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A Structured Pre- and Post-Operative Voice Therapy Program for Benign Vocal Fold Lesions

Un programa estructurado de terapia vocal pre y post-operatoria para lesiones benignas de pliegues vocales

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Abstract
Benign vocal fold lesions (BVFLs) are acquired structural anomalies of the vocal folds, and these are primarily a result of vocal abuse or phonotrauma. Phonotraumatic lesions are not generally regarded as recurrent, provided that appropriate behavioral changes are made after resolution or surgical removal. Voice therapy plays a crucial role in this aspect. The aim of this article is to propose a structured pre- and post-operative voice therapy program for patients undergoing surgical intervention for BVFLs. Voice therapy post-surgery has been proven to reduce the rate of recurrence in BVFLs. Having a standard treatment protocol is a useful tool for the therapist, particularly one without extensive voice training.

Keywords
Voice; voice therapy; post-operative; vocal rest; benign lesions; phonotrauma.

Resumen
Las lesiones benignas de los pliegues vocales (LBPV) son anomalías estructurales adquiridas de los pliegues vocales, y son principalmente el resultado de un abuso vocal o fonotrauma. Las lesiones fonotraumáticas generalmente no se consideran recurrentes, siempre que se realicen cambios apropiados en el comportamiento después de la resolución o la excisión quirúrgica. La terapia vocal juega un papel crucial en este aspecto. El objetivo de este artículo es proponer un programa estructurado de terapia de voz pre y postoperatorio para pacientes que son expuestos a una intervención quirúrgica para LBPV. Se ha demostrado que la terapia de voz después de la cirugía reduce la tasa de recurrencia en LBPV. Tener un protocolo de tratamiento estándar es una herramienta útil para el terapeuta, particularmente uno sin un entrenamiento extenso en patología de la voz.

Palabras clave
Voz; terapia vocal; período post-operatorio; reposo vocal; lesiones benignas; fonotrauma.

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Contribution of the authors
Juliana Codino: Conceptualization, data curation, formal analysis, methodology, resources, supervision, writing – original draft, writing – review & editing.
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Introduction

Benign vocal fold lesions (BVFLs) are acquired structural anomalies of the vocal folds, and these are primarily a result of vocal abuse or phonotrauma. BVFLs can also be a consequence of irritant factors, such as laryngopharyngeal reflux or smoking, because they tend to cause phonotraumatic behaviors such as throat clearing or vocal straining due to vocal fold edema. Phonotraumatic behaviors happen with laryngeal hyperfunction, whenever the vocal folds are adducted with increased force. This may be a consequence of excessive inappropriate vocal properties such as loud talking or shouting, hard glottal attacks, and production of vocal noises; or laryngeal behaviors such as coughing and/or throat clearing [1].

Phonotraumatic lesions are not generally regarded as recurrent provided that appropriate behavioral changes are made after resolution or surgical removal. Voice therapy plays a crucial role in this aspect. Treatment for lesions caused by phonotrauma may start with a behavioral intervention with voice therapy. The primary goal of voice therapy is to maximize efficiency of phonation and to eliminate maladaptive vocal behaviors that exacerbate the lesion(s). Vocal hygiene is discussed during voice therapy to reduce aggravating factors. When this intervention is not enough to achieve satisfactory improvement, surgical treatment is considered. Other times, surgery is recommended as the first line of treatment given the type and/or size of the lesion. The decision to pursue surgical intervention, should consider multiple factors, including the patient's vocal impairment, type and location of the lesion, and preparedness to adhere to post-operative recommendations [2]. When surgical treatment of BVFLs is necessary, it aims to re-establish the mechanism of normal phonation, which is often altered by the changes in mass, flexibility, elasticity, and resistance of the vocal folds. Some patients may not need surgical intervention if the impairment from their lesions is not limiting.

In a study performed by Upadhay et al. [3] among 114 patients with BVFLs, 57% of patients responded to conservative management (voice therapy, steroids, voice rest, and lifestyle modifications) while the remaining 48 patients underwent phonosurgery using cold instruments. Doloi et al. [4], in a study that included 80 patients with BVFLs, found that ~91% of patients with vocal fold nodules (20/22) responded to conservative management and ~87% with vocal polyps (26/30) required surgery.

Prevalence of BVFL has been widely studied. In a recent study, the association between BVFLs and noise exposure in the workplace was found to be 1.52 times more likely (95% CI) to occur in individuals with occupational noise exposure, after adjusting for age, sex, smoking, drinking, obesity, hypertension, diabetes, income, education, and occupation [5]. These findings can be explained through the Lombard effect [6]. The most common symptoms BVFLs present are certain degrees of dysphonia, vocal fatigue, and foreign body sensation [4,5]. The voice quality changes depend on the stiffness effect the lesion(s) exert(s) on the vocal folds, and the effort to operate them increases with it. The degree of air escape, and the degree of contact of the vocal folds will also determine the quality of the voice [7]. Vocal fold nodules, mid fold masses, and pseudocysts are more prevalent in women [8–11]. Similarly, but in a smaller ratio, granulomas have been observed to be more prevalent in men [12].

Published research on voice therapy post-operative programs is sparse [13,14] with no clinical guidelines [7,15]. There are some inconsistencies in treatment approach of these lesions. Sulica and Behrman [16] examined these inconsistencies in a survey among +1200 clinicians, who were members of the American Academy of Otolaryngology-Head and Neck Surgery. The authors found that there was lack of consensus in the use of voice therapy for BVFLs other than nodules. Supporting this argument, White et al. [13] conducted a systematic review to examine the evidence regarding pre- and post-operative voice therapy interventions in patients with BVFLs. They concluded that the literature is limited in content, timing, and intensity of the interventions. Recent studies have discussed how voice therapy interventions fail to use specific terminology for similar interventions and have proposed theoretical frameworks such as the Rehabilitation Treatment Specification System [17] or the Behaviour Change Technique Taxonomy [18].

Ju et al. [19] found that after vocal fold polyp removal surgery, post-operative voice therapy improved patients' vocal discomfort, emotional responses, and everyday self-perception. In regards to timing of voice therapy in BVFLs, Tang and Thibeault [20] concluded that groups receiving a pre-operative counseling session, whether with post-operative therapy or not, had statistically significant improvements in their VHI total scores compared to groups that did not have a pre-operative session.

There is also lack of consensus regarding recommendations for pre- and post-operative voice rest (absolute or relative) [21], although it has been related to better surgical results and to reduce prolonged dysphonia after a surgical intervention [2,7,22,23]. Patient reported outcome measures also produced inconsistent results when studying the duration of absolute voice rest. In patients who underwent surgery for polyps and cysts, King et al. [24] did not find any statistical differences on patient's VHI among 43 patients that were recommended post-operative absolute voice rest that lasted 7 days, less than 7 days or more than 7 days. The approach to voice rest recommendations was also examined in another section of the above-mentioned survey by Behrman and Sulica [25]. Preference for absolute voice rest versus relative voice rest as well as the duration of voice rest following vocal fold surgery for vocal fold nodules, polyps, and cysts was explored. The majority of the clinicians (62.3%) preferred relative voice rest, 51.4% recommended absolute voice rest, and 15% never recommended either absolute or relative voice rest. The most common duration recommended was seven days, with a range of zero to 14 days for absolute voice rest and zero to more than 21 days for relative voice rest. No significant difference was found with the type of voice rest recommended by clinicians based on the lesion type.

The aim of this article is to propose a structured pre- and post-operative voice therapy program for patients undergoing surgical intervention for BVFLs. The program refers to BVFLs following this diagnostic scheme: *nodules or fibrovascular masses* (also referred in the literature as *mid fold masses*) are subepithelial fibrotic changes located at the midpoint of the membranous fold, *cysts* are encapsulated subepithelial masses, *polyps* are sessile or pedunculated subepithelial lesions at the midpoint of the membranous vocal fold and they can be hemorrhagic or fibrotic, *pseudocysts* are defined as translucent lesions on the vibratory margin of the vocal folds that are not encapsulated, and *granulomas* are unilateral or bilateral lesions typically located on the vocal process.

Method

The program

Typically, patients are evaluated at Lakeshore Professional Voice Center by an interdisciplinary team (a fellowship trained laryngologist and a speech-language pathologist specialized in voice and upper airway disorders). A medical history, a head and neck exam and a rigid and/or flexible laryngoscopy with videostroboscopy are performed. The voice team discusses the findings with the patient and recommendations are made. In the case of BVFLs, a medical, surgical, or behavioral approach (or a combination of those) is explained, while answering the patient's questions. When discussing the surgical approach, the procedure and its risks are explained, as well as the time line for voice rest and for the pre- and post-operative voice therapy program.

As stated above, the objective of this article is to present a pre- and post-operative voice therapy program for patients undergoing surgical intervention for BVFLs. The proposed program consists of five sessions with a voice specialized speech-language pathologist: one pre-operative session and four post-operative sessions.

Pre-operative voice therapy session

Several goals need to be accomplished in the pre-operative voice therapy session to ensure that the patient is adequately prepared for surgery. These include completing any necessary voice evaluation; counseling about any behaviors that may have contributed to BVFL formation or that may hinder recovery; discussing preparation for surgery and typical recovery process; and preliminary teaching of therapy exercises that will be used during recovery.

First, an evaluation is completed. A pre-operative behavioral and acoustic-aerodynamic voice evaluation typically consists of obtaining baseline acoustic and aerodynamic measures, VHI-10, and in-depth patient interview regarding daily voice use and functional goals for treatment. This evaluation typically includes education about hydration, reflux, phonotraumatic behaviors, and other general vocal hygiene considerations.

In addition to evaluation, patient questions and expectations for surgery are discussed as needed in this pre-operative session. The patient will have already talked with the laryngologist and will also talk to the surgical scheduler, but may want to have their diagnosis, overview of the surgical procedure, or other information explained again.

It is at this point that the post-operative voice rest protocol is discussed with the patient, as follows:

Week 1. Total voice rest. No talking, whispering, singing, laughing, coughing, throat-clearing, bearing down, or heavy lifting.[1]

Week 2. Up to 5 minutes of voice use per hour. Avoid talking on the phone, in loud environments, or in any way that feels strained or causes voice quality to deteriorate.

Week 3. Up to 10-15 minutes of voice use per hour, assuming there have been no setbacks.

Week 4. Up to 20-25 minutes of voice use per hour, still limiting long conversations or other demanding vocal situations as needed (no singing).

Weeks 5-6. Back to "normal" voice use depending on how the patient feels and sounds. Still no singing.

[1] Many patients need guidance regarding athletic activities that do not necessarily require voice use, but may trigger grunting or bearing down, like lifting heavy weights.

To finish the pre-operative session, the patient is taught semi-occluded vocal tract exercises (SOVTE) with a straw in water. The first exercise, SOVTE 1, is airflow only (i.e., blowing a steady stream of bubbles for 5-10 seconds). The patient is encouraged to be mindful of sensations in their throat while completing this exercise and to maintain a relaxed, easy feeling on exhalation. It is recommended that the patient complete 1-2 minute sets of this exercise every hour during their week of voice rest.

It is important to mention that sometimes patients cannot adhere to these restrictions due to inability to take time off work. In these cases, we encourage them to take as much time off as they can while minimizing voice use. Occasionally, the patient states they will be able to adhere to the post-operative recommendations in the future; for example, once the school year is over or after the running of a show or tour. In those cases, the patient may be enrolled in voice therapy while they wait for the ideal time to perform the surgery.

Post-operative voice therapy sessions

As mentioned previously, the typical recommendation is absolute voice rest and hourly sets of SOVTE 1 (airflow only, no voicing) for the first week after surgical intervention for BVFLs. After the first week, patients return to the office for a follow-up videolaryngostroboscopic exam to make sure that there are no contraindications to beginning voice use. Assuming this is the case, the patient will have their first post-operative voice therapy session immediately afterward. The typical program for this session, along with the following three sessions (ideally scheduled weekly), is described in detail below.

Post-operative session 1

If the patient has observed one week of absolute voice rest, this session and the preceding appointment with the laryngologist are their first voice use after surgery. In this session, SOVTE 1 (airflow only) is reviewed and SOVTE 2 (sustaining one comfortable pitch) is introduced. If the patient is struggling to produce voicing without strain, they are cued for reduced effort (e.g., "sigh sensation," "gentle onset," etc.) and reminded that these exercises should feel relaxed and not pushed or effortful. The patient is recommended to practice SOVTE 1 and SOVTE 2 ten times each for one set, and to complete 4-6 sets each day as tolerated.

The guideline for voice use during the second week of recovery is given, as explained during the pre-operative session. If the patient is still experiencing any pain or discomfort with voicing, these recommendations may be adjusted.

Post-operative session 2

This session typically is scheduled about two weeks after the surgery, so the patient will have been using their voice for about a week. In this session, time is taken to review SOVTE 1-2 and troubleshoot any issues the patient may have had in their home practice. If the patients have progressed well and are tolerating their current level of voice use, they are then taught SOVTE 3 (ascending pitch glide, comfortable low to comfortable high), SOVTE 4 (descending pitch glide, comfortable high to comfortable low), and SOVTE 5 (connecting three ascending and descending glides on one breath). For pitch glides, range is limited as necessary to what is easy and comfortable, particularly for singers and other voice users who are used to covering a wide pitch range. Now that the patient is doing SOVTE 1-5, each exercise is completed five times for one set, and the patient is invited to continue with the schedule of four to six sets throughout the day.

Voice use is advanced according to voice rest protocol for week 3, with reminders to avoid voice use in loud environments, limit long conversations, and continue to rest as needed if they experience vocal fatigue or worsening voice quality with prolonged use.

Post-operative session 3

Assuming everything is progressing well and the patient is not experiencing any setbacks, this session includes a review of SOVTE 1-5 and introduction of the Resonant Voice Therapy basic training gesture (RVT). For this, the patient is cued to hum gently and pay attention to vibration sensation in the face (nose, lips, cheeks, etc.). The patient is taught to use the RVT basic training gesture throughout the day embedded in conversation (e.g., "mm-hm," "mmm") to promote easy, efficient voicing.

Voice use is advanced according to week 4 recommendations.

Post-operative session 4

In this session, RVT is advanced as far as the patient is able. The typical progression includes first blending /m/, /n/, /z/, and /v/ with vowels in CVC combinations, then moving on to words, phrases, sentences, reading passages, and conversation with various combinations of chanting and inflection to facilitate forward resonance in regular voice use. The patient is encouraged to continue to practice these exercises and principles as needed moving forward, depending on how their voice is doing by this point.

Voice use is advanced to "normal" as tolerated. If the patient is a singer, it is recommended that they hold off on singing until they have their 6-week recheck with the laryngologist to ensure that healing is sufficient to support athletic voice use.

Reflection

One primary consideration when approaching pre- and post-operative voice therapy for patients with BVFLs is getting the vocal folds vibrating in a way that limits impact stress. It is also often necessary to break patterns of vocal hyperfunction that may have contributed to or developed in response to BVFL formation, and to prevent the development of hyperfunction after surgery. SOVTE and RVT are both suited to help accomplish these goals.

As described by Titze [26], SOVTE increase source-filter interactions, "square up" the shape of the glottis, and reduce phonation threshold pressure. The wide-narrow configuration created with the vocal tract and straw helps to maintain low-amplitude vibration even at increased lung pressures, reducing injury concern. In short, SOVTE provide a relatively safe, supported way for patients to resume voice use after surgery while maintaining lower stress on the vocal folds.

As outlined by Verdolini [27], RVT exercises encourage relatively large-amplitude, low-impact vibrations of the vocal fold tissues. Theoretically, this allows for tissue mobilization while minimizing potential for phonotrauma. It is hypothesized, and some preliminary data suggest, that gently mobilizing the vocal fold tissue may promote healing by reducing inflammatory markers and increasing anti-inflammatory markers. RVT also lends itself well to building carryover into everyday voice use as the patient may incorporate the RVT basic training gesture in conversation and can also practice forward-focused resonance with functional phrases.

White et al., in an effort to identify areas of agreement regarding best practices around pre- and post-operative voice therapy, describe important components and considerations when delivering intervention for patients with benign vocal fold lesions [14]. The authors list eleven components with agreement. Eight of them are addressed in the voice therapy protocol here presented, such as "modify level of voice use", "provide opportunities to practice modified levels of muscle activation" and "provide semi-occluded vocal tract exercises". In a previous systematic review about evidence for pre- and post-operative voice therapy [13], these authors concluded that even though the direct voice therapy techniques implemented varied among the studies that were reviewed, specific aims were addressed with similar therapy techniques including Resonant Voice Therapy, Accent Method, and Lax Vox exercises.

The authors believe that the direct and indirect voice therapy techniques administered in the program presented in this manuscript, over the course of five sessions and with special attention during the last two sessions to carry over into everyday voice demands, meet the fundamental goals of pre- and post-operative intervention.

Conclusions

The journey through therapy, surgery, and healing is unique for every patient with BVFLs. The voice team (SLPs and ENTs) working together may benefit from a time-structured advance in voice use and exercises. Having a standard treatment protocol is a useful tool for the voice pathologist, particularly one without extensive voice training. Voice pathologists with many years of experience may have more confidence in their clinical judgement during post-operative recovery, and therefore may not need to rely on a structured protocol as much. Of course, the voice pathologist still must tailor the program to each patient's specific healing process and adjust if felt warranted. However, the program we describe should be safe for patients and help transition them from surgery to healthy voice use.

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