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Relationship of pharyngeal transition time and presence of residue with dyspnea and lung function in chronic obstructive pulmonary disease

Relação do tempo de trânsito faríngeo e presença de resíduo com dispneia e função pulmonar na doença pulmonar obstrutiva crônica

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Keywords

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ABSTRACT

Purpose: To relate pharyngeal transit time and the presence of residues with dyspnea and lung function in individuals with Chronic Obstructive Pulmonary Disease COPD. **Methods:** Study conducted with 19 adults (11 men, 8 women) with a clinical and spirometric diagnosis of COPD and a mean age of 63.8 years (SD = 9.3). Data collection was performed using the COPD Assessment Test (CAT) questionnaire, the modified Medical Research Council scale (mMRC) and a digital manovacuometer, to characterize the impact of the disease on the individual, dyspnea and lung function. The data related to pharyngeal transit time and pharyngeal residue were collected through the analysis of videofluoroscopic images performed by three blinded judges. **Results:** No significant relationship was found between pharyngeal transit time (PTT) with lung function (r = -0.71), pharyngeal residue and dyspnea (r = -0.06). PTT, when compared to normality, was increased. **Conclusion:** Individuals with COPD, regardless of the severity of the disease, showed no association between PTT and pharyngeal residue and dyspnea and lung function.

Descritores

Doença Pulmonar
Obstrutiva Crônica
Deglutição
Transtornos de Deglutição
Dispneia
Pneumopatias

RESUMO

Objetivo: Relacionar o tempo de trânsito faríngeo e a presença de resíduos com a dispneia e a função pulmonar em indivíduos com Doença Pulmonar Obstrutiva Crônica DPOC. **Método:** Estudo realizado com 19 adultos (11 homens e 8 mulheres) com diagnóstico clínico e espirométrico de DPOC e idade média de 63,8 (±9,3) anos. A coleta de dados foi realizada utilizando o questionário *COPD Assessment Test* (CAT, Teste de Avaliação da DPOC) a escala de dispneia do *Medical Research Council* modificada (mMRC) e um manovacuômetro digital, para caracterizar o impacto da doença no indivíduo, a dispneia e a função pulmonar. Os dados referentes ao tempo de trânsito faríngeo e resíduo faríngeo foram coletados por meio de análise das imagens videofluoroscópicas realizada por três juízes cegados. **Resultados:** Não foram encontradas relações significativas entre tempo de trânsito faríngeo (TTF) com função pulmonar (r = -0,71), e entre presença de resíduo faríngeo com a dispneia (r= -0,06). O TTF, quando comparado com a normalidade, apresentou-se aumentado. **Conclusão:** Os indivíduos com DPOC, independente da gravidade da doença, não manifestaram associação entre alterações no TTF e resíduo faríngeo e dispneia e função pulmonar.

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INTRODUCTION

Swallowing is a complex neuromotor process and concise coordination of phases that are essential for the transit of the bolus from the mouth to the stomach, starting with the preparatory and oral phases (voluntary) and, afterwards, culminating in the pharyngeal and esophageal phases (involuntary)[1]. In this sense, failure in any of these phases is classified as dysphagia, which can result in food aspiration in the airways, causing damage to the patient, such as malnutrition, dehydration, pulmonary complications, aspiration pneumonia, and can even lead to death[1-3].

Thus, in the pharyngeal phase of swallowing, as an essential defense process to protect the airways[4], the inversion of the epiglottis occurs over the entrance of the larynx, upper anterior displacement of the hyolaryngeal complex, closing of the vocal folds and opening of the upper esophageal sphincter. These are involuntary events that aim to protect the respiratory tract. Then, the esophageal phase is reached, in which the bolus is transported to the stomach[5].

Thus, the measurement of these swallowing events is considered a predictor for changes in swallowing[6]. Among the quantitative measures of the pharyngeal phase of swallowing, the pharyngeal transit time (duration of the movement of the bolus through the pharynx) is considered one of these main measures[7]. Previous studies that evaluated the pharyngeal phase of swallowing in individuals with chronic obstructive pulmonary disease (COPD) demonstrated increased pharyngeal transit times in this population when compared to healthy subjects[8,9].

Another quantitative measure for swallowing is the presence of pharyngeal residues after swallowing, which may occur in several structures and cavities, being the main ones the residues in vallecula and the residues in pyriform sinuses. Since this factor is reported as one of the main changes that lead to the occurrence of laryngeal penetration and tracheal aspiration[7].

To measure these measures, it is necessary to carry out an instrumental swallowing assessment. Videofluoroscopy of Swallowing (VFS) is considered a gold standard for instrumental evaluation, as it allows the extraction of temporal and visuospatial measurements for further analysis[10]. However, in addition to VFS, it is essential to use image analysis software in order to obtain reliable quantitative measurements.

Another mechanism of great importance for the safety of swallowing is the adequate coordination between swallowing and breathing. Healthy individuals, involuntarily, do a respiratory apnea, swallow and, later, return to breathing with an expiratory phase[3]. However, in individuals who have impaired lung function, as in COPD, the reciprocity between swallowing and breathing is compromised[11,12].

Some studies have shown that the failure of this protective mechanism may occur more in individuals with COPD than in healthy individuals, as well as it has been associated with episodes of exacerbations of the disease[12,13]. However, the etiology and characterization of dysphagia in COPD is still not clear. Thus, the aim of the present study was to relate the time of pharyngeal transit and the presence of residues with dyspnea and lung function in individuals with COPD.

METHOD

This is a cross-sectional observational study, approved by the Research Ethics Committee (REC) of the institution under registration number 1.967.549, and in accordance with the guidelines of the Conselho Nacional de Saúde in Resolution 466/2012, with the signing of the Informed Consent Form (ICF) of all participants.

The present sample consisted of 19 adult individuals, 11 (57.9%) were male and eight (42.1%) were female, aged between 39 and 74 years (mean age of 63.8 (± 9.3) years), with clinical and spirometric diagnosis of COPD, according to the criteria of the Global Initiative for Chronic Obstructive Lung Disease (GOLD)[14]. The individuals were referred to the Pulmonary Rehabilitation Program (PRP) by the Pulmonology Service of the Hospital Universitário de Santa Maria (HUSM) during the period of August 2017 and October 2018. The characterization of the sample according to anthropometric variables, the impact of the disease, dyspnea and lung function, can be observed in Table 1. It was divided, according to the severity of the disease,

Table 1. Characterization regarding anthropometric variables, impact of the disease, dyspnea and pulmonary function

	Amostra total (n=19)	DPOC Leve/Moderado (n=6)	DPOC Grave/Muito Grave (n=13)	p p*
Male, n (%)	11 (57.9)	2 (33.3)	9 (69.2)	0.141
Age (years)	63.8 ± 9.3	62.5 ± 13.0	64.4 ± 7.7	0.684
Weight (Kg)	66.0 ± 14.4	69.7 ± 11.7	64.3 ± 15.7	0.470
Height (m)	1.63 ± 0.8	1.61 ± 0.05	1.65 ± 0.10	0.272
BMI (Kg/m^2)	24.5 ± 4.8	26.9 ± 4.7	23.4 ± 4.7	0.154
CAT classification				
Mild	3 (15.8)	2 (33.3)	1 (7.7)	0.154
Moderate	9 (47.4)	2 (33.3)	7 (53.8)	0.405
Severe	6 (31.6)	1 (16.7)	5 (38.5)	0.342
Very Severe	1 (5.3)	1 (16.7)	0 (0)	0.130

Comparison between numerical variables with normal distribution (mean ± standard deviation): Independent Student t-test. Comparison between nominal variables: Chi-square test. *: Comparison between mild to moderate with severe to very severe;. #: $p \geq 0.05$

Caption: COPD - Chronic Obstructive Pulmonary Disease; BMI: Body Mass Index; CAT - COPD Assessment Test; MRCm - Medical Research Council modified; GOLD - Global Initiative for Chronic Obstructive Lung Disease; FEV_1 - Forced Expiratory Volume in the first second; FVC - Forced Vital Capacity; MIP - Maximum inspiratory pressure; Pred - predicted; MEP - Maximum expiratory pressure

Table 1. Continued...

	Amostra total (n=19)	DPOC Leve/Moderado (n=6)	DPOC Grave/Muito Grave (n=13)	p p*
*MRC*m				
0	0 (0)	0 (0)	0 (0)	-
1	2 (10.5)	2 (33.3)	0 (0)	0.028#
2	13 (68.4)	4 (66.7)	9 (69.2)	0.911
3	3 (15.8)	0 (0)	3 (23.1)	0.200
4	1 (5.3)	0 (0)	1 (7.7)	0.485
GOLD				
I	1 (16.7)	-	-	-
II	5 (83.3)	-	-	-
III	11 (84.6)	-	-	-
IV	2 (15.4)	-	-	-
FEV_1/FVC	49.9 ± 11.2	57.1 ± 11.1	46.6 ± 10.0	0.057
FEV_1 (%pred)	47.7 ± 21.9	73.4 ± 21.5	35.9 ± 6.7	0.007#
MIP(cmH_2O)	80.0 ± 31.0	88 ± 29.4	76.3 ± 32.1	0.464
MIP (%pred)	104.0 ± 34.6	116.2 ± 32.9	98.3 ± 35.1	0.308
MEP (cmH_2O)	89.7 ± 30.2	84.1 ± 18.4	92.3 ± 34.8	0.600
MEP (%pred)	82.0 ± 24.3	79.7 ± 14.2	83.1 ± 28.2	0.781

Comparison between numerical variables with normal distribution (mean ± standard deviation): Independent Student t-test. Comparison between nominal variables: Chi-square test. *: Comparison between mild to moderate with severe to very severe;. #: $p \geq 0.05$
Caption: COPD - Chronic Obstructive Pulmonary Disease; BMI: Body Mass Index; CAT - COPD Assessment Test; MRCm - Medical Research Council modified; GOLD - Global Initiative for Chronic Obstructive Lung Disease; FEV_1 - Forced Expiratory Volume in the first second; FVC - Forced Vital Capacity; MIP - Maximum inspiratory pressure; Pred - predicted; MEP - Maximum expiratory pressure

into two groups: mild and moderate COPD (n = 6) and severe and very severe COPD (n = 13).

Inclusion criteria were: spirometric diagnosis of COPD, with GOLD criteria[14] for FEV_1/FVC <70 (Forced Expiratory Volume in the first second/Forced Vital Capacity); respiratory failure of moderate to severe degree (FEV_1 <80% of predicted); ability of performing activities of daily living without the help of a caregiver and ability to communicate and cooperate.

On the other hand, the exclusion criteria were: having participated in respiratory physiotherapeutic intervention or speech therapy intervention in the last 6 months; medical diagnosis of coexistence of neurological condition; acute exacerbation that required hospitalization or use of systemic corticosteroids preceding 4 weeks; severe orofacial pain, including trigeminal neuropathy and uncontrolled systemic arterial hypertension.

ASSESSMENTS

Sociodemographic data (date of birth, age, etc.) and clinical data (last hospital stay, number of exacerbations in the last year, spirometry - collected from the medical record) were collected in addition to the anthropometric assessment to calculate BMI (Body Mass Index). The reference values used to classify the BMI were: BMI < kg/m^2 - malnutrition; BMI between 22 and 27 kg/m^2 - normal weight; and BMI> 27 kg/m^2 for obesity[15]. Physiotherapeutic and speech assessments took place on different days, within a week.

Physiotherapeutic clinical assessment

The physiotherapeutic assessment was performed by a physiotherapist blinded to the research aims, on the impact of COPD on the individual, degree of self-reported dyspnea and respiratory muscle strength, performed in sequence in the same session.

The impact of the disease was assessed using the COPD (Chronic Obstructive Pulmonary Disease) Assessment Test (CAT), a questionnaire of easy application and completed by the patient, composed of eight questions related to COPD symptoms that most bother the patient. The score ranges from 0 to 5 points on each item, reaching a total of 40 points, with lower scores corresponding to a low impact of the disease on health status. The impact classification is given according to the scores obtained: mild - 6 to 10 points; moderate - 11 to 20 points; severe - 21 to 30 points; and very serious - 31 to 40 points. The test questions are objective and the applicator does not influence the answers[16,17].

For the degree of dyspnea, the modified Medical Research Council scale (MRCm) was used. In this method, the patient self reports the degree of dyspnea subjectively, in a rating from 0 to 4, with 0 representing shortness of breath at maximum efforts and 4 at minimum efforts[18].

Respiratory muscle strength was assessed by maximum inspiratory pressure (MIP) and maximum expiratory pressure (MPE), using a digital manovacuometer (MDI®, MVD 300, GlobalMed, Porto Alegre, Brazil). The interpretation of the results followed the reference values of normality proposed by Pessoa et al.[19] for the Brazilian population.

Speech assessment

The speech assessment was carried out by means of videofluoroscopy of swallowing (VDS), performed at the Radiology Department of HUSM, performed by a technician or radiologist

and accompanied by a speech therapist with experience in the area. The videofluoroscopy images were obtained using the Siemens equipment, model Axiom Iconos R200, being captured and recorded using the software ZScan6 Gastro - Version: 6.1.2.11, installed on Itautec Infoway computer, Windows 7, Intel Pentium P6200 processor, with the image being recorded at 36 frames/second and with ideal quality for the study of the visualized regions[20]. The subjects were assessed in the sitting position, with lateral projection. The videofluoroscopic image field included the lips, oral cavity, cervical spine and proximal cervical esophagus[21].

The consistencies used in the exam, according to the IDDSI Framework[22], state: Thin: 25ml liquid + 25ml barium and Extremely Thick (25ml liquid + 25ml barium + 1 spoon and a half of 1.2g of RESOURCE® ThickenUp Clear from Nestlé).

The volumes used during the swallowing assessment were 10 ml offered with a spoon and free sips, with three repetitions of each consistency being observed and, subsequently, the best image for analysis was selected. Food was previously prepared by the examiner just before the exam.

The equipment used for the procedure was an Iconos R200 model (Siemens Medical Systems, Forcheim, Germany), coupled to a computerized image recording system, in fluoroscopy mode, with 36 frames per second; the videos were recorded in the capture software Zscan6. This software has as main technical characteristics: image with matrix until 720x576; 32-bit image resolution; JPEG image format with 1440 dpi; video system NTSC, PAL, SECAM (all standard); video up to 720x576 with images in real time (36 frames per second (frames/s) AVI format and divX compressor can be recorded on DVD and CD. The average dose value generated in this procedure is 0.14 mR/frame (2.1 mR/s), these dose measurements were performed under conditions that reproduce the technique and the positioning of the patient, using a 4 cm aluminum simulator and a Radcal electrometer, model 9010 with specific ionization chamber for procedures in fluoroscopy of 60 cm^3.

Subsequently, the analyzes of the VFS images were made, and three speech therapists, trained and experienced in the area of videofluoroscopy for at least five years, performed the analysis of the biomechanics of swallowing using the Kinovea® software (version 8.20, 2012)[23], blindly for research purposes, the identification of the subjects and the evaluation of the other judges.

The judges were instructed to carry out the swallowing analysis, contemplating visual-perceptual parameters (residue in vallecula and residue in pyriform recesses) and temporal parameter (pharyngeal transit time) as proposed by Baijens et al.[10]. The analyzed parameters were defined and measured as follows: Stale in vallecula: stasis of the bolus in vallecula after complete swallowing, being considered: 0 - absence of stasis; 1 - residue filled up to 50% of the vallecula; 2 - residue filled more than 50% of the vallecula. Stasis in pyriform recesses: stasis of the bolus in pyriform recesses after complete swallowing, being considered: 0 - absence of stasis; 1 - mild to moderate stasis; 2 - severe stasis, filling the piriform recesses. Pharyngeal transit time: defined as the time interval in seconds between the opening of the glossopalatal junction and the closure of the upper esophageal sphincter.

Additionally, the classification of swallowing was analyzed by the Dysphagia severity scale (O'neil et al., 1999)[24] and organized, according to the sample, into dysphagia (including levels 4 and 5), and 2 without dysphagia (including levels 6 and 7).

Statistical analysis

Descriptive analysis of the variables was performed with calculations of mean, standard deviation or median and interquartile range. For the comparison between numerical variables with normal distribution, the independent Student t test was used and, for the ones with non-normal distribution, the Mann-Whitney U test; for qualitative variables, the Chi-square test was used. For associations between numerical variables, the Pearson's correlation test was used. Statistical analysis was performed using the Statistical Package for the Social Sciences software, version 21.0 (SPSS Inc. Chicago, IL, USA).

The linear regression model was used to verify which clinical variables were independently associated with PTT.

To verify the agreement between the three judges, the Wilcoxon test was applied for the temporal variable and Kappa for the visual-perceptual variables, the classification proposed by Landis and Koch[25]: <0.00 poor agreement; 0.00 - 0.9 poor agreement; 0.20 – 0.39 weak agreement; 0.40 – 0.59 moderate agreement; 0.60 – 0.79 substantial agreement; 0.80 – 1.00 almost perfect agreement. For the variables of residue in vallecula and residue in pyriform sinuses, the agreement was 1.00 and for pharyngeal transit time it was 0.51.

The sample calculation was performed with the use of the OpenEpi program (Version 3), considering the number of patients seen in the second semester of 2017 at the PRP (n = 21). With a confidence level of 80% and a margin of error of 5%, 19 individuals were estimated.

RESULTS

19 individuals were stratified from the sample according to the severity of the disease, six with mild to moderate degree of the disease and 13 were classified between severe to very severe. Dysphagia, assessed by VFS, was found in 23.1% of the subjects with the most severe stage of COPD. The swallowing variables are presented according to the COPD severity classification (Table 2).

No association between PTT in liquid and pasty consistencies with anthropometric and disease severity variables (FEV_1) and respiratory muscle strength was found (Table 3).

In Tables 4 and 5, residue in vallecula in liquid and pasty consistencies, and residue in pyriform sinuses in pasty consistency, with the severity of COPD, impact of COPD and dyspnea were respectively related. A moderate association was verified between the very serious classification of the impact of the disease with residue in the vallecula, both in liquid consistency ($r = 0.687$, $p = 0.001$) and in pasty consistency ($r = 0.687$, $p = 0.001$). However, when analyzing the association between the ratio of Residues in Pyriform Sinuses with the degree of the disease,

Table 2. Characterization of the sample for swallowing variables

	Total sample n=19 (%)	COPD Mild/Moderate n=6(%)	COPD Severe/Very Severe n=13(%)	p*
VFS				
Dysphagia	3 (15.8)	0 (0)	3 (23.1)	0.200
Without Dysphagia	16 (84.2)	6 (100)	10 (76.9)	0.200
Vallecula residue				
Liquid	2 (10.5)	1 (16.6)	1 (7.7)	0.368
Pasty	2 (10.5)	1 (16.6)	1 (7.7)	0.152
Residue in pyriform sinuses				
Liquid	0 (0)	0 (0)	0 (0)	
Pasty	2 (10.5)	0 (0)	2 (15.4)	
PTT				
Liquid	0.86 ± 0.36	0.86 ± 0.29	0.85 ± 0.39	0.969
Pasty	0.81 ± 0.18	0.76 ± 0.09	0.83 ± 0.20	0.426

Comparison between numerical variables with normal distribution (mean ± standard deviation): Independent Student t-test. Comparison between numerical variables with non-normal distribution [median (interquartile range)]: Mann-Whitney U test. Comparison between nominal variables: Chi-square test. *Comparison between mild to moderate with severe to very severe

Caption: COPD: Chronic Obstructive Pulmonary Disease; VFS: Videofluoroscopy of Swallowing; PTT: Pharyngeal Transit Time

Table 3. Relationship of Pharyngeal Transit Time in liquid and pasty consistencies with anthropometric and pulmonary function variables

	LIQUID		PASTY	
	r	p	r	P
BMI	-0.294	0.222	-0.195	0.423
FEV_1	-0.079	0.749	-0.150	0.540
MIP (cmH_2O)	-0.257	0.289	-0.212	0.383
MIP (%pred)	-0.215	0.376	-0.066	0.787
MEP (cmH_2O)	0.007	0.977	-0.188	0.630
MEP (%pred)	0.136	0.578	0.081	0.741

Test used for numerical variables: Pearson's correlation. Test used for qualitative variables: Chi-square test for association

Caption: BMI: Body Mass Index; FEV_1 - Forced Expiratory Volume in the first second; MIP - Maximum inspiratory pressure; Pred - predicted; MEP - Maximum expiratory pressure

Table 4. Relationship between residue in vallecula in liquid and pasty consistencies with variables of severity and impact of the disease and dyspnea

	LÍQUID		PASTY	
	r	p	r	p
Degree of disease (COPD)				
Mild to Moderate	0.136	0.579	0.136	0.579
Severe to Very Severe	-0.136	0.579	-0.136	0.579
CAT				
1 (mild)	-0.149	0.544	-0.149	0.544
2 (moderate)	-0.325	0.174	0.018	0.941
3 (severe)	0.136	0.579	-0.233	0.337
4 (very severe)	0.687	0.001*	0.687	0.001*
MRCm				
1	-0.118	0.631	-0.118	0.631
2	-0.136	0.579	0.233	0.337
3	0.322	0.179	-0.149	0.544
4	-0.081	0.742	-0.081	0.742

Test used for numerical variables: Pearson's correlation/Test used for qualitative variables: Chi-square test for association. *$p \geq 0.05$

Caption: COPD: Chronic Obstructive Pulmonary Disease; CAT - COPD Assessment Test; CAT - COPD Assessment Test; MRCm - Medical Research Council modified

Table 5. Relationship between Residues in Pyriform Sinuses in pasty consistency with severity and impact of the disease and dyspnea

	PASTY	
	r	P
COPD		
Mild to Moderate	-0.233	0.337

Test used for numerical variables: Pearson's correlation/Test used for qualitative variables: Chi-square test for association

Caption: COPD: Chronic Obstructive Pulmonary Disease; CAT - COPD Assessment Test; CAT - COPD Assessment Test; MRCm - Medical Research Council modified

Table 5. Continued...

	PASTY	
	r	P
Severe to Very Severe	0.233	0.337
CAT		
1 (mild)	-0.149	0.544
2 (moderate)	0.362	0.128
3 (severe)	-0.233	0.337
4 (very severe)	-0.081	0.742
MRCm		
1	-0.118	0.631
2	0.233	0.337
3	-0.149	0.544
4	-0.081	0.742

Test used for numerical variables: Pearson's correlation/Test used for qualitative variables: Chi-square test for association
Caption: COPD: Chronic Obstructive Pulmonary Disease; CAT - COPD Assessment Test; CAT - COPD Assessment Test; MRCm - Medical Research Council modified

with the impact of the disease and with the sensation of dyspnea, no association was noticed between the variables analyzed.

DISCUSSION

The results of the present study showed no relationship between PTT, in both consistencies, with dyspnea and pulmonary function, in COPD individuals. Likewise, no relationship was found between the presence of residues in vallecula and pyriform sinuses, in liquid and pasty consistency, with dyspnea and lung function. However, there was a significant association between the presence of residue in the vallecula, in both consistencies, and CAT, which assesses the impact of the disease on the subject.

In the present sample, four individuals presented residues in one of the consistencies in vallecula or pyriform sinuses. The presence of pharyngeal residue demonstrates impaired swallowing efficiency[26] and it increases the risk of bronchoaspiration[27], which can worsen the respiratory condition of patients with COPD. However, in a study aimed at exploring the relationship between pharyngeal residues with penetration/aspiration episodes, there was no relationship of residue in pyriform sinuses with the safety of swallowing, raising the hypothesis that the use of multiple swallows may be a functional strategy to reduce the quantity of residue and, as a consequence, the risk of aspiration[28]. In the present study, we did not evaluate the presence of multiple swallows. However, we observed that there was no significant residue in pyriform sinuses, as well as no association with the severity of the disease, dyspnea or even some impact of the disease on the subject.

It should also be noted that most of the patients who presented pharyngeal residue were classified as grade 3 in terms of COPD severity, CAT from moderate to very severe and dyspnea degree equal to or greater than 2. Patients with these clinical features are eligible for pharmacological treatment in groups B or D according to the ABCD scheme proposed in GOLD[14]. Although the relationship is not clear, studies have pointed to the inhaled medication used in the treatment of COPD as a possible cause of sensory changes detected in the oral and laryngopharyngeal cavities of individuals with COPD[29-30]. The sensory impairment in the laryngopharynx may justify the presence of pharyngeal residue in these individuals.

In a study carried out by Vale-Prodomo[7], the pharyngeal phase of swallowing was assessed in 58 healthy individuals and there was an average time of duration of the pharyngeal phase of 0.71 seconds in liquid consistency. The PTT of the individuals evaluated in our research, in the liquid consistency, was 0.86 seconds, that is, considered high, when compared to normality. Similarly, de Deus Chaves et al.[29] carried out a study to evaluate the pharyngeal transit time of swallowing and the characteristics of residue in the vallecula of 20 individuals with stable COPD and without complaints of swallowing and compared it with 20 healthy individuals. COPD subjects presented a PTT higher than the ones from the control group. The authors infer that this increase in time is a protective physiological maneuver, so that breathing and swallowing events have more time to coordinate, even before the swallowing reflex starts. This hypothesis corroborates the findings of our research, since these adaptive events contribute to safer swallowing. In the present study, it was also observed that there was no significant relationship between PTT and BMI or lung function.

When it comes to the fact that no association was verified between PTT with dyspnea and pulmonary function variables, it is possible to infer the possibility that the condition of respiratory muscle strength may have contributed, since patients may be using the diaphragmatic muscles more effectively and, as a consequence, the accessory muscles and coordination swallowing breathing is better preserved.

However, the lack of a control group can be considered as a limiting factor of the study. Future research should consider analyzing patients with stable COPD and in an episode of exacerbation, in order to better understand the impacts of the severity of the disease on the dynamics of swallowing.

CONCLUSION

We concluded that subjects with COPD, regardless of the severity of the disease, showed no association between PTT, presence of pharyngeal residue and dyspnea and lung function.

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Author contributions

DP: Developed the project, carried out the data collection and writing of the paper. FBR: Developed the project and the writing of the paper; DFDB: Helped in the final writing of the paper; TDS: Helped in the final writing of the paper; IMA: Co-mentored and reviewed the paper; RM: Developed the project, co-mentored and reviewed the paper; ASP: Developed the project, mentored and reviewed the paper.