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Original Article

Proposed Adaptation for Measuring Vocal Effort Based on the Rate of Perceived Exertion Scale (RPE)

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ABSTRACT

This study proposed an adaptation of the Rate of Perceived Exertion Scale (RPE) and the Modified Borg CR-10 Scale to measure vocal effort. Translation and application processes were carried out in accordance with the guidelines provided by the International Test Commission (ITC). The translation process resulted in an initial scale developed in Chilean Spanish, tailored explicitly for vocal effort. The application process involved fifteen participants with an ENT diagnosis of dysphonia. They also had the opportunity to provide feedback on the semantic and morphosyntactic content of the scale, as well as on the incongruence of specific terms with Chilean usage norms. No observations were reported by the participants in this regard. Subsequently, the final version of the instrument was obtained, which included directions that assist in representing vocal effort, specific application instructions, and different categories expressing varying degrees of vocal exertion. In conclusion, this study proposes an adaptation of the aforementioned instruments to measure vocal effort in the Chilean context.

Keywords:
Physical Exertion; Vocal Effort; Surveys and Questionnaires: Dysphonia; Voice

Propuesta de adaptación para la medición del esfuerzo vocal basada en el Índice de Esfuerzo Percibido (IEP)

RESUMEN

Este estudio tuvo como objetivo proponer una adaptación para la medición del esfuerzo vocal basada en la estructura del Índice de Esfuerzo Percibido (IEP) y del Modified Borg CR-10 scale for vocal effort. Para esto, gracias a los lineamientos entregados por International Test Commission (ITC), se ejecutaron procesos de traducción y de aplicación. El proceso de traducción dio como resultado una primera escala construida en español chileno y específica para el esfuerzo vocal. En el proceso de aplicación participaron quince personas con diagnóstico otorrinolaringológico de disfonía, quienes, además, tuvieron la oportunidad de entregar observaciones vinculadas al contenido semántico y gramatical-morfosintáctico de la estructura de la escala, así como de la incongruencia de alguna de las palabras según la norma chilena. En relación con lo anterior, no existieron observaciones por parte de los participantes. De esta forma, se obtuvo la versión final del instrumento, la que incluye las indicaciones que ayudan a representar el esfuerzo vocal, las instrucciones específicas de aplicación y las distintas categorías que expresan diversos grados de esfuerzo vocal. En conclusión, se establece una propuesta de adaptación para la medición del esfuerzo vocal basada en los instrumentos previamente indicados.

Palabras clave:
Esfuerzo físico; Esfuerzo vocal; Encuestas y cuestionarios; Disfonía; Voz

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INTRODUCTION

Vocal effort is defined as the sensation of physical exertion during a vocal task (Hunter et al., 2020). It is considered a multifactorial, speaker-dependent perception influenced by factors ranging from environmental vocal demands to the structural condition of the vocal folds (Camargo et al., 2019). It has also been described as an individual perception shaped by cognitive factors—including how the sensation is interpreted, contextual factors related to vocal demand and the speaker's response to it, organic factors associated with the structural condition of the vocal folds, and emotional factors involving motivation to meet the imposed demand (Ford Baldner et al., 2015; Hunter et al., 2021).

Multiple tools and procedures have been developed within vocal science to directly or indirectly assess perceived vocal effort in people with and without voice disorders. These include methods for quantifying subglottal pressure, transglottal airflow, and vocal-fold adduction during phonation (van Mersbergen et al., 2021). However, these procedures are costly and often inaccessible to clinicians. To reduce the economic burden associated with vocal effort assessment, some authors have proposed employing Visual Analog Scales (Castillo-Allendes et al., 2023) and the Voice Handicap Index (Ruel & Thibeault, 2020). Nonetheless, existing evidence indicates that these instruments lack the specificity and sensitivity required to adequately capture this perception (Camargo et al., 2019; Ford Baldner et al., 2015).

Other authors have developed the concept of Perceived Exertion from exercise science. This concept refers to the individual, subjective perception of physical activity intensity during a task (Halperin & Emanuel, 2020). Tools designed to measure this construct are known as Ratings of Perceived Exertion (RPE), with the most widely used being the Borg scale (Figure 1), the OMNI-RES scale (Figure 2), and Foster's modified RPE (0–10) scale (Figure 3). Commonly, such indices rate exertion from 0 to 10, where 0 indicates no exertion and 10 represents maximal exertion, as exemplified by the Borg category-ratio 10 scale (Borg CR-10; Williams, 2017). The Borg CR-10 scale has demonstrated strong validity and reliability for measuring exertion levels across diverse age groups and genders, and in various types of physical activity (Frasie et al., 2024; Lea et al., 2022).

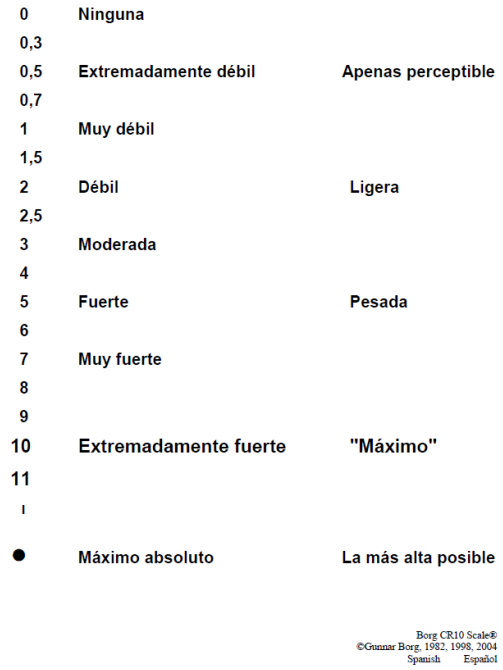

Figure 1. Borg CR-10 scale adapted to Spanish (Borg, 1982).

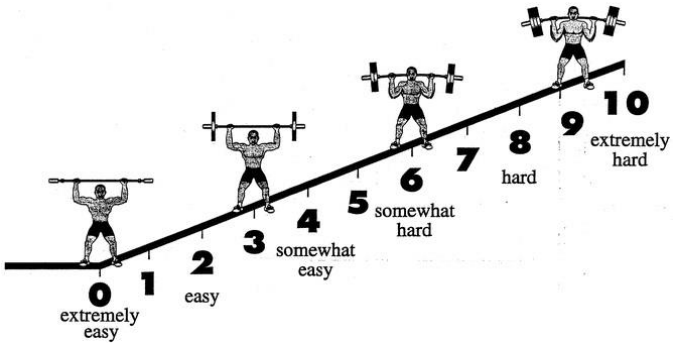

Figure 2. OMNI-Resistance Exercise Scale (OMNI-RES) of perceived exertion (Robertson et al., 2003).

A 2015 study reviewed the tools used to measure vocal effort, noting that all existing instruments rely on estimates that distance vocal effort from its physical foundations, instead assigning greater relevance emotional or psychological factors, among others (Ford Baldner et al., 2015). Consequently, given the usefulness of this construct for measuring physical exertion, the authors proposed a vocal version of the Borg CR-10 scale, the Modified Borg CR-10 Scale for Vocal Effort. To date, this

adaptation has shown promising results in measuring vocal effort in people with organic and functional vocal-fold lesions (Ford Baldner et al., 2015), phonotraumatic hyperfunction (van Leer & van Mersbergen, 2017), and hypernasality (Ramos-Favaretto et al., 2019). Moreover, it has been shown to effectively identify the degree of perceived effort across different levels of vocal intensity (Hunter et al., 2021).

Rating	Descriptor
0	Rest
1	Very, Very Easy
2	Easy
3	Moderate
4	Somewhat Hard
5	Hard
6	.
7	Very Hard
8	.
9	.
10	Maximal

Figure 3. Foster's modified RPE (0–10) scale (Foster et al., 2001).

The adapted Borg CR-10 scale for vocal function is currently the only specific procedure available for identifying perceived effort during phonation. Its efficiency and simplicity facilitate its use in research, academia, and even routine clinical practice (Berardi & Hunter, 2022). This has led to the development of various versions of the scale, such as its Brazilian Portuguese adaptation (Camargo et al., 2019). Despite these developments, the Borg scale and its variants follow a precise protocol for their administration, which hinders adequate adaptation to Chilean Spanish. Therefore, this study proposes an adapted instrument for measuring vocal effort based on the structure of the RPE and the Modified Borg CR-10 Scale for Vocal Effort.

METHOD

Design

This project was approved by the Scientific Ethics Committee of Universidad Mayor under number 0380. It was also authorized by the primary author of the Modified Borg CR-10 Scale for Vocal Effort to use and interpret elements specific to vocal effort, as well as by BorgPerception for research purposes (code #PUWWXX#). This allows for the inclusion of instructions and concepts related to vocal effort during the administration of the Borg scale.

This proposal employed two pillars for its development. First, the work conducted using the Modified Borg CR-10 Scale for Vocal Effort, specifically its qualitative indicators and instructions. Second, the typical structure of any RPE measure, namely the 0-to-10 effort rating system, as already implemented and recommended in several studies (Eston, 2012; Petro et al., 2025; Zourdos et al., 2016). A psychometric design, following the guidelines of the International Test Commission (ITC) (Bartram et al., 2018), was employed to interpret and reformulate the required elements of the Modified Borg CR-10 Scale. Based on these considerations, the study was structured into two main stages: translation and administration. Each of these stages is described in detail below.

Stage 1: Translation

The first step of the study was completing a forward translation of the Modified Borg CR-10 Scale for Vocal Effort into Chilean Spanish. This was carried out by two bilingual (English–Spanish) speech-language therapists (SLTs) specializing in voice, each certified at C1 English on the TOEFL exam and independent from the research team. This translation process included adapting the instructions, items, and response options to ensure comprehensibility for Chilean people diagnosed with dysphonia (Table 1). Both professionals worked autonomously—blinded to each other's work and without communication—although they were informed of the study's objectives. Once completed, both forward translations were submitted to the research authors.

The forward translations were then compared by an expert committee composed of three bilingual (English–Spanish) SLTs specializing in voice, each with at least 5 years of experience in the field. The committee reviewed and compared the two translations and assessed their correspondence with the Modified Borg CR-10 Scale for Vocal Effort, identifying the translation most consistent with the original scale. This process resulted in the creation of a single document, referred to as the Final

Translation (FT), which was subsequently back-translated into English, following ITC guidelines.

The back-translation was performed by a professional with a degree in English–Spanish translation and interpretation, who had not participated in the previous stages of the study, had no background in SLT, and was unfamiliar with the original instrument. The original version of the scale and its back-translation were deemed semantically equivalent by the aforementioned expert committee.

Subsequently, the research team conducted a pilot administration of the instrument to ensure the cultural equivalence of the translation. At this stage, an "observations" option was added to the translated tool, allowing participants to indicate any concerns related to semantic content, grammatical or morphosyntactic structure of the items, or lexical choices that did not align with Chilean linguistic usage.

Stage 2: Administration

The administration of the resulting instrument was carried out based on the basic structure of the RPE and the instructions and qualitative indicators of the Modified Borg CR-10 Scale for Vocal Effort, translated into Spanish.

The sample in this stage was determined by convenience, using the Brazilian Portuguese adaptation of the Modified Borg CR-10 Scale for Vocal Effort as a reference (Camargo et al., 2019). Fifteen people participated: 11 cisgender women and 4 cisgender men, ages 21 to 66 years, with a mean age of 34.6 ± 15.6 years. Table 2 describes the participants' characteristics.

The inclusion criteria were as follows: being over 18 years of age, having Chilean citizenship, attending speech-language therapy, being diagnosed with dysphonia by an ENT, and receiving care at either the Speech-Language Therapy Center at Universidad de Valparaíso (CAFUV) or the Speech-Language Therapy Clinic at Universidad Mayor (CFUM).

All participants signed an informed consent form that had been previously reviewed and approved by the Scientific Ethics Committee. Each person was given basic instructions for administering the RPE, was introduced to the concept of vocal effort, and asked to complete the following tasks, paying attention to the vocal effort experienced during each of them: (a) produce sustained /a/ and /i/ vowels at conversational pitch and loudness for 3 to 5 seconds; (b) read the sentences from the Spanish version of the CAPE-V (Núñez-Batalla et al., 2015); and (c) answer naturally to the prompt: "Tell me about your voice disorder." These tasks were selected due to their similarity to those used in the Brazilian Portuguese adaptation (Camargo et al., 2019).

After completing each task, participants were required to circle the number corresponding to their perceived vocal effort during the task.

Finally, each participant was asked to complete the observations section if they did not understand any of the statements, either because they were not culturally appropriate for Chilean Spanish or because of the translation's wording choices.

RESULTS

No observations were reported by participants during the administration stage. Therefore, the translation and administration processes resulted in a first version of the instrument. This version includes instructions on vocal effort, specific administration guidelines, and categories reflecting different degrees of vocal effort (Appendix 1).

Table 1. Translation process for the Modified Borg CR-10 scale for vocal effort into Chilean Spanish.

Original Version	Translated Versions	Back Translation	Final Translation
Instructions on vocal effort: I just wanted to define a concept that will come up a little later in the experiment that you are participating in today. Vocal effort refers to the amount of physical effort you feel it takes to produce or make a voice. If you have to work hard to produce voice (perhaps with more breath or straining or pushing to create your voice) then vocal effort would be higher. If it feels easy to produce your voice (with little strain or breath exertion), vocal effort would be low. Do you understand this concept or have any questions about it?	T1. Instrucciones sobre el esfuerzo vocal: Solo quería definir un concepto que surgirá un poco más adelante en el experimento que está participando hoy. El esfuerzo vocal se refiere a la cantidad de esfuerzo físico que siente que requiere producir o hacer una voz. Si tiene que esforzarse mucho para producir voz (quizás con más aliento o esfuerzo o presión para crear su voz), entonces el esfuerzo vocal sería mayor. Si se siente fácil producir su voz (con poco esfuerzo o esfuerzo de respiración), el esfuerzo vocal sería bajo. ¿Comprende este concepto o tiene alguna pregunta al respecto? T2. Instrucciones sobre el esfuerzo vocal: Sólo quiero definir un concepto que saldrá un poco más adelante en el experimento en el que estás participando. El esfuerzo vocal se refiere a la cantidad de esfuerzo físico que tu sientes que necesitas para producir o emitir la voz. Si tu realizas un gran esfuerzo para producir la voz (quizás con una mayor inspiración, tensión o fuerza para producir tu voz) entonces el esfuerzo vocal podría ser mayor. Si sientes que es fácil producir tu voz (con poca tensión o poco esfuerzo respiratorio), el esfuerzo vocal podría ser bajo. ¿entiendes este concepto o tienes alguna pregunta al respecto? FT. Instrucciones sobre el esfuerzo vocal: Sólo quiero definir un concepto que saldrá un poco más adelante en el experimento en el cual está participando. El esfuerzo vocal se refiere a la cantidad de esfuerzo físico que sientes necesario para producir o emitir la voz. Si realiza un gran esfuerzo para producir la voz (quizás con una mayor inspiración, tensión o fuerza para producir su voz) entonces el esfuerzo vocal podría ser mayor.	Instructions on vocal strain: I just want to define a concept that will come up a little later in the experiment in which you are participating. Vocal strain refers to the amount of physical effort that you feel necessary to produce or emit the voice. If you realize a big effort to produce the voice (perhaps with a greater inhalation, tension or strength to produce your voice) then vocal strain could be greater. If you feel that it is easy to produce your voice (with lower tension or breathing effort), the vocal strain may be low. Do you understand this concept or have any question about it?	Instrucciones sobre el esfuerzo vocal: Sólo quiero definir un concepto que saldrá un poco más adelante en el experimento en el cual está participando. El esfuerzo vocal se refiere a la cantidad de esfuerzo físico que siente necesario para producir o emitir la voz. Si realiza un gran esfuerzo para producir la voz (quizás con una mayor inspiración, tensión o fuerza para producir su voz) entonces el esfuerzo vocal podría ser mayor. Si siente que es fácil producir su voz (con poca tensión o poco esfuerzo respiratorio), el esfuerzo vocal podría ser bajo. ¿Comprende este concepto o tiene alguna pregunta al respecto?

	Si siente que es fácil producir su voz (con poca tensión o poco esfuerzo respiratorio), el esfuerzo vocal podría ser bajo. ¿Comprende este concepto o tiene alguna pregunta al respecto?		
Directions: Please circle the number that corresponds to the amount of vocal effort you felt it took you to produce your voice during the previous task.	T1. Instrucciones: Por favor, encierre en un círculo el número que corresponde a la cantidad de esfuerzo vocal que sintió al producir su voz durante la tarea anterior. T2. Instrucciones: Por favor encierre o marque con un círculo el número que corresponda a la cantidad de esfuerzo vocal que sintió al costar producir tu voz durante la tarea anterior. FT. Instrucciones: Por favor, encierre en un círculo el número que corresponde a la cantidad de esfuerzo vocal que sintió al producir su voz durante la tarea anterior.	Instructions: Please circle the number that corresponds to the amount of vocal strain you felt when producing your voice during the previous task.	Instrucciones: Por favor, encierre en un círculo el número que corresponde a la cantidad de esfuerzo vocal que sintió al producir su voz durante la tarea anterior.
Severity	T1. Severidad T2. Severidad FT. Severidad	Severity	Severidad
Scale	T1. Escala T2. Escala FT. Escala	Rating	Escala
No vocal effort at all	T1. Ningún esfuerzo vocal en absoluto T2. Sin esfuerzo vocal FT. Ningún esfuerzo vocal en absoluto	No vocal strain at all	Ningún esfuerzo vocal en absoluto
Very slight vocal effort	T1. Esfuerzo vocal muy leve T2. Muy poco esfuerzo vocal FT. Esfuerzo vocal muy leve	Very slight vocal strain	Esfuerzo vocal muy leve
Slight vocal effort	T1. Esfuerzo vocal leve T2. Poco esfuerzo vocal FT. Esfuerzo vocal muy leve	Slight vocal strain	Esfuerzo vocal leve

Moderate vocal effort	T1. Esfuerzo vocal moderado T2. Esfuerzo vocal moderado FT. Esfuerzo vocal moderado	Moderate vocal strain	Esfuerzo vocal moderado
Somewhat severe vocal effort	T1. Esfuerzo vocal algo severo T2. Esfuerzo vocal entre moderado y severo FT. Esfuerzo vocal moderado	Slightly severe vocal strain	Esfuerzo vocal algo severo
Severe vocal effort	T1. Esfuerzo vocal severo T2. Esfuerzo vocal severo FT. Esfuerzo vocal severo	Severe vocal strain	Esfuerzo vocal severo
Very severe vocal effort	T1. Esfuerzo vocal muy severo T2. Esfuerzo vocal muy severo FT. Esfuerzo vocal muy severo	Very severe vocal strain	Esfuerzo vocal muy severo
Very very severe vocal effort (Almost maximum)	T1. Esfuerzo vocal muy, muy severo (casi máximo) T2. Demasiado esfuerzo vocal (Casi Máximo) FT. Esfuerzo vocal muy, muy severo (casi máximo)	Very very severe vocal strain (near maximum)	Esfuerzo vocal muy, muy severo (casi máximo)
Maximum vocal effort	T1. Esfuerzo vocal máximo T2. Máximo esfuerzo vocal FT. Esfuerzo vocal máximo	Maximum vocal strain	Esfuerzo vocal máximo

Abbreviations: T1: Translation 1; T2: Translation 2; FT: Final Translation.

Table 2. Participant characteristics

Participant	Gender	Age (Years)	ENT Diagnosis	SLT Diagnosis (Behlau, 2005)
1	Woman	21	Minor Structural Alteration	Functional Dysphonia secondary to anatomical maladjustment
2	Man	30	Muscle Tension Dysphonia	Functional Dysphonia
3	Woman	41	Left Vocal Fold Paresis	Organic Dysphonia
4	Woman	21	Muscle Tension Dysphonia	Functional Dysphonia
5	Woman	22	Muscle Tension Dysphonia	Functional Dysphonia
6	Woman	22	Minor Structural Alteration	Functional Dysphonia secondary to anatomical maladjustment
7	Man	27	Left Vocal Fold Paresis	Organic Dysphonia
8	Man	53	Left Vocal Fold Paralysis	Organic Dysphonia
9	Woman	37	Right Vocal Fold Paralysis	Organic Dysphonia
10	Man	23	Muscle Tension Dysphonia	Functional Dysphonia
11	Woman	21	Muscle Tension Dysphonia	Functional Dysphonia
12	Woman	66	Vocal Fold Paralysis	Organic Dysphonia
13	Woman	62	Muscle Tension Dysphonia	Functional Dysphonia
14	Woman	27	Muscle Tension Dysphonia	Functional Dysphonia
15	Woman	46	Unilateral Vocal Fold Polyp	Organic-Functional Dysphonia

DISCUSSION

This study aimed to propose an adaptation for measuring vocal effort based on the Rating of Perceived Exertion (RPE) and the Modified Borg CR-10 Scale for Vocal Effort. This process was successfully carried out and administered to people within a specific age range who were diagnosed with various vocal pathologies.

The proposed instrument incorporates the typical gradation of any RPE measure and selected elements from the Modified Borg CR-10 Scale for Vocal Effort. In doing so, it complies with the licensing requirements of the Borg scale, which prohibit the use of its concepts, instructions, and specific gradation format. For example, the Borg scale (Figure 1) uses descriptors such as "very weak" and "strong" for indicators "1" and "5," respectively. In contrast, our proposal uses "very mild vocal effort" and "severe vocal effort" for those same indicators. Additionally, the Borg scale includes values such as 0.3, 0.5, 0.7, 1.5, and 2.5, whereas our RPE-based instrument ranges from 0 to 10 and does not include these values. This shows that the proposed instrument maintains a clear distance from elements explicitly restricted in any adaptation of the Borg Scale (Eston, 2012).

Despite the innovative nature of this proposal, it should be noted that its use is not intended for research purposes nor for highly controlled environments. Similar to other existing proposals, its use is recommended primarily in clinical settings (Lea et al., 2022).

On the other hand, the present study included a sample spanning a wide age range, specifically from 21 to 66 years. This variability could influence the perception of effort during instrument administration. However, previous studies have shown that daily vocal effort, as perceived by people without vocal pathology aged 20 to 65 years, does not vary significantly and typically falls into the "no effort" category (Morton-Jones et al., 2024). Although this finding pertains to vocally healthy individuals, it suggests that perceived vocal effort may not be substantially altered by age alone. Nevertheless, it remains unknown whether this stability is maintained among people with vocal disorders, such as those included in the current sample.

This study should be regarded as a proposal rather than a definitive tool. Its contribution lies in advancing the study of vocal effort by reducing reliance on general statements or descriptors that may be poorly aligned with how this perception is measured. Thus, the present proposal should be considered a contribution to clinical practice and to those who require primarily qualitative observations of vocal effort.

Limitations

This is an initial proposal that requires multiple revisions and improvements for full implementation in research or highly controlled environments. Consequently, it presents several limitations, most notably an instrument that is not validated. This aspect negatively affects its reliability in quantifying and analyzing vocal effort. Another limitation is the lack of diversity in the sample, reflected in the reduced sample size and limited linguistic representativeness, as it includes only participants from Santiago and Valparaíso. Taken together, these factors constrain the generalizability of the findings and result in a sample that does not adequately reflect the demographic, sociocultural, and linguistic characteristics of the Chilean population, thereby limiting the applicability of the instrument to only those represented.

The legal considerations associated with the use of scales such as the Borg scale also limit the scope of this research, as they prevent a complete adaptation of this type of instrument to vocal function. The Borg scale is protected by copyright and intellectual property laws, which, under a prior licensing agreement, require the preservation of elements from the legally authorized version. This means that any adaptation to populations or topics other than exercise or physical activity must comply with legal constraints that restrict full adaptation and validation for vocal function. As a result, only an adaptation proposal is feasible, similar to what has been done in other contexts, such as in cases of dyspnea (Boshuizen et al., 2013).

A further limitation of this study is the absence of structured cognitive interviews with respondents. Their exclusion made it difficult to understand how participants interpreted and answered the questions in our RPE measure, which, in turn, could affect the adequacy of its adaptation and administration. Nonetheless, to mitigate this limitation, each participant was asked to read the questionnaire aloud before responding. If comprehension difficulties were observed for any item, the participant was instructed to note them in the observations section. Based on this feedback, modifications were made to the phrasing and terminology.

Suggestions

This is an innovative proposal that incorporates a set of effort-related elements for application in the voice field. However, we offer several recommendations to improve the instrument. For example, to avoid effort ratings influenced by age or by specific vocal disorders, it would be helpful to standardize and expand the sample, thereby including a broader age range, greater variability of vocal disorders, and the full spectrum of sociolinguistic characteristics associated with Chilean Spanish.

Furthermore, to expand the study of vocal effort in clinical practice, it is crucial to continue proposing or adapting scales that measure this perception in both the spoken and singing voice. Additionally, to enhance the validity of this type of instrument, it is essential to compare its results with those of other scales, such as the OMNI scale.

CONCLUSION

The proposed adaptation for measuring vocal effort, based on the RPE structure and the Modified Borg CR-10 scale, was successfully implemented, yielding an instrument that enables the qualitative study of perceived vocal effort during phonation.

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Appendix 1

Propuesta de adaptación para la medición del esfuerzo vocal

Instrucciones sobre el esfuerzo vocal: Sólo quiero definir un concepto que saldrá un poco más adelante en el experimento en el cual está participando. El esfuerzo vocal se refiere a la cantidad de esfuerzo físico que siente necesario para producir o emitir la voz. Si realiza un gran esfuerzo para producir la voz (quizás con una mayor inspiración, tensión o fuerza para producir su voz) entonces el esfuerzo vocal podría ser mayor. Si siente que es fácil producir su voz (con poca tensión o poco esfuerzo respiratorio), el esfuerzo vocal podría ser bajo.

¿Comprende este concepto o tiene alguna pregunta al respecto?

Instrucciones: Por favor, encierre en un círculo el número que corresponde a la cantidad de esfuerzo vocal que sintió al producir su voz durante la tarea anterior.

Ningún esfuerzo vocal en absoluto	0
Esfuerzo vocal muy leve	1
Esfuerzo vocal leve	2
Esfuerzo vocal moderado	3
Esfuerzo vocal algo severo	4
Esfuerzo vocal severo	5
	6
Esfuerzo vocal muy severo	7
	8
Esfuerzo vocal muy, muy severo	9
(casi máximo)	
Esfuerzo vocal máximo	10