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Case reports

Diagnosis and non-surgical intervention of sulcus vocalis concomitant with psychogenic dysphonia: A case report

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ABSTRACT

Although sulcus vocalis can be challenging to diagnose, it is frequently observed in clinical settings. Currently, there is no evidence showing its coexistence with psychogenic dysphonia and the associated clinical consequences. This case report presents a non-surgical therapeutic intervention conducted by a speech-language therapy team for a 24-year-old female patient diagnosed with sulcus vocalis based on her clinical history and laryngostroboscopy findings. Despite the intervention, limited progress was observed. After four months, a reassessment revealed the possibility of psychogenic dysphonia, casting doubt on the initial sulcus diagnosis. This case highlights the importance of establishing a framework to evaluate the impact of the psychological and emotional state of patients presented with sulcus vocalis. The voice effects of the vocal fold state and the distinction between physiological and pathological sulcus are influenced by the psychological condition of the dysphonic patient.

Keywords: Dysphonia; Somatoform Disorders; Voice Disorders; Voice Quality; Voice Training

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INTRODUCTION

The distinction between physiological and pathological sulcus vocalis is based on two main criteria: a histopathological criterion, determined by the integrity or alteration of the lamina propria[1], and a laryngeal stroboscopy criterion, which considers the oscillatory characteristics of the affected vocal fold[2]. However, it is precisely the dynamic parameters of amplitude, the assessment of the mucosal wave, and the evaluation of vibratory regularity that pose the greatest challenges in laryngeal stroboscopy[3]. Consequently, the reliability of the diagnosis is compromised, especially when attempting to assess the depth of the pathological invagination.

Psychogenic dysphonia is typically diagnosed when there is no evidence of structural laryngeal pathology. However, it is important to recognize that there may be instances where psychogenic dysphonia coexists with organic pathology, especially when the lesion alone cannot fully explain the voice disorder [4]. Given that the diagnosis of psychogenic dysphonia is usually established as a diagnosis of exclusion[5], it becomes challenging to establish this diagnosis when structural changes are present. The term "symptom incongruity" has been introduced to describe the lack of correlation between the organic condition and the symptoms observed during clinical presentation. It is worth noting that clinicians may not always recognize this discrepancy, as additional symptoms may be expected in the underlying condition[6]. The simultaneous presence of sulcus and psychogenic dysphonia can further complicate the differentiation between physiological and pathological sulcus, as well as mask other laryngeal disorders. Given this situation, the role that voice therapy can play as a clinical tool is evident, as it allows us to specify aspects of the diagnosis through the type of response achieved through therapeutic intervention.

CASE REPORT

This study was approved by the Bioethics and Biosafety Committee of the Universidad del Bío-Bío, as recorded in the official documentation dated February 26, 2024. The Committee confirmed that the research upholds the human rights of the participants and complies with the scientific and ethical standards of both the discipline and the Institution. The participant provided written informed consent authorizing the disclosure of the case details.

A 24-year-old female occupational therapy student sought consultation out of "genetic curiosity," noting that "all the women in her family on her mother's side spoke similarly." The assessment was conducted at the Department of Health Rehabilitation Sciences of the Universidad del Bío-Bío, with no financial burden to the patient. The assessment involved a multidisciplinary team consisting of an otolaryngologist (MB) with 22 years of clinical experience and an international fellowship in laryngology, a speech-language pathologist specialized in voice (JC) with 12 years of experience and a master's degree in vocology, along with undergraduate students of speech-language pathology (AJ, AH, FS, GI).

During the medical history interview, the patient reported that she could not pinpoint a specific start for her dysphonia. She explains that she "has always spoken this way," so she "never considered her voice a problem," until a speech-language pathology (SLP) student suggested seeking an assessment. The patient mentioned that she had never attended speech-language therapy before. Signs of vocal fatigue were noted, along with difficulties increasing vocal intensity and pitch breaks. She also showed symptoms of pharyngeal globus, coughing, and throat clearing, which she often uses to "clear her voice." Regarding her medical history, she reported allergic symptoms and bruxism, which worsen with stress. The patient also noted that she is frequently exposed to stressful situations due to academic demands and household responsibilities, as she lives with her mother, who has been diagnosed with bipolar disorder. Additionally, she exhibits phonotraumatic behaviors related to frequent consumption of irritants, low water intake, and lack of rest. It is important to mention that the patient signed an informed consent form authorizing the disclosure of her case details.

RESULTS

The results of the assessment, speech-language therapy intervention and reassessment are presented below. All relevant information has been integrated in this section to highlight the importance of progress in clinical care rather than treating each aspect separately.

When the body-related voice parameters were assessed, a mild increase in cervical lordosis was observed. Palpation revealed excessive tension of the suprahyoid and cricothyroid muscles at rest and during phonation, as well as laryngeal elevation. Hypertonicity of the shoulder girdle is observed. The maximum

phonation time for /a/ (MPT /a/) was 5 seconds, the maximum expiratory time for /s/ (MET /s/) was 12 seconds, and the s/a ratio was 2.4, indicating glottal insufficiency[6,7].

An acoustic voice analysis was conducted using the Praat software, with a sustained /a/ speech sample. The analysis revealed an alteration in the fundamental frequency, with a measured value of 260 Hz, which is slightly higher than normative parameters for the patient's sex and age. The average vocal intensity was 59 dB. Regarding the formants, F1 (794 Hz) and F2 (1572 Hz) were within expected ranges, while F3 (3183 Hz) was significantly elevated. Perturbation and noise parameters showed local jitter at 0.67% and local shimmer at 0.45%, both of which were altered. The Harmonics-to-Noise ratio (HNR) and Noise-to-Harmonics ratio (NHR) were within normal limits, with values of 17.87 dB and 0.03 dB, respectively. Qualitative spectrographic examination of the /a/ emission revealed harmonics reaching up to 4000 Hz, with no subharmonics detected. In terms of formant visualization, only F1 and F2 were distinctly visible. The F0 contour was stable and flat, whereas the intensity contour was unstable and sloped downward. The spectrogram also evidenced the presence of interharmonic noise. Oscillographic and spectrographic features derived from the /a/ speech sample using Praat are presented in Figure 1.

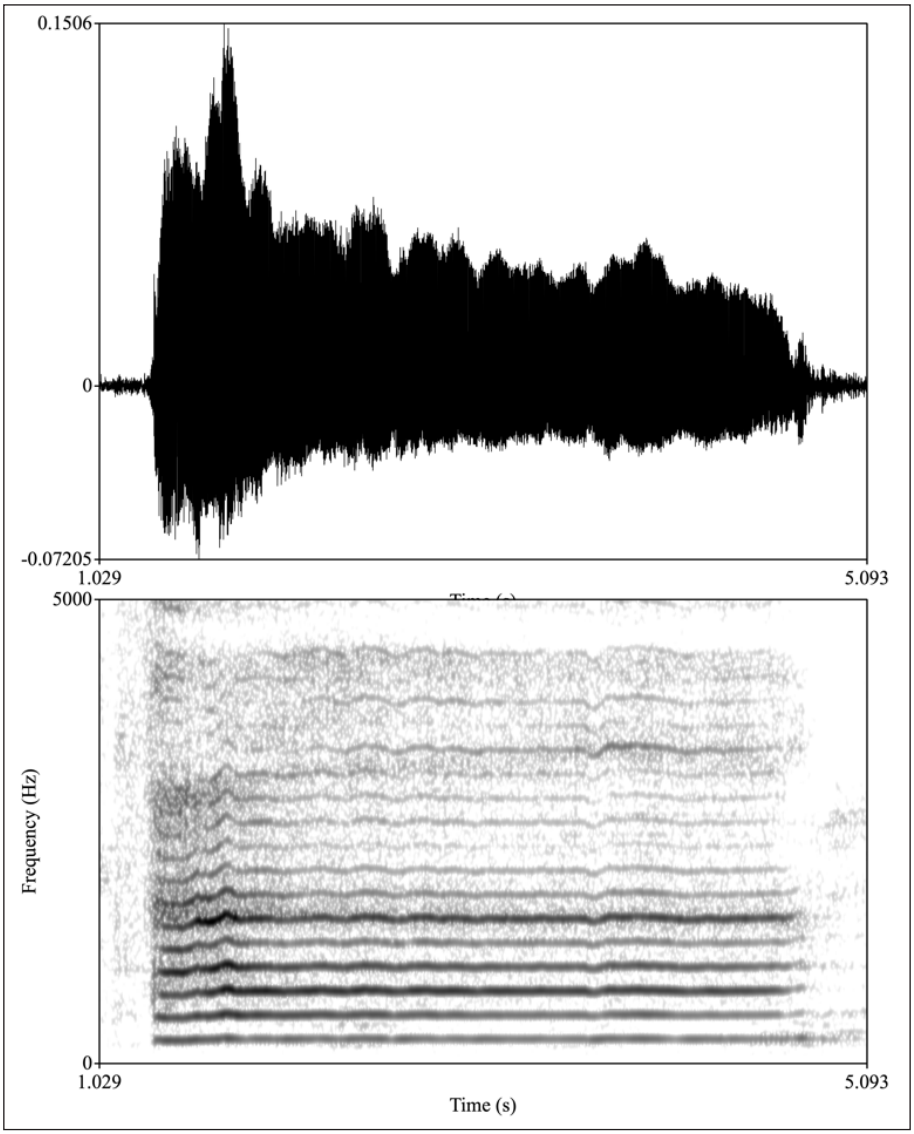

Figure 1. Oscillogram and spectrogram of /a/ speech sample extracted from the Praat software used for the initial acoustic assessment

During the perceptual voice assessment, a dysphonic voice was noted, characterized by a perceptually lowered pitch, reduced intensity, and a breathy vocal onset. No voice breaks were observed. The patient showed oral resonance. Regarding vocal registers, the patient was unable to produce the *fry* or *falsetto* registers. Pitch range was limited and reduced towards the bass, spanning from G#2 to F3, equivalent to 10 semitones. Perceptual evaluation using the GRBASI scale yielded scores of G3, R2, A1, B3, S1, and I0. A mild degree of vocal dysfunction was identified according to the Chilean version of the Voice Handicap Index (VHI-30), IDV-CL[8].

The laryngeal stroboscopy was performed following the Voice-Vibratory Assessment With Laryngeal Imaging (VALI) protocol[3], revealing anteroposterior supraglottic shortening, a longitudinal hiatus with mild bowing, irritation at the posterior commissure and the posterior pharyngeal wall, and signs consistent with sulcus vocalis on both vocal folds, more clearly visible in the posterior third of the right vocal fold, where a deep invagination of the free edge was noted. Regarding the mucosal wave and presence of non-vibratory segments, mild asymmetry was observed. The mucosal wave amplitude covered approximately 80% of the right vocal fold and 70% of the left vocal fold. Oscillatory amplitude was 40% bilaterally, with phase symmetry at 50%. The patient exhibited an open phase predominance due to the type of glottic closure. Poor periodicity was observed, with irregularity reaching 40% (Figure 2).

Figure 2. Frames from the laryngeal stroboscopy assessment. Above, vocal folds in abduction. Below, vocal folds in adduction

The speech-language therapy intervention focused on several key areas: (1) implementing vocal hygiene practices, (2) reducing breathiness, (3) enhancing the mucosal wave involved in producing a rough voice, (4) attaining an optimal vocal intensity, and (5) addressing body-related voice parameters. The voice therapy lasted for 2 months and 2 weeks, during which 10 sessions were conducted (one session per week), each lasting 40 minutes. These sessions were carried out jointly by the lead speech-language pathologist (JC) and the group of students (AJ, AH, FS, GI).

The initial interventions focused on vocal hygiene and education to increase the patient's awareness of her voice. Additionally, a monthly calendar was devised to encourage increased water intake and reduced consumption of chili peppers, with adherence being monitored daily. Although a referral was made for the patient to consult with a gastroenterologist, she declined this recommendation. Subsequently, intervention on body-related voice parameters was conducted to increase the patient's proprioception regarding appropriate head positioning and to reduce hypertonicity in the shoulder girdle through massage therapy techniques. Concurrently, various phonatory techniques were introduced to enhance the patient's voice quality parameters, including vibratory, plosive, nasal, and fricative sounds, as well as the prolonged /b/ technique, vocal onset control exercises, and vowel-only reading technique, among others. These vocal exercises were consistently performed in combination with pitch variations aimed at improving habitual speaking pitch and intensity tonal range, intensity variations to increase conversational volume, postural adjustments to promote adequate resonant proprioception, and cervical movements necessary for maintaining a eutonic larynx within the neck. The therapeutic goals addressed during the initial, intermediate, and final stages of the intervention are outlined in Table 1.

Table 1. Sample of voice therapy intervention goals

	Goals addressed
Initial Stage (Sessions 1 and 2)	- The patient will achieve an understanding of her current vocal status through education supported by visual feedback of her own laryngeal stroboscopy images, with a qualitative outcome criterion based on patient feedback. - The patient will gain knowledge of the processes involved in voice production by watching a video, with a quantitative outcome criterion of 80% correct responses on a questionnaire. - The patient will increase water intake by meeting daily hydration goals, with an outcome criterion of consuming 1 liter daily for one week. - The patient will reduce the consumption of irritant substances (such as chili pepper) through counseling on their effects on the voice, with an outcome criterion of consuming at least three meals per week without chili. - The patient will decrease cervical hyperlordosis during phonation through suboccipital stretching exercises, with a tactile and visual perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce suprahyoid muscle tension during phonation through mylohyoid muscle stretching techniques, with a tactile perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce suprahyoid muscle tension during phonation through stretching techniques of the digastric muscles, with a tactile perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce suprahyoid muscle tension during phonation through stretching techniques of the stylohyoid muscles, with a tactile perceptual qualitative outcome criterion assessed by the therapist. - The patient will decrease cervical muscle tension during phonation through massage of the shoulder girdle, with a tactile perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce breathiness through the production of plosive sounds, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will reduce breathiness through maximum phonation time exercises, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient - The patient will decrease vocal tension using tongue vibration technique, with an auditory perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce suprahyoid muscle tension through lip vibration technique, with a tactile qualitative outcome criterion assessed by the therapist.
Intermediate Stage (Between sessions 3 and 6)	- The patient will achieve adequate vocal projection through the vowel-only reading technique, with an auditory perceptual qualitative outcome criterion assessed by the therapist. - The patient will achieve appropriate intensity control using the Messa di Voce technique, with an auditory perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce vocal tension using the body method associated with the production of facilitatory sounds, with an auditory perceptual qualitative outcome criterion assessed by the therapist - The patient will decrease suprahyoid muscle tension through voiced tongue vibration, with a tactile perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce shoulder girdle muscle tension during phonation using the shoulder rotation technique, with a tactile perceptual qualitative outcome criterion assessed by the therapist. - The patient will reduce breathiness through inspiratory phonation technique, with an auditory perceptual qualitative outcome criterion assessed by the therapist. - The patient will improve vocal projection using the tongue burst technique associated with nasal sounds, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will enhance vocal projection a technique involving nasal phonation, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will increase speech intensity through the vowel-only reading technique, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will increase speech intensity through vocal onset control technique, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will reduce breathiness through the head position change technique combined with voicing, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient.

	Goals addressed
Final Stage (Session 7 onwards)	- The patient will reduce breathiness through the technique of voiced incomplete swallowing, with an auditory perceptual qualitative outcome criterion assessed by both therapist and patient. - The patient will increase speech intensity using the hard vocal onset control technique with pitch variation, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will improve vocal projection through mouth opening technique combined with visual monitoring and shoulder rotation, with an auditory perceptual qualitative outcome criterion assessed by both therapist and patient. - The patient will decrease breathiness using the glottal closure technique, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will reduce breathiness through the prolonged /b/ technique, with an auditory perceptual qualitative outcome criterion assessed by both the therapist and the patient. - The patient will integrate improved voice use in isolated word productions, with an auditory perceptual qualitative outcome criterion assessed by the patient. - The patient will integrate improved voice use in automatic speech tasks, with an auditory perceptual qualitative outcome criterion assessed by the patient. - The patient will integrate improved voice use during reading, with an auditory perceptual qualitative outcome criterion assessed by the patient. - The patient will integrate improved voice use during conversations, with an auditory perceptual qualitative outcome criterion assessed by the patient.

Following the intervention, a vocal reassessment was conducted, which included laryngeal stroboscopy, acoustic, perceptual, and self-perceptual assessments to evaluate the vocal changes that had been produced. A comparison of relevant aspects of the patient's condition before and after the intervention is presented in Table 2. In the self-perception assessment, the patient was found to have a mild vocal dysfunction, as indicated by the IDV-CL. During the laryngeal stroboscopy reassessment, no positive changes were initially observed regarding glottic closure, although a decrease in anteroposterior supraglottic compression was noted. However, after a brief analysis by the treatment team, it was occasionally possible to achieve greater medial approximation of the vocal folds using laryngeal manipulation techniques involving horizontal movements and pressure applied to the thyroid cartilage laminae, combined with the production of *glissandos* on the /i/ phoneme. This approach immediately resulted in increased vocal fold contact during phonation and greater oscillatory amplitude, particularly in the left vocal fold. This finding is noteworthy given the presumed organic component initially identified in the first laryngeal stroboscopy (Figure 3).

Figure 3. Frames from the laryngeal stroboscopy assessment after therapy. Above, vocal folds in abduction. Below, vocal folds in adduction

During the same reassessment session, acoustic analysis of sustained /a/ speech sample revealed a flatter yet unstable oscillographic contour, with overall spectrographic characteristics remaining similar to those of the initial sample (Figure 4). The obtained F0 was 259 Hz, showing a slight decrease. In contrast, the average emission intensity remained at 59 dB. Local shimmer was 7.41% and local jitter was 0.414%, both of which were altered. HNR (7.97 dB) and NHR (0.25) values were this time outside the expected range.

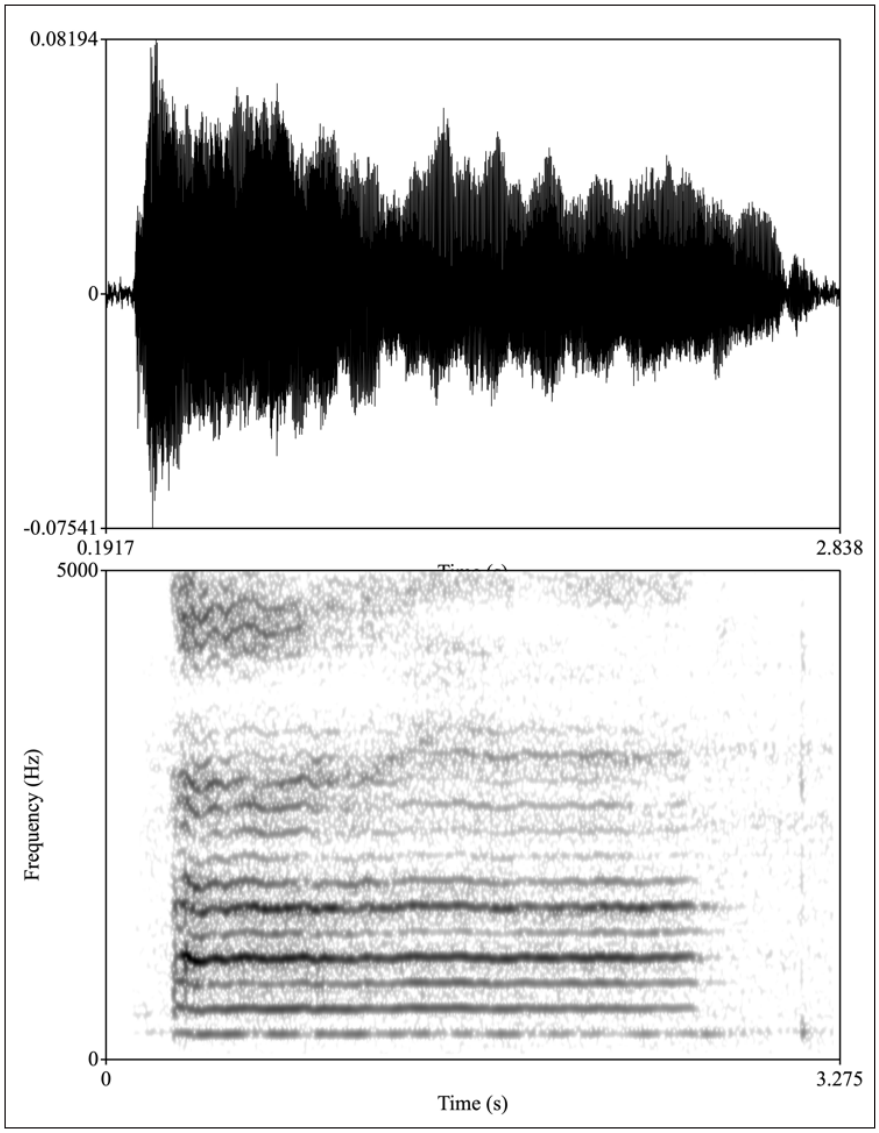

Figure 4. Oscillogram and spectrogram of the /a/ speech sample extracted from the Praat software used for the final acoustic assessment

The proposed intervention goals were moderately accomplished at the vocal level. Although a reduction in breathiness and an increase in intensity during conversational speech were perceptually evident, these changes did not correlate with spontaneous complete vocal fold contact.

Table 2. Comparison of vocal assessment results before and after therapy

Assessment Tool	Evaluation before therapy	Evaluation after therapy
Laryngeal Stroboscopy Assessment	Anteroposterior supraglottic compression, vocal fold bowing, lack of vocal fold closure during phonation with longitudinal hiatus, and reduced presence of the mucosal wave were observed.	After manual laryngeal manipulation maneuver, reduced supraglottic compression, complete vocal fold closure without hiatus during phonation, and a straighter free edge were observed.
Acoustic Assessment	Qualitatively, the acoustic assessment reveals spectrographic alterations, including the loss of harmonics at higher frequencies. Quantitatively, elevated fundamental frequency, reduced intensity, and altered perturbation parameters were observed.	Spectrographic characteristics remained. Fundamental frequency and average vocal intensity showed no significant changes. Perturbation and noise parameters remained altered.
Perceptual Assessment	G3 R2 A1 B3 S1 I0; decreased intensity	G2 R1 A0 B1 S0 I0; improved intensity
Self-Perception of Voice	Mild degree of vocal disability	No changes

At the end of the therapy period, the patient reported feeling comfortable and satisfied with the intervention. She stated that, from her perspective, the goals set at the beginning of therapy had been met. Additionally, she noted that she felt her voice had noticeably improved.

DISCUSSION

The patient underwent both instrumental and clinical assessments at two stages of voice therapy: before and after the intervention. The initial laryngeal stroboscopy revealed a pathological sulcus, characterized by an invagination along the free edge of both vocal folds, accompanied by altered mucosal wave propagation, decreased vibratory amplitude, and increased stiffness. These findings were consistent with the patient's clinical history. Although the voice intervention resulted in limited improvements in overall voice quality, a significant therapeutic effect was observed, aligning with findings reported in the limited literature on sulcus interventions[2,9,10]. Specifically, notable changes included a reduction in breathiness and improved vocal projection, mainly due to increased intensity during conversational speech. Additionally, a gradual decrease in vocal roughness was noted. These vocal improvements were observed intermittently across sessions but showed inconsistent maintenance between therapy visits. The follow-up laryngeal stroboscopy assessment indicated minimal structural and functional changes. However, it is noteworthy that traditional laryngeal repositioning maneuvers, entailing both lowering and approximation of the thyroid cartilage laminae, produced marked improvements, as evidenced by enhanced vocal fold closure and decreased breathiness.

In cases where the primary cause of dysphonia is indeed the presence of a bilateral sulcus, how is it possible that a manual maneuver on the larynx alone can modify its mechanical-oscillatory conditions? This question is difficult to answer. The classical classification of vocal sulcus types[1] indicates that the difference between types I, II, and III lies in the histological involvement of the free edge of the vocal fold. Based on this, different depths of pathological invagination can be determined, depending on whether the lamina propria is damaged or not, which consequently leads to varying degrees of vocal and vibration impairment. In this sense, a distinction is made between type I sulcus, considered physiological, and types II and III, both pathological[11]. However, the differences between these subtypes, both clinically and in laryngeal stroboscopy, are not always clear, making subtype identification difficult when relying solely on non-invasive techniques, as is usually the case[12].

Based on the foregoing, it is possible that the sulcus initially observed during laryngeal stroboscopy was not severe enough to prevent adequate vocal fold vibration on its own. However, due to the limited detail available in the patient's clinical history, the dysphonia may have been solely attributed to the observed glottic structural deficiency. This association might have resulted from the overlap between the stroboscopic features of physiological and pathological types of sulcus, which often leads to diagnostic uncertainty. Nevertheless, the presence of markedly high levels of roughness and breathiness during perceptual evaluation is noteworthy, as this is not consistent with a Type I sulcus[13].

Another possible scenario is that, given the signs of posterior glottic and pharyngolaryngeal irritation, the vocal condition was more likely associated with secondary effects of a diagnosis of laryngopharyngeal reflux (LPR)[14]. This could, in turn, have produced a pseudosulcus with a glottic configuration resembling a sulcus caused by inflammation[15,16]. This hypothesis would partly explain the improved vocal fold contact observed during the reassessment, attributed to reduced glottic edema through therapeutic behavioral management. However, similar to the previous scenario, it does not fully account for the patient's vocal presentation, particularly the pronounced breathiness.

In this context, we believe that the most plausible diagnostic hypothesis explaining the patient's clinical presentation is the presence of either a physiological or pathological bilateral sulcus, with vocal symptoms that appear or worsen in response to the psychoemotional conditions described by the patient during the initial assessment, specifically, academic and family-related stress, compounded by a family history of mental health issues, as her mother has been diagnosed with bipolar disorder. It is well established that many patients with dysphonia also exhibit psychological factors that accompany their vocal condition. These factors may originate from personality traits or diagnosed or underdiagnosed psychiatric disorders, although there is limited evidence regarding the actual prevalence of this comorbidity[17]. Neither the severity of dysphonia nor the presence of vocal fold lesions necessarily predicts worsening in patients' self-perceived voice quality or overall self-reported well-being[18]. This is consistent with the classic presentation of conversion disorders exhibiting *belle indifférence*[19] which is evident in this case where the patient appears indifferent to her vocal condition and unaware of the severity of her symptoms. These signs and symptoms are consistent with a diagnosis of psychogenic dysphonia type 2, in accordance with Baker's classification[20]. Similarly, the positive response to manual manipulation of the larynx is among the primary effects observed with these muscular maneuvers in cases of psychogenic dysphonia[20,21].

CONCLUSIONS

The presence of a vocal fold lesion observed on laryngeal stroboscopy examination, along with any associated vibratory impairment, does not necessarily indicate a direct cause–and–effect relationship. Therefore, when treating patients presented with vocal fold lesions, whether acquired or congenital, it is essential that the influence of psycho-emotional factors that may accompany the voice disorder to determine the most appropriate therapeutic approach, whether pharmacological, surgical, psychological, and/or speech-language intervention, be considered.

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Authors' contributions:

JC-A: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – Original draft; Writing – Review & editing

MB-B: Conceptualization; Data curation; Project administration; Software; Supervision; Validation; Visualization.

AJ-B; AH-U; FSM-B; GI-G: Conceptualization; Data curation; Writing – Original draft.

Data sharing statement:

Data related to the user's assessment and intervention will not be available due to ethical considerations.