

Evaluation of Voice Quality in Pulmonary Function Tests Laboratory Technicians

Solunum Fonksiyon Testleri Laboratuvarı Teknisyenlerinde Ses Kalitesinin Değerlendirilmesi

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ABSTRACT

Objective: The suitability of spirometric studies depends on the patient-technician-equipment relationship. The technician uses visual and verbal stimuli during the pulmonary function test (PFT). It is common for technicians to coach patients firmly and loudly during the test and to demonstrate breathing maneuvers close to the patient. This practice, amounting to voice abuse, can lead to voice quality impairments in PFT lab (PFTL) technicians. Our study aimed to examine voice disorders among PFTL technicians in our country.

Material and Methods: Demographic data, the number of patients tested weekly, weekly working hours, and medical diagnoses related to voice were collected through a questionnaire created using the online survey software program SurveyMonkey®. The Voice Handicap Index (VHI) and Voice-Related Quality of Life (V-RQOL) were administered to technicians.

Results: Forty-five PFTL technicians participated. The mean VHI-10 score was 17.1 (SD 9.385), and the mean V-RQOL score was 17.2 (SD 8.794). There was no statistically significant difference between the number of patients tested, the number of hours spent shouting/loud talking per week, the presence of known hoarseness, and the VHI-10 and V-RQOL total scores ($p>0.05$).

Conclusion: Although loud voice use to the point of shouting test instructions is required to obtain quality data in PFT results, this practice lacks scientific basis. It is essential to recognize the negative impact on voice quality in PFTL technicians, similar to professional groups like teachers and clergy. According to our results, it is difficult to assert that the voice quality of PFT technicians is unaffected. To our knowledge, no previous study has examined the voice quality of PFTL technicians. Visual and verbal substitutes for “voice misuse” can be employed to protect workers’ vocal health.

Keywords: PFT technicians, voice quality, VHI, V-RQOL.

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ÖZ

Amaç: Spirometrik incelemelerin uygunluğu, hasta, teknisyen ve ekipman arasındaki ilişkiye bağlıdır. Solunum fonksiyon testi (SFT) sırasında teknisyen, vizüel ve sözel uyarılar kullanır. Test sırasında hastaya güçlü ve yüksek sesle koçluk yapmak ve hastaya yakın bir yerde soluma manevralarını göstermek sık kullanılan yöntemlerdir. Bu uygulama, sesin kötüye kullanımına varabilir ve SFT laboratuvarı (SFTL) teknisyenlerinde ses kalitesi bozukluklarına yol açabilir. Çalışmamız, ülkemizdeki SFTL teknisyenlerinde ses bozukluklarını incelemeyi amaçlamaktadır.

Gereç ve Yöntemler: Çevrimiçi anket yazılımı programı (SurveyMonkey®) kullanılarak oluşturulan bir anket aracılığıyla demografik veriler, haftalık test yapılan hasta sayısı, haftalık çalışma saatleri ve ses ile ilgili tıbbi tanılar toplandı. Ses Handikap Endeksi (SHİ-10) ve Sesle İlişkili Yaşam Kalitesi Ölçeği (SYKÖ) teknisyenlere uygulandı.

Bulgular: Kırk beş SFTL teknisyeni değerlendirildi. Çalışanların ortalama SHİ-10 puanı 17,1 (SD 9,38471), ortalama SYKÖ puanı ise 17,2 (SD 8,79446) idi. Bireysel olarak test yapılan hasta sayısı, haftada bağırarak/yüksek sesle konuşulan saat sayısı ve bilinen ses kısıklığı varlığı ile SHİ-10 ve SYKÖ toplam puanları arasında anlamlı istatistiksel bir fark bulunamadı ($p>0.05$).

Sonuç: Kaliteli SFT verisi elde etmek için test talimatlarını bağırma derecesinde yüksek bir sesle vermek gerektiği düşünülse de, bu uygulamanın bilimsel bir temeli yoktur. Öğretmenler ve din adamları gibi profesyonel gruplarda olduğu gibi, SFTL teknisyenlerinde ses kalitesinin olumsuz etkilenmesi önemlidir. Sonuçlarımıza göre, SFT teknisyenlerinin ses kalitesinin etkilenmediğini söylemek zordur. Bildiğimiz kadarıyla, SFTL teknisyenlerinin ses kalitesi üzerine daha önce bir çalışma yapılmamıştır. Çalışanların ses sağlığını korumak için “sesin kötüye kullanımı” yerine görsel ve sözel alternatifler kullanılabilir.

Anahtar kelimeler: SFT teknisyenleri, ses kalitesi, SHİ, SYKÖ.

INTRODUCTION

When workers in coal mines began losing their respiratory functions at an early age and retired early, Dr. John Hutchinson recognized the need for a device to measure respiratory functions.^[1] This simple spirometry, widely used in the diagnosis and follow-up of many lung and non-pulmonary diseases, has evolved over the years to its current form.^[2] What has remained constant is the necessity for a technician who can guide the patient during respiratory function tests. The compatibility between the technician, patient, and equipment is crucial for spirometric studies to be suitable for evaluation. The technician prepares the patient for the test, provides information, and ensures clear and decisive guidance in the maneuvers, thus enhancing patient compliance.^[3] The technician employs visual and verbal stimuli during the pulmonary function test (PFT). It is a common practice for the technician to firmly and loudly coach the patient during the test and demonstrate the maneuvers closely to the patient.^[4,5] However, loud operations may lead to voice disturbances. Literature reports that incorrect or harmful voice use, such as loudly speaking, shouting, screaming, and excessive throat clearing—referred to as vocal abuse/misuse—causes phonotrauma.^[6] These behaviors do not lead to ideal voice production and can cause damage if persisted. Voice disorders resulting from loud noise in the work environment have been investigated in various occupational groups, particularly in voice professionals like singers and presenters.^[6–9]

A meta-analysis found that the prevalence of dysphonia was 44% among voice professionals.^[7] Preliminary studies on non-audio professionals have shown that many non-professional voice users suffer from voice problems, significantly affecting their job performance.^[10] Literature includes studies on teachers, evaluating voice disorders as occupational diseases.^[6,11–13] The prevalence of voice disorders among PFTL technicians, who use their voices

extensively and continuously during their workday, is unknown, although it is thought to vary with the intensity of the work environment. In our study, we sought to uncover voice disorders in PFTL technicians, a group not previously evaluated in this regard. We aimed to examine voice disorders among technicians by conducting an electronic questionnaire that included the Voice Handicap Index (VHI-10) and Voice-Related Quality of Life (V-RQOL) for PFTL technicians in our country.

MATERIAL AND METHODS

Technicians working in pulmonary function testing laboratories were administered a questionnaire using the online survey software program SurveyMonkey®, which inquired about their daily work patterns and included the Voice Handicap Index (VHI) and the Voice-Related Quality of Life (V-RQOL). Informed consent forms were obtained from the participants. The Turkish short form of the VHI questionnaire, developed as a result of the studies by Kiliç et al.^[14] in 2008, which investigated its reliability and validity in Turkish, was utilized. Pulmonary function test technicians were reached through a WhatsApp® communication network established by the technicians. The results of the study by Tezcaner et al.^[15] in 2015 suggest that the Turkish version of the V-RQOL measure is reliable and valid, and may play a crucial role in evaluating patients with voice disorders. Although it is estimated that close to 500 technicians have received PFT training and still perform PFT in hospitals, the number of individuals working as PFTL technicians on a regular basis is thought to be fewer than 100. There were 74 individuals in the WhatsApp contact group, with a 60% participation rate in the survey. The questionnaires (VHI-10 and V-RQOL) used are validated tools for this type of assessment. Table 1 presents the content of the questions from the two surveys. Data were compiled and analyzed using the Statistical Package for the Social Sciences

Table 1: Question contents of the two surveys

VHI-10 questionnaires	V-RQOL questionnaires
My voice makes it difficult for people to hear me	I have trouble speaking loudly or being heard in noisy situations
People have difficulty understanding me in a noisy room	I run out of air and need to take frequent breaths when talking
My voice difficulties restrict my personal & social life	I sometimes do not know what will come out when I begin speaking
I feel left out of the conversations because of my voice.	I am sometime anxious or frustrated (because of my voice)
My voice problem causes me to lose income.	I sometimes get depressed (because of my voice)
I feel as though I have to strain to produce voice	I have trouble using the telephone (because of my voice)
The clarity of my voice is unpredictable.	I have trouble doing my job or practicing my profession (because of my voice)
My voice problem upsets me	I avoid going out socially (because of my voice)
My voice makes me feel handicapped	I have to repeat myself to be understood
People ask, What's wrong with your voice?"	I have become less outgoing (because of my voice)

VHI-10: Voice Handicap Index, V-RQOL: Voice-Related Quality of Life.

(SPSS), Version 24.0 (IBM Corp., Armonk, New York, USA). Descriptive statistics such as frequencies and percentages were utilized to summarize the data on VHI and V-RQOL scores. Continuous and categorical variables were analyzed using Student's t-test and the Chi-square test. A p-value of <0.05 was considered significant for all statistical analyses. The study received approval from the university's ethics committee (7475-GoA. 2022/34-04). This study adhered to the ethical standards laid down in the Declaration of Helsinki of the World Medical Association, as well as the ethical standards of the institutional and/or national research committee, for conducting medical research involving human participants.

RESULTS

In the study, responses from a total of 45 pulmonary function test technicians were evaluated. 82% of the participants were female. The mean age was 41.42 (SD±8.675). 31% of the participants were smokers (Table 2). The average number of years working in the PFT laboratory was 8.82 (SD±7.764). 62% of the participants tested 31 or more patients per day. 13% had a medical diagnosis related to voice, and 33% of these employees were diagnosed after they began their PFT work. Participants reported working loudly/yelling for an average of 22.98 (SD±16.954) hours per week. The mean VHI score was 17.1 (SD±9.38471), and the mean V-RQOL was 17.2 (SD±8.79446). No statistically significant difference was found between the number of patients tested, the hours spent shouting/loud talking per week, the presence of known hoarseness, and the VHI-10 and V-RQOL total scores (p>0.05).

DISCUSSION

In our study, the high VHI-10 scores indicate a deterioration in the voice quality of technicians. During spirometry tests, PFTL technicians often use a loud voice, sometimes to the point of shouting or screaming, to obtain quality data. This practice lacks scientific basis and is generally unnecessary. It is suggested that demonstrating the maneuver to the patient before the test and using suggestive body language during the test are more effective than shouting or

Table 2: Demographics of the participants

	n	%
Gender		
Male	8	18
Female	37	82
Institute		
Private	4	9
Ministry of Health	15	33
University	26	58
Number of patients tested/day		
<31	17	38
≥31	28	62
Diagnosis of voice disorder		
Yes	6	13
No	39	87
Hours of audio abuse/week		
<25	21	47
≥25	24	53
Smoke		
Yes	14	31
No	31	69

screaming.^[16] Moreover, such loud instructions can be frightening for children, uncomfortable for teenagers, and less audible for those with hearing impairments. While enthusiasm during the test is recommended, facial expressions and body language are deemed more important than vocal instructions. Good spirometry results can be achieved through the use of body language and observing the patient's body language.^[17] Our study was designed to raise awareness about protecting the vocal health of PFT laboratory employees by acknowledging the potential vocal abuse from speaking loudly. To our knowledge, this is the first study to evaluate the voice quality of PFTL technicians. The VHI, used in our study, is a widely recognized tool globally for assessing the physical, functional, and emotional as-

pects of voice disorders.^[18] A simplified 10-item version of the VHI (VHI-10) was developed in 2004, which is quicker, easier to administer in clinical settings, and statistically more robust than the full scale.^[19] Although there is no definitive cut-off value, a VHI-10 score above 11 is generally considered indicative of voice disorder, and the mean score in our study was 17.1. The V-RQOL scoring categorizes scores as 10–15 (Excellent), 16–20 (Very Good), 21–25 (Good), 26–30 (Moderate), and 31–50 (Poor), with our study's average score being 17.2.^[20] These results suggest that the voice quality of PFTL employees is likely affected. The fact that 13% of employees have a voice-related medical diagnosis, with 33% of these diagnoses made after employment, is concerning. To protect employees' vocal health, alternatives to vocal misuse, such as high-visibility videos and software for patient instruction, should be considered. General coaching recommendations include providing audible stimulation throughout the test and using tactile and verbal cues for slow vital capacity measurement, forced vital capacity, and flow volume loop, with sharp, forced 'voicing' for commands.^[5] Voice is an essential tool in many professions. A meta-analysis involving various professionals showed that over 82% of participants experienced voice problems at some point.^[21] Studies have found voice hygiene education beneficial, suggesting it should be integrated into professional training programs.^[22] Recent publications often use the term "professional voice" when discussing voice use in the workplace, with "vocal abuse/misuse" referring to harmful vocal behaviors like speaking loudly, shouting, and excessive throat clearing.^[23] Voice disorders, common among those who use their voices extensively, such as singers and teachers, can affect individuals' quality of life by hindering effective communication and causing emotional problems.^[24,25] Continuous vocal abuse in PFT laboratory employees could lead to severe dysphonia, affecting work performance. Occupational diseases are those caused by workplace exposures,^[26] but there is no consensus on defining occupational voice disorders.^[27] While some countries recognize dysphonia due to vocal load as an occupational disease, many developed countries, including ours, do not yet acknowledge hoarseness as such.^[28]

CONCLUSION

We believe this study will contribute to raising awareness about a potentially overlooked issue in occupational health, alongside the more recognized risks such as work accidents, dust, and chemicals. Additionally, to the best of our knowledge, this is the first study focusing on the voice quality of PFTL technicians. To safeguard the vocal health of employees, we recommend using engaging alternative tools like high-visibility videos and software for patient instruction, rather than relying on "poor voice use" without objective sound quality assessment criteria.

The primary limitation of our study is the small sample size. We were unable to ascertain an official count of PFTL technicians in our country. It is believed that fewer than 100 individuals are currently employed as PFTL technicians on a regular basis, though nearly 500 technicians have been trained and are still active in hospitals. Moreover, the absence of laryngoscopic evaluation for voice disorders, which would provide an objective differential diagnosis, is a limitation. However, as a preliminary study, its significance lies in its ability to raise awareness about this issue.

Disclosures

Ethics Committee Approval: The study was approved by The Dokuz Eylül University Non-interventional Research Ethics Committee (date: 26.10.2022, number: 2022/34-04).

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