

# Breathing and voice self-assessments after the use of a heat and moisture exchange in total laryngectomized patients

## Autoavaliação de aspectos respiratórios e vocais após uso do umidificador de traqueostomia em laringectomizados totais

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### ABSTRACT

**Introduction:** A heat and moisture exchange device could modify respiratory and vocal conditions in patients who received a total laryngectomy. **Purpose:** To verify breathing and voice self-assessments before and after the use of a heat and moisture exchange device in patients who had received a total laryngectomy. **Methods:** The sample included 15 subjects of the Speech Therapy department of a cancer hospital; subjects included 1 woman and 14 men aged 49 to 76 years who had undergone a total laryngectomy. Patients completed a self-assessment questionnaire about breathing and voice before and after two weeks of use of a heat and moisture exchange device. **Results:** Thirteen individuals completed the study and reported improvement in cough, secretion accumulation, sleep, breathing, and esophageal voice after use of a heat and moisture exchange device. **Conclusion:** Patients who had received a total laryngectomy perceived improvements in breathing and voice after two weeks of the use of a heat and moisture exchange device, as measured by self-assessment.

**Keywords:** Laryngectomy; Respiration; Voice; Tracheostomy; Laryngeal neoplasms

### RESUMO

**Introdução:** O umidificador de traqueostomia é um dispositivo permutador de calor e umidade que pode interferir nas condições respiratórias e vocais de laringectomizados totais. **Objetivo:** Verificar a autoavaliação de aspectos respiratórios e vocais antes e após o uso do umidificador de traqueostomia, em pacientes submetidos à laringectomia total. **Métodos:** A amostra foi composta por 15 indivíduos acompanhados no serviço de Fonoaudiologia de um hospital oncológico, sendo uma mulher e 14 homens, com idade entre 49 e 76 anos, submetidos à laringectomia total. Foi aplicado um questionário de autoavaliação, relacionado a aspectos respiratórios e vocais antes e após o uso do umidificador de traqueostomia, durante duas semanas. **Resultados:** Permaneceram no estudo 13 indivíduos que referiram melhora da tosse, diminuição do acúmulo de secreção e melhor qualidade respiratória e de voz esofágica, após uso do umidificador de traqueostomia. **Conclusão:** Pacientes laringectomizados totais perceberam melhora na autoavaliação de aspectos respiratórios e vocais após duas semanas de uso do umidificador de traqueostomia.

**Descritores:** Laringectomia; Respiração; Voz; Traqueostomia; Neoplasias laríngeas

This study was carried out at the Hospital de Câncer de Pernambuco – HCP – Recife (PE), Brazil.

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**Authors' contribution:** AMBA contributed with conception, data collect, writing and final review; ECBS contributed with data collect, writing and final review; LP contributed with research supervision and final review.

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## INTRODUCTION

Total laryngectomy is an aggressive surgical procedure that causes irrecoverable aesthetic and functional lesions<sup>(1)</sup>. After this type of treatment, the patient must face the challenge of adapting to a new anatomical condition, as well as managing demanding postoperative care and sequelae in the quality of life, which includes the loss of the laryngeal voice and a definitive tracheostoma<sup>(2)</sup>.

The physiological changes in the voice and respiratory system after a total laryngectomy are due to separation of the upper and lower airways, which prevents natural production of the voice due to lack of aerodynamic flow in the laryngeal region and interrupts the normal conditioning of air filtration through the nose. A tracheostomy allows the passage of unconditioned airflow directly into the trachea; it interferes with air protection, resistance, and humidification properties, and also causes a deficit in olfactory function. In addition, the entry of cold, dry air, microorganisms, and dust directly into the lower airways increases the incidence of bronchopulmonary infections<sup>(3)</sup>.

Respiratory complaints show a strong correlation with other physical and psychosocial problems<sup>(4)</sup>. Therefore, a comprehensive speech-language pathology rehabilitation program for total laryngectomy patients should also consider the prevention and resolution of respiratory problems arising from the surgical procedure.

One of the options to aid lung protection after a total laryngectomy is the heat and moisture exchange (HME) device, which is placed around the tracheal stoma with an airtight seal. The HME has three physical properties: heat and moisture exchange, resistance to airflow, and particle filtering comparable to nose function<sup>(5)</sup>. There are four different types of adhesives, with three distinct adhesion properties and two different shapes (oval and round)<sup>(6)</sup>.

Clinically, the reduction of cough complaints and mucus production in HME users is noticeable. However, the scientific evidence that proves the benefits of this device and the importance of its use are still limited. Therefore, the objective of this study was to identify the frequency of vocal and respiratory signs and symptoms before and after use of the tracheostomy humidifier in patients that underwent a total laryngectomy.

## METHODS

This study was approved by the Ethics and Research Committee on Human Beings of the *Hospital de Cancer de Pernambuco* under protocol 1.160.082/2015. All participants received an explanation of the research objectives and signed a Free and Informed Consent Form before submitting to the procedures.

The sample consisted of 15 individuals (14 men, 1 woman) aged 49 to 76 years. All received a total laryngectomy with cervical emptying and radiotherapy; all had clinical indications

to use an HME. Volunteers with no definitive decannulation were excluded, as were those who used nasal decongestants, inhalation, or nasal lavage during the study period. All subjects were patients at the Speech and Hearing Clinic of the Cancer Hospital of Pernambuco.

HMEs were used with FlexiDerm® (Atos Medical, Inc., New Berlin, WI, USA) or regular adhesives. Before the placement of the HME, the patients were interviewed; they answered questions written by the authors regarding the signs and symptoms associated with their respiratory and vocal characteristics. Subsequently, the patients were referred for speech therapy, adaptation of the HME, and acquisition or improvement of the esophageal voice. They were instructed to use the HME continuously, withdrawing it only to exchange it for another or for hygiene of the tracheostomy cannula. After two weeks of HME use, the researchers repeated the interview conducted before the intervention.

In addition, clinical and epidemiological data were collected from medical records. Data analysis considered the absolute and relative distribution of the data at the two time points evaluated.

## RESULTS

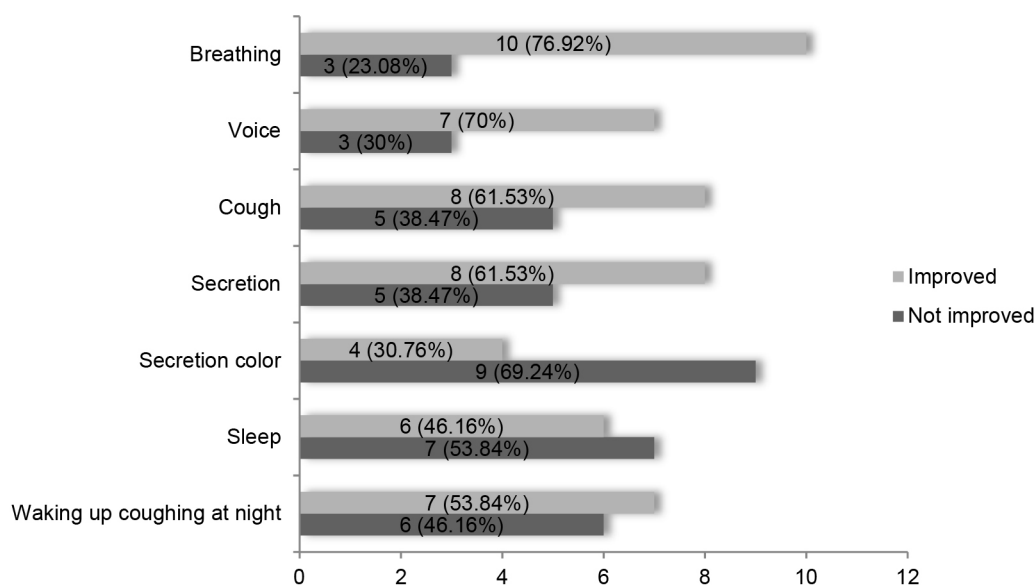
Of 15 patients screened, two were excluded because they did not use the HME properly and for the recommended time. The final study included 12 men and 1 woman aged 49 to 76 years (mean,  $59.46 \pm 7.47$  years). The volunteers had undergone surgical treatment 3 years previously, on average. Most of the participants had been tracheostomized in an emergency procedure ( $n = 9$ , 69.24%) less than five years ( $n = 9$ , 69.24%) previously, and the cannula was withdrawn within 1 year after surgery ( $n=8$ , 61.54%). Ten volunteers communicated using an esophageal voice and the others by writing, gestures, or buccal speech.

After the use of an HME for two weeks, there was an observed decrease in cough and accumulation of secretions in the tracheostome and improvement in the self-perception of respiratory quality, sleep, and esophageal voice (Figure 1).

## DISCUSSION

This study verified that according to self-evaluation, aspects of breathing and esophageal voice improved after using an HME for two weeks. Although the HME was used for a relatively short time, the results corroborated evidence of the benefits of HME not only over time, but also in shorter post-operative periods<sup>(2,7)</sup>.

For breathing, the nose naturally filters, moistens, and heats the air that it is then transported through the airways. However, in tracheostomized patients, the inhaled air is dry and relatively cold, irritating the trachea and lungs. To minimize these sequelae, the HME collects moisture during exhalation, which is reintroduced during inhalation and taken to the trachea



**Figure 1.** Absolute and percentual distribution of variables related to total laryngectomized self-perceptions on cough, amount of secretion in tracheostome, breathing and esophageal voice quality after the use of the Heat and Moisture Exchange (HME)

and lungs<sup>(8)</sup>. The use of an HME results in fewer lung infections and also fewer sleep problems, improving the quality of life of the user<sup>(9)</sup>. The influence of the HME on the pulmonary state can begin to be observed after two weeks of use<sup>(7)</sup>, which agrees with the results of the present study.

It was also observed that associating the use of HME with esophageal voice training improved esophageal voice self-assessment in volunteers who already used this type of communication. Because the intervention with HME was concomitant with therapy for communicative readaptation, it is not possible to state that only the use of the device was responsible for the improvement in self-evaluation of the esophageal voice. However, we believe that the decrease in cough and accumulation of secretions in the tracheostome, in addition to generating a greater sensation of comfort, makes speech more fluent because it does not need to be interrupted for the subject to cough. In addition, HME contributes to the blockage of airflow from the stoma, reducing the compensation and noise that the patient naturally makes during eructation attempts and esophageal voice production.

It is worth emphasizing that self-perception of the voice considers auditory and sensorial aspects; it is possible that the sensation of improvement of the respiratory condition may provide perception of greater fluidity, comfort, and ease of producing the esophageal voice. Because it involves aspects that only the individual can evaluate, the self-assessment can be distinct from an external perceptual-auditory evaluation. A previous study conducted in Brazil showed that the use of an HME for six weeks did not influence the perceptual-auditory parameters of the esophageal voice<sup>(6)</sup>. Therefore, it is assumed that the reports of vocal improvement in this study may be more closely associated with sensory aspects related to speech fluency and not directly to auditory quality.

This study has some limitations, such as the absence of a control group, reduced sample size, reduced external validity, and a data collection protocol with psychometric properties to be investigated. This study is still in progress to include comparative groups, an enlarged sample, other studied variables, and the investigation of the psychometric properties of the collection protocol to evaluate and monitor the effects of HME use.

## CONCLUSION

Patients who had received a total laryngectomy reported self-assessed improvement of cough, secretory buildup, sleep, breathing, and fluency of esophageal voice emission after two weeks of use of HME with concomitant speech therapy.

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## Appendix 1. Interview

Name:

Register:

Phone number: ( )

1. What is your municipality of residence?

2. Surgery date: 3. HME date (start of use):

4. Birth date: 5. Age:

6. Gender: ( ) male ( ) female

7. Have you been tracheostomized for how long?

( ) until 3 months

( ) 3 to 6 months

( ) 6 months to 1 year

( ) 1 to 5 years

( ) up to 5 years

8. When did you perform the tracheostomy?

( ) urgency (before surgery) ( ) at the surgery (total laryngectomy)

9. When did you remove the metal cannula after the surgery?

( ) until 6 months

( ) 6 months to 1 year

( ) 1 to 2 years

( ) up to 2 years

10. Do you cough?

( ) no ( ) a few ( ) moderate ( ) a lot

11. Do you have secretion in the tracheostome?

( ) no ( ) a few ( ) moderate ( ) a lot

12. What do you think about your breathing?

( ) good ( ) not so good ( ) bad

13. What is your type of voice?

( ) esophageal voice

( ) thacheoesophageal voice

( ) electronic larynx

( ) none

14. If you have a fluent speech, what do you think about your voice?

( ) good ( ) not so good ( ) bad