CORRELATION BETWEEN SLOW VITAL CAPACITY AND THE MAXIMUM PHONATION TIME IN HEALTHY ADULTS

Correlação entre a capacidade vital lenta e o tempo máximo de fonação em adultos saudáveis

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ABSTRACT

Purpose: to correlate the value of slow vital capacity (SVC) with the maximum phonation time (TMF) in order to estimate the vital capacity. **Methods:** the study is a cross-sectional crossover and participated in this research one hundred one (101) healthy subjects 71 women and 30 men. The slow vital capacity (SVC) was measured using a spirometer and TMF was evaluated by vowel "a", the phoneme "s" and "z" and the manner of counting numbers. **Results:** there was significant correlation between the SVC (ml) and TMF (a, s, z) and technique of counting with r * respectively (0.420, 0.442, 0.399, 0.279) with a p-value <0.05 in total population. There was a positive correlation between the slow vital capacity and the variables /a /, /s /, /z / and technique of counting for females, according to values of r * (0.296, 0.334, 0.326, 0.320) respectively and p-value < 0.05 . **Conclusion:** in this study was possible to observe a positive correlation between the SVC and TMF in total population and females, this correlation was not observed among males.

KEY WORDS: Respiratory Function Tests**;** Vital Capacity; Phonation

INTRODUCTION

The measurement of lung volumes is commonly used in clinical practice for functional diagnosis of various diseases that damage lung function. In this context, the reduction of slow vital capacity (SVC) is associated with restrictive ventilatory disorders, being below its normal value in the post - operative thoracic surgery, neuromuscular disorders and pulmonary fibrosis[1,2].

Quantitation of SVC requires the use of specific equipment, such as spirometry and / or ventilometer, which are not always available in all areas of clinical practice. This fact justifies the need of obtaining simple and accurate methods that can measure the SVC [3,4].

The voice is a product of complex and dynamic interaction and can not be treated in isolated segments of phonation, breathing and articulation. The physiological functioning of the human larynx has a active role in sharing a common area between the digestive system and the airways. The production of a vowel depends on the balance between the pulmonary aerodynamic forces and the larynx myoelastic forces, so any impairment of this function has a direct effect on speech and voice, which can be detected by measurements of lung function or phonation[5-8].

The maximum phonation time (MPT) is the duration that a person maintains a sound during exhalation after a maximal inspiration through sustained vowel. As lung function is directly related to voice production, individuals with lung disease may have altered the MPT, as well as reducing the amount of air available, hampering the aerodynamic forces necessary for the process of phonation[8-11].

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The assessment of lung volumes and capacities is necessary to identify patients who have some degree of impaired function pulmonar[12]. The possibility of employing other techniques that do not require specific equipment is a challenge for researchers.

The aim of this research was to investigate the correlation between the SVC and MPT in healthy adults.

METHODS

This study was approved by the Ethics Committee of Agamemnon Magalhães Hospital, Recife-PE on 17/12/2008. All participants were informed about the research objectives as well as their rights as participants and signed an informed consent.

This was a transversal study, crossover, conducted at cardiopulmonary clinical laboratory of the Mauricio de Nassau College in Recife - PE, Brazil, from January through June, 2009.

The study included 101 healthy subjects (71 women and 30 men with a mean age of 23.21 ± 3.652 and 23.40 ± 3.158, respectively), selected from the institution. There were excluded asthmatic individuals in crisis, pregnant, obese according to the World Health Organization[13], who had already attended any classe in the professionalization cycle of health courses and those who had cold or flu in the week of reaserch. There were also excluded, professional athletes, and people who participated in singing classes and / or played blows instruments.

General data were collected through the total body mass, height, body mass index (BMI), age, gender and health status[4-19], furthermore, values of slow vital capacity, numerical count tecnique and maximum phonation time.

The measurement of total body mass (TBM) and height was conducted by a single examiner following the standardization of the International Society for the Advancement of Kinanthropometry (ISAK)[18]. For both measurements was used accurate scale to 50g and accurate stadiometer to 0.5 cm (W-200 - WELMY, São Paulo, Brazil). The BMI was calculated using the anthropometric measurements according to standard equation[19].

The slow vital capacity was measured through an analog ventilometer by brand Ferraris Mark Wright spirometer - USA. All participants were instructed to breathe through a mouthpiece on the device and all made use of a nasal clip during the maneuver[20]. During the tests, they were instructed to sit with proper posture and make a maximum deep inspiration to reach maximum inspiratory capacity. After the inspiration each participant was instructed to blow all the air slowly until it reached the expiratory reserve volume, then the corresponding values were registered and was chosen the best measurement of three attempts following by a rest time of two minutes between each one [2,16,20].

To evaluate the appropriate volume of air through the issuance of a sound or uninterrupted speech in one exhalation, there were chosen the /a/ vowel being the same, central, open, so the vowel of choice for any voice test, the phoneme /s/ when it is issued after a deep breath, evaluates the pulmonary air support, especially regarding the ability to control it, since there is no vibration of the vocal folds in this sound and phoneme /z/ by requiring the glottal source activity, for verifying the minimum structural alterations of the vocal fold cover, being associated with the kind of insufficient glottal closure, allowing the evaluation of vocal behavior [6,7].

The participant was instructed to sit properly, make a maximal inspiration, reaching maximum inspiratory capacity, and during exhalation to release a continuous sound until the expiratory reserve volume (maximum expiration), in separate steps for each letter, MPT values were recorded using a stopwatch KENKO®, model KK-2808, where the value chosen for analysis was the best of three attempts mark, following by a two minutes rest between measurements[5,21,22].

Another way to assess the MPT was by counting numbers on which the guidance on posture and explanation of how the test was to be performed was the same as above and the patient were asked to tell the numbers in ascending order and naturally, starting from the numeral one to the highest number achieved without performing new inspiration, fulfilling a range of fifteen seconds between attempts[11].

The order of the tests execution (slow vital capacity, phonemes /a/, /s/, /z/ and technique of counting numbers) was taken randomly (simple drawing) for each participant, all procedures were performed by the same investigator and it was given a ten minute rest between techniques.

Statistical analysis

The variables were analyzed using the SPPS 13.0 for Windows and Excel 2003 softwares and all tests considered a 95% confidence interval.

The normality Kolmogorov-Smirnov test, the Student's T test (normal distribution), the Mann-Whitney test (Not Normal) and the correlation coefficient of Pearson (normal distribution) were used.

RESULTS

The variables weight, height, body mass index (BMI), slow vital capacity (SVC) and maximum phonation time (a, s, z and counting technique) were expressed as mean and standard deviation divided by sex (Table 1). There was statistical difference between male and female, for weight, height, BMI, and slow vital capacity (TMF / a /, / s /, / z /).

There was verified a positive correlation with statistical difference between slow vital capacity and the variables / a /, / s /, / z / and count technique for females and in both sexes (Table 2).

Table 1 - Variables of age, weight, height, BMI, and SVC MPT with their mean and standard deviation

Variables	Gender		P-valor
	Male (n=30) Mean ± SD	Female (n=71) Mean ± SD	
Age	23,40 ± 3,158	23,21 ± 3,652	0,704 *
weight (Kg)	78,36 ± 11,434	60,47 ± 12,541	< 0,001 **
height (m)	1,77 ± 0,086	1,63 ± 0,058	< 0,001 **
BMI (Kg/m^2)	25,03 ± 3,257	22,77 ± 4,431	0,014 **
SVC (ml)	4905,33 ± 772,157	3315,63 ± 630,518	< 0,001 **
A (s)	27,16 ± 9,133	20,68 ± 6,703	< 0,001 **
S (s)	29,31 ± 11,853	22,75 ± 8,118	0,008 **
Z (s)	28,54 ± 10,142	22,63 ± 7,442	0,002 **
TCN	55,07 ± 15,693	50,49 ± 14,729	0,165 **

BMI = Body mass index SVC = Slow vital capacity TCN = Technique of counting numbers A, S e Z = phonemes concerning the maximum phonation time (*) Mann-Whitney; (**) t Student.

Table 2 - Correlation between SVC with the variables of MPT (A, S, Z and Technique of counting numbers) for male, female and both sexes

Gender	SVC (ml)	
	r *	p-value
Male		
A	0,145	0,446
S	0,339	0,067
Z	0,175	0,356
TCN	0,160	0,398
Female		
A	0,296	0,012**
S	0,334	0,004**
Z	0,326	0,005**
TCN	0,320	0,006**
Both sexes		
A	0,420	0,000**
S	0,442	0,000**
Z	0,399	0,000**
TCN	0,279	0,005**

A, S, e Z = phonemes used for maximum phonation time TCN = Technique of counting numbers.** **P<0,05.**

DISCUSSION

The evaluation of the slow vital capacity is extremely important for functional assessment of the lung which allows diagnostic, to verify therapeutic efficacy and assist in preventing diseases. The possibility of employing other techniques that do not require specifics equipments and the voice can be a mean of evaluation for estimating vital capacity would be a resource to assist health professionals in the clinical evaluation of the patient.

A study by Salomon et al.,[10] denote the importance of maximum phonation time (MPT) as a means of clinical assessment for as phonatory system as respiratory system. The contributions of the larynx and respiratory systems in MPT are questioned in relation to lung volume and capacity for being routinely performed for the diagnosis of voice disorders.

The measurement of slow vital capacity (SVC) was performed using a ventilometer through a mouthpiece to ensure less air leakage as well as Junior Fiori et al.,[20] which reports that different methodological approaches to assess the SCV and the level of patient cooperation might interfere in the performance of maneuvers and consequently affecting the evaluated measures. In the same study[20], results from respiratory pressures and vital capacity (VC) evaluated between facial mask and a mouthpiece adapted to the ventilometer and manovacuometer were compared. It was found that the VC can be evaluated by the mouthpiece and by the face mask because there was no evidence of air leak, preferring to evaluate healthy and cooperatives with a mouthpiece, leaving the masks for uncooperative patients or those who had any problem that would interfere with the understanding of the technique.

According to Pereira et al.,[16] and Crapo[1] for a population of the same age, varying only sex, there was statistical difference between weight, height, body mass index (BMI) and slow vital capacity (SVC). In our study there was statistical difference between the SVC for men, 4905.33 ± 772.157 (mean and standard deviation), and for women, 3315.63 ± 630.518 (mean and standard deviation). Furthermore, for young people of the same height was found that males have higher values of lung function than young females[3].

The vowels test, uninterrupted phonemes test and numerical count test are traditional measures for investigation of phonation, because they indicate the patient's ability to control the aerodynamic forces of the lung and larynx myoelastic forces. Our findings showed a positive correlation between the SVC and the MPT (/a/, /s/, /z/ and count technique) for the total population and in females, there was no correlation in the male. Rossi et al.,[7] also reported that influencing factors in vital capacity as weight, height and sex can indirectly interfere with the MPT.

The normative standards for MPT, reported by Cielo et al.,[22] for men were 20 seconds and 14 seconds for women, however when analyzing both the mean was 20 to 27 seconds. Our research found a mean for the maximum phonation time above these values, for men was greater than 25 seconds and in women over 20 seconds. For the total population we were also found values of MPT above 22 seconds.

No values of normative standards for maximum phonation time were found in the form of numerical count. In this study, a counted value of 51.85 ± 15.1 (mean ± standard deviation) was found for total population, 55.07 ± 15.7 (mean ± standard deviation) in males and 50.49 ± 14,729 (mean ± standard deviation) in females.

Rossi et al.,[7] associated the maximum phonation time and peak expiratory flow (PEF) in asthmatic patients to verify the bronchopulmonary involvement and found that there was proportionality between the measures and the greater the severity of the disease, the lower the MPT and PEF. They also reported that the MPT and PEF are influenced by many factors, so the MPT not be appropriate for a generalized evaluation of the population should be considered as a test of individual monitoring.

Salomon et al.,[10] describes the alveolar pressures and larynx are the main factors that regulate the MPT and that this examination is rarely performed in clinics. Also described that the MPT was used as the assessment of support for people with vocal disorders and other neuromuscular disorders, furthermore, the result is inversely proportional to the severity of the disease or respiratory impairment.

It should be mentioned that the importance of studying a new technique without the need for specific devices and to use the voice as a resource, allowing the realization of functional assessment of the patient in any environment and at lower cost. Some studies[23] have tried to assess and / or correlate the SVC with other devices, however it was not found studies using the voice as a means of estimating the SVC.

CONCLUSION

This study identified a positive correlation between the Slow Vital Capacity and Maximum Phonation Time in healthy adult subjects

RESUMO

Objetivo: analisar o papel do tempo máximo de fonação (TMF) como método de avaliação da capacidade vital lenta (CVL) e a possível correlação entre essas variáveis. **Métodos**: trata-se de um estudo do tipo transversal, *crossover* e a escolha entre as técnicas foram realizadas de forma randomizada. Foram avaliados 101 indivíduos adultos saudáveis de ambos os sexos sendo 71 mulheres. A CVL foi mensurada por meio do ventilômetro, enquanto o TMF foi avaliado por meio da verbalização da vogal /a/, dos fonemas /s/ e /z/ e da contagem numérica. **Resultados**: ao analisar a população total, observou-se uma significante correlação positiva entre a CVL e o TMF (/a/, /s/, /z/ e contagem numérica; R = 0,420, 0,442, 0,399 e 0,279, respectivamente com p < 0,05). Quando subdividida a amostra por sexo, apenas no sexo feminino foi verificada a existência de correlação entre essas variáveis (R = 0,296, 0,334, 0,326 e 0,320 respectivamente com p < 0,05). **Conclusão:** nesse estudo foi observada uma correlação positiva entre os valores de CVL e TMF para a população total e do sexo feminino, não se verificando essa associação entre os indivíduos do sexo masculino.

DESCRITORES: Testes de Função Respiratória; Capacidade Vital; Fonação

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