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Time for Complete Vocal Recovery in Voice Professionals Undergoing Polyp Surgery

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Abstract

Introduction: The voice is an important element for an individual in his personal and professional relationships. By means of it, we convey a message and are able to maintain communication. Some people use it as a working tool; they are called voice professionals and are classified into Koufman's levels. Improper and strenuous use added to external elements, however, may cause vocal fatigue and when exertion exceeds the compensatory mechanisms, dysphonia by phonotraumatic lesions mainly polyps happen as a result.

Aim: To establish a secure parameter for the required time of vocal rest for functional and professional voice recovery after laryngeal microsurgery.

Methods: Through objective variables, 68 voice professionals, Koufman's level I and II with vocal polyps, who underwent laryngeal microsurgery, were selected and compared to 100 people with healthy voice from the preoperative moment up to 3 months postoperatively, based on an acoustic analysis with the shimmer, jitter, NHR and VPQ variables.

Results: All variables at 1 month postoperatively were seen to be adequate within normal limits.

Conclusion: After the surgical correction of polyps, we found the need for 1 month vocal rest for complete and safe vocal recovery.

Keywords: Larynx; Polyps; Microsurgery

Introduction

The voice, an essential personal element when conveying a message, has its development from birth to the complete anatomical maturation of the vocal organ, which defines it as an important element in interpersonal, social and professional relationships [1]. It is even more relevant for those who use it as an occupational tool-they are called voice professionals and are divided into categories [2]. Based on the connection between jobs and the use of voice and taking into account the demand and importance of the voice for the professional practice, Koufman has developed a classification in which occupations are divided into four levels [3]:

- Level I-Elite vocal performer (singers and professional actors);
- Level II-Professional voice user (teachers, lecturers, clergy);
- Level III-Non-vocal professionals (businesspeople, doctors, lawyers);
- Level IV-Non-vocal nonprofessionals (computer programmers, factory workers).

Among the occupations encompassed at levels I and II, the strict vocal exertion reaches the functional capacity of vocal organs, while creating adjustments. When that compensatory mechanism reaches its limit, dysphonic symptoms arise, such as vocal fatigue, voice quality fluctuations and loss of voice power and volume, which hinder a person's verbal and emotional communication [3].

Apart from organic disorders, dysphonia may cause psychological disorders, difficulties in social and personal relationships, while negatively impacting quality of life. It is a multifactorial condition and it should be analyzed within the context and environment in which it occurs [4]. Studies have shown that excessive noise, dust, air conditioning and carpets deteriorate the quality of teachers' voice, as well as ventilation and poor cleaning of classrooms [5].

Work-related dysphonia, in particular, varies according to degree and complexity [6]:

- **Mild degree:** Worker is able to perform his/her usual vocal activities with minimal difficulty, rare fatigue and without interruptions;
- **Moderate degree:** Worker is able to perform his/her usual vocal activities, but with him/herself and/or other listeners perceiving struggle, failures, occasional to frequent fatigue and need for interruptions;
- **Severe degree**: Worker is unable to perform his/her activities or performs them with great struggle, severe fatigue and long interruptions;
- **Extreme degree or aphonia:** Worker is unable to perform his/her activities.

When facing a dysphonia scenario, it is necessary to proceed with etiological and morphological investigations, as well as grading of its severity in order to create safe parameters for treatment [7]. For some

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laryngeal diseases, non-surgical treatment is recommended with exercises that will improve voice functional capacity and the vocal lesion. However, if the traditional treatment in itself is either not enough or not advised (malignant lesions, acute hemorrhagic lesions, among others) then surgical intervention is needed [7]. In a study carried out at the Paranaense Institute of Otorhinolaryngology (IPO Hospital), the most prevalent larynx lesions were determined and surgical intervention was recommended as a first-choice treatment or due to therapeutic failure. The most common lesion was the vocal polyp – with 37% of cases studied – followed by papilloma, cyst, nodules, Reinke's edema and ultimately sulcus vocalis and carcinoma [8].

According to the literature, the recovery time for the professional voice after microsurgery of the larynx due to phonotraumatic lesion is yet to be well established, especially for the most frequent etiology: Vocal cord polyps. Polyps are phonotraumatic lesions with exophytic appearance, mostly unilateral, sessile or pediculated with gelatinous, fibrous or angiomatous appearance [9].

There is evidence that singers should recover for a period of 2 to 3 months with the possibility of taking up to a year to feel comfortable with their voice. In most severe cases, patients may require years of rehabilitation [10]. In this study, we tried to establish a parameter for the vocal rest time needed for functional and professional recovery of the voice after microsurgery of the larynx, while looking at polypoid phonotraumatic lesions in voice professionals of economically active age.

Materials and Methods

This is a prospective study. Koufman's Level I (vocal elite) and II (professional voice user) voice professionals were studied, who were diagnosed with vocal fold polyps after being examined by laryngologists at the IPO Hospital in the city of Curitiba from January 2013 to January 2015 [3]. The research project was approved by IPO Hospital's Ethics Committee for Human Research under No 0018/2013 and an informed written consent was collected from each patient. The study included 18 to 65 year old patients, Koufman's level I and II with vocal fold polyps-smokers ruled out-who comprised group 1 [3]. For comparative reasons, there was a control group consisting of 100 non smoking people, without larynx lesions and half of each gender.

Patients underwent the following analyses:

a) Completion of the Vocal Performance Questionnaire (VPQ) in Brazilian Portuguese [11].

b) Vocal Acoustic Analysis with measurement of the following parameters:

- Jitter (%), it evaluates the frequency cycle by cycle and is related to roughness. Reference value: lower or equal to 1.040% [12].
- Shimmer (%), it evaluates the amplitude; it is related to hoarseness and is accurate in the description of the vocal features of normal and dysphonic speakers. Reference value: Lower or equal to 3.810% [12].
- Noise Harmonic Ratio (NHR), is higher for women between the ages of 21 and 63, but not sensitive to tell normal voice and dysphonia apart. Reference value: higher than 20 [12].
- Videostroboscopy

The questionnaire completion, vocal acoustic analysis and videolaryngoscopy examination were carried out throughout four different moments: one day before surgery, on the 30th, on the 60th and on the 90th day postoperatively. The acoustic analysis was performed in an acoustically treated room with the Praat software [13]. A Shure SM 48 dynamic microphone was used and kept at a fixed distance of 5 cm from the patient's mouth.

Vocal samples were gathered during the sustained emission of the /a/ vowel, while keeping height and intensity at comfortable levels. Both first and both final seconds of each sample were disregarded.

Videostroboscopy examinations were performed under topical anesthesia with lidocaine 10%, with a telescope for cooperative patients and nasofibroscope for the others, as well as the following equipment:

- 7 mm Rigid Laryngeal Telescope at 70° (STORZ)
- 3.2 mm Flexible nasofibrolaryngoscope (MACHIDA ENT 32)
- Karl *Storz* laryngostroboscope Pulsar
- Microcamera (ASAP)
- DVD recorder (SONY)
- Video monitor (LG 22 inches)

Systemic and General otorhinolaryngoscopic examination were done for every patient to exclude patients with chronic respiratory and heart diseases. The surgeries were performed at IPO Hospital's Surgical Center with suspension laryngoscopy. Patients were intubated with endotracheal tube (5.5 to 6.0 mm diameter) under general anesthesia. Subsequently, with the patient in dorsal decubitus without any pillows, we inserted the universal suspension Dan laryngoscope; whose size is 18 cm length, 2 cm height and 1.5 cm width. The materials used in the surgery were the following: microscope (ZEISS PICO), 400 mm objective lens coupled to the microcamera, 42 inches LG video monitors, rigid laryngoscopes with laryngeal clamps and micro-tweezers. Microsurgeries were performed through the cold technique. In no case was laser used. All the patients were advised to have an eight-day vocal rest and subsequently referred to at least eight phonotherapy sessions.

Statistical Analysis

Quantitative variables were expressed as the statistical mean, median, minimum value, maximum value and standard deviation (SD). The Student's t-test was used to determine significant differences. Differences with p-values <0.05 were considered significant.

Results

Sixty eight patients completed the four stages of data collection. There is a higher number of women who underwent microsurgery of the larynx, which is compatible with previous studies. Average age was 35.4 years old. Angiomatous polyps were the most frequent ones with 39 cases (54.9%). Such findings were compatible with previous studies [14,15].

Discussion

Phonotraumatic lesions, which are common in our practice, clinically appear in various forms depending on patient's response to the aggression. Elements such as glottic configuration and exposure to chemicals and allergens have already been described to explain the formation of different types of lesions. Recent studies have discussed the different amount of fibronectin and hyaluronic acid in the vocal folds of men and women, which also seem to explain the higher prevalence of nodules in females and polyps in males [16,17]. In accordance with the literature, this study has shown higher incidence of polyps in males, with 38 cases (55.8%) [18-20].

In the preoperative evaluation, great alterations in the acoustic analysis measurement, as well as in the score of the vocal performance questionnaire were observed. As for the acoustic evaluation, which is useful to complement both vocal evaluation and speech production, there are several parameters to be studied. The most common ones are: fundamental frequency, jitter, shimmer and NHR [21]. Those parameters, with the exception of the fundamental frequency, were compared between group 1 and the control group from the preoperative moment up to 3 months postoperatively, as shown on Table 1. The measurements of frequency and amplitude variation cycle by cycle, jitter and shimmer respectively, in the emission of sustained vowels have proved to be useful in the description of the vocal features of normal and dysphonic speakers and are related, respectively, to roughness and hoarseness [21].

The NHR characterizes the relationship between both components of the acoustic wave of a sustained vowel: the periodic component, regular sign of the vocal folds and the additional noise coming from the vocal folds and the vocal tract.

As it can be seen on Table 2 through the jitter variable, group 1 values were different from the control group and from the results from the literature in the preoperative moment [13]. In the 1 month moment, the results from group 1 were already considered normal and remained so up to the final 3 month moment. There was no significant statistical difference between the 1 month and the 2 months moments, neither between the 2 months and the 3 months moments.

In the evaluation of the shimmer variable, as shown on Table 3, group 1 values were different from the comparison group and from the results from the literature in the preoperative moment [12]. In the 1 month moment, the results from group 1 were already considered normal and remained so. There was a significant statistical difference between the 1 month and 2 months moments and between the 1 month and 3 months ones, while the difference between the 2 months and 3 months moments was not significant.

In the evaluation of the NHR variable shown on Table 4, group 1 values were different from the control group and from the results from the literature in the preoperative moment [12]. In the 1 month moment, the results from group 1 were already considered normal just like the other ones. There was a significant statistical difference only between the preoperative vs. 1 month moments and not significant between the 1 month vs. 2 months and 2 months vs. 3 months moments [22].

Period	Variables	n	Average	Standard Deviation	Minimum	Median	Maximum
Preoperative	Jitter	68	1.05	0.39	0.09	1.06	2.18
	Shimmer	68	2.04	0.41	1.22	2.06	3.07
	NHR	68	14.68	2.57	10.45	14.17	22.76
	VPQ	68	44.65	4.97	35.00	45.00	52.00
1 month postoperatively	Jitter	68	0.64	0.26	0.08	0.63	1.31
	Shimmer	68	1.57	0.10	1.35	1.57	1.83
	NHR	68	20.30	1.75	11.72	20.59	23.73
	VPQ	67	18.51	2.32	15.00	18.00	24.00
2 months postoperatively	Jitter	68	0.72	0.25	0.00	0.78	1.21
	Shimmer	68	1.40	0.20	1.01	1.41	1.72
	NHR	68	19.97	1.95	10.67	20.41	22.40
	VPQ	68	16.66	1.32	14.00	17.00	19.00
3 months postoperatively	Jitter	68	0.69	0.24	0.17	0.75	1.16
	Shimmer	68	1.25	0.36	0.18	1.31	2.01
	NHR	68	20.93	1.81	12.69	20.95	23.69
	VPQ	68	16.46	1.77	13.00	16.00	19.00
Control	Jitter	100	0.84	0.18	0.47	0.84	1.14
	Shimmer	100	1.66	0.11	1.18	1.66	1.83
	NHR	100	20.95	0.95	18.68	20.85	23.73
	VPQ	100	18.97	1.44	17.00	19.00	21.00

Table 1: Statistical comparison of vocal analysis and VPQ variables: group 1 × control group.

Comparison	Estimated difference*	p-value	Confidence Interval (95%)	
1 month pre-post	0.41	<0.01	0.32	0.49
2 months pre-post	0.33	<0.01	0.24	0.41
3 months pre-post	0.36	<0.01	0.28	0.45
1 month post-2 months post	-0.08	0.07	-0.16	0.01
1 month post-3 months post	-0.04	0.31	-0.13	0.04
2 months post-3 months post	0.03	0.42	-0.05	0.12
Control-pre	-0.21	<0.01	-0.29	-0.13
Control-1 month post	0.20	<0.01	0.11	0.28
Control-2 months post	0.12	<0.01	0.04	0.20
Control-3 months post	0.15	<0.01	0.07	0.23

*Square root transformation was used in the response variable

Table 2: Descriptive statistics of the Jitter variable.

Comparison	Estimated difference*	p-value	Confidence Interval (95%)	
1 month pre-post	0.47	<0.01	0.38	0.56
2 months pre-post	0.64	<0.01	0.56	0.73
3 months pre-post	0.79	<0.01	0.70	0.88
1 month post-2 months post	0.17	<0.01	0.09	0.26
1 month post-3 months post	0.32	<0.01	0.23	0.41
2 months post-3 months post	0.15	<0.01	0.06	0.23
Control-pre	-0.38	<0.01	-0.46	-0.30
Control-1 month post	0.09	0.03	0.01	0.17
Control-2 months post	0.26	<0.01	0.18	0.34
Control-3 months post	0.41	<0.01	0.33	0.49

* Square root transformation was used in the response variable

Table 3: Descriptive statistics of the Shimmer variable.

Comparison	Estimated difference*	p-value	Confidence Interval (95%)	
1 month pre-post	-5.62	<0.01	-6.17	-5.08
2 months pre-post	-5.29	<0.01	-5.83	-4.75
3 months pre-post	-6.25	<0.01	-6.79	-5.71
1 month post-2 months post	0.33	0.23	-0.21	0.87
1 month post-3 months post	-0.62	0.02	-1.17	-0.08
2 months post-3 months post	-0.96	<0.01	-1.50	-0.41
Control-pre	6.27	<0.01	5.71	6.82
Control-1 month post	0.64	0.02	0.09	1.20
Control-2 months post	0.97	<0.01	0.42	1.53
Control-3 months post	0.02	0.95	-0.54	0.57

Table 4: Descriptive statistics of the NHR variable.

Comparison	Estimated difference*	p-value	Confidence Interval (95%)	
1 month pre-post	26.14	<0.01	25.26	27.03
2 months pre-post	27.99	<0.01	27.10	28.87
3 months pre-post	28.19	<0.01	27.31	29.07
1 month post-2 months post	1.84	<0.01	0.96	2.73
1 month post-3 months post	2.05	<0.01	1.16	2.94
2 months post-3 months post	0.21	0.65	-0.68	1.09
Control-pre	-25.68	<0.01	-26.49	-24.86
Control-1 month post	0.46	0.27	-0.36	1.28
Control-2 months post	2.31	<0.01	1.49	3.12
Control-3 months post	2.51	<0.01	1.70	3.33

Table 5: Descriptive statistics of the VPQ variable.

As for the VPQ, in the preoperative evaluation there was great alteration in the score. In this study, the VPQ average for patients in group 1 was 44.65. Such result shows a great vocal impact in this type of phonotraumatic lesion. In group 1, an improvement in the VPQ score already in the first month postoperatively is observed; the values reach those of the control group (18.51 in group 1 and 18.97 in the control group) and keep falling in the subsequent 2 months postoperatively, as shown on Table 5. A comparison between the results gathered and other studies is not possible, because there are no similar studies available in the literature.

The measurement of quality of life as an evaluation method in the treatment of patients with dysphonia has increased. This makes possible to assess the effectiveness of the therapy, as well as to identify patients' preferences. One way to perform that evaluation is by giving a self-evaluation questionnaire with questions related to behavior, feelings and symptoms [15,23,24].

The VPQ facilitates the study of the impact of a voice problem in the quality of life of dysphonic individuals. The use of protocols that evaluate the quality of life related to the voice, such as the VPQ, may provide - in big populations with vocal complaints-the identification of details in the perception of the impact caused by the dysphonia according to gender, age group and professional vocal use. In the VPQ validation in Brazil, Paulinelli et al. gave this questionnaire to 165 people with no vocal complaints and reported an average score of 19 points, which is similar to our control group [11].

Conclusion

Given the argumentation and data shown, we have determined that the necessary period of time for complete vocal recovery after a microsurgery of the larynx in voice professionals, due to vocal polyps, is one month.

Conflict of Interest

The authors deny any conflict of interest.

References

1. do Amaral Catani GS, Hamerschmidt R, Moreira AT, Timi JR, Wiemes GR, et al. (2016) Subjective and objective analyses of voice improvement after phonosurgery in professional voice user. Med Probl Perform Art 31: 18-24.
2. Silva MSB (2012) Considerações periciais acerca da voz enquanto instrumento de trabalho. Goiânia: Revista Especialize.

3. Koufman JA (1991) Approach to the patient with a voice disorder. Otolaryngol Clin North Am 24: 989-998.
4. Ortiz E, Costa EA, Spina AL, Crespo AN (2004) Multidisciplinary protocol proposal for professional dysphonia: preliminary study. Rev Bras Otorrinolaringol 70: 590-559.
5. Araújo TM, Reis EJ, Carvalho FM, Porto LA, Reis IC, et al. (2008) Factors associated with voice disorders among women teachers. Cad Saude Publica 24: 1229-1238.
6. Associação Brasileira De Otorrinolaringologia e Cirurgia Cérvico-Facial (2017) 3° Consenso nacional sobre voz profissional, voz e trabalho: uma questão de saúde e direito do trabalhador.
7. Martins RH, do Amaral HA, Tavares EL, Martins MG, Gonçalves TM, et al. (2016) Voice disorders: Etiology and diagnosis. J Voice 30: 761e1-761e9.
8. Catani GSA (2012) Utilização de protocolo eletrônico de coleta de dados para avaliação das alterações laringoscópicas em pacientes submetidos à microcirurgia de laringe. Curitiba: Universidade Federal do Paraná.
9. Johns MM, Garrett CG, Hwang J, Ossoff RH, Courey MS (2004) Quality-of-life outcomes following laryngeal endoscopic surgery for non-neoplastic vocal fold lesions. Ann Otol Rhinol Laryngol 113: 597-601.
10. Emerich KA, Baroody MM, Carroll LM (1998) The singing voice specialist. In: Sataloff RT (eds.) Vocal Health and Pedagogy. San Diego: Singular Publishing Group, pp 315-334.
11. Paulinelli BR, Gama ACC, Behlau M (2012) Validação do questionário de performance vocal no Brasil. Rev Soc Bras Fonoaudiol 17: 85-91.
12. Araújo SA, Grellet M, Pereira JC, Rosa MO (2002) Normatização de medidas acústicas da voz normal. Braz J Otorhinolar 68: 540-544.
13. Boersma P, Weenink DJM (2001) Praat, a system for doing phonetics by computer. Glot International 2001; 5: 341-345.
14. Deary IJ, Wilson JA, Carding PN, MacKenzie K (2003) VoiSS: A patient-derived voice symptom scale. J Psychosom Res 54: 483-489.
15. Lehmann W, Pampurik J, Guyot JP (1989) Laryngeal pathologies observed in microlaryngoscopy. Otorhinolaryngol Relat Spec 51: 206-215.
16. Kleinsasser O (1974) Microlaryngoscopy and endolaryngeal microsurgery. II: A review of 2500 cases (author's transl). HNO 22: 69-83.
17. Gaston J, Thibeault SL (2013) Hyaluronic acid hydrogels for vocal fold wound healing. Biomatter 3: e23799.
18. Mizuta M, Hirano S, Ohno S, Kanemaru S, Nakamura S, et al. (2014) Restoration of scarred vocal folds using 5 amino acid-deleted type hepatocyte growth factor. Laryngoscope 124: E81-E86.
19. Tateya I, Tateya T, Watanuki M, Bless DM (2015) Homeostasis of hyaluronic acid in normal and scarred vocal folds. J Voice 29: 133-139.
20. Carding PN, Wilson JA, MacKenzie K, Deary IJ (2009) Measuring voice outcomes: State of the science review. J Laryngol Otol 123: 823-829.
21. Williamson G (2015) Objective measurement of voice.
22. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, et al. (1997) The voice handicap index: Development and validation. Am J Speech Lang Pathol 6: 66-70.
23. Hogikyan ND, Sethuraman G (1999) Validation of an instrument to measure voice-related quality of life (V-RQOL). J Voice 13: 557-569.
24. Gliklich RE, Glovsky RM, Montgomery WW (1999) Validation of a voice outcome survey for unilateral vocal cord paralysis. Otolaryngol Head Neck Surg 120: 153-158.