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Keywords

Dysphonia
Autonomic nervous system
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Descritores

Disfonia
Sistema nervoso autônomo
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Estresse fisiológico

Signs and symptoms of autonomic dysfunction in dysphonic individuals

Sinais e sintomas da disfunção autônoma em indivíduos disfônicos

ABSTRACT

Purpose: To verify the occurrence of signs and symptoms of autonomic nervous system dysfunction in individuals with behavioral dysphonia, and to compare it with the results obtained by individuals without vocal complaints. **Methods:** Participants were 128 adult individuals with ages between 14 and 74 years, divided into two groups: behavioral dysphonia (61 subjects) and without vocal complaints (67 subjects). It was administered the Protocol of Autonomic Dysfunction, containing 46 questions: 22 related to the autonomic nervous system and had no direct relationship with voice, 16 related to both autonomic nervous system and voice, six non-relevant questions, and two reliability questions. **Results:** There was a higher occurrence of reported neurovegetative signs in the group with behavioral dysphonia, in questions related to voice, such as frequent throat clearing, frequent swallowing need, fatigability when speaking, and sore throat. In questions not directly related to voice, dysphonic individuals presented greater occurrence of three out of 22 symptoms: gas, *tinnitus* and aerophagia. Both groups presented similar results in questions non-relevant to the autonomic nervous system. Reliability questions needed reformulation. **Conclusion:** Individuals with behavioral dysphonia present higher occurrence of neurovegetative signs and symptoms, particularly those with direct relationship with voice, indicating greater lability of the autonomic nervous system in these subjects.

RESUMO

Objetivo: Verificar a ocorrência de sinais e sintomas da disfunção do sistema nervoso autônomo em indivíduos com disfonia comportamental e compará-la com resultados obtidos por indivíduos sem queixa vocal. **Métodos:** Participaram 128 indivíduos adultos, com idades entre 14 e 74 anos, que foram divididos em dois grupos: disfonia comportamental (61 sujeitos) e sem queixa vocal (67 sujeitos). Foi aplicado o Protocolo de Disfunção Autônoma contendo 46 questões, sendo 22 relacionadas ao sistema nervoso autônomo e sem relação direta com a voz, 16 relacionadas tanto ao sistema nervoso autônomo quanto à voz, seis questões não-relevantes e duas questões de confiabilidade. **Resultados:** Nas questões relacionadas à voz, como pigarros constantes, necessidade de engolir frequentemente, cansaço ao falar e dor de garganta, houve maior ocorrência de alterações neurovegetativas no grupo com disfonia comportamental. Nas questões sem relação direta com a voz, os indivíduos disfônicos apresentaram maior ocorrência de três dos 22 sintomas: gases, zumbido e engole ar enquanto fala. Os dois grupos apresentaram resultados semelhantes nas questões consideradas não relevantes ao sistema nervoso autônomo. As questões de confiabilidade necessitaram de reformulação. **Conclusão:** Indivíduos com disfonia comportamental apresentam maior ocorrência de sintomas neurovegetativos, principalmente daqueles que possuem relação direta com a voz. Tais resultados indicam maior labilidade do sistema nervoso autônomo nesses indivíduos.

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INTRODUCTION

The autonomic nervous system (ANS) also known as visceral, vegetative or automatic, has the function of maintaining the organism stable in order to adapt any imbalance between the internal and external environments⁽¹⁾. The autonomic nervous system presents two main divisions: sympathetic (SNS) and parasympathetic nervous system (PNS). Both SNS and PNS work together in order to maintain body homeostasis, defined as the ability of the body to obtain a stable balance, despite external changes (physiological stability)⁽²⁾.

The sympathetic nervous system, in stressful situations, accelerates several body activities and prepares the body to the so called flight or fight attitude. The stress organic activation occurs in three stages: alarm stage, resistance stage, and exhaustion stage⁽³⁾. In alarm stage, at stress moment, an intense hormone discharge occurs with the main purpose of preparing the organism to one of the two possibilities: attack or escape from stress. This is called the “General Adaptation Syndrome” that is a whole body intense mobilization to dealing with stressful events. In this stage physical symptoms may occur, such as palpitations, sweating, headache, pallidness, high blood pressure, fatigue, and tinnitus, etc.

After initial excitation, the body may rest and return to a homeostatic condition in an adaptation reaction similar to what happens to any live organism (health stress reaction or eustress)⁽⁴⁾. If the body does not return to rest stage due to a stressor in which the strategies are not effective, it will search for a more satisfactory way of living with the condition. Thus, instead of general organism mobilization, it is going to have a localized mobilization, the “Local Adaptation Syndrome”. In this last case, the most vulnerable organ of the body is going to centralize all internal stress reaction. Therefore, some psychosocial symptoms may begin taking place, such as irritability, social isolation, inability to turn off and fear sensation, among others. If this situation lasts the vulnerable organ, mobilized to combat the stressor until this moment, may collapse which emerges specific symptoms to a disorder related to this organ. At this moment, the exhaustion stage begin⁽⁴⁾.

The relationship between stress and voice is well known whereby some voice disorders present emotional etiology, i.e. psychogenic dysphonia. This vocal disorders are understood by some experts as a kind of functional disorder⁽⁵⁾ or even as a totally independent category⁽⁶⁾. Traditional references in the voice field reinforce that laryngeal muscles are sensitive to stress, which may cause anxiety, irritability, impatience, frustration, and depression^(7,8). Current researches link the stress theory and voice disorders suggesting that great part of voice disorders are related to the person’s difficulty to dealing with stressful situations⁽⁹⁾.

People with voice disorders report some symptoms that may be considered as dysfunction signs in this system. However there are few researches exploring this relation between autonomic nervous system and voice. Therefore, the purpose of this research was to investigate the occurrence of signs and symptoms of dysfunction in autonomic nervous system in people with behavioral dysphonia (non-organic causes) and

to compare this population to a group of people without vocal complaint.

METHODS

This research was approved by the Research Ethics Committee of the Universidade Federal de São Paulo – UNIFESP (protocol number 0763/07). All participants signed the free and informed consent.

Participants were 128 individuals of both genders living in São Paulo city, who were divided into two groups: the group with behavioral dysphonia (BDG), composed by 61 subjects, 18 men (mean age 48.2 years) and 43 women (mean age 38.5 years); and the group without vocal complaints (WVCG), composed by 67 subjects, 22 men (mean age 35 years) and 45 women (mean age 39 years).

The inclusion criteria to BDG were: presence of vocal complaint, deviant vocal quality in the perceptual analysis, medical diagnosis for functional or organic-functional dysphonia⁽⁸⁾, and absence of previous voice treatment. The inclusion criteria to WVCG were: absence of vocal complaint or voice disorder, a self-reported good general health state, and no report of neurological or psychiatric disease.

All the participants answered to the Autonomic Dysfunction Protocol (ADP)⁽²⁾. This instrument has 46 questions, 22 related to ANS without direct relation to voice, 16 related to ANS and voice, six non-relevant questions, and two reliability questions. In order to use the questionnaire in Brazilian Portuguese, the original protocol underwent cultural and linguistic adaptation, following these strategies and steps: translation by two bilingual speech-language pathologists, one of this also an English teacher; then this version underwent a back translation to English by an English teacher non speech-language pathologist, without any previous contact with the original questionnaire and did not participate in the first translation step; finally a group of five speech-language pathologists, voice specialists, reviewed the translations and back translation (Appendix 1).

The original questionnaire just asked the respondent to mark the presence or absence of autonomic dysfunction signs and symptoms. Trying to better characterize the symptoms frequency a change was made in the instrument in which a manifestation grade of signs and symptoms was included, following this gradation scale: 0 = never, 1 = rarely, 2 = sometimes, 3 = often, 5 = always. This change is the result of a pilot project in which the gradation importance was suggested as an accurate index of the relation between dysphonia and autonomic dysfunction. “Never” indicator was considered absence of symptoms and “rarely”, “sometimes”, “often” and “always” were considered presence of neurovegetative signs and symptoms, with or without direct relation with voice. Likewise, a reorganization of tables regarding neurovegetative signs and symptoms was done and its answers were redistributed in low occurrence (“rarely” and “sometimes”); average occurrence (“often”); and high occurrence (“always”). All participants answered individually to the questionnaire in a single meeting.

The statistical analysis used the Kruskal-Wallis test, in order to check possible differences between groups. To describe and

Tabela 1. Presence of neurovegetative signs and symptoms in both groups (BDG and WVCG)

Signs and symptoms	BDG (n=61)				WVCG (n=67)				p-value
	Yes		No		Yes		No		
	n	%	n	%	n	%	n	%	
Symptoms non-related to voice									
1. Cold hands	23	37.7	38	62.2	22	32.8	45	67.2	0.395
2. Cold feet	34	55.7	27	44.3	30	44.8	37	55.2	0.203
3. Excessive transpiration	30	49.2	31	50.8	32	47.8	35	52.2	0.151
4. Excessive sensitiveness to coldness	34	55.7	27	44.3	37	55.2	30	44.8	0.847
5. Excessive sensitiveness to heat	38	62.3	23	37.7	44	65.7	23	34.3	0.093
6. Diarrhea	16	26.2	45	73.8	11	23.9	51	76.1	0.753
7. Constipation	37	60.7	24	39.3	33	49.3	34	50.7	0.405
8. Puffiness	52	85.2	9	14.8	42	62.7	25	37.3	<0.001*
9. Aerophagia	35	57.4	26	42.6	20	29.9	47	70.1	0.003*
10. Nausea	30	49.2	31	50.8	30	44.8	37	55.2	0.195
12. Eructations	39	63.9	22	36.1	32	47.8	35	52.2	0.157
13. Hiccups	33	54.1	28	45.9	39	58.2	28	41.8	0.766
14. Heartburn	46	75.4	15	24.6	43	64.2	24	35.8	0.236
15. Dizziness	39	63.9	22	36.1	41	61.2	26	38.8	0.415
16. Tinnitus	36	59	25	41	23	34.3	44	65.7	0.002*
17. Dancing spots before the eyes	28	45.9	33	54.1	33	49.3	34	50.7	0.796
18. Difficult concentration	43	70.5	18	29.5	34	50.7	33	49.3	0.079
19. Disturbed sleep	34	55.7	27	44.3	41	61.2	26	38.8	0.818
20. Lack of energy	38	62.3	23	37.7	49	73.1	18	26.9	0.948
42. Palpitations	34	55.7	27	44.3	32	47.8	35	52.2	0.680
44. Nail biting	12	19.7	49	80.3	17	25.4	50	74.6	0.183
45. Sensation of excessive tiredness	38	62.3	23	37.7	38	56.7	29	43.3	0.688
Symptoms related to voice									
23. Need of constantly swallowing	42	68.9	19	31.1	23	34.3	44	65.7	<0.001*
24. Sore throat	40	65.6	21	34.4	34	50.7	33	49.3	0.011*
25. Hyperventilation	37	60.7	24	39.3	32	47.8	35	52.2	0.580
27. Frequent sneezing	46	75.4	15	24.6	47	70.1	20	29.9	0.327
28. Fluctuating nose obstruction	41	67.2	20	32.8	38	56.7	29	43.3	0.097
29. Difficulty breathing to the nose at rest	22	36.1	39	63.9	26	38.8	41	61.2	0.994
30. Habitual mouth breathing at rest	38	62.3	23	37.7	43	64.2	24	35.8	0.883
32. Feelings of tension in the head while speaking	21	34.4	40	65.6	12	18.2	54	81.8	0.017*
34. Constant need to yawn	35	57.4	26	42.6	22	32.8	45	67.2	0.002*
35. Gnashing of teeth	9	14.8	52	85.2	14	20.9	53	79.1	0.696
36. Temporomandibular pain or discomfort	21	34.4	40	65.6	17	25.4	50	74.6	0.359
37. Neck pain (while or after speaking)	21	34.4	40	65.6	11	16.4	56	83.6	0.013*
38. Chest discomfort	26	42.6	35	57.4	12	18.2	55	82.1	0.001*
39. Fatigability when speaking	41	67.2	20	32.8	18	26.9	49	73.1	<0.001*
40. Frequent throat clearing	53	86.9	8	13.1	32	47.8	35	52.2	<0.001*
43. Social (communicative) handicap	21	34.4	40	65.6	17	25.4	50	74.6	0.275
Nonrelevant questions									
11. Lack of appetite	23	37.7	38	62.3	27	40.3	40	59.7	0.230
22. Renal problems	3	4.9	58	95.1	7	10.4	60	89.6	0.293
26. Specific allergy	30	49.2	31	50.8	28	41.8	39	58.2	0.257
31. Hearing loss	20	32.8	41	67.2	20	29.9	46	69.7	0.333
33. Headache	48	78.7	13	21.3	53	79.1	14	20.9	0.673
41. Chronic illness	22	36.1	39	63.9	24	35.8	43	64.2	0.265

*Significant values ($p \leq 0.05$) – Kruskal-Wallis test**Note:** BDG = behavioral dysphonia group; WVCG = without vocal complaint group

Tabela 2. Frequency of neurovegetative signs and symptoms

Signs and symptoms	BDG (n=61)						WVCG (n=67)					
	Low		Average		High		Low		Average		High	
	n	%	n	%	n	%	n	%	n	%	n	%
Symptoms non-related to voice												
1. Cold hands	15	24	2	3.2	6	9.8	20	29	0	0	2	3
2. Cold feet	17	27	7	11	10	16	19	28	3	4.4	8	11
3. Excessive transpiration	17	27	7	11	6	9.8	20	29	7	10	5	7.4
4. Excessive sensitiveness to coldness	21	34	7	11	6	9.8	24	35	6	9	7	10
5. Excessive sensitiveness to heat	30	49	4	6.5	4	6.5	32	47	3	4.4	9	13
6. Diarrhea	14	22	0	0	2	3	15	22	0	0	1	1.4
7. Constipation	20	32	7	11	10	16	21	31	5	7.4	7	10
8. Puffiness	23	37	12	19	16	26	31	46	6	9	5	7.4
9. Aerophagia	25	40	5	8	5	8	14	20	2	3	4	6
10. Nausea	21	34	6	9.8	3	4.9	26	38	3	4.4	1	1.4
12. Eructations	30	49	6	9.8	3	4.9	26	38	3	4.4	3	4.4
13. Hiccups	32	52	1	1.6	0	0	39	58	0	0	0	0
14. Heartburn	36	59	4	6.5	6	9.8	33	49	5	7.4	5	7.4
15. Dizziness	31	50	5	8.1	3	4.9	36	53	3	4.4	2	3
16. Tinnitus	26	42	4	6.5	6	9.8	20	29	1	1.4	2	3
17. Dancing spots before the eyes	22	36	3	4.9	3	4.9	27	40	5	7.4	1	1.4
18. Difficult concentration	28	46	8	13	7	11	23	34	8	11	3	4.4
19. Disturbed sleep	18	29	7	11	9	14	22	32	8	11	11	16
20. Lack of energy	19	31	8	13	11	18	32	47	8	11	9	13
42. Palpitations	29	47	3	4.9	2	3.2	28	41	1	1.4	3	4.4
44. Nail biting	7	11	2	3.2	3	5	10	14	1	1.4	6	9
45. Sensation of excessive tiredness	25	40	4	6.5	9	14	23	34	8	11	7	10
Symptoms related to voice												
23. Need of constantly swallowing	20	32	12	19	10	16	12	17	4	6	7	10.4
24. Sore throat	27	44	7	11	6	9.8	31	46	0	0	3	4.4
25. Hyperventilation	27	44	6	9.8	4	6.5	20	29	5	7.4	7	10.4
27. Frequent sneezing	35	57	7	11	4	6.5	37	55	2	3	8	12
28. Fluctuating nose obstruction	13	21	2	3.2	7	11	27	40.2	4	6	7	10.4
29. Difficulty breathing to the nose at rest	15	24	3	4.9	20	32	17	25	3	4.4	6	9
30. Habitual mouth breathing at rest	9	14	1	1.6	10	16	15	22	2	3	26	38
32. Feelings of tension in the head while speaking	30	49	13	21	5	8.1	11	16	0	0	1	1.4
34. Constant need to yawn	5	8.1	2	3.2	2	3.2	19	28	1	1.4	2	3
35. Gnashing of teeth	13	21	4	6.5	4	6.5	11	16	0	0	3	4.4
36. Temporomandibular pain or discomfort	12	19	7	11	2	3.2	12	17	1	1.4	4	6
37. Neck pain (while or after speaking)	14	22	7	11	5	8.1	8	12	1	1.4	2	3
38. Chest discomfort	23	37	7	11	11	18	8	12	3	4.4	1	1.4
39. Fatigability when speaking	22	36	14	22	17	27	14	20	1	1.4	3	4.4
40. Frequent throat clearing	22	36	14	22	17	27	26	38	2	3	4	6
43. Social (communicative) handicap	12	19	3	4.9	6	9.8	8	12	6	9	3	4.4
Questões não-relevantes												
11. Lack of appetite	20	32	2	3.2	1	1.6	19	28	2	3	6	9
22. Renal problems	3	5	0	0	0	0	4	6	1	1.4	2	3
26. Specific allergy	14	22	8	13	8	13	17	25	5	7.4	6	9
31. Hearing loss	12	19	4	6.5	5	8.1	12	17	2	3	6	9
33. Headache	22	36	6	9.8	7	11	37	55	6	9	10	15
41. Chronic illness	17	27	3	5	2	3.2	13	19	4	6	7	10

Chi-square test

Note: BDG = behavioral dysphonia group; WVCG = without vocal complaint group

compare the groups regarding symptoms occurrence, the results were analyzed with Chi-squared test, adjusted by Fisher statistics. The statistical significance level adopted was 5% (0.05). The Multivariate Analysis of Variance (MANOVA) was done to study the variables "age" and "sex".

RESULTS

The results show the neurovegetative signs and symptoms occurrence in BDG and WVCG (Table 1). Three symptoms non-related to voice in behavioral dysphonia group were significant: puffiness ($p<0.001$), tinnitus ($p=0.002$), and aerophagia ($p=0.003$). To voice-related symptoms in BDG, the significant ones were: frequent throat clearing ($p<0.001$), need of constant swallowing ($p<0.001$), fatigability when speaking ($p<0.001$), sore throat ($p<0.011$), constant need to yawn ($p=0.002$), chest discomfort ($p=0.001$), neck pain (while or after speaking) ($p=0.013$), and feelings of tension in the head while speaking ($p=0.017$). To WVCG, only three symptoms were higher: difficult breathing to the nose at rest ($p=0.994$), habitual mouth breathing at rest ($p=0.883$), and gnashing of teeth ($p=0.696$) but any of this were statistically significant and this result is according with previous researches^(2,11-12).

Results also show the frequencies of neurovegetative signs and symptoms (NSS) in both studied groups, in order to compare them (Table 2).

DISCUSSION

Analyzing the results from the Autonomic Dysfunction Protocol (ADP) it was observed that BDG participants had higher occurrence of signs and symptoms not related to voice. These findings are similar to the ones of a research, which concluded that a person with a non-organic dysphonia presents a higher number of symptoms related to autonomic nervous system than people without dysphonia⁽¹¹⁾. In another research, with telemarketers⁽¹²⁾, using the ADP the signs and symptoms without direct relation to voice also had a higher occurrence (seven of 22 symptoms). Comparing these results with the present study, the BDG had only three significant symptoms. It was observed that telemarketers had higher occurrence than dysphonic people, maybe due to be in a high stress environment, present in diverse ways, such as: sale goals, time and service quality, and client satisfaction⁽¹²⁾.

Regarding the neurovegetative signs and symptoms direct related to voice, the BDG was statistically different from the WVCG in eight out of 28 questions. It is known that dysphonic people, different from non-dysphonic, apply greater value to negative stress events. Besides, researches point out that stress leads to several physical consequences and autonomic nervous system may modify oral and vocal fold secretions, the cardiac rhythm and the gastric acid production⁽¹¹⁾.

Analyzing neurovegetative signs and symptoms frequency to both groups, BDG presented higher frequency of signs and symptoms both with and without direct relation to voice. The frequency of non-relevant signs and symptoms was not statistically significant between groups. There was an important

frequency of headache, result already observed^(13,14).

The survey of neurovegetative signs and symptoms frequency favored the comprehension and interpretation of obtained results. These findings allow deducing that people with behavioral dysphonia may present high number of neurovegetative signs and symptoms that may compete with predisposing etiological factors to develop dysphonia⁽¹⁵⁻¹⁸⁾.

Using the Autonomic Dysfunction Protocol in voice clinic may provide relevant information to a better comprehension of the dysphonic patient. The most deviant items and related direct to voice may be addressed in voice therapy and its evolution followed with the development in therapy; if an important deviation in autonomic nervous system items without direct relation to voice are identified an evaluation of a specialist may be suggested.

CONCLUSION

In general, people with behavioral dysphonia present higher occurrence of neurovegetative symptoms, mainly the ones directly related to voice. These results indicate higher Autonomic Nervous System liability in these individuals.

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Appendix 1. Autonomic Dysfunction Protocol (ADP) in Brazilian Portuguese

Nome: _____ data: _____
Idade: _____ H.D: _____

Marque com um X os sintomas ou queixas que tem sentido ultimamente. Não existem respostas certas ou erradas. Para responder ao questionário, considere tanto a gravidade do problema, como sua frequência de aparecimento, avaliando cada item abaixo de acordo com o sinal ou sintoma que você tem. A escala que você irá utilizar é a seguinte: 0 = nunca; 1 = raramente; 2 = às vezes; 3 = muitas vezes; 4 = sempre

Número	Queixa	Grau				
		0	1	2	3	4
1	Mãos frias	0	1	2	3	4
2	Pés frios	0	1	2	3	4
3	Suor excessivo	0	1	2	3	4
4	Sente muito frio	0	1	2	3	4
5	Sente muito calor	0	1	2	3	4
6	Diarréia	0	1	2	3	4
7	Prisão de ventre/intestino preso	0	1	2	3	4
8	Gases	0	1	2	3	4
9	Engole ar	0	1	2	3	4
10	Enjôos	0	1	2	3	4
11	Falta de apetite	0	1	2	3	4
12	Arrotos	0	1	2	3	4
13	Soluços	0	1	2	3	4
14	Azia (queimação)	0	1	2	3	4
15	Tontura	0	1	2	3	4
16	Zumbido	0	1	2	3	4
17	Vê pontos luminosos	0	1	2	3	4
18	Dificuldade de concentração	0	1	2	3	4
19	Dorme mal	0	1	2	3	4
20	Sente falta de energia	0	1	2	3	4
21	Você é tenso	0	1	2	3	4
22	Problemas nos rins	0	1	2	3	4
23	Necessidade de deglutir constantemente	0	1	2	3	4
24	Dor de garganta	0	1	2	3	4
25	Respiração ofegante	0	1	2	3	4
26	Alergia específica	0	1	2	3	4
27	Espirros	0	1	2	3	4
28	Nariz entupido	0	1	2	3	4
29	Respiração nasal difícil	0	1	2	3	4
30	Respira pela boca (quando em repouso)	0	1	2	3	4
31	Perda de audição	0	1	2	3	4
32	Tensão na cabeça enquanto fala	0	1	2	3	4
33	Dor de cabeça	0	1	2	3	4
34	Necessidade constante de bocejar	0	1	2	3	4
35	Ranger os dentes	0	1	2	3	4
36	Dor ou desconforto temporomandibular	0	1	2	3	4
37	Dor no pescoço (durante ou após a fala)	0	1	2	3	4
38	Desconforto no peito (durante ou após a fala)	0	1	2	3	4
39	Cansaço ao falar	0	1	2	3	4
40	Pigarros constantes	0	1	2	3	4
41	Doenças crônicas	0	1	2	3	4
42	Palpitações do coração	0	1	2	3	4
43	Dificuldade de se comunicar com outras pessoas	0	1	2	3	4
44	Roer unhas	0	1	2	3	4
45	Sensação de cansaço extremo	0	1	2	3	4
46	Você é nervoso	0	1	2	3	4

Source: translated and adapted from Demmink-Geertman L, Dejonckere PH. Nonorganic habitual dysphonia and autonomic dysfunction. J Voice. 2002;16(4):549-59.