Phoniatrics

Videokymographic analysis of patients after frontolateral laryngectomy with sternohyoid muscle flap reconstruction

Analisi videochimografica in pazienti sottoposti a laringectomia frontolaterale con ricostruzione con lembo infraioideo

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SUMMARY

A retrospective study was conducted to analyse videokymographic findings from patients who underwent vertical frontolateral laryngectomy with reconstruction using a sternohyoid muscle flap. Overall, 22 patients with T1b and T2 glottic tumours and more than one year of follow-up were studied. Two experienced observers analysed the recorded videokymographic data. A cross-sectional descriptive design was used. The images showed the vocal vibratory behaviour during sustained /i/ phonation. The vibratory source was supraglottic in 7/22 patients, glottic in 11 and mixed in 4. The mean duration of the glottic cycles extracted from the supraglottic, mixed and glottic vibratory sources was 6.4 ms, 5 ms and 4.6 ms, corresponding to the fundamental frequency (f0) of 188.7 Hz, 200 Hz and 215.7 Hz, respectively. Of the 11 patients with a glottic vibratory source, 4 did not present a closed phase in the glottic cycle. The mean open quotient was 79%, 40% and 63%, for the supraglottic, mixed and glottic vibratory sources, respectively. All 11 reconstructed vocal cords presented a rounded lateral peak. Of the 15 preserved vocal cords, 11 presented a rounded lateral peak and 4 had sharp peaks. All patients with a glottic vibratory source presented a rounded medial peak. All the vocal cords evaluated presented a mucosal wave, which was normal in 3 patients with a glottic source and clearly reduced in the others. Only one case presented phase asymmetry. The mean values for the amplitude asymmetry index were 0.92 and 0.68, for the mixed and supraglottic vibratory sources, respectively.

KEY WORDS: Larynx • Malignant tumours • Laryngoscopy • Frontolateral laryngectomy • Kymography

RIASSUNTO

Allo scopo di valutare i risultati della videochimografia in pazienti sottoposti a laringectomia verticale fronto-laterale con ricostruzione con lembo di muscolo sternoioideo, abbiamo realizzato uno studio retrospettivo su 22 pazienti affetti da carcinoma T1b o T2 glottico con più di un anno di follow-up. Due osservatori esperti hanno analizzato i dati della videochimografia, ed è stato realizzato uno studio descrittivo. Le immagini evidenziano il comportamento vibratorio delle corde vocali durante l'emissione sostenuta di una "i". La sorgente di vibrazione è stata localizzata in sede sovragottica in 7 dei 22 pazienti, in sede glottica in 11, e mista in 4. La durata media del ciclo glottico ricavato dalla vibrazione sopraglottica, glottica o mista è stato rispettivamente di 6,4, 5 e 4,6 msec, corrispondenti ad una frequenza fondamentale di 188,7 Hz, 200 Hz e 215,7 Hz. 4 degli 11 pazienti con una sorgente vibratoria glottica non presentavano una fase completa del ciclo glottico. Il quoziente medio di apertura è stato del 79, 40 e 63% per la sorgente vibratoria sopraglottica, mista e glottica rispettivamente. Tutte le corde vocali valutate presentavano un'onda mucosa, che è risultata normale in 3 pazienti con sorgente vocale glottica, mentre era significativamente ridotta negli altri casi. La media dell'ampiezza dell'indice di asimmetria è risultato di 0,92 e 0,68 rispettivamente, per le sorgenti vibratorie miste e sopraglottiche.

PAROLE CHIAVE: *Laringe • Tumori maligni • Laringoscopia • Laringectomia frontolaterale • Chimografia*

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Introduction

Complex motion of the vibratory margins of the vocal cord mucosa is essential for producing the voice. This vibration can be altered by various diseases causing irregularity and instability of the vibratory pattern and by morphological changes, among other causes [1 2].

There have been technical descriptions of frontolateral laryngectomy for treating early glottic tumours[3]. Good reconstruction of the vocal cords is necessary for an adequate voice, satisfactory swallowing and unobstructed airways. One such method uses a bipedicle sternohyoid muscle flap [4]. This technique is an efficient type of treatment for selected cases of early glottic squamous cell carcinoma [5].

Today, videolaryngoscopy makes it possible to evaluate, quantify, diagnose and document vibratory changes [6]. Vibratory cycles are assessed in real time. A retrospective study analysing videostroboscopic data from 21 patients who underwent vertical frontolateral laryngectomy with reconstruction using a sternohyoid muscle flap showed that the vibration of the vocal cords had diminished on both sides, and particularly on the reconstructed side [7].

However, voices with a very aperiodic vibratory pattern or with moments of aperiodicity cannot be efficiently evaluated by means of stroboscopy. Svec & Schutte [8], in 1996, described the videokymography technique, which is a video-documentation method consisting of real-time digital examination of the larynx. With this technique, images obtained by means of laryngoscopy (conventional mode) enable analysis of the vocal cord mucosa, from which the vibratory details can be seen better [8]. After selecting the line to be examined, in the conventional mode, the camera picks up the line, which is the first from the top of the monitor, and analyses it at a rate of 7,812.5 images per second.

The aim of the present study was to evaluate, by means of videokymography, the characteristics of the vibrations in the vocal cord mucosa of patients who underwent frontolateral laryngectomy and reconstruction using a sternohyoid muscle flap.

Patients and methods

This study, granted approval by the Research Ethics Committee of Universidade Metropolitana de Santos, was a retrospective study on 22 male patients with glottic squamous cell carcinoma, in clinical stages T1b and T2, documented by means of histopathological examination of the primary tumour. These patients were consecutively enrolled and underwent frontolateral laryngectomy and reconstruction using a bipedicle sternohyoid muscle flap and external perichondrium from the thyroid cartilage. They were treated at the Head and Neck Surgery Services of Hospital Ana Costa de Santos and Santa Casa da Misericórdia de Santos, between January 1996 and December 2005.

Mean age of the patients was 63 years (range 43-71), 17 individuals (75%) were Caucasian. Their clinical history ranged from 3 to 12 months, and all presented the symptom of dysphonia. Patients were clinically staged as T1bN0M0 (19 cases) and as T2N0M0 (3 cases). Three patients underwent adjuvant radiotherapy: two because of narrow surgical margins in the primary tumour and the third because of recurrence in the neck, which was resolved by means of unilateral radical cervical dissection and adjuvant radiotherapy.

The oropharynx was anaesthetized using a spray of 10% lidocaine solution. The videokymography system (Kay Elemetrics®, New Jersey, USA, Model 8900) was used first in a conventional manner, as a conventional black-and-white camera, while the patient was asked to produce the sustained vowel sound/i/. This allowed the rigid Karl Storz® (Tuttlingen, Germany) 70° telescope to be correctly positioned, in order to select the line to be examined. The foot pedal was then used to switch the camera to videokymography mode. In conventional mode, the camera captures 30 images per second, which are represented successively by large numbers of lines on the monitor screen. Since the human eye does not have sufficient resolution to evaluate the capture of so many images, the impression given to the naked eye is that the final video image is continuous, whereas in actual fact, successive pictures are presented at a very fast rate. In an analogous manner, since the vocal cords vibrate at a frequency that is usually greater than 90 Hz, it is impossible, for the naked eye, to recognize their movement in detail, image by image. In the high velocity mode, the camera captures one line (scan) and analyses it at a speed of 7,812.5 images/sec., also in black and white. However, it does not analyse the entire plane of the image, but just one selected line, which is the top line on the monitor (the first from the top).

The data were recorded on DVD and were analysed jointly by two specialists in Head and Neck Surgery with experience in stroboscopy. These were real-time images representing the phases of the vibratory cycle on the line analysed. Success in the examination depended on the patient's tolerance and glottic conformation. It would, for example, be difficult to select an adequate line in patients with a high epiglottis [9].

There are two basic phases of the glottis - open and closed. The open phase can be subdivided into opening and closing phase. Therefore, the images thus obtained showed three stages in time: open, closing and closed. The sum of the duration of open and closing represented the total length of time for which the vocal folds remained open.

The parameters chosen for observation were based on those in the studies by Qiu et al. [10] and Svec et al. [11]. For all parameters, in each patient, three measurements were made and the mean was calculated. In the cases of glottic and mixed sources, the measurements for some of the parameters were only made on the preserved vocal cord, because of the low-amplitude vibratory pattern in the reconstructed vocal cord or in the ventricular fold.

Evaluation of the vibratory source and the fundamental frequency

Vibratory source evaluation.

When the conventional examination was performed, the patients were stratified into 3 groups, according to their source of phonatory vibration: glottic vibratory source, when the vibratory source was produced by both vocal cords (reconstructed and preserved); supraglottic vibratory source, when the vibratory source was produced by both ventricular folds, thus making it impossible to view the vocal cords during phonation; and mixed vibratory source, when the vibratory source was produced by one vocal cord with the contralateral ventricular fold, thus making it impossible to view the other vocal cord. Co-vibration of saliva and fluids, which represents extra-glottic interference of surroundings, was also evaluated.

Extraction of the glottic cycle duration and the fundamental frequency (f0)
The videokymographic images were represented by 7,812.5 lines/second. The duration of the vibratory cycle was calculated as a simple proportional equation, i.e., the number of lines in a complete cycle was counted from the start of the closed phase to the end of the open phase of the next cycle. The fundamental frequency (f0) represents the number of glottic cycles per second. They are inversely proportional to each other (f0 = 1/T).

Glottic wave morphology

Open and closed quotient (OQ and CQ)
The OQ represents the proportion of time in the open phase of the glottis in relation to the vibratory cycle of the vocal cord. This is defined as the duration of the open phase, divided by the period duration. In Figure 1, this has been calculated using the formula OQ = TO/T. The CQ represents the proportion of time, in the closed phase of the glottis, in relation to the vibratory cycle of the vocal cord. It can be directly derived from the value of OQ using the relationship CQ = 1 - OQ.

Glottic closure categorization
The changes in duration of the closed phase of the glottis can be stratified into closure absent, closure excessively short (< 20%) and closure excessively long (> 60%) [11].

Speed quotient (SQ)
The SQ represents the symmetry between the opening and closing phases of the glottis as previously described [12-14]. It is defined as the relationship between the length of time open and the duration of the closed phase. Because of the small excursion of the mucosal wave into the ventricular fold when the vibratory source was glottic or mixed, and into the reconstructed vocal cord in cases of a supraglottic source, it was not possible to establish the exact point at which the open phase of the glottis finished and the close started, in these cases. For this reason, measurements of SQ were only made on the preserved vocal cord in cases of glottic and mixed sources.

Shape of lateral and medial peaks (Fig. 1)
The lateral peak in the glottic cycle is determined by the point at which the opening of the glottis finished and the closing started. It is classified as sharp or rounded. The patients with a supraglottic vibratory source could not be evaluated. For those with a mixed source, only the preserved vocal cord was evaluated. The medial peak was determined as the point at which the closed phase finished and the opening of the mucosa of the vocal cord started, within the glottic cycle. This peak is often occluded by the closure of the glottis itself. The medial peaks can also be classified as sharp or rounded, and they reveal the shape of the medial surface (free margin) of the vocal cords [11].

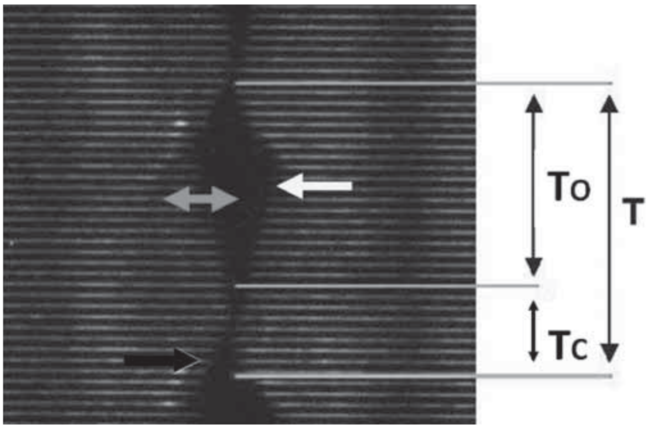

Fig. 1. Scheme for calculating open quotient (T0/T) and closed quotient (TC/T) in glottic cycle. Lateral peaks (white arrow) and medial peaks (black arrow), and t lateral excursion of mucosal wave (gray arrow), within glottic cycle.

Lateral excursion of the mucosal wave
It consists of lateral movement of the vocal cord that occurs during medial movement of the free margin of the vocal cord (Fig. 1). The mucosal wave reflects the capacity of the mucosa to transfer vibration energy from the free margin of the vocal cord to its cranial surface, and it is an indicator of the flexibility of the mucosa. The abnormalities that may be found are absent, reduced and excessive mucosal wave [11].

Cycle aberrations
The following cycle aberrations have been described: ripple, double medial peak and medial lack of smoothness.

Cycle-to-cycle variability

Time periodicity index (TPI)
This represents the proportion between the shorter and longer duration of the glottic cycles within the time evaluated, in two successive cycles. Thus, the value obtained will be between zero and one. The closer it is to one, the more periodic the voice is.

Amplitude periodicity index (API)
This represents the proportion between the smaller and larger amplitudes of duration of the glottic cycles within the time evaluated, in two successive cycles. Thus, the value obtained will be between zero and one. The closer it is to one, the more periodic the vibration is with regard to amplitude. The amplitude is defined as the measurement between the midline and the point of greatest lateral excursion of the mucosa (upper labium) during the glottic cycle.

Phase symmetry index (PSI)
This is defined as the difference between the phases of the two vocal cords, divided by the complete glottic cycle. The quantity "t" is defined as the length of time between the start of the open phase and the moment of maximum opening, with t1 < t2. Thus, the value obtained will be between

zero and one. The closer it is to zero, the more perfect the phase symmetry will be.

Amplitude symmetry index (ASI)
This is defined as the difference between the amplitudes of the two vocal cords, divided by the sum of the amplitudes of the two vocal cords. This has been calculated using the formula ASI = a1 - a2/a1 + a2. The quantity "a" is defined as the measurement between the midline and the point of maximum lateral excursion of the mucosa (upper labium) during the glottic cycle, with a1 < a2. Thus, the value obtained will be between zero and one. The closer it is to zero, the more symmetrical the amplitude of the vocal cords will be.
The quantitative variables are reported in Tables showing minimum, maximum, and mean values.

Results

Due to the small excursion of the mucosal wave into the ventricular folds, when the vibratory source was supraglottic or mixed, it was not possible to extract some of the measurements in some cases (Table I).

Evaluation of vibratory source of mucosal wave
Of the 22 cases in which kymograms were obtained, 7 presented a supraglottic vibratory source. In 3 of these, due to the absence of a vibratory pattern, it was not possible to extract the fundamental frequency or evaluate the vibratory characteristics. Among the other cases, 11 presented a glottic source and 4, a mixed source. In 3 cases of a mixed source, the vocal cord that took part in the vibratory source was the preserved one and the ventricular fold was the opposite one, i.e., on the side reconstructed using the muscle flap (Fig. 2). One patient with a glottic vibratory source presented interference in the videokymographic examination due to large quantities of fluid (saliva) (Fig. 3).

Extraction of glottic cycle duration and fundamental frequency (f0)
Of the 7 patients with a supraglottic source, 3 did not present any significant vibratory pattern. In the other 4, there was vibration of the ventricular folds, which was evaluated.

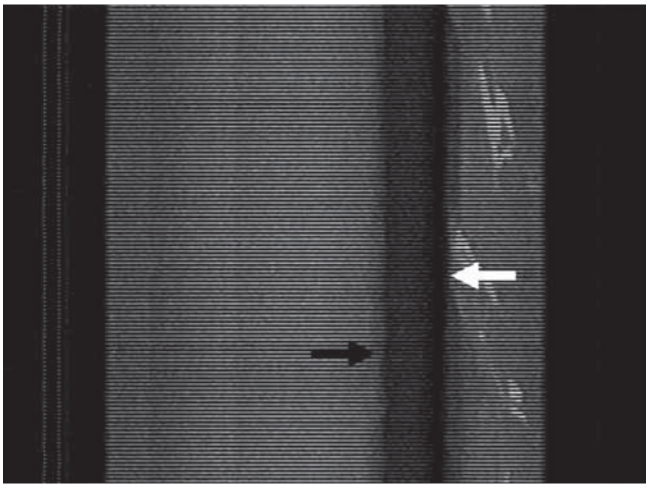

Fig. 2. Kymogram from patient with mixed vibratory source, showing participation of preserved vocal cord (white arrow) and ventricular fold on reconstructed side (black arrow).

Table I. Averages and variations of the numerical parameters.

Variable	Measurement	Vibratory source		
		Supraglottic*	Mixed	Glottic
Fundamental frequency (f0)**	n	4	4	11
	Variation (ms)	93.3-289.3	153.2-194.6	156.2-295
	Average (ms)	188.7	200	215.7
Open quotient (OQ)	n	4	4	11
	Variation (%)	20-100	20-63	50-74
	Average (%)	79	40	63
Speed quotient (SQ)	n	Not feasible	4	11
	Variation		0.82-1.6	0.43-1.5
	Average		1.25	0.94
Time periodicity index (TPI)	n	4	4	11
	Variation	0.96-1	0.98-1	0.98-1
	Average	0.99	0.99	1
Amplitude periodicity index (API)	n	4	4	11
	Variation	0.9-1	1	0.98-1
	Average	0.975	1	1
Phase symmetry index (PSI)	n	Not feasible	4	11
	Variation		0	0-0.35
	Average		0	0.03
Amplitude symmetry index (ASI)	n	Not feasible	4	11
	Variation		0.67-~1	0.34-~1
	Average		~0.92	~0.68

* *The vibratory data could be evaluated in 4 out of the 7 patients with supraglottic source;* ** *The "supraglottic cycle" was evaluated in patients with supraglottic source.*

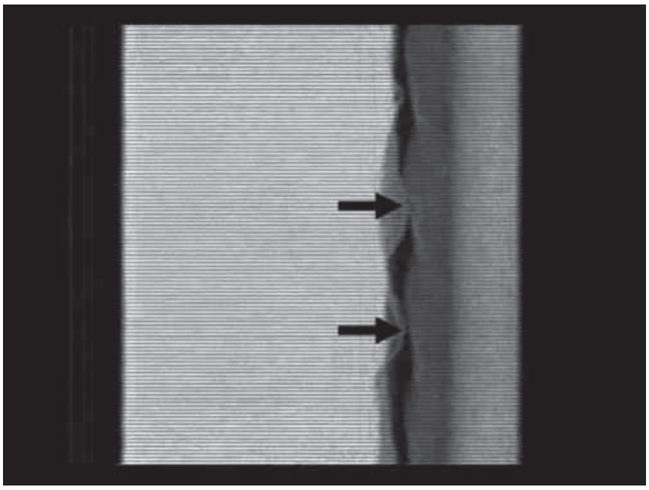

Fig. 3. Kymogram from patient with interference due to presence of saliva (black arrows).

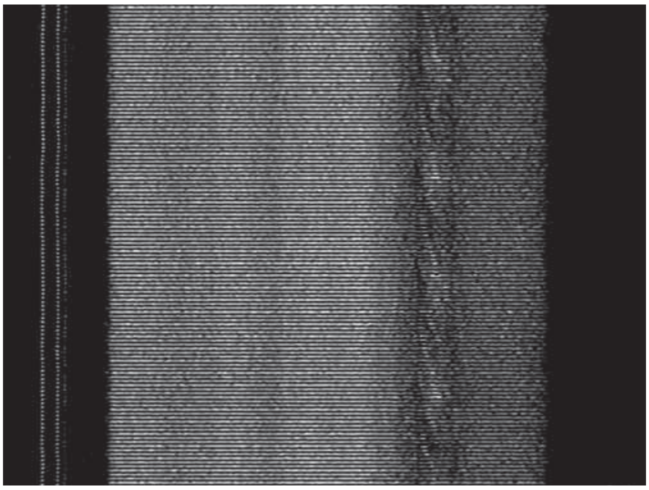

Fig. 4. Kymogram from patient showing decreased open phase.

The measurements obtained from the supraglottic (n = 4), mixed (n = 4) glottic (n = 11) vibratory sources were, respectively, 5.2 ms, 5 ms and 4.6 ms, which corresponded to the fundamental frequencies (f0) of 188.7, 200 and 215.7 Hz, respectively (Table I). The term "glottic cycle" does not apply to the patients with a supraglottic vibratory source. For these patients, the term "supraglottic cycle" could be used, since the ventricular folds were the structures evaluated.

Open quotient

Of the 7 patients with a supraglottic vibratory source, 4 did not present a closed phase in the glottic cycle, i.e., there was no coaptation of the ventricular folds during phonation. The mean values obtained from the supraglottic (n = 7), mixed (n = 4) and glottic (n = 11) vibratory sources were, respectively, 79%, 40% and 63% (Table I).

Glottic closure categorization

Among the cases with a supraglottic vibratory source, there was absence of glottic closure in 4 of the 7 patients. All the cases with a glottic vibratory source showed glottic closure that was within adequate limits. Table II shows the findings and Figure 4 gives example of the decreased open phase.

Speed quotient

The preserved vocal cords, in the cases of mixed vibratory source, presented a mean speed quotient of 1.25. On the other hand, in the cases of glottic vibratory source, the preserved vocal cords presented a mean of 0.94 (Table I).

Table II. Changes of the close quotient (CQ) of the glottic cycle according to the vibratory sources.

	Supraglottic (n = 7)	Mixed (n = 4)	Glottic (n = 11)
Closure absence	4	0	0
CQ < 20%	1	0	0
CQ > 60%	1	1	0

Shape of lateral peaks

Among the 11 reconstructed vocal cords, evaluated in patients whose vibratory source was glottic, all of them presented the shape of a rounded lateral peak. Of the 15 preserved vocal cords (11 patients with a glottic vibratory source and 4 with a mixed source), 11 presented a rounded lateral peak and 4, a sharp lateral peak.

Shape of medial peaks

It was not possible to adequately evaluate the shape of the medial peaks in any of the cases of supraglottic or mixed vibratory sources. Among the 11 patients with a glottic vibratory source, it was possible to evaluate the medial peak in 9 cases, which was rounded in all these cases.

Lateral excursion of mucosal wave

It was not possible to adequately evaluate the lateral excursion of the mucosal wave in any of the cases of supraglottic vibratory source. The 11 patients with a glottic vibratory source and the 4 with a mixed source, all presented a mucosal wave. The lateral excursion was normal in 3 patients with a glottic source. In all the other 12 patients, the lateral excursion was clearly decreased.

Aberrations of glottic cycle

It was not possible to adequately evaluate the occurrence of aberrations of the glottic cycle in any of the cases of supraglottic vibratory source. Among the 11 patients with a glottic vibratory source, one presented undulation (glottic source) but no other aberrations were found.

Time periodicity index (TPI)

Out of the 7 patients with a supraglottic vibratory source, it was not possible to obtain a TPI within the glottic cycle in 3, because of the absence of any significant vibratory pattern. Among all the other cases evaluated, the only cases in which the TPI was not equal to one were one case of supraglottic source (TPI = 0.96), one of mixed source (TPI = 0.98) and one of glottic source (TPI = 0.98) (Table I).

Amplitude periodicity index (API)
Out of the 7 patients with a supraglottic vibratory source, it was not possible to obtain an API within the glottic cycle in 3, due to the absence of any significant vibratory pattern. Among all the other cases evaluated, the only cases in which the API was not equal to one were in one case of supraglottic source (API = 0.9) and one of glottic source (API = 0.98) (Table I).

Phase symmetry index (PSI)
It was not possible to evaluate the PSI in any of the cases of supraglottic vibratory source, since this index depends on comparison between the two sides. In the cases of mixed source, we compared the phase of the preserved vocal cord with the phase of the contralateral ventricular fold. Out of all the cases evaluated, only one presented phase asymmetry (Table I).

Amplitude symmetry index (ASI)
It was not possible to evaluate the ASI in any of the cases of supraglottic vibratory source, since the vocal cords were not visible in any of these cases. In the other cases, only the ASI of the preserved vocal cords was evaluated. The mean values for these, for the mixed and glottic vibratory sources, respectively, were 0.92 and 0.68.

Discussion

When the evaluated voices are very aperiodic, the stroboscope is unable to emit its flashes except in a random manner. This prevents the formation of a continuous stroboscopic vibratory pattern, since no sequential segments are captured from the different cycles analysed. Therefore, voices with a very aperiodic vibration pattern or with moments of aperiodicity cannot be evaluated efficiently by stroboscopy.
Videokymography presents certain advantages: it allows evaluation of the characteristics of each vibratory cycle, even in cases of very aperiodic voices [15-17]. Nevertheless, this method presents disadvantages that make it unpopular in clinical practice. The main disadvantage of the equipment currently available is that it selects a single horizontal line from the monitor, and this line is the uppermost. The laryngoscope should be positioned in the conventional manner, thus enabling a full view of the endolarynx. The examiner needs to mobilize the laryngoscope and rotate it to make the uppermost line on the monitor coincide with the glottic segment to be examined. When the foot pedal is actioned, the equipment starts to function in videokymographic mode.
Depending on the patient's anatomy (shape of the epiglottis, posteriorization of the base of the tongue, etc.) and any possible hyper-reflexiveness, it may become impossible to perform the examination in some cases. It is not always possible to view the desired region. In our experience, among the patients who underwent partial vertical laryngectomy, if they used the remaining supraglottic larynx as their vibratory source, this made it impossible to view the vocal cords during phonation. This was seen in 7/22 patients. Production of the sustained vowel sound /i/ gives results in greater elevation of the larynx than is seen when the vowel sound produced is /e/. In this light, we standardized our evaluation on the vowel /i/.
The most frequent reasons for an incomplete examination are hyperreflexiveness of the patient, excessive supraglottic activity, and poor cooperation on the part of the patient. Limitations presented by the patient, with regard to following the examiner's instructions, anxiety during the examination, fatigue and other health problems may interfere with the vibratory pattern. Anxiety may simulate a hyper-functional disorder, and the clinician must be alert to the possibility of having to repeat the examination. The use of the telescope may increase the tension, considering that the examination is performed with traction applied to the tongue, i.e., not under physiological conditions [15]. Another limiting factor is that, while performing the examination in videokymographic mode, it is not possible to view the entire larynx and, if there is any movement of the telescope, by the patient, the position of the selected line is lost. However, the new generation videokymography appears to have eliminated most of those problems [18].
In our study, 28 patients were evaluated and we were able to interpret the data on 22 of these. The other six cases were excluded. The line evaluated reflected important properties of the vocal cord vibrations, including the open and closed phases of the glottic cycle and the opening and closing movements. One additional disadvantage, at the time when this method started to be used, was the relative subjectivity of the evaluation. However, recent studies have made these evaluations more objective, with extraction of certain measurements [10 11]. Nonetheless, the application of objective measurements depends on evaluation of the kymographic images, frame selection and graphical representation of these frames for subsequent analysis, as we performed in the present study.
In frontolateral laryngectomy, surgical ablation is performed on a segment of the glottis, together with the keel of the thyroid cartilage, and it is replaced by tissue obtained through reconstruction using a flap. Our sample of patients was uniform, in that all the cases underwent reconstruction by means of a bipedicle sternohyoid muscle flap, with external perichondrium from the thyroid cartilage. Although rotation of the flap prevented glottic failure, the covering for the reconstructed larynx presented a reduced mucosal vibration pattern or even its absence.
In another series of frontolateral laryngectomy procedures with subsequent reconstruction, vibration was more frequently demonstrated at non-glottic sites, and particularly in the ventricular folds (55% of the cases) [19]. After undergoing partial laryngectomy, the patients used what remained in the larynx for voice production. Among the 22 cases from which kymograms were obtained, seven presented a supraglottic vibratory source, 11 had a glottic source and 4 had a mixed source. Of the 7 patients with a supraglottic vibratory source, 3 did not present any significant vibratory pattern because of the rigidity of the

supraglottic mucosa, which does not have a Reinke space. Nevertheless, despite the absence of the latter, the other 4 cases presented a supraglottic source with vibration and voice production.

Among all the cases (11 patients with a glottic vibratory source and 4 with a mixed source), 11 presented a rounded lateral peak and 4, a sharp lateral peak. Among the 11 patients with a glottic vibratory source, the medial peak could be evaluated in 9 cases, which were all rounded peaks. This tendency towards rounded peaks within the glottic cycle can be explained by the fact that the lateral excursions were small in most cases. Among all the cases evaluated, only one case of supraglottic source (TPI = 0.96), one of mixed source (TPI = 0.98) and one of glottic source (TPI = 0.98) did not present TPI = 1. Likewise, only one case of supraglottic source (API = 0.9) and one of glottic source (API = 0.98) did not present API = 1, and only one case presented phase asymmetry. Thus, within each segment evaluation, there was no great variability in the vibratory pattern.

Protocols are not widely available and should be better standardized[20]. Moreover, the relevance of the method depends on the clinician's skill in interpreting the images obtained. Today, the videokymography can be considered a complementary tool to stroboscopy. It can be particularly useful in patients whose voices are aperiodic or even chaotic under the stroboscopic evaluation. Patients undergoing laryngeal surgery for the treatment of cancer often present this kind of voice. Thus, besides characterizing the vibratory pattern and the vocal source, the videokymography can establish the choice for speech rehabilitation methods and can also aid in determining the results of such management.

The videokymography provides improvement of the conventional stroboscope system, the possibility to see the swing of the vocal folds in real time, further evaluation of irregular aperiodic vibration and the evaluation of short vocal segments without the need to record the voice. However, further studies are needed and more widespread availability of this technology would be useful.

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