Umidificador de traqueostoma: influência na secreção e voz de laringectomizados****

Tracheostoma humidifier: influence on secretion and voice of patients with total laryngectomy

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Abstract

Background: total laryngectomy has several consequences such as loss of the laryngeal voice and alterations in the respiratory system. Aim: to evaluate the influence of a traqcheostoma humidifier (heat moisture exchanger - HME) on the control of lung secretion and esophageal and traqueoesophageal vocal quality in patients with total laryngectomy. Method: nine male individuals, aged between 46 to 67 years, submitted to total laryngectomy. The patients answered a protocol containing subjective questions related to lung secretion in three different moments: T1 (pre-use assessment of the HME), T2 (pre-use assessment of the HME six weeks after the first assessment) and T3 (assessment six weeks after the use of the HME). Voice samples were recorded during these 3 different assessments and were evaluated by three speech-language pathologists, in a blind study format, according to a perceptual auditory vocal analysis protocol. The non-parametric test of Wilcoxon was used to compare results of both protocols. Results: no significant differences were observed for traqueoesophageal and esophageal vocal quality in the three different moments of assessment: T1 (pre-use assessment of the HME), T2 (pre-use assessment of the HME six weeks after the first assessment) and T3 (assessment six weeks after the use of the HME). On the other hand, there were significant differences, after the period of the HME use, regarding occurrence of cough and forced expectoration during the day time. Conclusion: The use of the HME during the period of six weeks reduced cough and expectoration of patients with total laryngectomy. However, the use of the humidifier did not have any influence on the traqueoesophageal and esophageal vocal quality of these patients.

Key Words: Laryngectomy; Voice quality; Tracheostomy.

Resumo

Tema: a laringectomia total acarreta sequelas como a perda da voz laríngea e alteração no sistema respiratório. Objetivos: avaliar a influência do uso do umidificador de traqueostoma (*heat moisture exchanger* - HME) no controle da secreção pulmonar e na qualidade vocal esofágica e traqueoesofágica de pacientes submetidos à laringectomia total. Método: nove pacientes do sexo masculino, com idades entre 46 a 67 anos, submetidos à laringectomia total. Os pacientes responderam a um protocolo sobre questões subjetivas relacionadas à secreção pulmonar em três momentos, sendo T1 (avaliação pré-uso do HME), T2 (avaliação pré-uso do HME após seis semanas da primeira avaliação) e T3 (avaliação após seis semanas do uso do HME). Conjuntamente foram feitas gravações das vozes dos pacientes nos mesmos três momentos citados acima. As vozes foram avaliadas por três fonoaudiólogas, em estudo cego, de acordo com um protocolo de avaliação perceptivo-auditiva da voz. Para comparar os resultados obtidos em ambos os protocolos aplicados foram utilizados teste não-paramétrico e Wilcoxon. Resultados: não foi observada nenhuma diferença estatisticamente significativa dos parâmetros de qualidade vocal esofágica ou traqueoesofágica entre os tempos T1 (avaliação pré-uso do HME) e T2 (avaliação pré-uso do HME pós seis semanas) e T3 (avaliação após seis semanas do uso do HME). Verificaram-se diferenças estatisticamente significativas para as variáveis de quantidade de tosse e expectoração forçada, durante o dia, após o período de uso do HME. Conclusão: O uso do HME durante seis semanas diminuiu a tosse e a expectoração em pacientes laringectomizados totais, porém não apresentou influência na qualidade vocal esofágica ou traqueoesofágica.

Palavras-Chave: Laringectomia; Qualidade da Voz; Traqueostomia.

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Introduction

The loss of voice is considered the greater impact after total laryngectomy surgery. However its impact is not of lesser importance to the respiratory system (1).

After a total laryngectomy the patient does not inspires nor expires the air through superior aerial ways. It occurs directly through the trachea thus excluding the opportunities of air warming, moisturizing and filtering during inhalation. As a consequence respiratory problems characterized by the excessive production of secretion, cough, forced expectoration to air-way cleansing , stoma cleansing and reduced lung capacity are common features on this kind of patient. In addition changes on the pulmonary physiology may produce a decrease on the pressure gradient of pulmonary alveolus and trachea (2-8).

A possible non-chemical treatment available to the respiratory problems of total laryngectomees is the regular use of the tracheostoma humidifier (HME - heat and moisture exchanger). The HME kit consists of a plastic filter with internal aired foam and a hypoallergenic transparent adhesive that shell be placed around the stoma. There are round and oval adhesives that fit to each patient's stoma's size.

Prior studies, most of them conducted on the Dutch Cancer Institute by Ackerstaff et al (1-3,6,9), with objective and subjective tests have shown decrease of breathing problems and therefore the improvement of subject's voice quality. It is important to point out that the improvement of voice quality wasn't evidenced through objective tests.

The pulmonary rehabilitation can be objectively evidenced by the significant increase on the values of inspiration volume (3). Recently it was shown that the use of HME also resulted on the increase of tracheal temperature in almost 9oC and the relative moisture in more then 20% (10).

An important factor referring to voice that apparently influenced on the effectiveness of the HME was the rehabilitation vocal method. Patients that used esophageal voice or electronic larynx were benefited more than the ones using tracheo-esophageal voice because they had difficulties to completely shut the stoma thus impeding the voice production (11). It is important to note that the study does not explicit which were the assessed voice aspects but only describes voice improvement. The present research had the purpose to assess the influence of the use of the tracheostoma humidifier (HME) on the secretion control of patients after total laryngectomy and the possible improvement on the quality of esophageal and tracheo-esophageal voice.

Method

Sample description

The study was approved by the institution's Research Ethics Commission (ISCMSP - 152/03) and was conducted at the Speech and Language Pathology Rehabilitation Center for Oncology Patients of the Head and Neck Surgery Unit, Surgery Department, Irmandade da Santa Casa de Misericórdia de São Paulo. Subjects were fourteen patients that undergone total laringectomy, twelve of them at the same institution and two on Clinical Hospital of the University of Sao Paulo.

Five of these fourteen subjects had to be excluded from the research due to the following reasons: health troubles during the research (n=1), esophageal recidivism (n=1), problems with the adaptation of the adhesive to the skin (n=1), problems with the vocal prosthesis (n=1), non-adaptation to the product due to esthetic reasons (n=1). Of the nine studied subjects, six patients (66.7%) used esophagial voice and three (33.3) used tracheosophagial prosthesis.

Ages varied from 46 to 67 years, mean 57.8, standard deviation 5.9. Post surgery time varied from 16 to 123 months, mean 47.2, standard deviation 33.8 months.

Cervical emptying was not performed in one patient (11,1%), was lateral-bilateral in four patients (44.4%), selective bilateral II, III and IV in three patients (33.3%) and radical in one patient (22.2%). None of the patients presented distant metastasis during the research.

Methodology

A Personal Data Chart, with information about surgery, type of cervical emptying, TNM classification and posterior treatments was used to this study, with data withdrawn from each patient's protocol.

After this information the research was conducted in four steps:

Assessment prior to the use of HME (T1)

At this moment the patients had the first contact with the HME and received the proper orientations about its use, as follows:

. cleaning the skin around the tracheostoma with a cotton swab soaked with Benjoim oil.
. fixing the adhesive around the tracheostoma and removing it only when replacing it with other adhesive and avoiding moisture during shower.
. placing the HME on the adequate hole of the adhesive, removing it only during shower or coughing to avoid clogging it with excessive secretion.

Then the patients answered a questionnaire about their respiratory function with information abut cough, secretion production, forced expectoration and stoma cleaning. After that they had their esophageal or tracheo-esophageal voices recorded on a digital recorder GP-161 DVR Gama Power on a silent setting when it was asked that they:

A. counted numbers from 1 to 20
B. produced 10 emissions of sustained vowel /a/ or /pa/
C. produced 20 emissions of sustained vowel /a/ or /pa/
D. produced 30 seconds of spontaneous speech

The items b and c above mentioned were used by the researcher to assess the proportion of voicing of /a/ or /pa/ on twenty trials and the mean (in seconds) of the sustained vowel /a/ or/pa/ on ten trials, according to the Berlin Scale (12). This analysis was performed on the three times of the research (T1, T2 and T3).

Assessment prior to the use of HME after six weeks (T2)

The patients were submitted to the same assessment described on the prior item, according to the same criteria. This second recording after six weeks without the use of the HME was performed to confirm the data obtained on the first assessment and to verify if there is any natural variation on the respiratory function and on voice quality independent of the use of HME. Following this procedure the patients used the HME for the same period of prior recordings (six weeks) to posterior comparison.

Assessment after six weeks of the use of HME (T3)

After six weeks using the HME the patients were once again assessed as described on item 1 (T1). It is important to note that the Speech and Language Pathologist that conducted this research provided a weekly follow-up for the patients orienting and helping with possible difficulties with the use of the product.

Each subject received three to four HME kits (adhesive + filter) weekly along with instructions on how to use them. The subjects were also informed about the increase on air resistance while passing through the filter when it is obstructed by secretion and that it is important to change the filter when it happens.

Blind study about the perceptual auditory voice evaluation

The spontaneous speech and counting numbers samples prior and after the HME use on the three research steps were examined by three speech and language pathologists, voice specialists. This analysis was based on the Perceptual-Auditory Assessment Protocol by Fouquet (13) and on the Mc Connel et al. (14) intelligibility scale on a consensus blind-study (Appendix).

Statistical analysis

The results obtained on the four steps of the research were submitted to statistical analysis.

Non-parametric tests were used to complete the data analysis in order to attain the proposed research objectives due to the identification of non-normal sample distributions.

To compare the esophageal voice quality parameters of each subject at the different times T1 - T2 and T2 - T3 the Wilcoxon test was used, with a significance level of 0.05.

Results

The subjects' answers to the questionnaires about respiratory problems on the three assessment times (T1, T2 and T3) are shown on Table 1. The statistically significant values about cough and forced expectoration decrease are highlighted.

The results of Berlin (12) objective measures on the three assessment moments and their statistical values, which were non-significant, are shown on Table 2.

Table 3 shows the voices' perceptual-auditory evaluation performed by speech and language pathologists on the three moments of assessment and the statistical values that show no statistically significant difference.

The mean number of filters and HME adhesives used weekly was around 3.0 on the first week and 2.5 on the sixth week without significant difference among the other weeks of the study.

TABLE 1. Individual answers to the questionnaires about respiratory problems on the three assessment moments and statistical significance values.

Assessment times	T1	T2	T3	p*
cough				
absent	5	4	7	
little	2	3	1	**0,05***
medium	1	1	0	
much	1	1	1	
secretion production				
absent	0	1	0	
little	4	2	8	0,08
medium	3	4	1	
much	2	2	0	
forced expectoration				
1 time daily	0	0	0	
2 times daily	0	1	2	
3 times daily	2	2	4	
4 times daily	1	1	0	
5 times daily	2	1	2	**0,04***
6 times daily	0	1	0	
7 times daily	1	0	0	
de 8 to 10 times daily	2	1	0	
de 11 to 15 times daily	1	0	0	
de 16 to 20 times daily	0	2	1	
tracheostoma cleaning				
1 time daily	3	2	3	
2 times daily	1	3	2	
3 times daily	1	1	4	
times daily	0	2	0	
5 times daily	2	1	0	0,06
6 times daily	0	0	0	
7 times daily	1	0	0	
8 to 10 times daily	0	0	0	
11 to 15 times daily	0	0	0	
16 to 20 times daily	1	0	0	

TABLE 2. Results of Berlin (1963) objective measures on the three assessment moments and the statistical significance values.

Assessment times	T1	T2	T3	p*
proportion of voicing on 20 trials				
95%	1	1	0	0,32
100%	8	8	9	
maximum phonation time with sustained /a/vowel or /pa/				
0 to 1 second	4	2	3	
1,1 to 2 seconds	3	5	3	
2,1 to 4 seconds	0	0	1	1,00
4,1 to 6 seconds	1	1	1	
6,1 to 10 seconds	0	0	0	
10,1 to 15 seconds	1	1	1	

TABLE 3. Perceptual- auditory voice evaluation performed by speech and language pathologists on the three assessment moments and statistical significance values.

Assessment times	T1	T2	T3	p*
fluency				
A	0	0	0	
B	3	3	2	
C	3	1	2	0,18
D	1	2	2	
E	0	0	0	
F	0	2	0	
G	2	1	3	
speech intelligibility				
unintelligible	4	3	3	
intelligible with attention	2	2	3	1,00
partially intelligible	1	2	0	
intelligible	2	2	3	
voice quality				
hoarse	5	5	3	
tense	3	4	5	0,18
rough	0	0	1	
wet	1	0	0	
sonority				
constant	6	7	8	0,56
intermittent	3	2	1	
clunk				
absent	4	5	6	
mild	4	1	0	0,16
moderate	1	1	2	
severe	0	2	1	
stoma noise				
absent	1	1	2	
mild	2	5	2	0,56
moderate	4	1	3	
severe	2	2	2	
oral speech				
absent	8	9	8	0,32
present	1	0	1	
pharyngeal speech				
absent	7	8	6	0,16
present	2	1	3	

Discussion

When starting this study it was questioned if using the HME and therefore probably improving the patient's breathing and comfort there would also occur esophageal and tracheo-esophageal voice improvement as well. It would also generate less speech interruptions due to discomfort related to the amount of secretion and consequently decrease on the effort necessary to phonation and voice fluency.

Patients were oriented to use the HME for a period of 6 weeks - enough to show advantages and/or disadvantages of its use according to the studies by Ackerstaff et al.(1,3,15), previously mentioned. It was expected that most of the assessed patients would need a considerable amount of time to get used to the product. But actually this adaptation occurred on the first week for all the patients.

Only nine of the fourteen patients included on the study completed it. Five of them had to be excluded from the research due to the following reasons: health troubles during the research (n=1), esophageal recidivism (n=1), problems with the adaptation of the adhesive to the skin (n=1), problems with the vocal prosthesis (n=1), non-adaptation to the product due to esthetic reasons (n=1). The nine remaining patients used the product for 24 hours a day without presenting skin harshness problems related to the adhesive or problems like filter loss due to cough or forced expectoration.

Although a six-week period seams to be relatively short to allow the observation of any changes of respiratory symptoms of patients with total laringectomy, it was possible to statistically confirm a significant reduction on the amount of cough and forced expectoration during the studies

period (Table 1). The secretion production and cleaning frequency decreased considerably but these differences were not statistically significant.

These results agree with the study by Hilgers et al. (11) that also identified significant reduction on forced expectoration though not statistically significant after a six-week period using the HME.

The amount of filters and adhesives used also decreased when comparing the first and the sixth weeks of the study. When asked about this decrease, patients pointed out to the relation of this fact with the reduction on the frequency of cough and forced expectoration. It is important to mention that on the weeks of very hot weather the mean amount of adhesives used was higher due to patients' transpiration that generated troubles with adherence of the adhesives on the skin. The study by Ackerstaff et al. (19) has also shown decrease of the number of adhesive used after six weeks of study.

The decrease of the necessity of expectoration played an important role on the improvement of patients' life quality. Some of them reported that the frequent need of forced expectoration made them uncomfortable in social settings.

In what refers to the perceptual auditory analyzed aspects of esophageal or tracheo-esophageal voice such as fluency, speech intelligibility, voicing, maximum phonation time (MPT), voice quality, clunk, stoma noise, oral speech and pharyngeal speech, there was no significant improvement. The study by Ackerstaff et al.(1) observed improvement on the intelligibility of the speech of 46% of the studied patients, 30% of them showed improvement on loudness, 37% on fluency and 40% on speech intelligibility when speaking on the telephone. It is important to mention that the present study didn't include the assessment of loudness and speech intelligibility on the telephone. Besides, most of the patients of this study used esophageal voice to communicate, and its characteristics are different of those of the tracheo-esophageal voice.

The present study didn't identify significant differences on the benefits of the use of HME by the patients with esophageal voice and by the patients with tracheo-esophageal voice. Studies by Hilgers et al (11) showed that patients that use esophageal voice or electronic larynx reported more benefits with the use of HME than patients with vocal prosthesis because these patients reported difficulties to completely shut the tracheostoma, resulting on air escape by unfixed parts of the adhesive or by the filter, resulting in lower voicing. When asked if they would prefer to have respiratory symptoms improved or more intelligible voice, the patients have chosen the second option, that is, they choose to stop using the HME.

After this research it was observed the importance of medical and speech and language pathologist's assistance before the patients start using HME and during its use to guarantee they receive appropriate orientations and use the product successfully.

After six weeks using the product all of the patients reported that they would like to continue to use the HME.

The results presented in this study suggest that the use of HME may reduce the respiratory symptoms after total lagyngectomy improving the social life of the patient that becomes less uncomfortable with excessive secretion. However it didn't show significant results referring to the improvement of esophageal or tracheo-esophageal voice.

Conclusion

We conclude that the use of HME during sic weeks reduced cough and expectoration in patients with total laringectomy but didn't influence the quality of esophagic or thacheoesophagic voices.

Appendix

Esophageal/ Tracheo-esophageal Voice Perceptual Auditory Assessment:

1. Fluency (13):
   A - no sound production ( )
   B - some partial control; produces isolated sounds ( )
   C - produces simple words ( )
   D - combines two to three words ( )
   E - produces a few sentences ( )
   F - consistently produces sentences ( )
   G - fluent speech, without hesitation ( )
2. Speech intelligibility (14):
( ) unintelligible ( ) intelligible with attention
( ) partially intelligible ( ) intelligible
3. Voice Quality:
( ) hoarse ( ) tense ( ) rough ( ) wet
4. Sonority:
( ) constant ( ) intermittent
5. Clunk:
( ) absent ( ) mild ( ) moderate
( ) severe
6. Stoma noise:
( ) absent ( ) mild ( ) moderate
( ) severe
7. Oral Speech:
( ) absent ( ) present
8. Pharyngeal Speech:
( ) absent ( ) present

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