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Respiration training: A case study.

Tina Shaffer-Sleyster

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RESPIRATION TRAINING: A CASE STUDY

by

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Chairman, Board of Examiners

Dean of the Graduate School

Date

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INTRODUCTION

The choice of voice therapy techniques and procedures has often been regarded largely as an "art" (Moore, 1971; Batza, 1977) since very few scientific investigations or descriptive studies in vocal rehabilitation have been documented. Speech pathologists frequently rely on authoritative opinion, and/or their own clinical experiences and knowledge of the phonatory system as a basis for selecting therapy procedures. With the recent and continuing federal and state legislature budget cuts in the funding of health services, the demand for program accountability is ever increasing in our field (Reed, 1980; McReynolds & Kearns 1983). Inherent in documenting therapeutic success or lack of success is the need for improved understanding of how anatomical, physiological, perceptual, psychological, linguistic and feedback parameters interact in the production of voice. Improved agreement and clarity of description in terminology, acoustical measurements and perceptual judgments of voice and voice disorders would also enhance documentation of therapy programs and their efficacy.

This paper examines the efficacy of respiration training with a single subject. Interest in this therapy technique grew from clinical observations of two patients while serving as a clinical extern at Fitzsimons Army Medical Center. Both of these patients' voice qualities significantly improved during the course of a six-week abdominal breathing class. The audible changes noted in
their vocal quality prompted the author to implement a case study with a third patient (the subject in this study) to allow for more systematic and controlled observations/investigations of the perceived vocal changes. The author's intent is that this document will lead to a more definite understanding of respiration training as a voice therapy technique.
Respiration

Respiration is an autonomic function that is completely under the control of the central nervous system and regulated by skeletal musculature. In addition to respiration for life, the unique organization of nerves, muscles, joints, and skin involved in respiration allows for metabolic and behavioral (phonatory) functions to be "overlaid" on each other (Campbell, 1974; Godfrey, 1974; Gould and Okamura, 1974; Plum, 1974; Viljanen, 1974; Widdicomb, 1974; Wyke, 1979).

The metabolic and primary responsibility of respiration allows for oxygen to be absorbed and carbon dioxide to be removed from the body's cells (Hixon, 1973). It is through this exchange of gases, particularly the absorption of oxygen, that the body derives its energy. The more efficient the breathing process the more oxygen will be delivered to the body for metabolizing and used as potential energy in voice production.

The primary inspiratory maneuvers most often cited in texts include diaphragmatic-abdominal displacement followed by thoracic cavity enlargement. During inspiration the lungs are stretched due to pleural linkage between the lungs and thoracic cavity. Intrapulmonary pressure drops and air flows into the lungs. During inspiration the lungs fill rapidly; first, to meet the demands of the body, and second,
to initiate and, or continue voice. When the forces of inspiration are lessened or removed and the forces of exhalation increase, the dimensions of the thoracic cavity decrease, the stretching force on the lungs is reduced, and air is expired.

In quiet breathing the expulsion of air from the lungs is accomplished solely by the elastic recoil of lung tissue and contraction of inspiratory muscles. In voice production, however, specific expiratory and inspiratory muscles and neurophysiologic reflexes are involved in the active regulation of the desired alveolar pressure (Hixon, 1973; Godfrey, 1974).

The important implication from the above discussion is that both muscular and nonmuscular forces are involved in the regulation of respiratory behavior for speech. [See Hixon, 1973 for a description of anatomical position and function of specific muscles involved in the inspiratory/expiratory cycle.]

Respiratory Mechanics in Phonation

In considering the application of respiratory mechanics to phonation a variety of factors and interrelationships become important. Recent research has established that postural adjustments (McClosky, 1977; Stough, 1970); body type (Hoit and Hixon, 1986); age (Ptacek, Sander, Maloney and Jackson, 1966); obesity (Proctor, 1974; Baken, 1979); physical exertion (Proctor, 1968); environment...
(Diehl, 1973); psychological factors (Stough, 1970); and linguistic parameters have marked effects on the respiratory and respiratory-phonatory mechanism.

In addition, particular significance has historically been ascribed to understanding the degree with which various respiratory patterns/styles and respiratory adjustments influence voice production.

A well recognized medical opinion is that the body will first satisfy its own biological, respiratory needs before generating voice. "Homeostatic" control mechanism(s) provide this biological safeguard (Baken, 1979). Consequently, the voice production of people with severe respiratory handicaps (e.g., emphysema, asthma, etc.) may be far less optimal than phonation by healthier persons, or persons with less involved respiratory handicaps.

The puzzling aspect regarding respiratory patterns/styles is that their influence on the general population's generation of vocal quality is far less well defined. The extent with which respiratory patterns influence airflow, laryngeal vibration and resonance is unclear. There is even less conclusive documentation regarding how the majority of

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1Optimal phonation is defined as voice which is customary and habitual for a particular society, culture, and communicative event and is produced without maladaptive struggle behavior and laryngeal hyperfunction relative to subglottic pressure (Kalen, 1933).
the population can use functionally defined inefficient breathing patterns for speech, yet whose voices remain asymptomatic.

**Breathing Patterns/Styles**

At this time three respiratory patterns/styles and their theorized phonatory consequences will be discussed. Each of the respiratory patterns/styles discussed are named for that part of the thorax that prevails physiologically.

"It is important to mention" that the information to be presented "is not entirely universal among speakers or to repeated utterances by the same individual" (Hixon, 1973, p.108). Various combinations and sequences of the three respiratory patterns may occur consciously or unconsciously within an individual.

**Clavicular breathing.**

Clavicular breathing is accomplished by noticeable elevation of the upper thorax. The "clavicles, sternum and the upper ribs are lifted rather strenuously and there is little, if any, expansion" [of the lower thoracic cavity] (Diehl, 1973, p.94).

While the intake of air with the clavicular breathing style is sufficient for phonation, clavicular breathing is undesirable for several reasons. Diehl (1973) reports that the elevation of the clavicles and sternum creates constriction in the laryngeal area preventing the relaxed function of the larynx during phonation. Clavicular breathing, most
likely, also interferes with potential resonators. The negligible expansion in the lower thorax, similarly, does not allow muscles in that area to assist at producing a controlled exhalation. "Exhalation is, therefore, more abrupt and requires the individual to inhale considerably more frequently" (Diehl, 1973, p.94).

Thoracic/costal breathing.
"Thoracic breathing consists of clavicular activity and diaphragmatic activity" (Diehl, 1973, p.94). Diehl (1973) describes thoracic breathers as occasionally experiencing shortness in breath support for longer phrases and weakened vocal projection during public performances. It is also not uncommon for thoracic breathers to speak on supplemental air\(^2\). Thoracic breathing does not appear to permit maximum respiratory-phonatory control (Diehl, 1973).

Diaphragmatic-abdominal breathing.
Diaphragmatic-abdominal breathing is the mechanical result of employing the diaphragm in the inhalation/exhalation process. The diaphragm is a muscle that divides the thoracic cavity from the abdominal cavity and extends all the way around to one's back. Diaphragmatic movement may be moni-

\(^2\)Supplemental air is defined as "the amount of air that can be forcibly exhaled following exhalation" (Zemlin, 1968, p. 83).
tored by observing anterior-posterior and transverse displacement of abdominal muscles, (Hixon, 1973) as the diaphragm itself is not visible externally. Abdominal musculature moves outward upon inhalation as a result of the lowered diaphragm displacing the musculature (Bouhuys, et al., 1966 cited in Leanderson, Sundberg, von Euler, Lagercrantz, 1979). At the onset of exhalation or phonation, the abdominal musculature moves passively inward as the diaphragm actively contracts for a brief moment (Draper, et al., 1959 cited in Leanderson, et al., 1979). The abdominal musculature, then, assists the diaphragm's return to its resting position, while the intercostals counteract the diaphragm's elastic recoil.

The key factor in this breathing pattern is that the inspiratory muscles work to oppose the relaxation (recoil) pressure and provide the necessary alveolar pressure for speech. Since alveolar pressure is different for different utterances, speech activities require different muscular pressures at each lung volume. Greater negative pressure is needed to counteract relaxation (recoil) pressure at high lung volumes for soft rather than normal-loudness utterances. Similarly, abdominal muscles especially play a part at low lung volumes (Mead and Hixon, 1974).

Tarasco (1983) considers the diaphragmatic-abdominal respiratory pattern "ideal" for phonation purposes. Tarasco reports that diaphragmatic-abdominal breathing provides "a
column of continuous and abundant tracheal air, and that the diaphragm allows the speaker to [increase his] expiratory time by using reserve expiratory lung volume" (p. 224).

Respiration Training

In spite of the undisputed importance of breathing in phonation there remains a large amount of controversy within the profession of speech pathology and among speech pathologists and other professionals regarding the effectiveness of "retraining" respiration patterns to improve voice.

A review of the available respiratory training literature, nevertheless, revealed encouragement for respiration training (thoracic and diaphragmatic-abdominal breathing) as early as the 15th century. In voice teaching, great emphasis continues to be placed on proper breathing technique.

During the inhalation stage of breathing, laryngeal and pharyngeal structures are trained to assume certain postures to produce the desired vocal quality when breath is exhaled and tone generated. Similarly, the "opened posture" of oral and pharyngeal cavities reduces airflow resistance allowing air to flow freely inward and outward.

Stratton (1966 cited in Estill, 1982) cites three, distinct, early methods by which exhalation was controlled. The first school of thought Stratton cites is that of
Castrati. Castrati, apparently, used exaggerated and intense breath pressure to press the air out of the lungs. Castrati's method implied that the speaker or singer was highly conscious of his/her breathing.

The second school of thought was reportedly developed by Manual Garcia's father and son. Their exhalation technique produced more of a "blown tone" as might be heard in a falsetto voice quality. Garcia's technique is believed to be similar to Boone's yawn-sigh therapeutic technique.

The third school of thought Stratton cites regarding controlled exhalation is that developed by Francesco and Lambert. Here, breath was controlled by reducing pressure to a minimum, then pressing it out. This technique appears to be similar to what voice teachers today consider "focused tone". Once phonation is initiated, the tone is perceived to start from "somewhere in the head" and the breath is perceived to be somewhat "held back".

The paucity of information regarding techniques used in each of the schools makes it difficult to thoroughly follow the theoretical basis regarding respiration training. Nevertheless, it is quite apparent that a "correct" method of breathing was assumed. Yet, nowhere in this author's review of the literature was there a definition of an "absolute", universal method of breathing, let alone conclusive evidence to indicate that a particular pattern of breathing is best for optimum phonation (Boone, 1983). Many
combinations of muscular activity may achieve the same end result (i.e., the desired alveolar pressure) (Hixon, 1973).

What the literature appeared to support was the importance of "breathing coordination" (coined by Stough, 1970). Broadly, breathing coordination deals with allowing the most efficient movement of air in and out of the lungs with the least amount of effort [for ventilation and phonation.]

The diaphragmatic-abdominal breathing pattern, previously discussed, appears to be closely synonymous with coordinated breathing because this pattern of breathing is efficient at the removal of carbon dioxide from the body, thereby allowing proportionally more oxygen to enter the body on the next inspiration. Air is supplied and expired as needed. Excessive tension is avoided as accessory and, or compensatory support is not necessary. An example of "coordinated breathing" occurs frequently prior to falling asleep; when the respiratory rate is reduced, breathing is very "natural" and deep, and one finds he/she has a continuous breath (Fitzgerald, 1979; Lowry-Romero, 1986).

Coordinated breathing is considered a "natural" phenomenon because newborn babies and young children typically demonstrate a synergistic, coordinated breathing pattern. Somehow during the course of growing up and internalizing tensions, along with the forces of gravity, body size and shape, effects of compensatory postural adjustments, etc., and an aging mechanism, many of us lose
this typical pattern of breathing. As a general rule, coordinated respiration is not observed in most normal adults (Dejonckere, Eeckhart, and Sneckpe, 1980).

Voice teachers and athletic coaches specifically train their pupils and athletes to more frequently and easily "re-obtain" breathing coordination. It is believed that breathing coordination provides them with the breath support and "second-wind" so often needed for them to excel in their professions (Stough, 1970; Proctor, 1979).

Andrews (1983) develops the thesis that respiration training allows voice students to develop a greater than normal tolerance for low levels of carbon dioxide. Andrews believes that by, theoretically, "resetting" the voice student's physiological need for oxygen, he/she learns to accommodate the phrasing demands in singing.

Respiration training is also typically used with voice disorders of laryngeal inefficiency and abuse. Boone (1983) reports the following specific cases with which respiration training may be useful:

1. altering pitch levels of deafened children and adults;
2. improving vocal resonance of the deaf;
3. functional aphonia;
4. unilateral adductor paralysis;
5. unilateral abductor paralysis;
6. decreasing (eliminating) pitch breaks;
7. abuse/misuse; and
8. partial laryngectomies.

In addition, Greene (1980) believes that respiration training teaches patient's awareness of how they are producing voice.

During this author's literature search, however, it became apparent that very few respiration training accounts were documented. Several authorities merely reported subjective descriptions of the effects of coordinated and uncoordinated breathing on phonation.

For example:

Cooper, (1971, p. 592) "hundreds of patients have indicated that lack of midsectional breath control has added and contributed to the onset and development of voice disorders".

Brodnitz, 1961, p. 442 (cited in Cooper, 1971) "The prevalence of chest breathing is very frequent in disturbed voices".

Huyck and Allen (1937) p. 592 (cited in Cooper 1971) "...regular diaphragmatic movement prevails in good voices".

Moore (1957) p. 694 (cited in Cooper 1971) "There can be little doubt that many persons with harmful vocal habits expend more effort on breathing than is necessary".

Dejonckere, et al (1980) p. 82. "No specific breathing patterns characterized dysphonic speakers, but qualitative, irregular breathing patterns were observed".

Documented respiratory differences between trained and untrained individuals included an overall increase in the
trained individuals' vital capacity\(^3\) and a decrease in their residual lung volume\(^4\) (Sataloff, O'Connor and Heurer, 1983). Interestingly, Gould and Okamura (1974) reported that tidal lung volumes\(^5\) were not sufficiently increased in trained individuals.

Baken (1979) reported that the better trained a speaker or singer, the more closely his/her lung volume of each prephonatory inspiration matched the expiratory volumetric requirements of the succeeding phonatory phrase. To achieve this high degree of respiratory-phonatory coordination the speaker or singer practiced repeatedly with the performance material. Respiratory-phonatory demands constantly change with the communicative intent, emotion, etc. behind each lecture or song.

Similarly, the conscious effort underlying different phonatory events was different between trained and untrained individuals. Colton (1972), in an attempt to quantify phonatory effort, reported that untrained singers found increasing their pitch and intensity effortful. Trained

\(^{3}\text{Vital capacity is defined as the maximum volume of air which may be exhaled following maximum inspiration.}\)

\(^{4}\text{Residual volume is defined as the volume of air that remains in the lungs.}\)

\(^{5}\text{Tidal volume is defined as the volume of air inhaled and exhaled during a quiet cycle of breathing (Zemlin, 1968).}\)
singers, nevertheless, when given the same instructions, reported that they could vary their effort, even on soft tones. The issue here is not the superior ability trained singers have over untrained singers at detecting or producing differences in their respiratory-laryngeal mechanism. Rather, the issue is that respiratory-laryngeal control appears to be related to differential adjustments in muscular tension (physiological correlate of effort).

Titze (1979 cited in Bunch, 1982) attributes unopposed muscular tension as responsible for possibly straining laryngeal tissues. Unopposed muscular tension may result from weakened or absent antagonistic muscular "pull" or tension. Unopposed respiratory or laryngeal musculature may create unusual "alignment" in the phonatory mechanism, thereby creating transient acoustic responses, wasted energy, and an overall lack of control in voice production.

Accordingly, the general opinion among authorities advocating respiration training (Moore, 1957; Cooper, 1971; Greene, 1980; Andrews, 1983; Gould, 1983; Stone, 1983; Tarasco, 1983; Lowry-Romero, 1986) is that breathing coordination reduces or eliminates unnecessary effort (i.e., tension). This author's understanding is that the elicitation of relaxed laryngeal musculature and the restoration of a nearly constant flow of air through the speech mechanism improves coordination of subglottic, laryngeal, and supra-glottic movements, thereby leading to increased control of pitch,
intensity, quality, and sound duration. Respiration training is, therefore, specifically recommended for persons demonstrating hyperfunctional voice characteristics.\(^6\)

Nevertheless, there are authorities (Hirano, 1981; Titze, 1979; Landes, 1982; Boone, 1983) who place less clinical emphasis on the effects of respiration training. These authorities emphasize how laryngeal structure and configuration additionally modify airflow in voice production. Less emphasis is placed on the coordination of subglottic pressure, airflow, and voice initiation.

These authorities appear to dismiss the previously cited accounts of respiration training by stating that individual breathing patterns are much too variable during normal communication to establish any kind of conclusive data with respect to phonation. In addition, minimal evidence is available indicating that "pure" diaphragmatic-abdominal breathing is employed by singers and speakers (Baken, 1979). The relative ease with which professional singers shift volume from the ribcage to the abdomen makes it difficult to judge just how many and to what degree different muscles are involved in the mechanical action of

\(^6\)Hyperfunctional voice characteristics are defined as the placement of excessive muscular force on the phonatory mechanism (Boone, 1983).
the respiratory pump (Hixon and Mead, 1974; Baken, 1979; Ludlow, 1981). A variety of thoracic cavity and diaphragmatic-abdominal displacements can be responsible for efficiently moving air in and out of the lungs.

Essentially, then, specific methodology regarding respiration training may result in a variety of operable and efficient respiratory movements. The validity in clinically training a "specific" respiratory mode is, therefore, questionable.

The foregoing discussion has established that breathing coordination is 1) assumed to be desirable, and 2) has been taught by voice and singing coaches and speech-language pathologists for many years. Nevertheless, exactly how breathing coordination is achieved with individuals is variable and, perhaps, even may be variable within the same person from time to time.

While general improvement in total respiration (i.e., increased vital capacity) and feelings of well-being appear to result from more efficient respiration, how respiration training specifically influences vocal characteristics has not been thoroughly investigated.

The purpose of this case study is to examine the successive, perceptual changes in a single subject's voice as he progresses through a respiration training program. The author's hypothesis is that following respiration training the subject will exhibit a less effortful, strained, and
variable vocal quality due to the establishment of increased breath support and reduced muscular tension in the shoulder-neck-laryngeal area.

STUDY DESIGN

Therapy Program Description

The respiration training procedure utilized (Appendix I) was developed by Fran Lowry-Romero and Jon Hasbrouck (1981) and is taught by Lowry-Romero to groups of patients with functional and organic voice disorders at Fitzsimons Army Medical Center in Aurora, Colorado.

Lowry-Romero advocates a group therapy design for this program as the group arrangement provides "motivation and competition amongst the members during the establishment of their 'new' breathing style", and provides "a natural situation for speech practice and carry-over of the newly learned speech habits" (Powers, 1971, p. 892). Individual sessions are scheduled as needed to supplement group work.

During the therapy sessions, Lowry-Romero increases the group's awareness of their breathing styles and discusses the different styles of breathing and their relationships in creating increased laryngeal tension [potential vocal misuse/abuse.] She instructs the patients in achieving and habituating abdominal breathing by working through a hierarchy of quiet, noncommunicative events (lying down, sitting, standing, walking) and communicative events (rote counting,
single words, short phrases, questions and answers, conversation). Patients are required to practice outside the therapy situation and to record their frequency of practice and effectiveness at using abdominal breathing with different people, in different environments. (See Appendix I for a more detailed description of the respiration training program and recording forms utilized).

Patients are selected as candidates for the respiration training program based on an ENT referral and a diagnostic voice evaluation conducted by either Lowry-Romero or speech pathology externs. Referral criteria for patients to the respiration training program include the presence of one or more of the following respiratory/phonatory characteristics which may lead to, or perpetuate a voice problem.

1. Thoracic or clavicular breathing noted during speech which may result in or be accompanied by shallow, inefficient breath support.
2. Excessive phonation on supplemental air.
3. Inadequate breath support as characterized by reduced vocal intensity during effortful phonation.
4. Observable breathing tension noted in the shoulder-neck-laryngeal area.

In addition, patients demonstrating vocal quality problems such as hoarseness, harshness, or breathiness are often referred to the respiration training class.
Pre- and post-therapy measurements include the following tasks:

1. five minutes of uninterrupted spontaneous conversation by the patient while two examiners record the frequency of the patient's breathing patterns every minute for five minutes;
2. an evaluation of the patient's laryngeal anatomy and physiology with a nasopharyngeal scope by the two previously cited examiners.

Changes in voice quality and breathing style are defined as perceived changes between pretest and post-test, and subsequent post-test observations.

The following sections of this paper describe in detail the implementation of this therapy program with a single subject.

METHODOLOGY

Subject

The subject in this case study was a 64-year old, black male whose vocal quality was characterized as hoarse-husky with excessive glottal fry. Vocal loudness, pitch and articulation were perceived to be within normal limits. Pitch (C₃) was determined by a pitch pipe. The diagnosis of the above voice dysfunction was based on an initial, diagnostic voice evaluation conducted by the author, and, then later, confirmed through perceptual ratings by five
practicing speech/language pathologists. (See Procedural section). Additional important identifying information includes: a bilateral, mild-to-moderate high frequency, sensorineural hearing loss above 2000 hertz, a history of high blood pressure and osteoarthritis, and a 10+ year history of allergies to grasses and weeds which are treated with Beclovent and Breath Aire (bronchodilators).

Laryngeal efficiency tasks (s/z ratio) conducted during the diagnostic voice evaluation revealed a significant reduction in voiced duration values (Eckel, et al., 1981) and in breath support on sustained vowel productions. (See Table 1). Indirect laryngoscopy by an otolaryngologist revealed normal appearing anatomical structure(s). Thoracic and mixed (thoracic-abdominal) breathing patterns were noted during the above tasks, as well as during reading, talking, and at rest. Phonatory inspiration was characterized by an upward, anterior movement of the rib-cage. Tension was noted in the subject's mandible and neck. Tension appeared to increase in the patient's neck region during laughter.

Environmental variables identified as perhaps contributing to the subject's vocal status through the effects of mucosal drying included: (1) minimal liquid intake per day with large amounts of coffee (caffeinated), exposure to saw
dust, ≥3000 mg vitamin C/day and low Colorado humidity. No vocal abuse was reported.

<table>
<thead>
<tr>
<th>Task</th>
<th>Maximum Sustained Duration (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/s/</td>
<td>23</td>
</tr>
<tr>
<td>/z/</td>
<td>12</td>
</tr>
<tr>
<td>/s/:/z/</td>
<td>2:1</td>
</tr>
<tr>
<td>/a/</td>
<td>9</td>
</tr>
<tr>
<td>/i/</td>
<td>18</td>
</tr>
</tbody>
</table>

Stimulability attempts with the subject to decrease his effort at producing voice were unsuccessful. The author specifically introduced easy voice onset and yawn-sigh techniques to reduce laryngeal-area tension. In addition, attempts to help the subject differentiate between associated levels of tension and pitch levels were discussed. The subject, nevertheless, continued to produce a strained, effortful vocal quality.

Procedures

Data collection.

The subject was seen individually for data collection one time per week for eight weeks, following each weekly respiration training class.
During two of these eight data collection sessions, pre and post therapy measures were collected as part of the "traditional" Lowry-Romero respiration training program. The subject's breathing style was recorded by two practicing speech-language pathologists and simultaneously tallied under the appropriate category (Abdominal/Thoracic, Thoracic, Clavicular) each minute for five minutes. (See Table 2 and Appendix II). Reliability measures for the breathing-style coding system were calculated for pre and post-therapy data. Interjudge reliability for each breathing style category over a five minute period during pre and post-therapy rating sessions was determined by counting the number of agreements divided by the number of agreements plus disagreements and multiplied by 100. Interjudge reliability coefficients were calculated as 82% agreement (pre-test) and 98% agreement (post test). Intrajudge reliability estimates were not obtained.

Nasopharyngeal scope observations were also made prior to and following therapy by the two previously cited judges. These observations were announced orally by, for example, the first judge and simultaneously recorded by the second judge while the first judge viewed the subject's vocal fold anatomy and physiology. The second judge served to verify observations by the first judge, and to further view the mechanism for features perhaps initially overlooked by the first judge, or perhaps the physician.
TABLE 2. Frequency of observed breathing patterns (AB/T = abdominal-thoracic; T = thoracic; C = clavicular) noted by two examiners during five minutes of conversational speech in pre and post therapy rating sessions.

<table>
<thead>
<tr>
<th>Breathing Style</th>
<th>Pre-Therapy</th>
<th>Post-Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Examiner 1</td>
<td>Examiner 2</td>
</tr>
<tr>
<td>AB/T</td>
<td>63</td>
<td>61</td>
</tr>
<tr>
<td>T</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

In addition, tape recorded samples of the subject's voice during spontaneous dialogue, reading from the Town-Heur Reading Passage (THRP) and the production of /a/ were obtained on a Sony TC 105A tape recorder at a speed of 7-1/8 inches/second in a therapy room. The microphone (Sony ECM 16, electret condensor) was placed approximately 12 inches from the subject's mouth.

During the additional six weeks data was collected, voice samples were recorded in an acoustically treated sound suite using a similar tape recorder and microphone. The microphone was clipped to the subject's eyeglasses to insure a 2-1/2 inch distance from the corner of the subject's mouth to the outside of the microphone for each recording session. Recording levels and the speed of the tape (7-1/2 inches/second) were consistent throughout the data collection period. During these recording sessions...
the subject was instructed to:

1. say his name, address and tell how he arrived at the clinic;
2. produce seven consecutive /a/'s at a comfortable level for as long as possible;
3. read the first paragraph of the Town-Heur Reading Passage (THRP);
4. produce /a/ at a comfortable pitch, and then proceed up and down the scale one note at a time, twice.

The order of the speech tasks was randomized to prevent any order effect. During the subject's performance of these tasks, the author and another speech-language pathology extern periodically evaluated the subject's habitual use of abdominal breathing. The consensus between these two judges was that the subject became more consistent at using abdominal breathing over the course of the six week training period.

Additional post-therapy data were collected three months following the termination of therapy. These data were tape recorded in a quiet room using the previously cited tape recorder, microphone, and recording distance and levels. Procedures were similar to those utilized during intra-therapy data collection.
Perceptual rating tasks.

Task I. Five practicing speech-language pathologists judged the quality and severity of the subject's voice from tape recorded samples. The listeners also indicated whether or not they believed voice therapy was necessary. Voice quality definitions (See Appendix III-A) and a severity rating scale (1 = mild, 2 = moderate, 3 = severe) were provided to the listeners prior to the presentation of the tape recorded samples. Additional comments regarding the voice qualities were encouraged. This perceptual rating consensus would serve to confirm the author's diagnosis of the subject's voice quality.

The perceptual ratings were performed individually in a therapy room to allow each rater time to confidently rate the voice quality in question. Each listener reported their hearing levels to be within normal limits. The stimulus presented to the five speech-language pathologists consisted of tape recorded readings of a paragraph in the THRP by seven subjects with various functional or organic voice disorders. The subject's voice was intermixed with six other voices to minimize biased ratings regarding the quality of the subject's voice, as four of the listeners were knowledgeable of this study. Three of the seven voices (one of which was the subject's voice) were duplicated in order to estimate listener consistency. The total number of voice samples, therefore, presented to the
listeners consisted of 10 male voices ranging from 45 to 65 years of age. The listeners recorded their judgments on form B in Appendix III. Intra and interjudge reliability coefficients (\( \frac{\text{# of agreements}}{\text{# of agreements} + \text{disagreements}} \times 100 \)) regarding judgments of the subject's voice were estimated to be 60% and 83%, respectively.

**Task II.** Following the above perceptual rating task, the listeners and the author indicated whether they noticed differences between the subsequent voice samples presented. The voice samples presented were pre- and post-therapy, and post- and subsequent post-therapy tape recordings of the subject's voice while reading from the THRP and sustaining /a/. Listeners were unaware of the order of voice sample presentation. Judgments were recorded on form B. This perceptual rating consensus served to confirm the author's perceptual judgment regarding change/no change in voice quality over time. Interjudge reliability (\( \frac{\text{# of agreements}}{\text{# of agreements} + \text{disagreements}} \times 100 \)) was calculated as 80% agreement between listeners for pre- and post-therapy recordings, and 60% agreement between post-therapy and subsequent post-therapy recordings. A learning effect may be responsible for the better reliability between pre- and post-therapy comparisons as the post- and subsequent post-therapy comparison was made first by the listeners.
**Task III.** The final perceptual rating task involved the author and two practicing speech-language pathologists independently counting the number of hyperfunctional voice characteristics (Boone, 1983) in the subject's pre-, intra-, post-, and subsequent post-therapy reading tapes. Each rater did this task twice for intrajudge (test-retest) reliability. Results were recorded on form C in Appendix III. Interjudge reliability was calculated by comparing the mean number of tallied occurrences for each vocal characteristic over the two trials for each rater divided by the mean total number of identified vocal characteristics times 100. Intra and interjudge reliability coefficients were calculated to be 92% and 84%, respectively. A reduction in the total number of tallied hyperfunctional voice characteristics between pre- and post-therapy taped voice samples would serve as additional qualitative measurements regarding symptomatic voice improvements.
RESULTS

Note: Pre-recorded intra-therapy data were discarded from the study as the subject on occasion made novel adjustments/alterations in his phonatory mode which the author considered unrepresentative of his habitual vocal style. Results were concluded from pre, post, and subsequent post-therapy data.

Respiration Pattern Results

Table 2 is a chart illustrative of the frequency of observed breathing patterns by the subject during five minutes of conversation prior to and directly following intervention. Breathing rate (observable inspirations per five minutes) did not appear to have changed between pre and post therapy observations. Similarly, the relative change in contributions of the rib cage and abdomen were negligible. What the frequency data failed to account for was the relative, observable change in the degree of abdominal-thoracic displacement following intervention. Both examiners agreed with the author that the "quality" of the subject's breathing pattern/style changed. Prior to therapy the subject's breathing pattern appeared constrained. Examiners questioned whether or not air "moved" with the subject's slight predominance in abdominal-thoracic displacement. However, following respiration training the subject's breathing pattern appeared more relaxed and comfortable. Inspiratory and expiratory adjustments were judged to be less variable.
Obviously, the frequency of occurrence in breathing pattern/style did not adequately discern the respiratory trends noted by the examiners and the author. Final data analyses and interpretation would be contingent upon subjective descriptions.

Nasopharyngeal Scope Observational Results

Pretest and post test observations were unremarkable. Vocal fold structure and physiology appeared to be normal in size, color, symmetry, abduction, and adduction.

Perceptual Rating Results

Task I.

The first perceptual listening task revealed that the five, independent listeners concurred with the author's judgment of the subject's vocal quality (hoarse-husky), its severity (2-moderate), and that voice therapy was warranted. The perceptual data also supported the author's identification of excessive glottal fry in the subject's voice.

Task II.

The second perceptual listening task examined the perceived differences between (1) pre- and post-therapy voice samples, and (2) post-therapy and subsequent post-therapy voice samples. See Table 3. For this task, five of the six listeners (including the author) noted differences be-
between the pre- and post-therapy recordings; and four of the six listeners noted differences between the post-therapy and subsequent post-therapy recordings.

<table>
<thead>
<tr>
<th>Voice Comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>pre- : post-therapy</td>
</tr>
<tr>
<td>YES</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

The listeners specifically described the post-therapy voice sample as "louder", "fuller" and "clearer" than the pre-therapy voice sample. In addition, glottal fry was found to occur less frequently in the post-therapy voice sample. The author specifically found that the incidents of glottal fry were occurring at the beginning and ends of phrases in the post-therapy voice sample rather than on individual words as they had in the pre-therapy voice sample. Greater inflectional variability and an overall reduction in effort was also perceived in the subject's intonation adjustments. Vocal quality (hoarse-husky) remained essentially unchanged; other than the addition of intermittent

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breathiness in the overall vocal quality.

The differences noted between post-therapy and subsequent post-therapy voice samples were that the occurrence of glottal fry had increased and that the subject's pitch appeared reduced in the subsequent post-therapy voice sample. Fewer episodes of breathiness also appeared to characterize the subject's hoarse-husky vocal quality.

Task III.

The third perceptual rating task examined the frequency of occurrence of selected vocal parameters from tape recorded samples of the subject reading a paragraph from the THRP. See Tables 4 and 5 for a summary of these results. The author and two other listeners initially tried to tally the frequency of occurrence of glottal fry and other hyperfunctional voice parameters, but found this task too complex as the subject's glottal fry occurred too frequently to tally. The task was altered. Listeners were re-instructed to tally the number of words on which glottal fry did not occur. Other hyperfunctional voice parameters were tallied as initially instructed.

A cursory review of the data (Tables 4 and 5) revealed an increase in the number of words without glottal fry following respiration training. The author questions the internal validity of counting the number of words with or without glottal fry. Glottal fry does not appear to be a
phenomenon that turns "on" or "off" quickly. Remnants of glottal fry occur across words and, or phrases. In addition, the literature is vague regarding if it is the frequency of glottal fry, the variability in the occurrence of glottal fry, or the persistence of glottal fry, which is more or less clinically significant. Authorities do not indicate the "amount" of glottal fry which is, or is not within normal-limits; only that excessive is significant (Hollien, 1966).

<table>
<thead>
<tr>
<th>Vocal Characteristic</th>
<th>Frequency</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pretest</td>
<td>post test</td>
<td>subsequent post test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tape: A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>10</td>
<td>9</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>9</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Similarly, counting occurrences of strained vocal quality does not appear to be a straightforward count. Incidents of glottal fry and strained vocal quality appeared to be reciprocal physiological events, each possibly occurring when the other did not occur. This count was disregarded in data interpretation.

Interpretation of the frequency of occurrence in pitch
breaks was unclear. Baseline data were unstable and no trend was established over time.

TABLE 5. Frequency of occurrence in vocal characteristics while the subject read a paragraph from the THRP (71 words).

<table>
<thead>
<tr>
<th>Vocal Characteristic</th>
<th>Frequency</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pretest</td>
<td>post test</td>
<td>subsequent post test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tape:</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>pitch break</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>phonation break</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>throat clearing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>abrupt glottal attack</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>strained vocal quality</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>coughing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Due to the limited usefulness of these data, perceptual judgments are emphasized for data interpretation.

Summary

In summary, the general opinion among the listeners was that perceptual changes occurred over time in the subject's voice. These changes were identified and characterized as "improvements" as indicated by the comments generated regarding pre- and post-therapy voice sample comparisons. The author had hoped that withdrawal of the completed therapy program would allow the subject to maintain "elicited" vocal changes (improvements). These "improvements", nevertheless
did not appear to have habituated as strongly as desired, as was indicated by subsequent post-therapy perceptual judgments. A consensus regarding whether the subject's subsequent post-therapy voice sample sounded better than the pretest voice sampling was not collected. It was the author's opinion, however, that less effort (tension) was perceived to accompany the subject's pitch and intensity adjustments, and less glottal fry was perceived to occur on words following the respiration training procedure. The subject's voice, nevertheless, remained hoarse-husky.

The subject's comments regarding the effectiveness of respiration training at influencing his voice production were (1) he was more aware of voice production following therapy sessions, and (2) he believed he could reduce the frequency of his glottal fry by using a "lighter", "airy" voice.

Threats to internal and external validity are numerous in this study, and severly interfere with gauging the effectiveness of respiration training at improving voice. These threats will be discussed in the following section.

DISCUSSION

In assessing the results from this study, the author concluded that this case study had not identified the effectiveness of respiration training at improving voice. Numerous threats to internal validity interfered with the measurement of hypothesized changes in the breathing pattern.
and voice. In addition, the study design was weak with only pre- and post-therapy voice samplings available. Periodic measurements of the hypothesized changes in vocal parameters were attempted, but invalidated by the subject's experimentation in vocal production during data collection procedures. This experimentation was regarded as unrepresentative of the subject's habitual voice quality.

While the study attempted to quantify changes in breathing pattern/style and voice, the measurement techniques were not sensitive enough to define changes in this subject's respiration pattern and voice. The perceptual, descriptive accounts were, however, most instrumental at differentiating and documenting qualitative changes. The use of rating scales, voice profiles, and subjective description have historically been suggested as effective, clinical methods of evaluating voice quality disorders (Wilson, 1979). The degree with which perceptual ratings interact with aerodynamic and acoustical parameters, nevertheless is unclear at this time.

Possible explanations for the subject's more relaxed, regular, and comfortable breathing pattern following respiration training were numerous. One explanation may be that more efficient, deep, coordinated breathing was actually established. Perhaps the subject's biological needs were met more efficiently and his body used the air he breathed more completely, thereby allowing for more relaxed
and comfortable respiration. A second explanation may be that compensatory muscular support became unnecessary as the subject became more relaxed. The respiratory and laryngeal mechanism began to function in a more coordinated, relaxed manner.

Another explanation may be that the subject's asthma and allergies were less of a problem for him during post-testing than during the pretest. Impairment of inspiratory airflow can result from airway resistance (as in bronchial asthma) (Stough, 1970).

Measurement artifact may have, nevertheless, occurred from the complexity of the task, limited data, observer drift, and the Hawthorne effect. These results indicated a need for the development and use of inexpensive instruments within the clinic that allow for the objective monitoring of physiologic properties. Our ethical responsibility to our patients is to truly understand why a particular procedure may or may not work with an individual.

While the present study had numerous methodological limitations, the principal finding was that the occurrence of glottal fry was perceived to have diminished over time. The author is curious as to the likelihood of respiration training influencing glottal fry. The author's intuition is that overall changes in vital capacity and subglottic pressure (McGlone, 1967) probably have very little to do with the production/decrement of glottal fry. Whereas
glottal aerodynamics, physiological properties of the vocal folds, and the coupling of the glottal wave to the vocal tract most likely influence the vibratory mode [frequency and amplitude] in the chest register (glottal fry).

Review of the pertinent literature dealing with the chest register revealed that the physiological mechanism was multidimensional. Physiological characteristics of glottal fry production included:

1. short, thickened vocal folds that close firmly for each vibratory cycle;
2. a small amplitude of vibration as oscillation is confined to the marginal edges of the vocal folds;
3. brief opening and closing phase, followed by a prolonged phase;
4. unopposed thyroid-arytenoid muscle activity compared to the crico-thyroid and thyroid-arytenoid muscle opposition in low modal phonation (Moore and von Leden, 1958; van den Berg, 1968; Zemlin, 1968).

While respiration training was not obviously aimed at directly dealing with these characteristics, respiration training may have had an affect on them. That is, through the establishment of more coordinated, efficient breathing patterns unopposed muscular strain in the laryngeal area may have been periodically reduced and a greater amplitude of oscillation in the vocal folds established, creating a different mode of vibration.
To investigate the author's hypothesis, however, would be a major, laboratory study as many parameters would need to be controlled. Besides measuring tension in laryngeal muscle pairs, airflow rate and simultaneous perceptual vocal characteristics, the sound pressure levels, vibratory patterns, structural and neuromuscular characteristics of the vocal folds, vowel selection, etc. would need to be controlled.

Further research is obviously needed to determine the physiologic-aerodynamic changes respiration training allows. Interestingly, the various respiration training protocols were not highly published or widely distributed. In this author's extensive review of the respiration literature only two training programs were presented. One was a respiration training program at Northwestern University Speech and Hearing Department which advocated two months to establish synergistic breathing and phonatory patterns. This program appeared comparable to the Lowry-Romero and Hasbrouck (1981) respiration training program. The other program was by Tarasco (1983), a phoniatrist, who advocated a "re-educator" to establish the "desired rhythm" and movements of the thorax. In Tarasco's procedure the patient is "hooked up" to an electrolung with galvanic electrodes placed on the thorax and above the major rectus, which stimulates diaphragmatic contraction. At first the electrolung "assists" the patient at moving the appropriate
structures, later the electrolung monitors the patient's established breathing pattern as the patient consciously controls the trained respiratory pattern. Tarasco recommended an additional two months of practice once the breathing pattern was established to learn how to couple the expiratory column of air with articulated sound production.

A survey of the various, established respiration training programs would be an interesting endeavor to compare and contrast procedures, measurement techniques, training period, patient characteristics, and external validity.

Although procedural problems account for the lack of conclusive evidence drawn from this case study, a systematic investigation of the effectiveness of respiration training at improving voice still appears to be a reasonable approach. It seems most likely that these type of data will have to be combined with other information on subglottal air pressure, airflow, lung volume, sequence of pressure and volume events, and patterns of vocal fold movement to produce useful information. A multiple-baseline strategy would appear to be a promising study design for evaluating the effectiveness of respiration training at improving voice. The multiple-baseline design would allow treatment effects to be carried across experimental phases and systematic replication.

The author also suggests the comparison of perceptual ratings to acoustical parameters. Yanagihara (1976 cited in Wilson, 1979) has an acoustical, noise spectrographic
classification system which would be valuable to use for following perceived vocal changes over time.

In summary, while the effects of this respiration training program at improving voice lack objective evidence, there appears to be sufficient subjective description to support the contention that respiration training is a useful voice therapy and relaxation technique. Subjective description should not be dismissed as less substantial documentation of a "change" as numerous precautions may be taken to insure improved validity and reliability. The author strongly believes that when perceptual changes are defined, differentiated, and described the subjective account of an event may become our most valid, clinical instrument.
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APPENDIX I-A

VOICE CLINIC
Abdominal Breathing

SESSION I - WEEK 1

Step A - Patients lie on floor. Immediately check breathing types of each and note.

Step B - Orientation

1. Clinician discusses tension-related reasons for good breathing. End goal is abdominal breathing as part of patients' lives. Start now.

2. Clinician discusses occurrence of supplemental air use and its relationship to tension.

Step C - Clinician demonstrates 3 breathing patterns--clavicular, thoracic, and abdominal and points out general areas of tension involved in clavicular and thoracic breathing. Points out type of breathing previously noted in each patient.

Step D - Abdominal Breathing

1. Patients lie on floor, supine with pillow. Allow them to relax in that position for several minutes. Clinicians check breathing patterns.

2. Separate into groups if necessary.
   a. Correct breathers - these patients sit up for brief period, then lie back down and assume abdominal breathing pattern again. Repeat as necessary until clinician determines that control is conscious.
   b. Incorrect breathers - clinicians give individual feedback until breathing is correct. When correct, follow same check procedures as for first group of correct breathers.
   c. Patients unable to breath abdominally during first session: (1) set up additional individual therapy time.
APPENDIX I-A (continued)

Step E - Assignment: 1. Awareness of breathing patterns at night.

2. Practice abdominal breathing in supine position, at least 6 times per day, 5 minutes per session. (1 time/hr if possible.)

3. Complete and return 7 Hourly Breathing Charts, Column 1.


Handouts: 1. Hourly Breathing Charts - 7
2. Sample Hourly Breathing Chart - 1
3. Abdominal Breathing Weekly Master Sheet - 1
4. Sample Abdominal Breathing Weekly Master Sheet - 1
5. Week 1 Homework Sheet - 1
APPENDIX I-A (continued)

SESSION II - WEEK 2

Step A - Review

1. Reiterate each patient's typical breathing pattern.

2. Review abdominal breathing in supine position, in silence.

3. Check each individual's breathing pattern.

Step B - Abdominal breathing, supine position, add speech.

1. Patients must have smooth abdominal breathing at a conscious level. Put hand on abdomen if necessary.

2. Clinician demonstrates counting from 1 to 10, one number per breath, using abdominal breathing in supine position.

3. Patients count individually from 1 to 10, one number per breath, using abdominal breathing in supine position.

4. Clinician demonstrates saying groups of 3 numbers per breath, at a normal rate, exhaling air after each set of numbers. Say numbers in order (1-2-3, 4-5-6, 7-8-9, 10-1-2, 3-4-5.) Patients practice sets of 3 numbers, using abdominal breathing, and exhaling any additional air after each set. Repeat until smooth. Alternate groups of 3 days of the week and months of the year after clinician demonstration.

5. Clinician demonstrates saying sets of 5 numbers, procedures as above.

Patients practice sets of 5 numbers, using abdominal breathing and exhaling any remaining air following each set. Repeat until smooth. Patients alternate saying sets of 5 days of the week and months of the year following clinician demonstration.
APPENDIX I-A (continued)

6. Clinician demonstrates phrasing numbers - varying the amount of numbers within a set per each exhalation. (1-2, 3-4-5, 6, 7-8-9-10, 1-2-3, 4, 5-6-7-8-9, 10-1, 1-2-4-5, 6-7, 8-9-10.)

Patients practice saying varying sets of numbers, one set per abdominal breath, exhaling any remaining air after each set. Repeat until smooth. Patients alternate saying varied sets of days of the week and months of the year following clinician demonstration.

Step C - Assignment: 1. Practice saying varying sets of numbers, day, and months, using abdominal breathing, in supine position.

2. Practice at least 6 times per day, 5 minutes per session. Practice 1 time per hour if possible.

3. Complete and return 7 Hourly Breathing Charts, Column 1.


Handouts: 1. Hourly Breathing Charts - 7
2. Sample Hourly Breathing Chart - 1
3. Abdominal Breathing Weekly Master Sheet - 1
4. Sample Abdominal Breathing Weekly Master Sheet - 1
5. Week 2 Homework Sheet - 1
SESSION III - WEEK 3

Step A - Review

1. Clinician asks each patient to state old breathing pattern. Clinician asks each patient if abdominal breathing has generalized at all.

2. Clinicians check abdominal breathing of each patient in supine position both at rest and while saying varying sets of numbers, days, or months.

Step B - Patients seated (slouched, or sitting straight) in arm chairs, abdominal breathing, add speech.

1. Clinician demonstrates abdominal breathing in a seated position at rest.
   Patients practice abdominal breathing as demonstrated. Repeat until smooth. Clinicians monitor.

2. Clinician demonstrates reading a list of single words, one word per abdominal breath, in a seated position.
   Patients practice abdominal breathing and words as demonstrated. Repeat until smooth with clinicians monitoring.

3. Clinician demonstrates reading marked passages, using abdominal breathing in a seated position. Alternate reading with saying sets of 4 days or months.
   Patients practice abdominal breathing as demonstrated. Repeat until smooth with clinicians monitoring.

Step C - Assignment: 1. Practice saying varying sets of numbers, days, months, and reading marked passages, using abdominal breathing, in a seated position.

2. Practice one time per hour, 5 minutes per session.

3. Complete and return 7 Hourly Breathing Charts, Column 1.
APPENDIX I-A (continued)


Handouts: 1. Hourly Breathing Charts - 7
2. Sample Hourly Breathing Chart - 1
3. Abdominal Breathing Weekly Master Sheet - 1
4. Sample Abdominal Breathing Weekly Master Sheet - 1
5. Week 3 Homework Sheet - 1
APPENDIX I-A (continued)

SESSION IV - WEEK 4

Step A - Review

1. Clinician asks what former breathing type was. Clinician asks patients if abdominal breathing has generalized.

2. Clinicians check abdominal breathing pattern in each patient in a seated position, both at rest and while saying varying sets of numbers, days, or months, and while reading marked passages.

Step B - Standing position, abdominal breathing, add speech.

1. Clinician demonstrates abdominal breathing in a standing position, at rest.

Patients practice abdominal breathing in a standing position at rest as demonstrated. Repeat until smooth with clinicians monitoring.

2. Clinician demonstrates saying or reading words with abdominal breathing in a standing position.

Patients practice saying or reading words with abdominal breathing in a standing position as demonstrated. Repeat until smooth with clinicians monitoring.

3. Clinician demonstrates reading marked passages using abdominal breathing in a standing position.

Patients practice reading marked passages using abdominal breathing in a standing position as demonstrated. Repeat until smooth with clinicians monitoring.

Step C - Assignment: 1. Practice saying varying sets of numbers, days, months, and reading marked passages, using abdominal breathing, in a seated or standing position.

2. Practice one time per hour, 5 minutes per session.

3. Complete and return 7 Hourly Breathing Charts, Column 1.
APPENDIX I-A (continued)


Handouts: 1. Hourly Breathing Charts - 7
2. Sample Hourly Breathing Chart - 1
3. Abdominal Breathing Weekly Master Sheet - 1
4. Sample Abdominal Breathing Weekly Master Sheet - 1
5. Week 4 Homework Sheet - 1
6. Reading Words List - 1
7. Marked Passages - 1 set
APPENDIX I-A (continued)

SESSION V - WEEK 5

Step A - Review

1. Clinicians ask each patient if abdominal breathing has generalized.

2. Clinicians check each patient for abdominal breathing in a seated or standing position, at rest, and while reading. (Move to different rooms or re-arrange chairs if necessary due to the noise level from all patients reading at the same time.)

Step B - Sitting position, abdominal breathing, questions-answers and conversation.

1. Clinician assigns patients to groups of 2. Clinicians rove from pair to pair and extern clinicians rotate through all pairs so they can gain experience with the different patients.

2. Clinician hands out question sheets instructing patients that questions are single statements and answers should be single statements. Patients alternate asking and answering questions, utilizing abdominal breathing in a seated or standing position. Clinician cautions against use of supplemental air. Patients practice questions and answers using abdominal breathing in a seated or standing position. Clinicians monitor and point out occurrences of use of supplemental air if necessary. Repeat until smooth.

3. Clinician hands out discussion topic sheets instructing patients to discuss those or any topics with their partners (sharing and talking) using abdominal breathing in a seated or standing position. Patients practice discussing topics using abdominal breathing in a seated or standing position. Clinicians monitor and point out occurrences of supplemental air if necessary. Repeat until smooth.
APPENDIX I-A (continued)

Step C - Assignment: 1. In any position, practice abdominal breathing while conversing. Practice 6 times for 5 minutes each session.

2. Self-rate breathing in conversation, once per hour, each day.

3. Complete and return 7 Hourly Breathing Charts, Column 1, 2, 3.


Handouts: 1. Hourly Breathing Charts - 7
2. Sample Hourly Breathing Chart - 1
3. Abdominal Breathing Weekly Master Sheet - 1
4. Sample Abdominal Breathing Weekly Master Sheet - 1
5. Week 5 Homework Sheet - 1
6. Questions Sheet - 1
7. Discussion Topics Sheet - 1
APPENDIX I-A (continued)

SESSION VI - WEEK 6

Same as Week 5 except entire session involves conversation in pairs with clinicians monitoring.

Step A - Review

1. Clinician asks each patient if abdominal breathing has generalized.

2. Clinicians check each patient for abdominal breathing in any position at rest and while reading.

Step B - Any position abdominal breathing, conversation.

1. Clinician hands out discussion topic sheets instructing patients to discuss those or any topics with their partners, sharing talking time, using abdominal breathing in any position. Clinicians monitor and point out the use of supplemental air, if necessary.

Step C - Assignment: 1. In any position, practice abdominal breathing while conversing. Practice six (6) times per day for 5 minutes each time.

2. Self-rate breathing in conversation, once per hour each day.

3. Complete and return 7 Hourly Breathing Charts, Columns 1, 2, and 3.


Handouts: 1. Hourly Breathing Charts - 7
2. Sample Hourly Breathing Chart - 1
3. Abdominal Breathing Weekly Master Sheet - 1
4. Sample Abdominal Breathing Weekly Master Sheet - 1
5. Week 6 Homework Sheet - 1
APPENDIX I-A  (continued)

SESSION VII - WEEK 7

Step A - Review

1. Clinician asks each patient if abdominal breathing has generalized.

Step B - Clinician answers any questions from patients about this therapy. All patient utterances must use abdominal breathing.

Step C - Patients practice conversation as in Weeks 5 and 6.

Step D - Assignment: 1. Continue using abdominal breathing during conversation 100% of the time for the rest of your life!

2. Return for follow-up session the following week for post test.
APPENDIX I-B

VOICE CLINIC

Homework - Abdominal Breathing

Week 1

Practice abdominal breathing, in a supine position, a minimum of six (6) times per day for five (5) minutes per session. If possible, practice more often up to one (1) time per hour.

To record your practice sessions, use a copy of the Hourly Breathing Chart and, in Column 1, check the time during which you practiced.

Use a different Hourly Breathing Chart for each day and put your name and the date at the top.

At the end of each day, fill in the number of checks in Column 1 at the bottom of the Hourly Breathing Chart. Then on Tuesday night or Wednesday morning before the next voice clinic, transfer the number of checks in Column 1 at the bottom of each Hourly Breathing Chart to the Weekly Master Sheet (1) next to Day 1, Day 2, etc. Add the column for number of checks in Column 1, (I), and enter the total at the bottom. (See sample.)
APPENDIX I-C

NAME _______________________________ DATE ______________________

VOICE CLINIC

HOURLY BREATHING CHART

<table>
<thead>
<tr>
<th>Times</th>
<th>Column 1 Practice (Check time)</th>
<th>Column 2 Situation (Circle)</th>
<th>Column 3 Abdominal Breathing (Circle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700-0800</td>
<td>A B C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>0800-0900</td>
<td>A B C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>0900-1000</td>
<td>A B C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>1000-1100</td>
<td>A B C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>1100-1200</td>
<td>A B C</td>
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<td>NO</td>
</tr>
<tr>
<td>1200-1300</td>
<td>A B C</td>
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<td>A B C</td>
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<td>NO</td>
</tr>
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<td>1400-1500</td>
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</tr>
<tr>
<td>1500-1600</td>
<td>A B C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>1600-1700</td>
<td>A B C</td>
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<td>NO</td>
</tr>
<tr>
<td>1700-1800</td>
<td>A B C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>1800-1900</td>
<td>A B C</td>
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<td>NO</td>
</tr>
<tr>
<td>1900-2000</td>
<td>A B C</td>
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<td>NO</td>
</tr>
<tr>
<td>2000-2100</td>
<td>A B C</td>
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</tr>
<tr>
<td>2100-2200</td>
<td>A B C</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

Number of Checks in Column _______ (I)

Number of A-Yes ______ (II)
Number of A-No ______ (III)
Number of B-Yes ______ (IV)
Number of B-no ______ (V)
Number of C-Yes ______ (VI)
Number of C-no ______ (VII)

KEY

A- Quiet
B- Preparing to talk
C- Talking
### APPENDIX I-D

**VOICE CLINIC**

**RELAXATION AND ABDOMINAL BREATHING**

Word List and Conversation Subjects

<table>
<thead>
<tr>
<th>weather</th>
<th>basketball</th>
<th>football</th>
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</thead>
<tbody>
<tr>
<td>candles</td>
<td>Halloween</td>
<td>gold</td>
</tr>
<tr>
<td>travel</td>
<td>books</td>
<td>skiing</td>
</tr>
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<td>gardens</td>
<td>indoor plants</td>
<td>bills</td>
</tr>
<tr>
<td>children</td>
<td>pets</td>
<td>Christmas</td>
</tr>
<tr>
<td>colors</td>
<td>microwaves</td>
<td>hunting</td>
</tr>
<tr>
<td>military</td>
<td>Hanukkah</td>
<td>wheelchair</td>
</tr>
<tr>
<td>clothing</td>
<td>music</td>
<td>laundry</td>
</tr>
<tr>
<td>Arizona</td>
<td>cows</td>
<td>arthritis</td>
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<td>cars</td>
<td>shoveling snow</td>
<td>matches</td>
</tr>
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<td>doctors</td>
<td>dentist</td>
<td>surgery</td>
</tr>
<tr>
<td>glasses</td>
<td>contact lens</td>
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</tr>
<tr>
<td>baking</td>
<td>motorcycles</td>
<td>lawns</td>
</tr>
<tr>
<td>in-laws</td>
<td>flag</td>
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<td>friends</td>
<td>enemies</td>
<td>magazines</td>
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<tr>
<td>smoking</td>
<td>drinking</td>
<td>jogging</td>
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<tr>
<td>diet</td>
<td>jewelry</td>
<td>leather</td>
</tr>
<tr>
<td>hometown</td>
<td>awards</td>
<td>fireplace</td>
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<tr>
<td>voice</td>
<td>breathing</td>
<td>tension</td>
</tr>
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<td>relaxation</td>
<td>sunshine</td>
<td>moving</td>
</tr>
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<td>fences</td>
<td>lobster</td>
<td>noses</td>
</tr>
<tr>
<td>whistle</td>
<td>maps</td>
<td>boats</td>
</tr>
<tr>
<td>swimming</td>
<td>Indians</td>
<td>goats</td>
</tr>
<tr>
<td>happiness</td>
<td>toadstools</td>
<td>gasoline</td>
</tr>
</tbody>
</table>
APPENDIX I-E

MESSAGE 50

One year the city's poll books were investigated by a United States Senate subcommittee. The probers found the cemeteries well represented; some of the voters "didn't exist"; others were "not known around the neighborhood"; "some had been gone at least five years" and several were in the "insane asylum." The probers concluded that in Jersey City a registered voter is a registered voter, dead or alive. Before their job was finished the poll books disappeared to provide "summer heat in City Hall."

In appearance, this hotbed of political ferment is somewhat run down at the heels. City Hall, the ultimate prize, is a faded granite structure, topped by a copper dome that's corroded a bilious green and surrounded by cold water flats. Frequently the town is shrouded by chemical haze and industrial smoke. Soot from trains and factories falls continually, like black snow. But the city's inhabitants love it dearly.

Since 1949 the electorate has been treated to a political slugfest as "Mayor" John V. Kenny battled for control of his Democratic stronghold. Their rivalry has the intensity and objectives of blood pit, but generally the results are comic opera. In last spring's election vendetta the two gladiators, after giving each other fearful political wounds, wound up on the city commission, still snarling and ready to resume the fight.

Former Public Safety Director Charles Witkowski, who claims he was described by Mayor Kenny as the best police commissioner Jersey City ever had--and then fired--interpreted the election results this way: "There are only two kinds of voters in Jersey City: those who don't want Kenny and those who don't want Eggers. Since the vote was evenly divided, it proves to me the voters don't want either one of them."
APPENDIX I-E (continued)

MESSAGE 60

It's easy to start/a stamp collection/-and inexpensive too./ An album, some stamps,/and a supply of "stamp hinges"/to fasten the stamps in the album,/are everything you really need./ One of the great thrills/of stamp collecting/and one of the advantages/of knowing about stamps/is the ever-present possibility/of discovering, in some unexpected place/or manner,/rare old stamps/worth hundreds or even thousands/of dollars./ Such discoveries are not uncommon,/and we hope that you, too/will some day/make a lucky "Find"/of valuable stamps./ In the meantime--/

A Treasure Hunt provides/the most exciting way/to start your collection./ Go searching for stamps/that may be stored away/and forgotten among old letters/and papers in your own home./

Letters of your grandparents/and great-grandparents,/ hidden away and long forgotten/in some dusty old trunk,/ cupboard, or desk drawer,/may well yield valuable stamps./ So the first place to go/stamp treasure hunting/is right in your own home--/in attic or cellar,/barn or storage room,/desk or filing cabinet./ If you have friends/and neighbors who will permit/you to look through/their old correspondence,/that will provide other/exciting opportunities/for a treasure hunt./

Ordinary letters and packages/will often yield/a fascinating variety/of United States stamps/- not only the regular/"Presidential" issues,/but also airmail,/special delivery,/and postage due stamps./

Businessmen/who get a great deal of mail,/and people who have/correspondence with foreign countries/are especially good sources/of supply./

Collectors usually acquire/more than one copy/of certain stamps./ These "duplicates,"/as they are called,/ can yield both pleasure and profit./ Just get together/ with your stamp collecting/friends and trade duplicates/-- exchanging surplus extra copies/to get new varieties./
APPENDIX I-E (continued)

TWENTY-ONE MEMOS

1. Don't spoil me./ I know quite well/that I ought not to have/all I ask for./ I'm only testing you./

2. Don't be afraid/to be firm with me./ I prefer it;/it makes me feel more secure./

3. Don't let me/form bad habits./ I have to rely on you/to detect them/in the early stages./

4. Don't make me feel/smaller than I am./ It only makes me/behave stupidly "big."/

5. Don't correct me/in front of others/if you can help it./ I'll take much/more notice/if you talk quietly with me in private./

6. Don't make me feel/that my mistakes are sins./ It upsets my sense of values./

7. Don't protect me/from consequences./ I need to learn/the painful way sometimes./

8. Don't be too upset/when I say, "I hate you." It isn't you/I hate but your power/to thwart me./

9. Don't take too much/notice of my small ailments./ Sometimes they get me/the attention I need./

10. Don't nag./ If you do,/I shall have to/protect myself/by appearing deaf./

11. Don't make/rash promises./ Remember that I feel/badly let down/when promises are broken./

12. Don't forget/that I cannot explain myself/as well as I should like./ That is why/I'm not always very accurate./

13. Don't tax my honesty too much./ I am easily frightened/into telling lies./

14. Don't be inconsistent./ That completely confuses me/and makes me/lose faith in you./
15. Don't put me off/when I ask questions./ If you do,/you will find/that I stop asking/and seek information elsewhere./

16. Don't tell me/my fears are silly./ They are terribly real/and you can do much/to reassure me/if you try to understand./

17. Don't ever suggest/that you are perfect or infallible./ It gives me too great a shock/when I discover/that you are neither.

18. Don't ever think/that it is beneath your dignity/to apologize to me./ An honest apology/makes me feel surprisingly warm/toward you./

19. Don't forget/how quickly I am growing up./ It must be very difficult for you/to keep pace with me,/but please try./

20. Don't forget/that I can't thrive without lots of/understanding love,/but I don't need to tell you, do I?/
CHILDREN IN TROUBLE

Children in trouble need:

- to be able to feel that they are worth something;
- to be able to think that they can change themselves and some circumstances around them;
- to be able to feel that change is worth making;
- to have skills and something to do with them;
- to know some adults who will listen to them;
- to know some adults who will answer them courteously;
- to know some adults who have jobs other than the children themselves, but who are interested in the children;
- to know some adults who have skills and yet who are strong enough not to appear perfect, controlled, and as if they didn't need to grow more themselves;
- to know some adults who behave toward children with the same gravity, respect and attention and lack of impertinence that they would grant a friend in trouble;
- to know some adults who will give them attention most strongly when they are doing worthwhile things and who are obviously not interested in them simple because they are bad;
- to know some adults who will tell them "no" fairly, consistently, and really mean it;
- to know some adults who understand that haircuts, fingernails, clothing and cleanliness are trivial and so teach children that concern for knowledge, self-control and ability are important;
- to know some adults who are strong enough not to need to make children need them; who can force children to make decisions for themselves and can help them live with and overcome bad decisions and so learn to make good ones.

(This is a portion of an article taken from Horizons, April, 1968, published by the Instructional Materials Center for Handicapped Children and Youth, 726 S. College St., Springfield, Ill., 62706.)
If a child lives with criticism, he learns to condemn.
If a child lives with hostility, he learns to fight.
If a child lives with ridicule, he learns to be shy.
If a child lives with shame, he learns to feel guilty.
If a child lives with encouragement, he learns confidence.
If a child lives with praise, he learns to appreciate.
If a child lives with fairness, he learns justice.
If a child lives with security, he learns to have faith.
If a child lives with approval, he learns to like himself.
If a child lives with acceptance and friendship, he learns to find love in the world.

- Dorthy Law Nolte
APPENDIX I-F

VOICE CLINIC

Questions for Weeks 5 and 6

How are you today?
What is your name?
Do you live in Aurora?
Do you like Colorado?
Do you like this weather?
Do you like to ski?
What is your favorite color?
What is your favorite food?
Do you drink tea or coffee?
Where is your favorite place?
What kind of music do you like?
What is your favorite activity?
Are you married?
What is your spouse's name?
Do you have any children?
How old are they?
What are their names?
Do you have any pets?
What do you eat for breakfast?
Do you watch television?
What is your favorite T.V. show?
Do you have a tape recorder?
What kind of car do you drive?
What is your favorite car?
Do you live in a house?
Can you ride a motorcycle?
Do you like to jog?
Do you ride a bicycle?
What is your favorite sport?
APPENDIX II

VOICE CLINIC

ABDOMINAL BREATHING

<table>
<thead>
<tr>
<th>TIME (Minutes)</th>
<th>BREATHING TYPE</th>
<th>ABDOMINAL/THORACIC</th>
<th>THORACIC</th>
<th>CLAVICULAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>2</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Patient sits in an armless chair facing straight ahead. One examiner sits on either side of the patient, facing the patient's sides. Patient sits with both feet on the floor, hands on thighs and lap unencumbered so examiners can easily view abdomen. Patient talks spontaneously for five uninterrupted minutes while examiners note breathing pattern(s). Five-minute conversation is tape recorded.
APPENDIX III-A

VOICE QUALITY DEFINITIONS

Breathy quality is a dysponia due to laryngeal dysfunction and characterized by the escape of unphonated air.

Nasal quality is a dysponia due to a dysfunction of the nasal resonators and characterized by excessive nasal resonance on sounds in which nasal resonance is not expected in such quantities.

Hoarse-husky quality is a dysponia due to laryngeal dysfunction and characterized by an unmusical noise factor and a pitch usually at least a little below normal. (Hoarse, husky, throaty, gutteral, raspy) Hoarseness is often described as a combination of breathiness and harshness.

Harsh quality is a dysponia due to laryngeal dysfunction and characterized by an unmusical noise factor, a pitch usually perceived to be at least a little above normal, and intensity (or volume) perceived to be in excess of adequacy (raucous, strident, shrill).

Normal quality is due to adequate laryngeal and resonance functions and characterized by the lack of any dysponia sufficient to attract attention.

APPENDIX III-B

Voice Sample #_____

(A) Judge the quality based on definitions provided (Appendix III-A).

Voice Quality _____________________________________

Comments: _______________________________________

(B) Check the appropriate box

Voice Rating Severity Scale

<table>
<thead>
<tr>
<th>Normal</th>
<th>Mild</th>
<th>Mod.</th>
<th>Sev.</th>
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</thead>
<tbody>
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<tr>
<td>Nasal</td>
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<td>2</td>
<td>3</td>
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<td>Normal</td>
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<td>Breathy</td>
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<td>1</td>
<td>2</td>
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<tr>
<td>Normal</td>
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</tr>
<tr>
<td>Hoarse-Husky</td>
<td>Normal</td>
<td>Mild</td>
<td>Mod.</td>
</tr>
<tr>
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<td>2</td>
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<tr>
<td>Normal</td>
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</tr>
<tr>
<td>Harsh</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

(C) Requires voice therapy?

Yes ☐ No ☐

(Check the appropriate box)

(D) Difference ☐ No Difference ☐

(Check the appropriate box)

Comments: _______________________________________

(E) Difference ☐ No Difference ☐

(Check the appropriate box)

Comments: _______________________________________

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APPENDIX III-C

Tally the number of occurrences of each of the following voice characteristics while listening to tape A, B, C, D, and E. Listen to each tape twice, each time recording the number of occurrences of each voice characteristic.

<table>
<thead>
<tr>
<th>Voice Characteristics</th>
<th>TAPE:</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<tbody>
<tr>
<td>(1st Time)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glottal fry</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pitch break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>phonation break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>throat clearing</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>abrupt glottal attack</td>
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<tr>
<td>strained vocal quality</td>
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<tr>
<td>coughing</td>
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<tr>
<td>pitch break</td>
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<tr>
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</tr>
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<tr>
<td>strained vocal quality</td>
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<tr>
<td>coughing</td>
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</tr>
</tbody>
</table>