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# Effect of the comprehensive voice rehabilitation program in teachers with behavioral dysphonia

# *Efeito do programa integral de reabilitação vocal em professoras com disfonia comportamental*

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**Keywords**

Voice
Dysphonia
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## ABSTRACT

**Purpose:** Analyze the effects of the Comprehensive Vocal Rehabilitation Program (CVRP) and the motivational stages during speech therapy in teachers with behavioral dysphonia. **Methods:** Retrospective, longitudinal, observational study using data from the medical records of 33 teachers regarding auditory-perceptual, acoustic, self-perception analyses and the Voice Handicap Index (VHI-10) protocol in pre- and post-speech therapy situations, and motivational stages of adherence to treatment. **Results:** Auditory-perceptual assessment of the voice showed that 64.7% of the participants improved voice quality post-speech therapy. Comparison between the pre- and post-speech therapy moments showed that 82.4% of the teachers improved their voice according to self-perception. The VHI-10 showed no statistically significant difference between the pre- and post-speech therapy moments ($p$=0.879). Acoustic analysis of the voice showed improvement in the means of all evaluated parameters. Statistically significant correlation was observed in the analysis between the pre- and post-speech therapy moments only for the variables maximum phonation time and shimmer. Most of the teachers were at the stage of contemplation on the URICA-VOICE scale. No statistical significance was observed in the correlation analysis between VHI-10, auditory-perceptual assessment of the voice, maximum phonation time, and parameters of acoustic analysis with vocal self-perception of teachers and with auditory-perceptual assessment of voice. **Conclusion:** The use of CVRP for the treatment of behavioral dysphonia presented positive results in the pre-and post-speech therapy evaluation. As for motivation, the teachers strongly believed in the possibility of facing the problem, but still without much effort to change this situation.

**Descritores**

Voz
Disfonia
Fonoterapia
Motivação
Docentes

## RESUMO

**Objetivo:** analisar os efeitos do Programa Integral de Reabilitação Vocal (PIRV) e os estágios motivacionais durante a terapia de voz em professoras com disfonia comportamental. **Método:** estudo observacional longitudinal retrospectivo com dados de prontuários de 33 professoras referente à análise perceptivo-auditiva, acústica, autopercepção vocal e Protocolo de Índice de Desvantagem Vocal (IDV-10) nas situações pré e pós-fonoterapia e estágios motivacionais de adesão ao tratamento. **Resultados:** Na avaliação perceptivo-auditiva da voz, 64,7% das participantes melhoraram a qualidade vocal pós-fonoterapia. Quando comparados os momentos pré e pós-fonoterapia, observou-se que 82,4% das professoras melhoraram a voz segundo a autopercepção. O IDV-10 não mostrou diferença entre os momentos pré e pós-fonoterapia (p=0,879). Na análise acústica da voz, observou-se melhora da média de todos os parâmetros avaliados. Houve associação estatisticamente significante na análise entre os momentos pré e pós-fonoterapia apenas nas variáveis tempo máximo de fonação e *shimmer*. A maioria das professoras encontrou-se no estágio de contemplação na escala URICA-VOZ. Não houve significância estatística na análise de associação entre o IDV-10, análise perceptivo-auditiva, tempo máximo de fonação e parâmetros da análise acústica com a autopercepção vocal das professoras e com a avaliação perceptivo-auditiva da voz. **Conclusão:** o uso do PIRV para tratamento de disfonias comportamentais promoveu resultados positivos quando comparada a avaliação vocal antes e após tratamento. Quanto à motivação, as professoras acreditavam com firmeza na possibilidade de enfrentar o problema, mas ainda sem muito esforço para mudar essa situação.

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## INTRODUCTION

Vocal unpreparedness to meet work demands is a basic problem of spoken voice professionals, and is the most common cause of behavioral dysphonia, which is characterized by excessive and incorrect use of the voice. Spoken voice professionals such as teachers present cumulative impairments that limit their performance in the course of their profession and can result in functional or organofunctional dysphonia, also called behavioral dysphonia[1].

Dysphonia can be defined as an oral communication disorder determined by difficulty in vocal emission that hinders the natural production of the voice[1]. Faced with demand, working conditions, and lack of vocal preparation, teachers often use inappropriate vocal adjustments such as variations in frequency and maintenance of increased intensity of the voice to compete with classroom noise and draw the attention of students, generating voice failures, hoarseness, effort in speaking, dry throat, and throat clearing[2-4].

In this context, the practice of Speech-language Pathologist (SLP) with teachers considers the voice as a work tool that, consequently, needs to be cared so that it is not influenced by impairment-triggering factors. It is also important to address the voice as an expression and, as such, the practice involves the potential of teachers, ensuring that they perceive the richness of effects that can be generated through the use of their voice in the communication with people, always adjusting the vocal parameters according to their individual social, personal and professional demands[5]. Thus, SLP practice with teachers aims at raising awareness and empowering these professionals regarding the development of their communicative and vocal potential, in addition to observing the environmental and organizational factors of teaching.

The clinical evaluation protocol for dysphonia consists of perceptual-auditory assessment, videostroboscopy, acoustic analysis, aerodynamic measurements, and voice impairment self-perception. Such standardization enables comparison between evaluation results and those described in the literature, regardless of the type of treatment employed[6]. In addition, other protocols such as the Voice Handicap Index (VHI-10)[7] and the University of Rhode Island Change Assessment (URICA-VOICE)[8,9] scale have been used to assist with understanding voice impairment in various domains of life and the individuals' motivation about their capacity for behavioral change related to health.

Speech therapy is considered the best treatment for behavioral dysphonia, and aims at guiding teachers about the basics of vocal hygiene, voice care, and abuse and misuse of the voice, and at indicating strategies that favor a better work environment, in addition to adjusting vocal resistance. Programs containing sessions of defined therapies, such as the Comprehensive Voice Rehabilitation Program (CVRP) can be used in this therapeutic process[10].

The present study aims to analyze the effects of the CVRP and the motivational stages during speech therapy in teachers with behavioral dysphonia.

## METHODS

This is a retrospective, longitudinal, observational study conducted with teachers with behavioral dysphonia from the public school system. The study assessed the medical records of teachers assisted at a university extension project conducted in the Speech-Language Pathology Outpatient Clinic of the Federal University of Minas Gerais (UFMG). All participants signed an Informed Consent Form (ICF) prior to study commencement.

Inclusion criteria were as follows: female teachers from the municipal educational network aged 18-55 years, with complaints of dysphonia, without laryngeal lesion at videolaryngoscopy, who were referred to the outpatient clinic by the Occupational Health sector. Exclusion criteria comprised teachers with other types of speech or language disorders; hormonal disorders; psychogenic, psychiatric or spasmodic dysphonia; professional singers, and professionals with a history of diagnosis of neurological problems or recent acute laryngeal conditions.

Functional dysphonic teachers attended 40-minute weekly sessions for two months. The developed sessions follow the Comprehensive Voice Rehabilitation Program (CVRP), which works on vocal aspects such as body-voice, glottal source, resonance, pneumophonoarticulatory coordination, and communicative attitude in sessions with orientation and alternative approaches that encourage the daily practice of proposed exercises, providing motor learning[10].

The following information contained in the medical records was used for data collection: auditory-perceptual assessment, acoustic analysis, pre- and post-program vocal self-perception, and analysis of vocal impairment self-perception and motivational stages of speech therapy.

Auditory-perceptual and acoustic analyses of the voice were performed before and after speech therapy to measure the results of this intervention. In addition to these assessments, the Voice Handicap Index (VHI-10) protocol was used[7] pre-and post-speech therapy to identify the voice impairments of teachers and the University of Rhode Island Change Assessment URICA-VOICE scale[9] was applied in the fourth session to identify the stages of motivation regarding vocal change. Self-perception of the teachers was verified by the question "How do you evaluate your voice?", and the following response options were available: excellent, very good, good, reasonable, and poor.

Samples of sustained emission of the vowel /a/ were collected for the auditory-perceptual evaluations of the voices. The assessments were conducted by two speech-language pathologists with over 15 years of experience in the field of voice. Evaluation was achieved by consensus and comparison task. For each pair of voices, the judges were instructed to respond whether they were the same or which one had improved or worsened, and also to inform the general degree of dysphonia (G) of the two voices using the auditory-perceptual parameter of the GRBAS scale: G (overall grade of hoarseness); R (roughness); B (breathiness); A (asthenic), and S (strained quality) of the voice, graded on a four-point Likert scale as follows: 0 = non-hoarse or normal, 1 = slight, 2 = moderate, and 3 = severe[11]. The referees had no prior knowledge about whether the analyzed voice had been

collected pre- or post-speech therapy, or to which time along the intervention it belonged.

Sustained emission of the vowel /a/ with habitual frequency and intensity were collected for the acoustic measurements. The beginning and end of the utterances were eliminated due to the irregularities usually contained in these sections.

Voice recordings were performed in an acoustic booth directly into a computer (Dell® - Optiplex GX260) equipped with a professional sound board (Direct Sound®), using of a condenser-type microphone (Shure® - 16ª) diagonally positioned 10 cm away from the patient's mouth with a 45º directional capture angle, using Audacity® software.

The following acoustic parameters were selected for evaluation: maximum phonation time (MPT), mean fundamental frequency ($F_0$), jitter (%), pitch perturbation quotient (PPQ %), shimmer (%), amplitude perturbation quotient (APQ %), and noise-to-harmonics ratio (NHR dB)[12]. The Computer Speech Lab (CSL) software and the Multi-Dimensional Voice Program (MDVP) (Kay Pentax®) were used in the acoustic analyses.

According to the MDVP, the acoustic parameters selected can be defined from the following aspects: the value of mean $F_0$, which is the average of all extracted periods of the frequency; Jitter, expressed as percentage, which is the value of the relative mean of frequency variation in relation to the period; PPQ, expressed as percentage, which consists of the relative mean of frequency perturbation every five periods (mean of five points); Shimmer, expressed as percentage, which is the relative mean of peak-to-peak amplitude variability; APQ, expressed as percentage, which is the relative mean amplitude variability every 11 periods (mean of 11 points); NHR, expressed in dB, which relates the harmonics component to the noise component of the acoustic wave. The normality values according to the program are presented in Chart 1.

The VHI-10 protocol is composed of 10 questions, and produces a single total score calculated by simple summation of the responses to its questions, ranging from zero to 40 points, with zero as indicative of no impairment and 40 as indicative of maximum impairment. Each question must be answered based on a 5-point scale: 0 = never, 1 = almost never, 2 = sometimes, 3 = almost always, and 4 = always[7].

The URICA[8] scale was adapted to the area of voice in 2013, and it was named URICA-VOICE. The scale comprises 32 items divided into four groups (pre-contemplation, contemplation, action, and maintenance) of eight statements. It aims to verify at which motivational stage of readiness for vocal rehabilitation is a patient with dysphonia. The motivational stages evaluated by the scale are defined as follows: pre-contemplation (PC), individuals do not yet realize that there is a problem to be faced; contemplation (C), individuals strongly believe in the possibility of facing the problem, but do not attempt to change this situation; action (A), individuals present perceptible attempts for change; maintenance (M), there is no regression with respect to speech therapy, with constant effort on the part of the individuals to preserve in the change achieved. Calculation of the URICA-VOICE scale consists in a simple mean of the markings of the affirmations of each group, excluding questions 1, 4, 9, 20, and 31; therefore, an average of seven questions is taken for each group.

After calculating the means of each stage, the following formula is employed: (Average of C + Average of A + Average of M) - Average of PC. Classification in stages depends on the numeric scores described ahead: ≤8 for individuals in the pre-contemplation stage; 8-11, for individuals in the contemplation stage; 11-14, for individuals who are prepared for an attitude of action before the problem[9].

The study convenience sample included all 33 teachers assisted at the outpatient clinic from August 2014 to December 2015. Results were compiled by means of descriptive analysis of the data and measures of association between the variables using the Pearson's Chi-Square test or the Fisher's Exact test and the Student's *t*-test with significance level of 5% ($p \leq 0.05$). All statistical analyses were processed using the IBM-SPSS Statistic Base 19.0 software.

This study was analyzed by the Research Ethics Committee of the Federal University of Minas Gerais (UFMG) and approved under protocol no. CAAE 44359215.5.0000.5149.

## RESULTS

Study participants were 33 female teachers aged 39.2 years on average (SD=7.68). Regarding time of professional teaching practice, five (15.2%) of the participating teachers had less than five years, 15 (45.5%) presented six to 15 years, and 13 (39.4%) had 16 to 31 years of experience.

Auditory-perceptual assessment of the voice was conducted by consensus by two experienced speech-language pathologists. The results were as follows: 21 (63.6%) participants improved, six (18.2%) presented no change, and six (18.2%) worsened their voice quality after speech therapy. Speech-language pathology (SLP) evaluation verified statistically significant improvement in the voice of the investigated teachers at the pre- and post-speech therapy comparison ($p$=0.019).

**Chart 1.** Normality values of the acoustic measures according to the Multi-Dimensional Voice Program (MDVP) by Kay Pentax®

| Parameter | Normality Female Voice | Normality Male Voice |
|---|---|---|
| $F_0$ | 243.973 Hz | 145.223 Hz |
| **PPQ** | 0.366% | 0.338% |
| **Jitter** | 0.633% | 0.589% |
| **Shimmer** | 1.997% | 2.523% |
| **APQ** | 1.397% | 1.986% |
| **NHR** | 0.112 | 0.122 |

**Captions:** $F_0$=fundamental frequency; PPQ=pitch perturbation quotient; APQ=amplitude perturbation quotient; NHR=noise-to-harmonics ratio

Table 1 shows the values regarding vocal self-perception pre- and post-speech therapy for 31 study participating teachers. Improvement in vocal self-perception was observed in most (87.1%) participants. Reduction in the number of teachers who reported pre-speech therapy vocal perception as reasonable/poor was also observed. The teachers reported improved vocal self-perception in the comparison between the pre- and post-speech therapy moments ($p$=0.008).

As for the results of the VHI-10 protocol, the total means obtained by the participants pre- and post-speech therapy were 6.45 (SD=4.86) and 6.39 (SD=6.47), respectively. The pre- and post-speech therapy comparison showed that 19 patients (57.6%) improved their vocal impairment indices, whereas 12 patients (42.4%) maintained similar values. However, no statistically significant correlation was observed between the pre- and post-speech therapy moments ($p$=0.951).

Table 2 shows the mean and standard deviation values for the MPT, $F_0$, APQ, NHR, PPQ, Shimmer and Jitter parameters of the study participants. Pre- and post-speech therapy comparison showed percentage improvement for the following acoustic measures: MPT (72.7%), APQ (66.7%), NHR (60.6%), PPQ (63.6%), Shimmer (63.6%), and Jitter (66.7%). However, statistically significant correlation was found only for the MPT, $F_0$ and Shimmer parameters in the pre- and post-speech therapy comparison.

The URICA-VOICE scale mean score of the assessed teachers was 8.35 (SD=3.82). With respect to the stages of the URICA-VOICE scale (Table 3), most of the teachers (54.83%) were at the contemplation stage. None of the study participants were at the maintenance stage. No statistically significant correlation was observed between the variables used in the study (VHI-10, auditory-perceptual assessment of the voice, MPT, and parameters of the acoustic analysis of the voice) with vocal self-perception of teachers (Table 4) and with the auditory-perceptual assessment of the voice conducted by the speech-language pathologists (Table 5).

**Table 1.** Frequency distribution of vocal self-perception of teachers

| | Pre-speech therapy | Post-speech therapy | *p*-value |
|---|---|---|---|
| Excellent / Very Good / Good | 20 (64.5%) | 27 (87.1%) | 0.008* |
| Reasonable / Poor | 11 (35.5%) | 4 (12.9%) | |

Chi-squared test (CI=95%); *Valor Significativo (p≤0,05)

**Table 2.** Correlation analysis between the means of the acoustic measures pre- and post-speech therapy

| | Pre-speech therapy | SD | Post-speech therapy | SD | *p*-value |
|---|---|---|---|---|---|
| MPT | 9.23 | 3.00 | 11.65 | 3.77 | 0.001* |
| $F_0$ | 190.24 | 28.22 | 201.07 | 29.17 | 0.027* |
| APQ | 6.99 | 14.62 | 3.80 | 1.36 | 0.230 |
| NHR | 0.15 | 0.48 | 0.14 | 0.23 | 0.190 |
| PPQ | 0.66 | 0.54 | 0.55 | 0.34 | 0.304 |
| Shimmer | 6.20 | 2.55 | 5.26 | 2.18 | 0.026* |
| Jitter | 3.75 | 15.15 | 0.97 | 0.62 | 0.303 |

Student's *t*-test; *Significant values ($p \leq 0.05$)
**Captions:** SD=standard deviation; MPT=maximum phonation time; $F_0$=fundamental frequency; APQ=amplitude perturbation quotient; NHR=noise-to-harmonics ratio; PPQ=pitch perturbation quotient

**Table 3.** Self-perception of motivational stages during speech therapy

| URICA-VOICE (motivational stages) | n | % |
|---|---|---|
| Pre-contemplation | 11 | 35.49 |
| Contemplation | 17 | 54.83 |
| Action | 3 | 9.68 |
| Maintenance | 0 | 0 |
| Total | 31 | 100 |

The value of n=31 refers to missing data of two teachers

**Table 4.** Frequency distribution and correlation between the explanatory variables (VHI, auditory-perceptual assessment of the voice and parameters of acoustic analysis of the voice) and vocal self-perception

| Variables | Total of participants | Vocal self-perception | | *p*-value |
|---|---|---|---|---|
| | | Better | Same or Worse | |
| | | n (%) | n (%) | |
| **VHI** | | | | |
| Better post-speech therapy | 21 | 8 (38.1%) | 13 (61.9%) | 0.337 |
| Same or worse post-speech therapy | 10 | 4 (40.0%) | 6 (60.0%) | |

Chi-square or Fisher's exact tests (CI=95%); The differences in the total of participants refer to missing data in the teachers' medical records
**Captions:** VHI=Voice Handicap Index; MPT=maximum phonation time; APQ=amplitude perturbation quotient; NHR=noise-to-harmonics ratio; PPQ=pitch perturbation quotient

**Table 4.** Continued..

| Variables | Total of participants | Vocal self-perception | | *p*-value |
|---|---|---|---|---|
| | | Better | Same or Worse | |
| | | n (%) | n (%) | |
| **Auditory-perceptual assessment of the voice** | | | | |
| Better post-speech therapy | 19 | 8 (42.1%) | 11 (57.9%) | 0.906 |
| Same or worse post-speech therapy | 12 | 4 (33.3%) | 8 (66.7%) | |
| **MPT** | | | | |
| Better post-speech therapy | 22 | 10 (45.5%) | 12 (54.5%) | 0.552 |
| Same or worse post-speech therapy | 9 | 2 (22.2%) | 7 (77.8%) | |
| **APQ** | | | | |
| Better post-speech therapy | 21 | 8 (38.1%) | 13 (61.9%) | 0.943 |
| Same or worse post-speech therapy | 10 | 5 (50.0%) | 6 (60.0%) | |
| **NHR** | | | | |
| Better post-speech therapy | 19 | 6 (31.6%) | 13 (68.4%) | 0.623 |
| Same or worse post-speech therapy | 12 | 7 (58.3%) | 5 (41.7%) | |
| **PPQ** | | | | |
| Better post-speech therapy | 20 | 7 (35.0%) | 13 (65.0%) | 0.816 |
| Same or worse post-speech therapy | 11 | 5 (45.5%) | 6 (54.5%) | |
| **Shimmer** | | | | |
| Better post-speech therapy | 20 | 8 (40.0%) | 12 (60.0%) | 0.816 |
| Same or worse post-speech therapy | 11 | 5 (45.5%) | 6 (54.5%) | |
| **Jitter** | | | | |
| Better post-speech therapy | 21 | 7 (33.3%) | 14 (66.7%) | 0.588 |
| Same or worse post-speech therapy | 9 | 5 (55.6%) | 4 (44.4%) | |

Chi-square or Fisher's exact tests (CI=95%); The differences in the total of participants refer to missing data in the teachers' medical records
**Captions:** VHI=Voice Handicap Index; MPT=maximum phonation time; APQ=amplitude perturbation quotient; NHR=noise-to-harmonics ratio; PPQ=pitch perturbation quotient

**Table 5.** Frequency distribution and correlation between the explanatory variables (VHI, maximum phonation time, and parameters of acoustic analysis of the voice) and auditory-perceptual assessment of the voice

| Variables | Total of participants | Auditory-perceptual assessment of the voice | | *p*-value |
|---|---|---|---|---|
| | | Better | Same or worse | |
| | | n (%) | n (%) | |
| **VHI** | | | | |
| Better post-speech therapy | 23 | 15 (65.2%) | 8 (34.8%) | 0.906 |
| Same or worse post-speech therapy | 9 | 6 (66.6%) | 4 (44.4%) | |
| **MPT** | | | | |
| Better post-speech therapy | 24 | 16 (66.7%) | 8 (33.3%) | 0.902 |
| Same or worse post-speech therapy | 9 | 6 (66.7%) | 3 (33.3%) | |
| **APQ** | | | | |
| Better post-speech therapy | 22 | 13 (59.1%) | 9 (40.9%) | 0.196 |
| Same or worse post-speech therapy | 10 | 8 (60.0%) | 2 (20.0%) | |
| **NHR** | | | | |
| Better post-speech therapy | 20 | 14 (70%) | 6 (30%) | 0.473 |
| Same or worse post-speech therapy | 12 | 7 (58.3%) | 5 (41.7%) | |
| **PPQ** | | | | |
| Better post-speech therapy | 21 | 15 (71.4%) | 6 (28.6%) | 0.326 |
| Same or worse post-speech therapy | 11 | 6 (54.5%) | 5 (45.5%) | |
| **Shimmer** | | | | |
| Better post-speech therapy | 21 | 14 (66.7%) | 7 (33.3%) | 0.304 |
| Same or worse post-speech therapy | 11 | 7 (63.6%) | 4 (36.4%) | |
| **Jitter** | | | | |
| Better post-speech therapy | 22 | 15 (68.2%) | 7 (31.8%) | 0.916 |
| Same or worse post-speech therapy | 9 | 5 (55.6%) | 4 (44.4%) | |

Chi-square or Fisher's exact tests (CI=95%); The differences in the total of participants refer to missing data in the teachers' medical records
**Captions:** VHI=Voice Handicap Index; MPT=maximum phonation time; APQ=amplitude perturbation quotient; NHR=noise-to-harmonics ratio; PPQ=pitch perturbation quotient

## DISCUSSION

Study participants showed improvement in clinical aspects and vocal self-perception after undergoing the Comprehensive Vocal Rehabilitation Program (CVRP). There is strong scientific evidence of the efficacy of vocal rehabilitation through this program for the treatment of behavioral dysphonia when compared with that of another method[13]. It is worth emphasizing the result of this survey - conducted with practically the same participants of the compared study - which showed signs of good adherence and satisfaction with the CVRP, despite the difficulty in performing the exercises at home, as recommended[14].

Auditory-perceptual assessment showed that most of the investigated teachers (63.6%) presented improved vocal quality after the intervention. The fact that the participants of this study present functional dysphonia reinforces the benefit of this approach for this occupational group with a specific clinical condition, preventing the appearance of lesions in the vocal folds. A study conducted with two groups of voice professionals of different occupations compared the effectiveness of the CVRP with that of the Vocal Function Exercises (VFE) method, and found improvement in vocal quality in both interventions. The CVRP presented better results at the end of the program compared with those of the VFE, but no statistically significant difference was observed[13]. Another research compared the vocal, laryngeal and self-perception evaluation of 42 teachers with functional or organofunctional dysphonia pre- and post-speech therapy using an eclectic approach, and found voice improvement in 73.8% of the cases[15].

Pre- and post-speech therapy analyses of the teachers' self-perception of voice demonstrated that most of the participants (87.1%) reported voice improvement after treatment, corroborating the findings of other studies[15,16]. It should be noted that the report of voice improvement identified by the teachers was mainly associated with reduction of hoarseness and vocal fatigue. The CVRP proposal considers that voice treatment can be effective when it identifies the problem, raises awareness, and modifies negative vocal habits proposing techniques of body-voice association, glottic adjustment, and ressonantal balance[10].

Pre- and post-speech therapy comparison showed that over 50% of the patients improved their voice handicap indexes, confirming the results found in studies that used the same self-perception protocol[13,16]. It should be considered that the teachers, even at the pre-speech therapy moment, presented little vocal impairment, which may have interfered with the absence of difference between the pre- and post-speech therapy moments. Analysis of the results should also consider that the assisted teachers were referred to the SLP Outpatient Clinic by the Occupational Health sector of the municipality, with clinical condition of dysphonia in its initial stage and, some of them, without vocal complaint, which does not configure a spontaneous demand for treatment.

Vocal self-perception protocols assist patients with measuring the dimension of their problem[17]. The efficacy of this assessment is confirmed when, at the end of treatment, patients report evolution of their vocal quality, reducing the impact of the handicap resulting from the vocal impairment.

Regarding acoustic analysis, the teachers showed improvement in all the acoustic measures investigated in the pre- and post-speech therapy comparison. The parameters maximum phonation time (MPT), Shimmer, and fundamental frequency ($F_0$) presented statistically significant difference. Current studies report impairment in the acoustic measures of teachers at the pre-speech therapy moment, but do not present post-rehabilitation changes[18,19]. Studies reporting results of post-speech therapy acoustic measures in teachers are scarce. A survey conducted with 42 patients with behavioral dysphonia found improvement in the parameters of Jitter, pitch perturbation quotient (PPQ), Shimmer, and amplitude perturbation quotient (APQ) after speech therapy. Only $F_0$ and noise-to-harmonics ratio (NHR) showed no difference between pre- and post-treatment[15].

In the present study, increased $F_0$ values were found post-speech therapy, and remained within the normality range. These results are often found in cases of behavioral dysphonia with moderately impaired voices[17]. Reduced $F_0$ values are observed in dysphonic patients whose etiology is associated with inadequate vocal behavior[20,21].

MPT was another parameter evaluated; it can be used as a means of diagnosis, monitoring, and therapy evolution in dysphonic patients[12]. An increase in the MPT of the teachers investigated in this research was verified after application of the CVRP. A study conducted with 17 teachers with dysphonia from a municipal educational network verified improved MPT values after application of the VFE method designed by Stemple and Gerdeman[22].

Acoustic analysis is an important tool in the clinical evaluation of dysphonic patients[12], but the use of only this instrument for voice assessment may be a limiting factor to diagnosis. Therefore, it is not viable to use only this tool to evaluate the effects of speech therapy.

Most of the study participants were at the motivational stage of contemplation in the application of the URICA-VOICE scale. It is worth noting that, in this study, the scale was applied in the fourth therapy session. Studies reveal differences in the motivational stages between dysphonic teachers and patients who have not yet undergone speech therapy or are under treatment, and the stages of pre-contemplation and contemplation are the most commonly found. The URICA-VOICE scale was not reapplied after treatment, limiting the possibility of learning the probable change of motivational stage caused by the intervention.

A survey that applied the URICA-VOICE scale to 138 teachers with vocal complaints from the municipal school network of the municipality of Montes Claros, Minas Gerais state, reported that most of the participants (59.4%) were at the stage of pre-contemplation[23]. It should be emphasized that these teachers had not yet undergone any speech therapy. Another study conducted with 151 dysphonic patients who underwent vocal screening at a public institution's outpatient clinic evaluated the stage of readiness for change of participants at the time of screening, and observed that the majority (76.2%) were concentrated at the contemplation stage[24].

Corroborating the findings of this study, a survey conducted with 66 patients who started speech therapy at least one week after the initial assessment in the outpatient clinics of university hospitals of two SLP institutions indicated that 57.6% of the participants were at the contemplation stage of motivation[9]. It can be inferred that the amount of time patients are under therapy influences the motivational stage, because those at the first stage (pre-contemplation) are individuals who are not yet aware that there is a problem to be faced.

This experience in the application of a vocal rehabilitation program showed that, in the case of teachers with functional dysphonia, the CVRP meets the vocal demands and, when applied in defined sessions, promotes greater adherence to speech therapy, corroborating the findings of another research conducted with the same population[14].

Effectiveness of vocal rehabilitation programs for teachers needs to be further explored, comparing groups with different clinical conditions such as functional and organofunctional dysphonia. There are few longitudinal studies addressing therapy evolution and identifying the quantitative and qualitative aspects of the program used, which are known in the present study. It should be highlighted that this research demonstrated improvement in all vocal aspects assessed on teachers with behavioral dysphonia without secondary vocal fold lesion, but the results can not be generalized. The small sample size may have influenced the associations found, reducing the statistical power of the test. Although the URICA-VOICE scale was not applied at two moments of the Program, hindering the analysis of change in motivational stage of the participating teachers, better readiness to face the voice problem was observed.

## CONCLUSION

The use of the Comprehensive Vocal Rehabilitation Program (CVRP) for the treatment of behavioral dysphonia presented positive results in the pre- and post-speech therapy evaluation. In the analysis of the motivational stages, most teachers were at the contemplation stage, that is, they strongly believed in the possibility of facing the problem, but still without much effort to change this situation.

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## Author contributions

*NRC was responsible for data collection and writing and final approval of the manuscript; BOS contributed to data collection and writing and final approval of the manuscript; ACCG participated in the orientation of the study and writing and final approval of the manuscript; AMM was responsible for the study design, data collection, orientation of the phases of the study, and writing and final approval of the manuscript.*