Articles Section

AERODYNAMIC TESTING IN PSYCHOGENIC VOICE DISORDERS: RESPIRATORY AND PHONATORY STUDIES

Myrna A. Zipursky, D.S.P.
Barbara M. Fishbein, D.S.P.
Grace Thompson, R.P.T.
Frances Ezerzer, D.S.P.A.
Stanley W. Epstein, M.D.

Toronto Western Hospital
Toronto, Ontario

Aerodynamic studies were performed on 47 patients with psychogenic voice disorders. Pulmonary function data indicated that 40% displayed features characteristic of respiratory abnormalities in the absence of any respiratory symptoms. Phontary air flow data for a sustained /a/ was obtained along three variables: phonation time ratio, phonation volume-vital capacity ratio, and mean flow rate. Pre and post-therapy data for these variables was obtained on 15 subjects. Of this group, 14 showed definite trends toward improvement following treatment. Possible explanations and implications of the findings are discussed.

Des études aérodynamiques ont été effectuées sur 47 patients atteints de troubles vocaux psychogéniques. Les données sur la fonction pulmonaire ont indiqué que 40% révélaient des signes caractéristiques d'anomalies respiratoires, en l'absence cependant de tout symptôme respiratoire. Les données sur l'apport d'air phonatoire pour un /a/ entretenu ont été obtenues en fonction de trois variables: le rapport phonation/durée, le rapport volume phonatoire/capacité vitale, et le taux moyen de débit. Des données pré et post-thérapeutiques pour ces variables ont été obtenues sur 15 sujets. Dans ce groupe, 14 ont marqué une tendance nette à l'amélioration après le traitement. Les explications et implications possibles de ces découvertes sont présentées.

Vocal rehabilitation depends on the ability to diagnose the laryngeal and respiratory components of voice production and to objectively assess the response to treatment. Speech pathologists traditionally rely on their subjective estimations of the patient's vocal functioning, the laryngologist's report of the patient's laryngeal status and the patient's report of symptoms in order to arrive at conclusions regarding the status, management and change of the vocal condition. However, objective evaluations of vocal function have been developed and employ a variety of electronic equipment. One such system involves a spirometer to study air flow during voice production.

Although the importance of respiration to voice therapy is a matter of debate, (Aronson, 1980), the literature suggests that studies of quiet respiration can yield significant information regarding abnormal voice production (Gordon et al, 1978; Kelman et al, 1981). The present authors have been including aerodynamic studies as part of their routine vocal evaluation. Each patient study evaluated both ventilatory and phonatory air flow functions. The purpose of this paper is to present the data obtained from these studies and to discuss implications of the findings.

METHOD

Subjects

Forty-seven patients referred by laryngologists to a hospital speech pathology clinic served as subjects for the study. In all cases, a psychogenic voice disorder was diagnosed by a speech pathologist. There were 28 cases of dysphonia with no laryngeal changes, 8 cases of vocal cord nodules, 9 cases of vocal cord paralysis, 1 case of bowing of the vocal cords and 1 case of dysphonia plicae ventricularis.

There were 15 males and 32 females. The subjects ranged in age from 18 to 82 years with an average age of 41 years. Case history information indicated that none had any apparent respiratory symptoms or known respiratory abnormalities.

Procedures

Standardized ventilatory studies were performed by a qualified pulmonary technologist in a pulmonary function laboratory. Lung volumes were measured on a Collins Modular Lung Analyzer by the helium dilution technique. Spirometry was measured with an Ohio Dry Rolling Seal Low Resistance Spirometer and a Hewlett Packard, X-Y-T recorder. Expiratory Reserve Volume (ERV) was measured from a spirogram produced during testing. The forced vital capacity (FVC) maneuver was analyzed for FVC, forced vital capacity in 1 second (FEV_1), FVC/FEV_1 ratios and maximum midexpiratory flow rate (MMEFR). Results were interpreted by a respirologist.

Phonatory air flow data was obtained using the aforementioned spirometer with the addition of a face mask. The subjects were instructed to inhale maximally, begin phonation of the vowel /a/ at a comfortable pitch and loudness level and sustain phonation as long as possible. Two practice attempts were included, one without the face mask, to familiarize the subjects with the task. The test run (Figure 1), was analyzed to determine maximum phonation time (MPT), phonation volume (PV) and mean flow rate in cc. per second (MFR). PV and FVC values were used to calculate the phonation volume: vital capacity (PV:VC) ratio. Predicted values for MPT were based on the formulae derived by Hirano et al (1968). Formulae used for predicting PV:VC and phonation time ratio (PTR) values are described in a study by Yanigahara et al (1967).

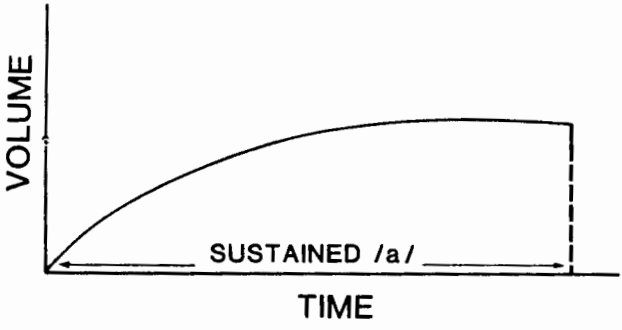

Fig. 1 Phonation/Time Curve

RESULTS

Pre-therapy data was obtained on 47 subjects. Complete pre and post-therapy measurements were available on 15 subjects.

Table 1. Summary of pre-therapy ventilatory studies including severity of deficit

	Normal	Abnormal		
		air trapping	restriction	obstruction
Males (n=14)	8	1 slight 1 moderate	1 slight 2 moderate	1 slight 1 moderate
Females (n=33)	20	3 slight 2 moderate	4 slight 2 moderate	2 slight 1 moderate
Totals: (n=47)	28	7	9	5

Table 1 outlines the results of the pre-therapy pulmonary function studies. A ventilatory defect was identified in 40.4% of the overall sample. This represents 42.9% of the male subjects and 39.4% of the females. There were 7 cases of air trapping, 9 cases of restrictive defects and 5 cases of obstructive defects. Of these, 11 were specified as slight defects and 9 as moderate ones. Multiple defects were present in 2 subjects. Ventilatory defects were demonstrated initially in 4 of the subjects where pre and post-therapy measures were available. Post-therapy testing showed persisting ventilatory defects in 3 of these subjects.

On discharge from therapy, voice had either returned to normal or vocal improvement had plateaued in 14 subjects. Only one subject was still categorized as having a significant vocal problem both acoustically and aerodynamically.

Table 2. Summary of pre and post-therapy phonatory air flow studies (n=15)

	Pre-therapy		Post-therapy		
	Normal	Abnormal	Normal	Improving	Abnormal
PTR	8	7	11	3	1
PV:VC	8	7	12	2	1
MFR	11	4	13	1	1

The pre and post-therapy air flow changes are illustrated in Table 2. Seven subjects showed abnormal pre-therapy PTR's. On post-therapy testing, 3 had become normal, 3 had improved toward normal and one remained abnormal. Seven subjects' pre-therapy PV:VC values were abnormal. On post-therapy testing, 4 had become normal, 2 had improved toward normal and one remained abnormal. Pre-therapy MFR values were abnormal on 4 subjects. On post-therapy testing, 2 had become normal, 1 had improved toward normal and 1 remained abnormal. A trend toward normal phonatory air flow functioning following voice therapy is demonstrated by this data.

DISCUSSION

One of the primary concerns of the speech pathologist dealing with a dysphonic patient is determining whether the abnormal voice signifies illness (Aronson, 1980). A precise diagnosis of the anatomical or physiological abnormality of the laryngeal and respiratory components of voice production is necessary prior to a programme of voice therapy (Gordon et. al., 1978).

Clinical literature on voice production and vocal abnormalities generally includes a discussion of respiration, particularly with respect to breathing patterns for speech purposes. Only specific respiratory diseases such as brinchitis have been documented in association with voice disorders. In a paper by Brewer (1975), in which he discusses the signs and symptoms of laryngeal disease, the only respiratory symptom mentioned is stridor. Gordon et. al. (1978), have studied respiratory and laryngeal function in dysphonia and found disturbed respiratory patterns at rest in 47.9% of their dysphonic patients. Interestingly, our results of 40.4% occurrence of ventilatory abnormalities is similar to Gordon et. al.'s findings.

It is a well-documented fact that musculoskeletal tension can alter physiological functioning and in some people, more than one system can be affected. This raises numerous questions. Is the respiratory abnormality another sign of emotional stress and/or musculoskeletal tension? Does the respiratory abnormality signify a true organic problem causing or concomitant to the dysphonia? Are both the respiratory and laryngeal conditions signs of separate underlying illness?

The answers to these questions will have obvious implications for management. The relationship between the respiratory and vocal abnormalities needs to be determined. Respiratory data can serve to index the severity of the problem and provide a baseline of objective data against which measures of progress can be made. Extensive research in this area could provide some answers.

Changes between the pre and post-therapy phonatory air flow data did reflect improvements in vocal functioning as noted by the speech pathologists. Again, our results appear to support Gordon et. al.'s (1978) findings that aerodynamic data can reflect changes in vocal status following direct vocal training. A more recent study by Kelman et. al. (1981), further demonstrated that the aerodynamic assessment of both the quiet respiratory pattern and the phonatory pattern during a sustained phonation agreed well with the subjective assessments carried out by speech pathologists. Although the conclusions drawn from our data support many of Gordon et. al.'s (1978) and Kelman et. al.'s (1981) findings, the aerodynamic measures employed

by these authors differed from our measure. Future research should be directed at establishing which combination of aerodynamic measurements best assesses respiratory and phonatory air flow functioning and most accurately reflects subjective impressions of vocal status.

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Acknowledgements

Requests for reprints should be directed to Mrs. Frances Ezerzer, Division of Speech Pathology, Department of Rehabilitation Medicine, The Toronto Western Hospital, 399 Bathurst Street, Toronto, Ontario, M5S 2T5.