6.1)	33.9	33.0	33.2	32.0
8	Extravasations to vocal folds	8	1	–	–	8 (2.6)	1 (1.5)	48.5	45.0	–	–
9	Hyperfunctional dysphonia	12	–	5	–	17 (5.5)	–	44.1	–	47.8	–
10	Hypofunctional dysphonia	20	1	10	–	30 (9.7)	1 1.5)	46.8	33.0	55.1	–
11	Phonatory insufficiency of the glottis	24	1	5	–	29 (9.4)	1 (1.5)	46.6	34.0	41.0	
12	Paralysis of the vocal folds	–	11	–	2	–	13 (20.0)	–	49.2	–	48.5
13	Post-intubation granuloma	–	1	–	5	–	6 (9.2)	–	48.0	–	43.8
14	Papillomas	–	4	–	1	–	5 (7.6)	–	48.0	–	56.0
15	Laryngeal cyst	–	7	–	2	–	9 (13.8)	–	48.0	–	45.0
16	Laryngeal cancer	–	–	–	4	–	4 (6.1)	–	–	–	57.5
17	Chronic simple laryngitis	–	1	–	1	–	2 (3.0)		32.0	–	45.0
	Total	215	43	94	22	309	65	–	–	–	–

group II 42 and 45 years, respectively. Women predominated in both groups (group I, 215 – 69% and group II, 43 - 66%). All the patients neither smoked nor abused alcohol. Tobacco smokers, patients with chronic diseases of the respiratory system or individuals exposed to irritating vapors were excluded from the study. The clinical evaluation included phoniatric examinations with use of videoendoscopy (VLS) and videolaryngostroboscopy (VLSS) of the larynx. Based on the larynx endoscopic image the voice organ pathology was diagnosed in the patients as organic and/or functional dysphonia (Table 1).

Hyperfunctional and hypofunctional dysphonia as well as insufficiency of the glottis were classified as functional dysphonia, whereas other laryngeal disturbances as organic dysphonia. The effect of employment duration on the frequency of respective laryngeal pathologies was analyzed in the both groups. The employment duration was divided into four intervals: below 2 years, 2–10 years, 10–20 years and over 20 years. On the subjective examination, the voice quality was compared with a six-grade scale of dysphonia defined by the Union of European Phoniatricians. Normal voice was defined as 1°, hoarse voice as 2°, mild dysphonia as 3°, medium dysphonia as 4°, severe dysphonia as 5° and aphonia or substitutive voice as 6°. Videolaryngostroboscopy was performed with use of RhinoLaryngoStroboscope type 4914 (Brüel-Kjear) equipped with a rigid endoscope type 5952 with 70 degree optics from the same manufacturer. Endoscopic and stroboscopic images of the vocal fold vibrations were videotaped using SOCAR-35 CCD videocamera and SONY VHS videorecorder. During examinations the vibrations regularity and amplitude, the presence or lack of the mucosal wave and the character of the glottal phonatory closure were recorded, thus facilitating unambiguous diagnosis of the larynx pathology. In the statistical analysis parametric χ^2 test of independence for two averages was used.

RESULTS

All the 374 patients were admitted to both Clinics due to the voice organ subjective symptoms. Hoarseness after the voice effort, dryness in the throat and changed color were the most common complaints reported by 198 (53%), 116 (31%) and 60 (16%) patients, respectively. Voice waning and transient aphonia were reported by 45 (12%) patients.

In group I the most common symptoms, hoarseness, transient aphonia and dryness of the throat during phonation, were reported by 234 (75%) patients.

In group II, the changed voice colour and breakable voice predominated (64.6% and 41.5% of patients, respectively).

In groups I and II, dysphonia of 2°, 3°, 4° and 5° was diagnosed, whereas there were no cases of 1° or 6° dysphonia (Table 2, Figs. 1 and 2).

Employment duration was found to influence the development of dysphonia in both groups of patients. In group I organic changes in the larynx occurred together with the beginning of professional use of voice. In the course of employment organic dysphonia was decreasing, while functional dysphonia was increasing. In patients employed for more than 20 years, organic dysphonia predominated

Table 2. Correlation between the larynx pathology and the degree of dysphonia in diagnosed patients

Diagnosis	Degree of dysphonia							
	2°		3°		4°		5°	
	I	II	I	II	I	II	I	II
Organic changes (%)	3.5	16.1	18.3	14.8	37.6	50	40.6	18.5
Functional changes (%)	12.7	25	11.3	5	59.2	40	16.9	30
P	0.0006	0.3842	0.1613	0.2556	0.0014	0.4476	0.0003	0.2893

Group I – professional voice users.
Group II – persons of other occupations.
P – probability for the test of independence.

Table 3. Correlation between organic and functional changes in the larynx and employment duration in professional voice users (group I) and in persons of other occupations (group II)

Group	Diagnosis	Employment duration (years)			
		≤ 2	2-10	10-20	20 ≤
I	Organic changes (%)	100.00	84.50	84.47	66.70
	P	0.2179	0.9250		0.0055
	Functional changes (%)	0.00	14.50	15.58	33.30
	P	0.2179	0.8623		0.0044
II	Organic changes (%)	0.00	1.00	68.75	74.36
	P	0.2179	0.0608		0.6731
	Functional changes (%)	0.00	0.00	31.25	25.64
	P	0.2179	0.0611		0.6732

P – probability for the test of independence.

Table 4. Correlation between organic and functional changes in the larynx and employment duration in professional voice users (group I).

Diagnosis	Employment duration (years)			
	≤ 2	2-10	10-20	20 ≤
Organic changes (%)	3.86	20.17	27.90	48.10
Functional changes (%)	0.00	14.50	15.58	33.30
P	–	0.0565	0.0350	0.0013

P – probability for the test of independence.

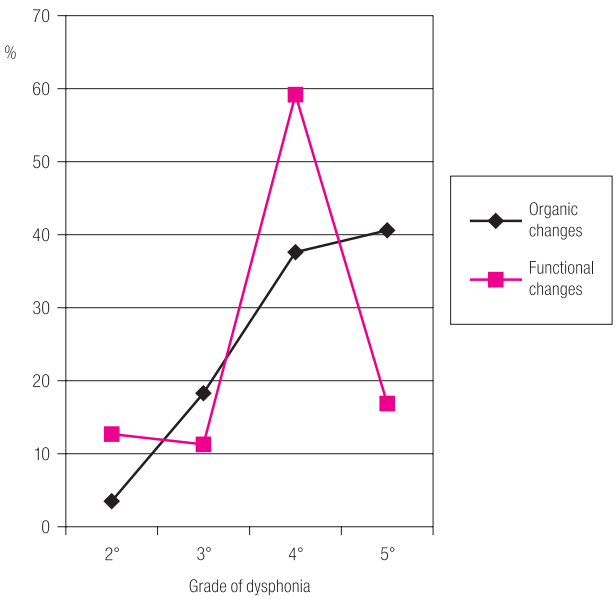

Fig. 1. Correlation between the larynx pathology and degree of dysphonia in professional voice users (group I).

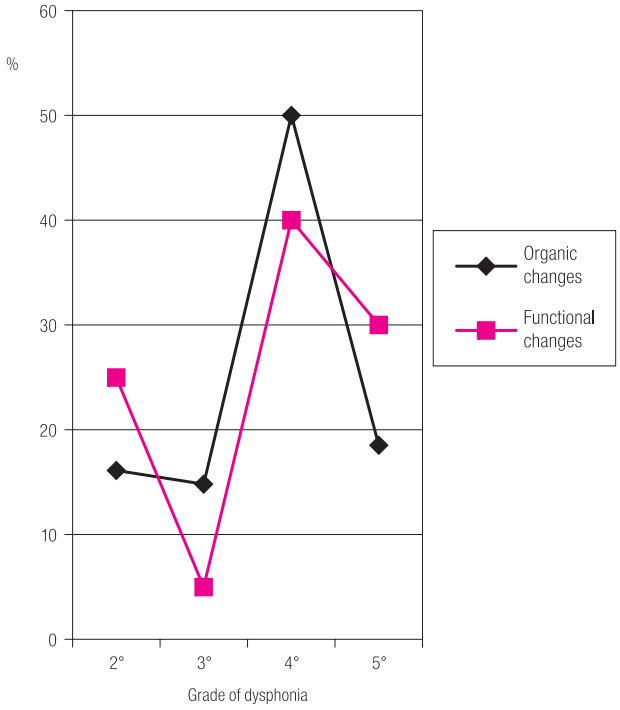

Fig. 2. Correlation between the larynx pathology and degree of dysphonia in persons of other occupations (group II).

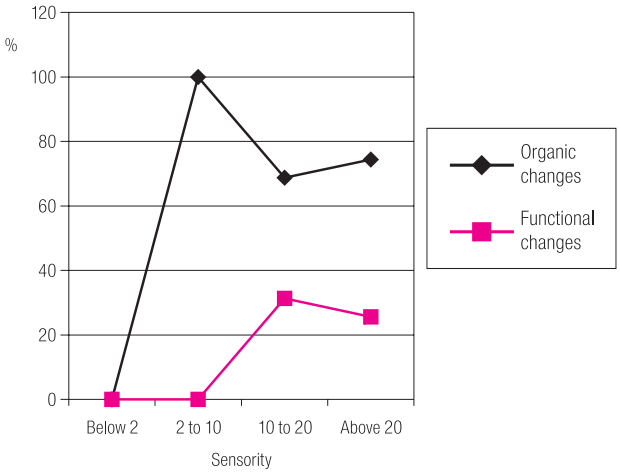

Fig. 3. Correlation between the larynx pathology and employment duration in professional voice users (group I).

(Tables 3, 4 and Fig. 3), which is apparently age-related or resulting from an untreated functional dysphonia.

In group II, patients with short employment (below 2 years) showed organic and functional dysphonia. Functional dysphonia increased with prolonged period of employment (over 15 years) (Fig. 4).

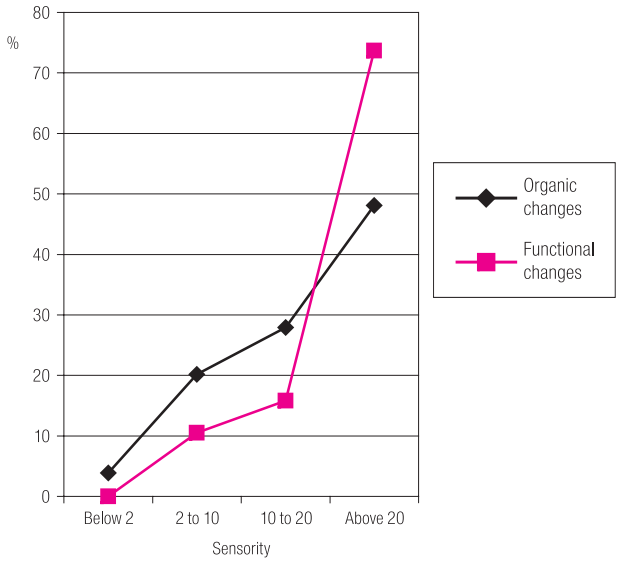

Fig. 4. Correlation between the larynx pathology and employment duration in persons of other occupations (group II).

DISCUSSION

The voice organ has constantly gained a relevance as an instrument of a professional career in modern societies. However, people tend to offer little time and attention for exercising voice and developing essential skills. They perceive their voice as a natural skill granted spontaneously during individual development. Still, intense voice usage may lead to obvious problems [10,11]. It should be emphasized that voice disturbances may be prevented by regular phoniatric control during professional career. Professional voice users tend to develop changes in voice quality, however, dysphonia is also likely to occur in persons of other occupations.

In the western countries, about 40% of teachers report voice complaints related to voice overuse [12,13]. In Poland, as much as 80% of teachers report dysphonia, which is confirmed by the objective phoniatric examination in about 40% of the cases [13]. The condition may result from abnormal voice emission and/or insufficient hygiene of the voice organ. Early phoniatric diagnosis and precisely recognized risk factors of voice pathology in professional voice users are decisive in prophylaxis of occupational diseases. Over several recent years, occupational diseases of the voice organ have advanced to the first place in this category of diseases diagnosed in Poland, thus posing a serious socioeconomic problem. In the group of professional voice users, female teachers of primary and lower secondary schools predominate, which is in agreement with the findings of other authors [7]. In this study, the voice organ pathology was determined using the most advanced objective videoendoscopic and videolaryngostroboscopic techniques of the larynx examination. This approach allows for obtaining magnified images that facilitate correct diagnosis of occupational dysphonia [6,7].

Numerous authors, laryngologists and phoniatricians frequently point to difficulties in the diagnosis of occupational diseases of the voice organ [2,5,7,9]. Therefore, new objective and recordable diagnostic techniques appeared to be necessary and the videostroboscopic method meets all essential requirements. We emphasize that this method should be also utilized in the phoniatric certification. Furthermore, accurate diagnosis and the ability to discriminate between the types of dysphonia ensures an early therapy and a better prognosis.

The most common pathologies of the voice organ in the group of professional voice users include organic changes manifested by edema of the larynx, vocal fold nodules and acute laryngitis. Their onset is observed in early years of employment, concurrently with functional changes, which aggravate in patients employed for 20 years or more. However, Zalesska-Kręcicka et al. [7] found functional changes in the vocal organ of patients after a short period of employment (≤ 10 years) with co-existent organic changes such as vocal nodules, laryngeal polyps and simple inflammations.

Organic dysphonia characterized by the vocal fold paralysis, laryngeal cysts, post-intubation granulomas predominated in patients whose occupation was not related with voice overuse. No functional dysphonia was recorded in patients with very short employment. Similar changes were found by Zalesska-Kręcicka et al. [7]. In the group of professional voice users the employment duration had statistically significant effect on the development of organic pathology in the larynx, whereas in functional pathology, this effect was mostly pronounced after 11 years of employment. In an early period of professional voice usage both functional and organic dysphonia occurred, however,

statistical differences between these types were evident not earlier than after the third year. The effect of employment duration on the organic and functional pathologies of the larynx was statistically insignificant in patients with no voice organ overuse.

The degree of dysphonia is always conditioned by aggravated pathology of the voice organ [8]. Zalesska-Kręcicka et al. [7] reviewed an ample clinical material, comprising 767 teachers, and demonstrated a higher incidence of functional voice disturbances in this group. On the other hand, the frequency of organic changes such as chronic laryngitis, vocal fold nodules or edema were similar in teachers and in the control group. In the group of professional voice users, functional changes in the larynx formed a major cause of severe dysphonia, while in other patients the etiology of dysphonia was both organic and functional.

An early onset of functional disturbances found in our material is likely to reflect the adaptation to professional voice usage as well as an occupation-related emotional component.

CONCLUSIONS

1. In the group of professional voice users significant pathological changes in the voice organ occur in the course of employment.
2. Organic changes develop earlier than functional changes in the group of professional voice users.
3. In the control group, organic dysphonia was more common than functional dysphonia.
4. In the group of professional voice users, functional changes in the larynx resulted in aggravated dysphonia in the course of employment.

REFERENCES

1. Miller MK, Verdolini K. *Frequency and risk factors for voice problems in teachers of singing and control subjects.* J Voice 1995; 9: 348–54.
2. *Statistical Yearbook of Poland*. Warsaw: Central Statistical Office; 2001 [in Polish].
3. Sułkowski W, Starzyński Z, Szeszenia-Dąbrowska N, Kubasiewicz M. *Epidemiology of otolaryngological occupational diseases in Poland in 1971–1977.* Otolaryngol Pol 1980; 34: 481–8 [in Polish].
4. Sułkowski M, Kowalska S. *Our experience in assessing of occupational diseases of the voice organ.* Otolaryngol Pol 1985; 39: 153–6 [in Polish]
5. Troczyńska A, Sułkowski W. *Diagnostic problems and certification of occupational diseases related with voice in view of our own observations.* Med Pr 1974; 25: 5–9 [in Polish].
6. Woskowiak G. *Attempt to assess causes of increased incidence of occupational diseases of the voice organ in teachers.* Med Pr 1996; 47: 519–23 [in Polish]
7. Zalesska-Kręcicka M, Kręcicki T, Gojanek P, Walulin J, Rozmiarek D. *Analysis of diseases of the voice organ in teachers treated in Phoniatric Laboratory and Otolaryngological Clinic, Medical University in Wrocław.* Przegl Lek 1999; 56: 139–43 [in Polish].
8. Pruszewicz A, editor. *Voice disturbances related with occupation*. In: *Clinical Phoniatry.* Warsaw: PZWL; 1992 [in Polish].
9. Chan RW. *Does the voice improve with vocal hygiene education? A study of some instrumental voice measures in a group of kindergarten teachers.* J Voice 1994; 8: 279–84.
10. Kosztyła-Hojna B. *Presbyphonia – evaluation of diagnostic methods in selected cases* [Post-doctoral degree thesis]. Białystok: Leda; 2001 [in Polish].
11. Kosztyła-Hojna B. *Application of videolaryngostroboscopy to diagnostics of voice disturbances in the senile age.* Pol Merk Lek 2001; 11: 221–3 [in Polish].
12. Smith E, Gray SD, Dove H, Kirchner HL, Heras H. *Frequency and effects of teachers' voice problems*. J Voice 1997; 11: 81–7.
13. Śliwińska-Kowalska M, Fiszer M, Niebudek-Bogusz E, Kotyło P, Prądzińska A. *Evaluation of the voice organ in students of the pedagogic school.* Med Pr 2000; 51: 574–9 [in Polish].