Introduction: The Voice Diagnostic Protocol and Initial Stages of the Diagnostic Process

The goal of this book is to provide detailed information regarding the rationale and procedures for an array of relatively low-cost and readily available methods of voice analysis that will be collectively referred to as the Voice Diagnostic Protocol (VDP). A protocol may be defined as a set of methods or procedures by which a clinical study may be carried out. By stressing the use of relatively low-cost methods, it is the intention of this book to provide detailed information and instruction on methods that can be used by any speech pathologist in any situation or environment. Although it is hoped that all readers interested in the study of voice evaluation procedures will benefit from the content of this book, it is particularly designed as a resource for (1) graduate students in speech-language pathology and (2) practicing speech-language pathologists interested in expanding their skills in voice diagnosis.

The VDP provides the clinician with a detailed and comprehensive assessment of voice function, incorporating elements of patient history, perceptual assessment, acoustic methods, and important estimates of physiological activity. By focusing solely on voice diagnostic procedures, it is the intention of this book to illuminate methods that are often “buried” or discussed in a cursory manner in more general voice texts. However, focus on a single topic necessarily means that certain associated areas of study will not be included:

- This is not a book dealing with resonance-based disorders such as velopharyngeal inadequacy/incompetence and associated speech characteristics such as hypernasality and hyponasality and nasal emission. This book deals with “voice” as a phonatory event, with focus primarily on laryngeal and respiratory mechanisms.
- Although aspects of this book will necessarily deal with elements of laryngeal anatomy, phonatory physiology, and acoustic principles, it is not an anatomy or speech science text.
- It is not a book dealing with the method and interpretation of laryngoscopy or stroboscopy. Although these are important elements of a voice diagnostic, most clinicians do not have the training and/or the equipment to carry out these procedures. In addition, when done for diagnostic purposes, it is essential that visualization of the larynx be carried out by an otolaryngologist familiar with laryngeal disorders, who will then make an appropriate medical diagnosis and recommendations. It is expected that the clinician reading this book will seek appropriate referral sources for laryngoscopic evaluation (as well as stroboscopy, if necessary).
- This is not a book dealing with instrumentation methods such as electroglottography (EGG), advanced aerodynamic assessment, or electromyography (EMG). Although these methods may add valuable information to our assessment of vocal function, they require an expense and expertise with instrumentation that may make them clinically unfeasible in many situations.
- This is not a book dealing with the method and interpretation of laryngoscopy or stroboscopy. Although these are important elements of a voice diagnostic, most clinicians do not have the training and/or the equipment to carry out these procedures. In addition, when done for diagnostic purposes, it is essential that visualization of the larynx be carried out by an otolaryngologist familiar with laryngeal disorders, who will then make an appropriate medical diagnosis and recommendations. It is expected that the clinician reading this book will seek appropriate referral sources for laryngoscopic evaluation (as well as stroboscopy, if necessary).

Although many of the tasks discussed in this protocol will appear “simple” or uncomplicated on the surface, review of the theoretical background of these tasks, descriptions in the literature, issues of validity and reliability, etc., make even “simple” procedures quite complex in terms of clinical use and interpretation. Therefore, the background information provided in this book is believed to be necessary if the clinical information gathered from these tasks is to be reasonably interpreted and used with maximum effectiveness. Even though many of the tasks incorporated in the VDP use instrumentation methods, they cannot really be judged to be objective in nature. True objective measures would be independent of human error, judgment, perceptions, and bias of the clinician (Behrman & Orlikoff, 1997; Nicolsi, Har­ryman, & Kresheck, 1989). In addition, an ideal objective test would also be independent of influence from patient behavior (i.e., the patient would not be able to influence
test results as a function of his or her immediate behavior). In the case of many instrumental tasks of vocal function, the ways in which measures are obtained and interpreted are subjective in nature and affected by both clinician and patient (Behrman & Orlikoff, 1997).

THE CONCEPT OF DIAGNOSIS VS. ASSESSMENT/EVALUATION

The title of this book clearly indicates that the procedures described herein are to be components of a diagnostic protocol. The term diagnostic has been specifically used to indicate that the outcome of this process will achieve several important goals:

1. Our diagnostic decisions will be based on a synthesis of information from diverse areas all dealing with aspects of voice function, such as anatomy and physiology, acoustics, perception, psychometrics, and knowledge of norms and testing techniques.
2. The final diagnosis will be derived from the ability to distinguish the patient’s problem from a large field of possibilities (Haynes, Pindzola, & Emerick, 1992). This process is referred to as differential diagnosis, a process that takes into account all significant variables contributing to the disorder and attempts to differentiate the presenting problem from related or dissimilar problems (Weinberg, 1983).
3. The final diagnosis will actually be the beginning of a continuous venture that will be open to revision on the basis of the patient’s future behavior.

Some may object to the use of the term diagnosis or diagnostic as used by speech-language pathologists, perhaps because of (1) the association of the term with the medical profession and (2) the possible implication that the speech-language pathologist will be carrying out a medical procedure. Some would prefer the use of terms such as assessment or appraisal to describe our methods. However, these terms are not synonymous with diagnosis and describe only the procedures used within the overall diagnostic method. In contrast, “diagnosis requires placing measurements and other observational data into context and perspective in order to decide whether a problem exists and to differentiate one problem from others which may have similar performance aspects” (Peterson & Marquardt, 1990, p. 4). It is my belief that the term diagnosis is a universal term that describes a process of investigation and deduction that cannot be reserved for a particular field or profession.

A PHYSIOLOGICAL VIEW OF VOICE DIAGNOSIS

The various sections of this book will stress the possible relationships between perceptual, acoustic, and other measures of voice and the underlying physiology of phonation. It is not enough to simply recognize that a patient has a rough-sounding voice, higher than expected fundamental frequency, or short maximum phonation time—the clinician must develop a rational hypothesis as to why the patient has certain characteristics. This is where application of our knowledge of the underlying physiology or pathophysiology affecting voice production comes into play. A number of previous works dealing with diagnosis of voice disorders have also stressed this point. Murry (1982) stated that “the assessment of the vocal mechanism...encompasses a detailed analysis of the abnormal physiologic behavior of the laryngeal mechanism, specifically, and the relationship between the behavior of the laryngeal mechanism and the patient’s general speech and voice production” (p. 478). Bless and Hicks (1996) stated that “assessment of vocal function has evolved to mean deriving a description of voice production...that allows clinicians to make inferences about the functioning of the underlying anatomical and physiological condition of the larynx” (p. 124). Behrman and Orlikoff (1997) go on to stress that “the underlying pathophysiology [italics added] the voice disorder that the clinician must seek to understand” (p. 10).

Once the clinician can hypothesize the possible causative factors (behavioral or organic) underlying the patient’s voice disorder, the development of treatment goals becomes evident. A physiological approach to diagnosis should lead to physiological voice therapy, in which “the management approach is a direct modification of the inappropriate physiologic activity” (Stemple, 1993, p. 4). It is clear that the success of voice therapy is highly dependent on the skill and inferences of the voice clinician derived from the initial diagnosis.

AVOIDANCE OF MEDICAL DIAGNOSTIC TERMS

The focus of the speech pathologist involved in the voice diagnostic should be to assess voice production, identify possible underlying factors (behavioral and/or organic) that may be responsible for the cause and maintenance of the voice problem, and determine the severity of the voice problem (Behrman & Orlikoff, 1997; Colton & Casper, 1996; Murry, 1982). It is not the speech pathologist’s responsibility to determine the specific existence and type of pathological condition that may be affecting the phonatory function of the patient (Behrman & Orlikoff, 1997; Murry, 1982). Although the literature is ripe with the perceptual and acoustic description of various pathological states, the voice clinician should focus his or her diagnostic conclusions on possible physiological mechanisms that may be responsible for the various perceptual, acoustic, and other signs observed in the particular patient rather than on diagnostic labels. This description is much more informative and potentially useful...
to the speech pathologist and the patient than applying a medical term or label to the patient's disorder. The use of medical diagnostic terminology should be avoided for the following reasons:

1. It is outside the realm of the speech pathologist to make medical diagnoses. An appropriate referral must be made to the attending physician or otolaryngologist, who will apply the “label” to the patient’s organic pathological condition.
2. A multitude of different disorders with different labels can result in similar perceptual, acoustic, etc., characteristics. As an example, vocal nodules, polyps, and other lesions that affect the margin(s) of the fold(s) and restrict glottal closure may all have some degree of breathiness. Therefore, it can be seen that the chance for error in applying a medical diagnostic term solely on the basis of perceptual and/or acoustic information is a strong possibility.
3. As in other areas of speech pathology, we do not treat labels. Instead, we must treat each patient as a unique entity with his or her own unique physiological disturbances (both primary and secondary [i.e., compensatory] in nature). Therefore, diagnosis should accentuate the underlying physiology of the patient and the voice disorder rather than a particular label or category to which they may belong.

THE USE OF INSTRUMENTATION: OBJECTIVE EVALUATION OF THE VOICE WITH METHODOLOGY AVAILABLE TO ALL VOICE CLINICIANS

Traditionally, the major component of a voice evaluation dealt solely with a perceptual description of voice characteristics. Although perceptual characterization of the voice is still an essential component of any voice diagnostic, it can no longer be the only parameter to be included in a complete voice diagnostic. There are several important reasons why perceptual judgments alone are not adequate:

1. Variability in training and experience between therapists inevitably leads to a lack of reliability and validity in the perceptual judgments that are made. Discussion with colleagues will often reveal that even such commonly used severity terminology such as mild, moderate, and severe may have very different meanings for different therapists.
2. Perceptual judgments alone do not allow for objective comparison with normative groups. One of the fundamental diagnostic decisions made in any evaluation is one of “normal” vs. “abnormal.” One of the valuable aids we have in making this decision is a measure of the average performance for a target group in conjunction with a measure of the average deviation. Unfortunately, perceptions cannot be compared with measurable norms in any valid manner.
3. Progress in therapy sessions may not be gauged effectively with perceptions alone. Perceptual judgments may not detect relatively small but significant changes in voice characteristics that may indicate that a treatment procedure is having a positive effect on the patient. In addition, perceptual judgments alone may not provide the data required to justify continuation of therapy and reimbursement for treatment.

It can be seen that the effective gauging of the patient’s voice characteristics in both diagnosis and treatment is somewhat lacking if perceptual judgments are used alone. Therefore, a key component of the VDP is the addition of instrumental measures wherever possible. Behrman and Orlikoff (1997) define instrumental measures as “those obtained using electronic or computer-based equipment” (p. 9). There are several key reasons why the addition of instrumental measures strengthens our diagnostic protocol (Behrman & Orlikoff, 1997):

1. Rapid evolution of the environment in which speech-language pathologists’ practice has demanded greater sophistication from the clinician in terms of diagnostic methods.
2. Health-care delivery and reimbursement issues have required the voice clinician to quantify patient characteristics both in diagnosis and through the course of therapy.
3. Instrumentation procedures may be able to tell the clinician how a patient is making use of and coordinating the various subsystems (respiratory, phonatory, articulatory) of the speech mechanism.
4. Instrumental measures may help form a more solid foundation for clinical judgments.
5. Instrumental measures allow for the comparison of vocal performance to appropriate normative data.

It can be seen that instrumental measures help to verify clinical judgments and hypotheses. If clinical experience, expertise, and perceptual judgments form the basis of diagnostic hypotheses, then instrumental measures are a key factor in the acceptance or rejection of these hypotheses.

RATIONALE FOR ACOUSTIC METHODS

A key element of the VDP is that perceptual signs of the voice will be verified and supported by means of acoustic methods. Acoustic analysis of the voice represents an area of instrumental analysis that presents a number of distinct advantages to the clinician.
Clinician Experience and Familiarity

All master's degree-level speech-language pathologists generally have one or more courses in basic speech science and acoustic methods as part of their academic training. Therefore, many of the concepts of frequency, intensity, periodicity vs. aperiodicity, etc., that underlie the acoustic methods used in the voice diagnostic will be relatively familiar to the clinicians using them.

Noninvasive

Acoustic methods are noninvasive and therefore may be used with all patients by any clinician. In addition, most patients are relatively familiar with the use of microphones and will be comfortable speaking into them. These benefits do not necessarily extend to other instrumental methods of voice analysis.

Good Availability and Relatively Low Cost

The equipment necessary for high-quality acoustic analysis is readily available to most clinicians for a relatively modest cost. The advent of low-cost multimedia computers in recent years, in conjunction with the proliferation of software for acoustic analysis, has made acoustic analysis methods widely available.

Correspondence with the Underlying Physiology of Voice Disorders

The acoustic signal is the by-product of phonation (the oscillation of the vocal folds as determined by aerodynamic and myoelastic forces). Because the acoustic signal is determined, in part, by movements of the vocal folds, there is a great deal of correspondence between the physiology and acoustics, and much can be inferred about the physiology based on acoustic analysis” (Colton & Casper, 1996, p. 21). It must be noted that the relationships between phonatory physiology and acoustics are certainly not perfect. The voice signal “is a complex product of the nonlinear interaction between aerodynamic and biomechanical properties of the voice production system” (Behrman & Orlikoff, 1997, p. 10). Because this interaction is nonlinear, accurate predictions regarding underlying phonatory physiology cannot always be made on the basis of the acoustic signal alone. However, when acoustic analysis results are placed within the context of a complete VDP, very powerful inferences may be made.

Good Applicability to Future Therapy

Acoustic methods lend themselves well to both diagnostic procedures and treatment methods. It has been my experience that most patients, even relatively young children, are able to easily understand (in a simple, but effective manner) many of the measures displayed in voice analysis programs (e.g., jitter values “should go down”; F0 values “should go up”; displayed F0 contours should flatten). In this way, acoustic methods provide a valuable link between the voice diagnostic and voice therapy.

Wide Body of Literature

Acoustic analysis methods have an extensive history of use with a wide range of voice-disordered populations. This provides the clinician with a vast body of literature that may be accessed to aid in the interpretation of diagnostic findings.

THE VOICE DIAGNOSTIC PROTOCOL DEFINED

The VDP provides the voice clinician with an array of test procedures by which reasonable and accurate diagnostic hypotheses may be made regarding the presenting voice disorder. The VDP incorporates a wide range of analysis methods (perceptual, acoustic, and selected physiological methods) that meet the following criteria (Hirano, 1991):

- They present minimum discomfort to the patient.
- They are noninvasive techniques.
- In most cases, they require minimal amounts of time to complete the procedure.
- They provide relatively immediate test results.
- They require minimum expense.

The various procedures in the VDP are shown in Figure 1–1.

The VDP can be described as a method of voice profiling. Voice profiling allows the clinician the opportunity to derive influences regarding the underlying anatomical and physiological status of the phonatory mechanism (Bless & Hicks, 1996). An accurate profile of voice function requires the acquisition of multiple measures and observations derived from a wide range of methods. Several important reasons for this method of voice profiling are shown below.

- Bless and Hicks (1996) state that single tests or measures must be considered as part of a larger battery of tests of vocal function. Diagnostic hypotheses should not be made on the basis of one test or measure because “one cannot look at an isolated phenomenon without running the risk of misinterpreting results” (Titze, 1991 in Bless & Hicks, 1996).
- Colton and Casper (1996) believe that the most complete information regarding the patient’s vocal functioning cannot be obtained by means of only one or two
Assessment Areas of the VDP

Background Information
- Presession information
- Case history re: patient dysphonia
- Speech and hearing mechanism results

Pitch/Frequency
- Perceptual determination (habitual pitch, pitch variability)
- Mean speaking $F_0$
- $F_0$ variability ($F_0$ standard deviation/pitch sigma)
- $F_0$ range (total phonational range and speaking range)

Loudness/Intensity
- Perceptual determination (habitual loudness, loudness variability)
- Mean/modal speaking intensity
- Intensity range—phonetogram
- "High-quiet" phonation

Quality
- Perceptual determination (primary quality deviations, instability, strain, diplophonia)
- Quantitative analysis of perturbation and noise (jitter, shimmer, HNR)

Duration—Respiratory/Phonatory Control
- Perceptual determination (including "five for five" testing and reading of a standard passage on one breath)
- Vital capacity
- Maximum phonation time
- S/Z ratio
- Phonation quotient

Evaluation of Muscle Tension Dysphonia (MTD)
- Effects of laryngeal reposturing and massage
- Effects of sustained speech production (rapid counting)

Figure 1-1 Outline of the Tasks Incorporated into the Voice Diagnostic Protocol
procedures. "Each procedure adds to our understanding of normal voice production and the deviations that alter the normal state" (Colton & Casper, 1996, p. 197).

- Kent, Kent, and Rosenbek (1987) state that "particularly when performance is deficient compared to norms, data should be taken from repeated trials, or other tasks should be used to complete the interpretative framework" (p. 383). In addition, Kent et al. (1987) indicate that the relationship and consistency of test results within a category of testing may tell the clinician something about the type and severity of a disorder.

- Gerratt and Kreiman (in Orlikoff et al., 1999) state that acoustic measures of vocal quality may be accounted for by many physiological conditions and affected in similar ways by various types of laryngeal behavior and pathological conditions. This fact exemplifies the notion that acoustics must be part of a comprehensive diagnostic protocol that includes detailed case history information, perceptual assessment, and physiological measures.

- Hirano (1991) notes that voice function is multidimensional in nature, and, therefore, we need a set of tests to evaluate vocal function in its entirety.

REQUIRED EQUIPMENT AND MATERIALS FOR THE VDP

The following items are necessary to complete the various tasks incorporated in the VDP (see Appendix A):

- A Pentium-level multimedia computer, incorporating Microsoft Windows 95 or higher (Microsoft Corporation). A multimedia computer generally includes a 16-bit sound card and speakers necessary for the recording and playback of speech samples.

- Voice analysis software. Several of these packages are available for use on a Windows-based PC. Examples are CSpeechSP (P. Milenkovic, Madison, WI); Dr. Speech (Tiger DRS Inc., Seattle, WA); EZVoicePlus (VoiceTek Enterprises, Nescopeck, PA); and Multi-Speech Model 3700 (Kay Elemetrics Corp., Lincoln Park, NJ). All these programs will use the sound card already installed in a multimedia computer for recording and playback. When obtaining voice analysis software, make sure that the program is able to provide perturbation and noise analyses from sustained vowel samples, as well as continuous speech analysis (some programs require add-on packages to provide all these analysis options).

- A good quality microphone (unidirectional dynamic or condenser). Ideally, this microphone will have a frequency response between 50 Hz and 15 kHz.

- Microphone preamplifier or mixer (see Figure 1-2). This item is not a necessity but is useful because many cassette, DAT (Digital Audio Tape), DCC (Digital Compact Cassette), and MD (MiniDisc) decks do not have microphone inputs. Therefore, the microphone can be input into the preamplifier mixer and then fed into the line input of the recording deck. In addition, a mixer is useful to input the signal into the computer. Although most sound cards have a microphone input, the line input of the sound card often provides better quality recording (Huang, Lin, & O'Brien, 1995). Therefore, the microphone would be plugged into the microphone input of the mixer, and the line out from the mixer would be connected to the line in of the sound card.

- A sound level meter (SLM). This is necessary to make measurements of vocal intensity. Most Radio Shack stores carry low-cost SLMs in either analog (Model 33-2050) or digital (Model 33-2055) models. The digital display is often easier to read than the meter display of the analog model. The SLM may also be used as a microphone by connecting its line out to the mixer microphone input.

- A spirometer. This is necessary for measurements of vital capacity and estimates of airflow. A number of relatively low-cost hand-held models are available.

- Stopwatch.

- Ruler (for measuring mouth-to-microphone distance).

- Good quality cassette, DAT, or MD. Most voice recording in the VDP is done directly into the computer. In fact, this is preferable because it removes possible detrimental effects of tape noise, multiple external amplifiers, etc. However, in the event that a portable recorder is
necessary for voice recording away from the computer (e.g., case history interviews that may take place in a room different from that which houses speech/voice instrumentation), I suggest the use of a portable MD unit. MD is a digital recording medium that provides many benefits over standard recording methods (no tape noise; no need for tape bias setting; no tape deterioration; ability to index samples for immediate recall; samples may be erased, combined, moved, named; up to 148 minutes of mono recording time on a single disc). In addition, portable MD units generally contain a microphone input, removing the necessity for a preamplifier mixer. A study by Winholz and Titze (1998) indicated that MD units are more than adequate for voice analysis purposes and do not introduce any significant distortions into the record/playback process.

The most expensive item in this equipment list will most probably be the computer. However, because most clinical settings (hospital, school, private office) will already have access to a computer with multimedia capabilities, the actual costs for the equipment used in the VDP are relatively low. Figure 1-3 shows a standard equipment setup as may be used during voice diagnostic testing.

THE BENEFITS OF REDUNDANCY

Voice profiling as conducted by means of the VDP incorporates an extremely important facet of accurate diagnostic decision making—redundancy. Most would consider redundancy a form of inefficiency, in which procedures and observations are simply repeated in an identical manner. However, in the case of diagnostic testing as discussed here, the redundant addition of observations to our overall voice profile is done according to slightly different procedures. Redundant data are not collected as exact copies but as associations of an underlying behavior or process. De Callatay (1986) states, “Because there are slight variations in possible solutions, there will be an increase in the number of pattern recognitions, increasing the chances of finding a best choice” (p. 97). In this form of redundancy, (1) a larger weight will be given in the development of clinical hypotheses to signs of underlying behaviors that have been frequently repeated, and (2) a more comprehensive view of the underlying behavior will be provided.

Redundancy is used for improved development of clinical hypotheses and for reliability (i.e., repeatability) purposes. However, redundancy in diagnostic testing does not have to be inefficient. Many of the redundant tests used in the voice diagnostic protocol are conducted on the same speech sample. As an example, the same continuous speech sample may be analyzed perceptually and acoustically. In terms of acoustics, several different but associated procedures can be conducted on the same recorded speech sample (e.g., computations of jitter, shimmer, and harmonics-to-noise ratio). Therefore, redundancy can be incorporated as a beneficial aspect of clinical decision making without impeding the efficient completion of the voice diagnostic.

KEY PARAMETERS FOR CONSIDERATION BEFORE BEGINNING THE DIAGNOSTIC SESSION

Before beginning the voice diagnostic, the clinician must be clear on three particular parameters that will be evaluated during the case history interview and throughout the diagnostic session:

- What is normal vs. disordered voice?
- If a voice is disordered, how may we describe its severity?
- Once we have identified a disordered voice, what are the primary voice disorder types by which we may categorize it?

Normal vs. Disordered Vocal Quality

To distinguish between normal and disordered behaviors, it is essential that we define our terms. Unfortunately, there is difficulty in actually defining what a normal voice is, even though most people, laypersons as well as professionals, are often able to identify voices that “sound different.” This point was emphasized in a study by Anders, Hollien, Hurme, Sonninén, and Wendler (1988), in which trained practitioners in clinical voice analysis (speech-language
pathologists, speech scientists, phoneticians) and laymen controls were asked to identify samples of normal vs. hoarse phonation and also rank the severity of the disordered samples. Anders et al. (1988) observed that the disordered samples could be easily identified and ranked by trained and untrained groups alike—the hypothesis that training could enhance the accuracy of perceptual identification was not supported.

Fex (1992) states that “normal voice quality is a conception based on subjective opinion, may vary with different cultures, and certainly is difficult to define; a vast number of people are supposed to have normal but nevertheless individually differentiated voice” (p. 155). So, what is it that the listener detects in the voice signal that allows for the discrimination between normal and disordered voice? It appears that there are a number of characteristics (age, gender, racial type, body size/type, etc.) that determine a range for normal voice type and quality. As we are exposed to the range of normal voice types throughout our lives, we gain experience as to the limits of normal voice and, thereby, develop a mental scale by which normal is gauged. As long as a particular voice does not deviate substantially from this internal gauge in terms of parameters such as pitch, loudness, quality, and duration, it will be considered within the normal range. When a voice is perceived as deviating from the normal range, it may be characterized as being dysphonic. The term dysphonia literally means “abnormal/difficult/impaired voice.”

METHODS FOR RATING SEVERITY OF DYSPHONIA

Having some definition by which we may distinguish normal from disordered/dysphonic voices, the clinician should also enter the diagnostic situation with some working knowledge of basic terminology by which we will categorize our patient’s characteristics and communicate them to others. In each of the following chapters of this book, the reader will be introduced to definitions for primary voice characteristics and disturbances that have been well established and can be agreed on by most voice scientists and clinicians. However, much of the difficulty in accurately defining the perceptual attributes of the voice comes not in applying the categorical label but in accurately describing the severity of the observed disorder. When we judge the severity of a disorder, we are recognizing that the condition may exist along a continuum. This continuum extends in growing proportions from an absence or minor amount of the observed deviant voice characteristic to an extreme amount. The lower end of this continuum should probably be best acknowledged as being a “minimal” level, because even normal voice signals are not necessarily perfect. On the other end of the continuum, an extreme level of voice deviation may overpower the normal voice signal and, most probably, has a significant effect on patient and listener alike.

Several methods have been described by which the severity of voice deviations may be described or quantified (Kreiman, Gerratt, Kempster, Erman, & Berke, 1993):

1. Categorical ratings: In this method, voice samples are assigned to discrete categories such as mild, moderate, severe.
2. Equal-appearing interval (EAI) scales: The severity of a perceived voice characteristic is assigned a number (most commonly between 1 and 7), with the higher numbers representing increased amounts of perceived disruption in the voice signal.
3. Visual analog (VA) scales: Instead of scaling the voice by use of specified incremental levels of voice disruption (as in EAI scales), VA scales provide the judge with an undifferentiated line on which a mark is placed to indicate the level of voice severity or deviation. Only the extremes of the line are labeled (e.g., minimal vs. extreme). The use of this type of scaling procedure may be helpful in reducing bias in the rating process.
4. Direct magnitude estimation (DME): In this method, a number is assigned to indicate the degree of voice deviation. Numbers may be assigned in an unrestricted manner (i.e., any number possible) or restricted fashion (anchored DME in which numbers are assigned in relation to a reference voice sample with a presigned magnitude).
5. Paired comparison: Two voice samples are judged as to the extent of difference on single or multiple dimensions of the voice signal.

Pros and Cons of Perceptual Assessment of Disordered Voice

Various methods have been described by which the severity of a deviant voice type may be documented. However, there has been considerable controversy as to the overall benefit and usefulness of perceptual assessment of the voice. An article by Orlikoff et al. (1999) presents various viewpoints dealing with the appropriate use of auditory-perceptual judgments of voice (and in particular, voice quality) in the assessment of dysphonia. The pros of perceptual assessment may be summarized as shown below.

- Perceptual assessment methods are available to all clinicians and may provide a global measure of vocal performance.
- Perceptual judgment and assessment are of primary relevance to most voice patients. The patient is often most concerned with how others perceive his/her voice.
• The perceptual severity and quality of the voice are often the impetus for the voice evaluation in the first place and, therefore, must be confirmed, evaluated, and described by the clinician.
• Perceptual rating is the "gold standard" for assessing the clinical relevance of subsequent acoustical analyses.
• Perceptual judgments provide a comprehensive impression of the voice that includes aspects of voice not captured by acoustic measures.
• Perceptual judgments are important in determining the ultimate success or failure of voice therapy.

Unfortunately, a number of factors are involved with the perceptual assessment of the voice that may make the process nebulous (Murry, 1982) and error prone. The cons of perceptual assessment of the voice may be summarized as shown below (Orlikoff et al., 1999).

• Perceptual assessment of the voice appears to be affected by problems of scale validity and reliability.
• Perceptual assessment does not provide an awareness of the physiological details that result in the acoustic product.
• Perceptual quality may be difficult to characterize and communicate in terms of quantified results and, therefore, may not be as credible as numerical test procedures. In this regard, results of perceptual assessment may not be sufficient for medicolegal purposes.

Although more pros than cons have been presented, the possible deficiencies in the perceptual assessment process are important for us to consider in more detail. In particular, we will focus on a discussion of the reliability and validity issues involved with perceptual assessment of the voice.

Reliability

Reliability of an assessment procedure focuses on the ability to repeat one's measurements or observations. The ability to repeat measurements is directly related to the precision and accuracy of measurements (Schiavetti & Metz, 1997). Kreiman et al. (1993) provide a comprehensive review of studies that have been concerned with the assessment of speech and voice quality. Their review indicates that, although average levels of intra-judge and inter-judge reliability are generally high, average reliability measures tend to mask considerable variability in perceptual judgments. In addition, the use of correlational statistics to substantiate the presence of reliability only indicates that judgments (whether intra-judge or inter-judge) may vary in a consistent manner; they do not necessarily indicate that judgments are in agreement (i.e., judgments were exactly the same).

The variability in ratings may be due to several factors:
• The severity of the perceived voice disturbance may affect intra-judge and inter-judge reliability. Kreiman et al. (1993) have observed that quality ratings vary more for pathological than normal voices and more for mid-scale voices (i.e., mild to moderate voice disturbances) than for voices at scale extremes (i.e., normal or severe voices).
• The type of scaling procedure used may result in variability in ratings, with EAI scale ratings observed to produce more drift in test-retest comparisons than VA scales.
• Because judges are exposed to more and different examples of voice productions, their internal gauge of what defines normal versus disordered may change, resulting in a lack of precision in their test versus retest ratings of voice quality.

It should be recalled that reliability does not ensure validity of measurement procedures but is a necessary prerequisite for validity (Schiavetti & Metz, 1997). Therefore, the aforementioned factors affecting reliability of perceptual assessment also contribute to the next section dealing with factors that affect the validity of perceptual assessment of the voice.

Validity

The validity of a test procedure refers to the ability to measure what we intend to measure. Validity implies a satisfactory and consistent definition or set of definitions for the characteristic behavior we are attempting to measure or rate. In terms of perceptual assessment of the voice, if the characteristics we are attempting to identify and rate are poorly defined, defined differently from person to person, or have shifting definitions, then validity will be affected in addition to reliability. Several issues possibly affecting the validity of perceptual judgments of the voice may be summarized as follows:

• Quality judgments that attempt to rate the severity of the voice deviation are characteristically poorly defined. Although it is common for working definitions or examples to be provided for scale anchors (normal and severe), there is generally little or no definition provided for the mid-scale ratings. With this in mind, it is no wonder that mid-scale ratings have been seen as the location of greatest variability and disagreement between judges rating voice quality (Kreiman et al., 1993).
• Quality judgments that are unidimensional in nature may have poor content validity because they do not account for the multidimensional nature of voice. It has been said that, "The voice is a multi-dimensional phenomenon, comprised of a number of elements that..."
contribute to overall voice quality and voice effectiveness" (Orlikoff et al., 1999, p. 90). Hammarberg, Fritzell, Gauffin, Sundberg, and Wedin (1980) showed that samples of pathological voices could be perceptually summarized in terms of five bipolar factors: (1) unstable-steady, (2) breathy-overtight, (3) hyperfunctional-hypofunctional, (4) coarse-light, and (5) head vs. chest register. Gelfer (1993) indicated that five dimensions of the voice signal accounted for the similarity or dissimilarity of normal female voices. The perceptual correlates of the five dimensions were: (1) perceived pitch, (2) perceived loudness, (3) perceived age and rate, (4) variability in perceived pitch, and (5) perceived voice quality. With this in mind, rating the voice by use of a single scale factor (e.g., “roughness”) may not account for other key voice characteristics that should be included in the description.

In addition to various voice characteristics, our perceptual measurements may be swayed by other extraneous sources. For example, severity of vocal roughness may be influenced by coexisting hypemasality or some other nonvoice source information (de Krom, 1994).

Overall, two key factors can be seen that may be the sources of reduced validity and reliability in perceptual assessment of the voice: (1) variation in definition for measurement terms and (2) variation in experience of the listeners. These factors may be seen to change the calibration of the judge on test-retest measurements or to affect the similar calibration of different judges (remember that calibration can refer to observers or scorers in addition to machines/instruments). These changes in calibration produce changes in the obtained measurements (i.e., voice ratings) (Campbell & Stanley, 1966). Both validity and reliability may be affected by changes in calibration.

**HOW TO DO IT: RATING DYSPHONIC SEVERITY**

Perhaps the challenge in selecting a method of perceptual assessment of voice quality is to find one that is complex enough to portray the multidimensional nature of voice quality deviation and yet be understandable enough that (1) clinicians may easily learn and use the system with limited training, and (2) results may be communicated easily among colleagues and other professionals. This book proposes that the severity of a particular voice disruption (pitch, loudness, quality, etc.) be rated on a 7-point categorical/EAI rating scale ranging from 0 to 6. A 0 rather than a 1 is suggested as the lower anchor of the scale to represent the absence or minimal nature of the perceived voice disorder. (See Appendix B.)

Within this scale, certain points (1, 3, 5) are labeled with the commonly used severity terminology of mild, moderate, and severe. These are our severity categories, which are ranked on an EAI scale of increasing magnitude. These terms are freely used by speech pathologists to describe various disorders. Yet, the next time a colleague uses one of these terms or you use one yourself, ask yourself, “What does mild, moderate, or severe really mean?” You will probably find (1) great difficulty in defining these terms and (2) a substantial amount of variation in definition from person to person. Of course, lack of agreement in definition is one of the key elements that results in reduced reliability and agreement in perceptual judgments of voice quality. Review of the voice literature finds very little in terms of definition for these commonly used severity terms. It is common that definitions are provided for the end points of the severity continuum, but not for the intermediate points. As an example, de Krom (1994) describes a 10-point EAI scale in which the left side of the scale...
(number 1 in this example) represented "not present at all," and the right side of the scale (number 10) represented "maximally present." Askenfelt and Hammarberg (1986) used a 5-point EAI scale, with 0 representing no deviance and 4 representing a high degree of deviance from normal. In studies using both 7-point EAI scales and VA scales, Kreiman et al. (1993) only provide definitions of the end points of each scale (e.g., "not rough at all" versus "extremely rough"). It is this lack of definition, particularly for the intermediate points of the severity continuum, that contributes to the increased variability and decreased reliability and agreement in perceptual ratings. Kreiman et al. (1993) confirm the variability or ratings in the midrange of vocal quality scales and conclude that "if the quality to be rated is poorly defined or lacks perceptual reality, listeners will not be able to rate it consistently" (p. 32).

Severity Terminology Defined

It seems that one of the major problems in judging voice is its multidimensional nature. Voice is composed of numerous characteristics that may be weighted differently by different judges (de Krom, 1994; Higgins, Chait, & Schulte, 1999). As an example, while listening to the same disordered voice sample, one judge may be focusing on aspects of pitch, whereas the other puts more emphasis on vocal quality. In addition to the perceptual characteristics of the voice, severity definitions should also take into account "the impact the voice problem may have on the speaker's ability to communicate and obtain employment" (Higgins et al., 1999, p. 103).

The following severity terminology attempts to incorporate a number of the possible diverse effects of dysphonia:

- **Mild:** Although the listener experienced in the perceptual characteristics of the disordered voice would consider the voice abnormal, the untrained listener may consider the voice to be only unusual in nature and within normal expectations. The voice characteristic is not distracting, and the ability to effectively communicate is not affected. The dysphonia does not interfere with phonation.

- **Moderate:** Both trained and untrained listeners would consider the voice abnormal. There may be intermittent periods in which the voice characteristic is highly distracting. The ability to effectively communicate is noticeably affected under certain conditions (e.g., noisy environments). The dysphonia may occasionally cause phonation to cease or become highly effortful.

- **Severe:** Both trained and untrained listeners would consider the voice extremely abnormal. The voice characteristic is highly distracting. The ability to effectively communicate is consistently affected. The dysphonia causes phonation to be mainly absent or extremely effortful.

The clinician is encouraged to closely compare the perceived abnormal voice characteristic(s) to all parts of these definitions. It may be that a disordered voice does not show all the characteristics mentioned under each definition, or it may show characteristics crossing definitions. In these cases, intermediate ratings (e.g., mild-to-moderate) may be appropriate. In addition, certain dysphonia types (e.g., inappropriately high pitch) may be considered abnormal but not necessarily disrupt the ability to phonate.

It can be seen that these severity definitions emphasize the noticeability and communicative effectiveness of the patient. These factors get to the heart of what may be considered "abnormal" voice production. As previously stated, the degree of deviation from our internal gauge of what normal voice should be is one of the key factors that signals the disordered voice. Therefore, in the severity definitions presented here, we range from a barely noticeable deviation (mild) to one that is so extreme (severe) that the normality of the voice signal is overwhelmed. In addition, these severity definitions take into account the overall effects on communication. As the voice deviation becomes more noticeable, communication between the speaker and the listener will become increasingly impeded. The listener becomes so distracted by the voice deviation that he or she has trouble focusing on and processing the underlying linguistic message. Orlikoff et al. (1999) agree that it is especially important that the attention of the listener is not deviated from the content of the message by a "disturbing voice quality." Prater and Swift (1984) indicated that judgments of intelligibility should be made in addition to judgments of voice severity and aesthetic quality. Andrews (1995) also includes effects on intelligibility in her definitions for mild, moderate, and severe ratings for vocal tremor. Although the listener is affected by the presence of a voice disorder, the speaker also may have increased awareness of the difficulty in communicating and attempt to compensate for the deficit in various ways (behavioral, psychological, social, etc.). Overall, we have the development of a handicapping condition (Haynes et al., 1992) in which the lack of communicative effectiveness begins to have a significant impact on the patient's day-to-day activities.

To account for the multidimensional view of voice production that appears to be so important in describing overall voice character and effectiveness (Gelfer, 1993; Orlikoff et al., 1999), these severity definitions will be applied to all key characteristics of the voice signal (pitch, loudness, quality, and duration). As an example, we may state that a patient has a "mild dysphonia characterized by abnormally low pitch and breathiness." The severity term (in this case, mild) describes the effect of the voice disorder on both
VOICE DISORDER TYPES

Having identified a possible dysphonia and assigned it a severity rating, the clinician should also form a working hypothesis regarding the type of voice disorder that the patient may have. Traditionally, voice disorders have been separated in two main groups.

Functional Voice Disorders

Commonly, the term functional dysphonia has been used to describe those voice disorders in which dysphonia was observed in the absence of organic pathological condition. However, the term “functional” has been challenged as being vague, with relatively little agreement on criteria by which inclusion into the functional dysphonia category is made (Goldman, Hargrave, Hillman, Holmberg, & Gress, 1996). Numerous varied opinions on what defines this type of voice disorder are found below.

- Koufman and Blalock (1982) believed that functional dysphonias are primarily due to abuse and misuse of a normal laryngeal mechanism, with prolonged abuse resulting in the development of conditions such as nodules, polyps, ulcers, or granulomas of the vocal folds. However, it is characteristic that the observed dysphonia is disproportionately poor compared with the status of the laryngeal mechanism. From a review of 52 functional dysphonia patients, these authors delineated five types of functional dysphonias:
  - Type 1. Hysterical Aphonial Dysphonia: This type is distinguished by a sudden onset often associated with a distinct precipitating event. The patient typically has a normal laryngoscopic examination, no significant associated symptoms, and no history of prior laryngitis. Voice is characterized by ahothia, whisper, limited pitch range, and variability (“pitch-locked” p. 372); consistent/stable voice dysfunction.
  - Type 2. Habituated Hoarseness: This patient reports persistent hoarseness usually after a preceding bout of viral laryngitis. The patient typically has a normal laryngoscopic examination and no significant associated symptoms. Voice is characterized by breathy, raspy, diplophonic quality; limited pitch range and variability; consistent/stable voice dysfunction.
  - Type 3. Falsetto: This patient reports a sudden or developmental onset with an abnormally high-pitched voice; limited pitch range and variability; consistent/stable voice dysfunction. This patient also typically has a normal laryngoscopic examination and no significant associated symptoms.
  - Type 4. Voice Abuse: This patient reports chronic voice problems, although dysphonia may be intermittent. Vocal abuse or misuse characterized by overuse, inappropriate pitch level, and use of excessive muscle tension are common characteristics. Pain or discomfort in the laryngeal region that worsens with increased voice use may be reported. Laryngoscopy may be normal or show a secondary pathological condition. Voice quality is variable; the patient may initiate voicing with abrupt onsets (hard glottal attack).
  - Type 5. Postoperative Dysphonia: This patient reports dysphonia after an operation. Laryngoscopy may be normal or show decreased fold compression, ulcers, or granulomas. Presence of pain or discomfort in the laryngeal region and voice characteristics are similar to the Type 4 patient; however, ventricular fold use may be prominent in this patient.
- Boone (1980) stipulated that functional dysphonias were those in which the voice problem was “related to faulty vocal fold approximation” (p. 315) in the absence of organic disease. Patients who were seen with dysphonia but normal vegetative function of the larynx (e.g., normal coughing, throat clearing) were referred to as psychogenic.
- Boone and McFarlane (1988) indicate that the patient is directly responsible for a functional dysphonia by using the laryngeal mechanism in a faulty manner. In these cases, the patient “may approximate the vocal folds in a lax manner,” “in a tight manner,” “or shut the voice off by bringing the ventricular folds together” (p. 52). In addition, the patient is often observed to have normal laryngeal structures, although “complete supraglottal shutoff (ventricular and aryepiglottic fold adduction)” (p. 53) is often observed.
- Aronson (1990a) sees “functional” as synonymous with “psychogenic,” with all associated voice problems attributable to some underlying “psychoneuroses, personality disorders, or faulty habits of voice usage” (p. 8). In addition, Aronson (1990a) believes that the term “psychogenic” has “the advantage of stating positively...that the voice disorder is a manifestation of one or more types of psychological disequilibrium, such as anxiety, depression, conversion reaction, or personality disorder, that interfere with normal volitional control over phonation” (p. 121).
- Unlike Aronson (1990a), Morrison and Ramage (1993) do not believe that “functional” and psychogenic” are synonymous. These authors describe a sub-
type of functional dysphonia that they refer to as "muscle misuse voice disorders" (MMVDs, p. 428). MMVDs may be associated with factors such as misuse of extralaryngeal musculature, poor laryngeal posture and misalignment, poor coordination between respiratory and phonatory functions, and excessive or inadequate laryngeal valving. The term "psychogenic" disorder is associated only with those functional dysphonias in which the observed dysphonia is a direct result of a psychoemotional origin as documented by means of formal psychological testing.

- Peppard (in Stemple, 1993) indicates that certain types of functional dysphonias may be related to altered feedback mechanisms (e.g., hearing impairment).
- Titze (1994) states that functional dysphonias may be related to improper use of the voice, although "some prefer to label all functional dysphonias as idiopathic, indicating that there is no known cause" (p. 307).
- In a review of functional dysphonias in adolescents, Peppard (1996) implies that cases of functional dysphonia (such as functional aphonia or puberphonia) are caused by inappropriate use/misuse of the larynx—"These two non-organically based voice pathologies involve the use by adolescents of relatively simple, often less efficient, modes of phonation" (p. 258). In addition, Peppard (1996) believes that not all functional dysphonias have a psychogenic base, because "some cases...may be the result of habituated patterns that, although inappropriate, were not caused by some underlying psychogenic disorder" (p. 259). According to Peppard (1996) key characteristics associated with functional dysphonias are (1) complete aphonia with very little attempt or struggle to produce phonation, (2) little or no indication of effort, and (3) relatively normal prosodic patterns. Similar to the report of Boone (1980), Peppard (1996) also reports that substantial discrepancies between speaking and vegetative voice use are often observed. In conclusion, Peppard (1996) states that functional dysphonia in adolescents may originate from psychogenic causes, efforts to cope with other communicative disabilities, and/or an habituated, inefficient manner of voice production.

- The multifactorial origins of functional dysphonia were stressed by Roy, Bless, Heisey, and Ford (1997a), who state that, "a disordered voice in the context of a structurally normal larynx is the product of a complex/blend of psychological, social, and physiological factors" (p. 322).
- Roy, McGrory, Tasko, Bless, Heisey, and Ford (1997b) state that, "functional implies a disturbance of physiological function rather than in anatomical structure" (pp. 433-444). However, the heterogeneous nature of functional dysphonia was observed by these authors in a review of the personality and psychological characteristics of 25 female functionally dysphonic (FD) patients. The overall conclusion by Roy et al. (1997b) was that FD patients “display an array of problems including multiple somatic complaints, diffuse anxiety, and dysphonia” (p. 449).

On the basis of the aforementioned opinions, functional voice disorders are those voice disorders in which (1) the patient's use of the voice mechanism is the underlying cause of the voice problem(s), and (2) the laryngeal mechanism appears normal or shows the development of a secondary pathological condition (i.e., a pathological condition that has developed because of the patient's abuse/misuse of the larynx). The faulty use of the laryngeal mechanism may be related to separate or combined factors of habituated muscle tension and vocal inefficiency, compensatory behaviors, and/or psychological stress. In effect, the patient's use of the vocal mechanism has resulted in the dysphonia—its origin is not attributable to some underlying physical or disease process.

**Organic Disorders**

Compared with functional disorders, the definition of an organic voice disorder seems to be relatively clear-cut. Organic voice disorders are those in which the underlying cause is a specific lesion affecting the laryngeal mechanism itself or within the neuromotor pathways serving the phonatory mechanism. An underlying physical disruption is responsible for the observed dysphonia, not faulty voice use. Commonality in definition for this term is reflected in the following statements:

- Boone (1980) states that organic problems are "related strictly to organic disease or structural problems" (p. 319).
- Boone and McFarlane (1988) identify organic disorders as those in which "the faulty voice is usually related more to a physical condition than to a vocal abuse-misuse per se" (p. 64).
- Titze (1994) states that “organic voice disorders are those for which a specific lesion can be identified in some organ of the body” (p. 307).

Although the underlying physical disruption is key in identifying organic disorders, it must be remembered that the effects of the physical lesion extend beyond perceptual and acoustic consequences. Bless and Hicks (1996) observe that "organic voice problems are multifarious" with effects that are "biological, psychological, and sociocultural" (p. 120).
Alternative Categories

The terms functional versus organic are not necessarily completely separate entities, because organic disorders can result in improper voice use, and improper voice use can result in organic lesions (Titze, 1994). For reasons such as this, several authors have chosen to categorize voice disorders in alternative categories rather than adhere to the traditional functional versus organic distinction as shown below.

- Weinberg (1983) categorizes voice disorders in terms of (1) abuse/misuse of the larynx; (2) voice disorders resulting from organic disease, physical trauma, or structural change; (3) voice disorders resulting from psychogenic factors; and (4) undetermined causes.
- Titze (1994) prefers to classify voice problems in terms of (1) congenital (structural) disorders; (2) disorders related to tissue change; (3) disorders related to neurological or muscular change; and (4) vocal fatigue.
- Verdolini (1994) distinguishes between physical (organic) and not strictly physical (nonorganic) causes. Within this framework, Verdolini (1994) categorizes voice disorders in terms of (1) discrete mass lesions of the vocal folds; (2) voice disorders caused by distributed vocal fold tissue changes; (3) organically based movement disorders; and (4) nonorganically based disorders.

OUTLINE FOR THE CASE HISTORY SESSION

Having reviewed the basic approach to voice diagnosis, equipment preparation, and definitions of key parameters by which we will describe the disordered voice, we are now ready to begin the diagnostic process. Figure 1-4 presents a flowchart summarizing the key elements of the case history session.

The VDP starts with the gathering of background information and significant information regarding the patient's possible voice problem(s) in the case history interview. The following are a number of key areas that should be explored with the patient. Wherever possible, it is best to incorporate these issues into a conversation with the patient/caregiver rather than in a "form-filling" exercise. In addition, the clinician will follow the interview with an examination of the speech and hearing mechanisms to identify any significant characteristics of form or function that may be related to the patient's voice deficits.

Pre-sessional Information

Before seeing the patient, it is generally advised to obtain as much background information as possible. Immediate access to information about the prospective patient may be affected by the particular setting in which one works, with the range of initial information extending from simple referral slips with next to nothing in terms of information about the patient's condition to extensive information obtained from medical charts and reports. It must be kept in mind that background information can present something of a double-
Edged sword to the clinician. On one hand, background information allows the clinician to develop initial hypotheses regarding the patient’s condition and underlying deficits. On the other hand, the clinician must be wary of being biased toward a particular clinical hypothesis before the actual collection of patient signs and symptoms has taken place in the diagnostic session. Clinical bias refers to factors that may predispose the clinician to select a particular diagnosis regardless of the actual data observed. The clinician must balance the possibilities presented by background information with the realities of the actual diagnostic session. The background information should spur the clinician on to develop clinical hypotheses, carry out any necessary research regarding the patient’s condition before evaluating the patient, and prepare any special tests that may need to be carried out (e.g., although we are focusing on voice evaluation, voice disorders may coexist with other communicative deficits that may also need to be evaluated). However, the clinician must always be prepared for the possibility that the patient may have characteristics that are quite different than background information has led us to believe.

Basic Identifying Information and General Medical History

Before the case history interview, the patient should be given a general case history form to fill out. Numerous examples of these forms are available; however, in using these forms, the clinician is primarily interested in documenting two aspects of the patient’s history that do not and should not have to be discussed at length in the interview setting:

1. Identifying information (name, age, date of birth, address, physician name, and contact information, etc.)
2. General medical background; developmental history (in the case of a child patient)

It is strongly suggested that the patient (or caregiver) fill out this general case history form before the interview. The general case history form can be reviewed by the speech-language pathologist and, if necessary, key informational points pertinent to the patient’s voice disorder can be brought up for clarification in the interview session. The voice clinician is encouraged to carry out a conversation with the patient regarding the key areas of case history questioning and not turn this into a form-filling exercise. It has been my experience that a clinician paying more attention to forms than to the patient appears amateurish. A clinician who appears comfortable with the form and content of the case history interview will be viewed with greater confidence by the patient; with greater confidence, the patient will be more willing to impart information to the clinician.

A review of most general case history forms reveals many areas of questioning that often have no significance to the current patient or the presenting voice disorder. The clinician must not waste time with this material. The clinician must select key areas of questioning that are pertinent to the possible disorder at hand and should always be prepared to answer why they are asking certain questions. This is especially important in certain sensitive areas of health history (e.g., sexual development, illicit drug use).

The Need for Laryngeal Examination Information

In voice disorders, the underlying laryngeal structures may appear normal (as in many functional disorders), show the presence of discrete or distributed benign lesions (e.g., nodules, polyps), or be affected by conditions that have significant, even life-threatening, effects on the patient’s overall health (e.g., progressive neurological disease, carcinoma). Unfortunately, all these conditions may have quite similar perceptual and acoustic characteristics. Colton and Casper (1996) demonstrate this fact quite effectively in their reviews of voice disorders related to abuse/misuse, nervous system involvement, and organic disease and trauma. The same perceptual and acoustic signs of hoarseness, increased perturbation levels, and increased spectral noise are reported for disorders as diverse as laryngeal carcinoma, unilateral vocal fold paralysis, laryngitis, and vocal nodules (Colton & Casper, 1996). Peppard (1996) also reports the same perceptual and acoustic signs as possible characteristics of functional dysphonia (with apparently normal larynges in most cases). Of course, perceptual and acoustic signs must be interpreted in light of significant information regarding the patient’s health, vocational/social/recreational voice use, etc., obtained by means of the case history interview and medical background. However, the point is clear that the voice clinician (particularly one with relatively little experience) could easily mistake a potentially life-threatening voice problem for one that is functional in nature. With this in mind, I believe that it is essential that referral be made to an otolaryngologist for all voice-disordered cases, with particular emphasis on those in which voice quality deviations are primary characteristics. The referral should occur, ideally, before the voice diagnostic session but definitely before initiation of any voice therapy.

Several authors have made valuable comments on the topic of when and why referral to the otolaryngologist should take place; these are found below.

- Weinberg (1983) described the importance of the laryngeal examination in identifying the possible cause of the voice problem, determining the need for medical treatment, and identification of physical factors that may limit voice change with treatment. The impor-
tance of this referral was emphasized by stating that "(n)...essential part of the diagnostic process for all patients with voice disorders is the completion of a general examination of the head and neck, including the larynx" (p. 159).

- Boone and McFarlane (1988) defer voice therapy until after medical examination because voice therapy may be contraindicated in some cases (e.g., papilloma, carcinoma). "In such cases, the delay of accurate diagnosis of these pathologies could be life-threatening" (p. 80).
- Haynes et al. (1992) emphasize the medical-legal implications and benefits of medical referral. These authors state that "the need for medical diagnosis cannot be overestimated because of the life-health implications for the client, the legal implications for the practicing clinician, and the requirement of third-party reimbursement agencies that services provided be medically necessary" (p. 285).
- Verdolini (1994) states a preference for otolaryngological referral for every voice patient seen. However, "adults older than 50, primarily men, who are hoarse or who have any change in voice for a period of two weeks or more that cannot be reasonably explained...are clearly at risk and should be referred to an otolaryngologist immediately" (p. 290).
- In particular reference to child patients, Case (1996) states that "any child with a voice disorder stemming from abnormal functioning of the vocal folds that produces a difference in voice quality, or in any way makes breathing difficult should be evaluated medically before management by a speech-language pathologist" (p. 72). Case (1996) also stresses that "it is better to err on the side of over-referral" (p. 73) rather than non-referral, particularly in the situation of the relatively inexperienced voice clinician.
- Even in cases of suspected functional dysphonia (voice disorders in which there is no apparent underlying organic pathological condition and the vocal mechanism appears normal), Peppard (1996) stresses that "ethical practice requires that before any management of voice pathology is started, an otolaryngologist skilled in laryngeal examination and voice disorders must perform a thorough (laryngeal) examination to rule out any possible organic base for the voice disorder" (pp. 259–260).

A complete laryngological examination should involve detailed medical history, head and neck examination, and visual examination of the larynx, with the final result being a medical diagnosis of the problem and recommendations for treatment (Stemple, 1993). Although some speech-language pathologists have acquired skills in laryngeal examination techniques such as mirror laryngoscopy and videostroboscopy, laryngoscopic methods must not be used by the speech-language pathologist for diagnostic purposes. The primary identification and treatment of laryngeal pathological conditions are the clear responsibility of the laryngologist (Boone & McFarlane, 1988). The speech pathologist should review the laryngological examination report for a specific medical diagnosis, description of possible underlying organic pathological condition, and physician recommendations. Although the laryngeal examination report will (generally) provide a diagnostic label for the patient’s condition, this does not eliminate the need for the voice diagnostic by the speech-language pathologist. Effective voice therapy recommendations will be made primarily on the basis of the detailed description of the patient’s voice characteristics and voice use described in the speech-language pathologist’s diagnostic report.

The Nature of the Problem

It is suggested that the clinician start the diagnostic interview with a general open-ended question such as “What can I do for you today?” or “Can you tell me why you are here today?” Several reasons exist for this type of opening question:

1. A general open-ended question provides the patient with the opportunity to describe the possible voice problem(s) in his or her own words. If the clinician began the interview with a closed statement such as “I see here that you have had a hoarse voice,” the result would quite possibly be (1) a very limited response from the patient (perhaps even a single word response) and (2) possible clinician and patient bias (the clinician is expecting a certain response, whereas the patient may feel that he or she should provide the expected response).

2. Colton and Casper (1996) have said that patients are often quite accurate in describing their problems. Therefore, we must allow the patient the opportunity and time to describe the problems he or she has been experiencing.

3. As the patient is speaking, the clinician is provided with (1) the first opportunity to observe some of the perceptual characteristics of the voice and (2) a chance to begin verifying some of the patient’s complaints (both verbal and what may have been reported in referral statements). Patient complaints are referred to as symptoms. One of the primary goals of the voice clinician is to verify as many patient symptoms as possible. Once symptoms are verified (i.e., directly observed by the clinician), they become signs (Colton & Casper, 1996). Perceptual judgments regarding the patient’s voice characteristics are often the first signs collected by the clinician during the
voice diagnostic—the initial descriptions of the patient about his or her voice problem(s) provide an excellent opportunity for these observations to take place.

4. As the patient is speaking, the clinician is also provided with the opportunity to visualize characteristics that may be accompanying the patient’s speech/voice characteristics. These characteristics may include excessive tension in the extralaryngeal region, limited oral movements, and rigidity in the mandibular region.

5. The clinician may start to get some inclination regarding the patient's personality traits and their possible relationship to the perceived voice characteristics and patient symptoms.

This initial aspect of the voice diagnostic interview is often described as an assessment of the nature of the problem (i.e., what is the problem and what are its characteristics). The patient’s description of the characteristics of his or her voice problem(s) allows “the clinician to better understand the disorder as the patient sees it” (p. 28, Prater & Swift, 1984). In many cases, the patient’s description of the voice problem (e.g., “My voice has had a raspy sound to it for the last few weeks”; “It gets hard to speak at the end of the day.”) will correspond closely to the perceptions of the clinician. However, other cases may show a lack of agreement with the views of the speech-language pathologist, with discrepancies caused by factors such as (1) patient misunderstanding of the problem (i.e., reflecting a possible lack of awareness of the disorder), (2) an inability of the patients to deal realistically with their voice deficits (Prater & Swift, 1984), or (3) intermittent voice problems with variable characteristics that may not be in evidence at the time of the interview.

It is hoped that the voice clinician is presented with a patient who is willing to impart information regarding the voice problem(s) relatively freely. However, some patients will require various cues so the nature of their deficits may be grasped. As an example, see below.

Clinician: “Can you please tell me why you are here today?” (general, open-ended question)
Patient: “I have been having trouble speaking lately.”
Clinician: “Do you have trouble with the way your speech sounds or in finding the right words to say?” (Focused, leading question)
Patient: “With the way it sounds.”
Clinician: “Can you describe for me how your voice sounds when you are having trouble speaking?”
Patient: “It sounds hoarse.”

In this example, the patient has answered the initial question regarding the nature of the problem with a short, vague answer. The clinician has responded with a follow-up question that guides the patient to a more descriptive answer that verifies the probable presence of a voice disorder. In the event that the patient is still unable to provide a reasonable description of the problems he or she has been experiencing, it is also useful to ask if the way the voice sounds today (i.e., during the interview) is the way the voice sounds when he or she is having the voice problems. If not, ask the patient to demonstrate the disordered voice.

In addition to the nature of the patient’s voice problem, observation of other patient symptoms (i.e., associated symptoms) may provide important information in reaching an appropriate diagnosis. Changes in associated symptoms over time may also be indicators of change in response to treatment (Colton & Casper, 1996). A number of neurological and stress-related symptoms may be associated with factors such as type of voice disorder and onset:

- Dysphagia
- Nasal regurgitation of food and liquids
- Weakness (either bilateral or unilateral) in other parts of the body
- Neurologically related speech and language deficits
- Characteristics of increased musculoskeletal tension
- Increased fatigue
- Heartburn
- Dryness in the mouth and throat

After initial questioning about the nature of the voice problem at hand, the patient must also be questioned in several other key areas so that a complete description of the presenting patient and his or her voice deficit may be acquired.

**Development of the Problem**

One of the most natural questions after the description of the initial complaint is “How long have you had this problem?” or “When did you first notice your voice problem(s)?” The description of the onset of the voice disorder can be an essential component of case history for both diagnosis and prognosis (Prater & Swift, 1984). The onset of the disorder may be characterized in terms of (1) long duration, gradual onset versus (2) those with sudden onsets. Voice disorders that have developed over a relatively long time generally do not have a specific date of onset that the patient can recall. Various types of voice disorders (organic and functional) may develop over weeks, months, or years. Types of voice disorders that may have a gradual onset are progressive neurological diseases and most laryngeal growths that affect vocal fold vibration (Colton & Casper, 1996). Patients who have had a slow, gradual onset to their voice problem may show less concern about their voice and/or less overall effect on their daily life because they have learned to cope with and compensate for their deficits. Boone and McFarlane (1988)
state that gradually developing dysphonias may suggest developing pathological conditions and that these patients may have a poorer overall prognosis for voice/behavior change.

In contrast to gradual onset disorders, those with a sudden onset are often more disturbing to the patient. Acute, sudden onset problems may pose a severe threat to the patient, certainly in terms of ability to carry out daily activities and possibly in terms of overall health (Boone & McFarlane, 1988). The patient may be able to describe the date and details of the onset of the voice disorder with great detail. Voice disorders that develop over a very short time (1 to 2 days or less) may be due to conditions such as severe laryngitis; psychogenic episode (conversion reaction); specific neurological insult (e.g., cerebrovascular accident, closed head injury); trauma to the larynx (external [e.g., blunt trauma to the neck region] or internal [e.g., sudden trauma to the vocal fold mucosa from a singular shouting/screaming episode]); voice disruption as a result of surgery (e.g., vocal fold paresis resulting from thyroid surgery; vocal fold ulceration resulting from intubation). Colton and Casper (1996) indicate that sudden voice change in the absence of symptoms suggestive of an organic pathological condition is often a key component of the psychogenic diagnosis.

**Variability and Consistency**

It is important for the clinician to discern whether the patient’s voice deficits have been relatively consistent over time or have shown degrees of fluctuation. Fluctuation back and forth between better versus poorer voice function is the hallmark of variability and differs from those patients who report consistent change in the voice in terms of steady improvement or worsening of symptoms (Colton & Casper, 1996). Disordered voices that periodically return to normal or near-normal characteristics may be functional in nature. On the other hand, most disorders that have underlying neurological dysfunction or definitive changes in vocal fold structure (e.g., mass lesions) generally do not improve spontaneously (Prater & Swift, 1984). An exception to this is the case of myasthenia gravis, a deficit of neural transmission affecting the myoneural junction. This disorder is variable over time, with patients showing progressive weakness with muscle use, followed by periods of improvement after rest. In those conditions in which dysphonia fluctuates, it is important to question the patient regarding the conditions that are associated with voice change (environmental effects; effects of vocational, social, recreational situations; specific periods of the day associated with poor vs. improved voice). In particular, the patient should be questioned about periods of emotional stress (personal, familial, work-related) that may cause the voice to worsen.

Several authors have commented on the variability of voice disorders. Boone and McFarlane (1988) indicate that hyperfunctional patients often report improved voice function earlier in the day, with increasing dysphonia with increased voice use. Voice that is worse in the morning versus later in the day may be a symptom of postnasal drip or gastroesophageal reflux disease (Boone & McFarlane, 1988; Colton & Casper, 1996). Haynes et al. (1992) state that factors such as personal habits (smoking, alcohol use), work conditions, or medical conditions may affect the variability of a voice disorder. Colton and Casper (1996) report that patients with psychologically based disorders often report considerable variability in their vocal function.

**Description of Voice Use**

Many voice disorders arise not from definitive underlying organic pathological conditions but from the manner in which the patient uses the phonatory mechanism. Therefore, it is essential that the clinician get a comprehensive view of how the patient uses his or her voice in various situations that may be found within his or her lifestyle. A description of voice use in vocational, social, and recreational settings is of great importance, with abuse, misuse, and overuse of the voice in these various situations often the cause of many functional voice problems (Boone & McFarlane, 1988; Colton & Casper, 1996). Because it is not always possible for the clinician to directly observe the patient in all the aforementioned situations, the patient may be encouraged to demonstrate the voice use in these various settings for the clinician (Boone & McFarlane, 1988). Haynes et al. (1992) state that the clinician must determine the vocal demands of the patient’s profession and also determine whether the patient must produce speech under adverse conditions. Several types of voice use and/or setting have been commonly associated with the development of voice disorders:

- Any work setting that requires the patients to use their voices for their livelihood (i.e., professional voice users [Colton & Casper, 1996]) may be potentially harmful in terms of the development of voice disorders, particularly if these patients have not had any professional voice training.
- Social settings such as gatherings at parties or in bars may present a potentially abusive environment.
- Sporting events present a potentially abusive situation for both spectator and participant. Forceful phonation that is potentially damaging to the vocal fold mucosa may accompany strenuous exercise (Colton & Casper, 1996).
- Singing in various situations (choir, theater, recreational musician) presents a potentially abusive condition for many, particularly if they have not had professional voice training (e.g., high-intensity voice in the presence of high levels of background noise; possibly under adverse conditions such as singing in bars in a smoky atmosphere; poor monitors).
Effects of Dysphonia on the Patient

Colton and Casper (1996) stated that “the severity of the (patient’s) reaction is not always proportional to the severity of the voice problem” (p. 190). This may be because voice disorders that affect the patient’s vocation or draw negative reactions from others will be of more concern to the patient than those voice disorders that do not adversely affect daily life. When asked about the effects of the dysphonia, some patients may be apprehensive about discussing what may be a potentially humiliating effect on their lifestyle. However, the clinician should ensure that expressions of denial regarding effects of the dysphonia are fully explored (Colton & Casper, 1996; Prater & Swift, 1984). It should be remembered that it may not be the actual reactions to the patient’s dysphonia that are as important as how a patient feels about the reactions of others (Prater & Swift, 1984). Feelings of stress, tension, and development of possible negative psychological outlook may arise as a result of reactions to dysphonia.

Health Status

The patient’s health history should be assessed to determine any possible relationship to the presenting voice disorder. Voice characteristics reflect not only the emotional state and personality of the patient but also the overall physical status (Colton & Casper, 1996). The voice clinician is particularly interested in health history in the following areas:

- Current health status.
- Injuries or trauma to the head and/or neck region.
- Neurological problems.
- Respiratory deficits.
- Allergy-related problems.
- History of frequent upper respiratory tract infections.
- Surgeries, particularly in which the patient may have been intubated.
- Smoking, alcohol use, illicit drug use.
- Ingestion of caffeinated beverages (coffee, tea, soft drinks).
- Use of prescription and over-the-counter medications (e.g., antihistamines, decongestants, diuretics).
- Endocrine imbalances.
- Previous occurrences of voice dysfunction or “loss” of the voice.
- Hydration status—Degree of internal hydration may affect the viscosity of mucus secretions and aids in lubrication of the vocal fold cover (Stemple, 1993). A well-lubricated cover protects the vocal fold during the vibratory cycle and aids in heat dissipation. Ingestion of six 8-ounce glasses of water or fruit juice per day is generally recommended.

Possible Causes

The voice clinician should ask the patient directly what he or she believes may have been the possible cause(s) of the voice problem(s) (Boone & McFarlane, 1988). Comparison of the patient’s response to descriptions of possible causes described by referral sources (e.g., physician, previous speech-language pathologist) may reflect on the knowledge and insight the patient has regarding his or her voice problem. Differing views on the possible cause of a voice disorder between the patient, referral sources, and family members may reflect (1) an inability to adequately understand what may have been explained to the patient, (2) an inability to recognize inner causes of the voice problem, or (3) an inability to accept and cope with the problem. Prater and Swift (1984) believe that differences in perception of what has caused the voice problem versus opinions offered by referral sources must be addressed if the patient is to have a positive prognosis for improvement in voice therapy.

Issues Dealing with Psychological Screening

Several authors have stressed the fact that voice disorders may be symptomatic of factors such as (1) inability to hold satisfactory interpersonal relationships (Boone & McFarlane, 1988), (2) struggle with social aspects of communication (Prater & Swift, 1984), and (3) psychological stress arising from diverse (financial, marital, personal, professional, physical, mental, or emotional) sources (Dworkin & Meleca, 1997). In order that these sources are fully investigated, psychological screening must be a critical aspect of voice diagnosis, particularly in the case of “functional” dysphonias. Aronson (1990b) stresses that a psychosocial history is crucial for successful diagnosis and therapy because it often uncovers “a disturbance in the patient’s psychologic equilibrium” (p. 288) that underlies the patient’s dysphonia.

“Functional” patients often have the following characteristics (Aronson, 1990b):

1. They describe the development of their voice problems in conjunction with the development of personal problems.
2. They are often reluctant to verbally express their conflicts.
3. They are patients with whom no one has bothered to take a psychosocial history.

In addition, evidence of psychological stress may be reflected in the following nonverbal cues (Andrews, 1995; Boone & McFarlane, 1988; Dworkin & Meleca, 1997; Prater & Swift, 1984):

- Sweaty palms
- Avoidance of eye contact
• Excessive postural adjustments
• Facial tics
• Masked facial expression
• Head and neck muscle tension
• Head and/or hand tremors

Although it is not within the purview of the speech-language pathologist to conduct formal personality testing, it is essential that the clinician derive at least an impression regarding the patient’s psychosocial behavior and basic adjustment to life (Aronson, 1990b; Haynes et al., 1992; Murry, 1982). Psychological screening of the patient should involve three key areas of questioning:

• Influence of stressors: Stressors are events that necessitate changes in how an individual conducts his or her life (Holmes & Rahe, 1967 in Goldman et al., 1996). Examples of stressors may be changing jobs, moving to a different part of the country, or going through a divorce.

• Influence of anxiety: Anxiety refers to the presence of an unpleasant emotional state or condition (Spielberger, Gorsuch, Lushene, Vagg, and Jacobs, 1983 in Goldman et al., 1996). Goldman et al. (1996) state that “different individuals may inherently experience different levels of anxiety and/or may react to a given stressor (e.g., life event) with different degrees of anxiety” (p. 45). Anxiety may be separated in two components: state anxiety versus trait anxiety. State anxiety refers to the patient’s present feelings of anxiety; trait anxiety refers to an individual’s persistent or personality-related level of anxiety (Goldman et al., 1996). Examples of anxiety could be feelings of worry or inadequacy.

• Somatic complaints: These are physical complaints, illnesses, weaknesses, etc. (e.g., headaches, heartburn). In some patients psychological stress and/or anxiety may manifest itself in the development of physical symptoms. Exhibit 1-1 provides an example of a simple survey developed by Goldman et al. (1996) that may be given to the patient to gather background information regarding common somatic complaints.

Several studies have directly examined the presence of factors such as stress, anxiety, and somatic complaints in a variety of voice disorders as shown below.

• Cannito (1991) examined psychometric measures of depression, anxiety, and somatic complaints in 18 female patients with spasmodic dysphonia (SD) and a group of matched normal controls. Results showed that 56% of the SD patients were either clinically anxious or depressed. In addition, the SD subjects demonstrated abnormally elevated levels of somatic complaints that were not observed in the normal control subjects. Cannito (1991) concluded that the identification and relief of emotional disorders in SD patients were critical for their effective management, and that any behavioral voice therapy gains would be temporary in patients who remained clinically anxious and depressed.

• Goldman et al. (1996) compared measures of psychological stress, anxiety, voice use, and somatic complaints in groups of women with vocal nodules. In addition, results were compared with women with functional dysphonia (i.e., presence of dysphonia in the absence of an organic pathological condition), as well as a group of normal controls. The Schedule of Recent Experience was used to obtain estimates of psychological stress, and the State-Trait Anxiety Inventory was used to assess levels of anxiety. Results indicated that both dysphonic groups (nodules and functional dysphonia patients) had greater than normal levels of anxiety (both state and trait) and a significantly greater incidence of somatic complaints than the normal controls. In addition, the functional dysphonia group showed a greater level of adjustment-related stress than the normal controls. These authors concluded that there appears to be “evidence of an association between selected psychosocial factors and hyperfunctional voice disorders” (p. 51). The assessment of psychosocial variables would appear to be an important component of a battery of tests used to assist in differential diagnosis and may be useful in identifying those patients who may benefit from counseling or formal psychological evaluation.

• Roy et al. (1997b) reported on results from the Minnesota Multiphasic Personality Inventory (MMPI) obtained from groups of FD women and a group of control subjects without voice disorders. Results showed that only 32% of the FD patients had “normal” profiles on the MMPI compared with 90% of the controls. In addition, the FD patients were significantly different from the control subjects on 7 of 10 personality scales. Two scales were observed to sufficiently discriminate the FD subjects from the controls: (1) a general index of frequency of somatic complaints and (2) a measure of diffuse anxiety. Roy et al. (1997b) concluded that somatic complaints and anxiety may be characteristic traits of FD patients. These traits “may constitute a persistent vulnerability (diathesis) for the development of tensional or somatic symptoms when under conditions of psychological distress” (p. 449). Failure to recognize the possible presence of underlying psychological stress and tension in FD patients may limit the long-term prognosis of these patients.

Psychological factors may be associated with voice disorders as (1) an underlying cause and/or (2) a result of
### Exhibit 1-1 Somatic Complaints Survey

<table>
<thead>
<tr>
<th>Question</th>
<th>Frequency Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you ever have trouble with heartburn, gastric reflux, or stomach upset?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>2. Do you ever have headaches?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>3. (when not exercising) Do you have pain in the chest or does your heart seem to pound or race?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>4. Fainting or dizziness?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>5. Trouble sleeping?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>6. (when not exercising) Do you have shortness of breath?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>7. Hot or cold spells? Are you easily chilled?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>8. Numbness or tingling?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>9. Poor appetite, associated weight loss?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>10. Overeating, associated with weight gain?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>11. Do you ever feel uncomfortable about eating or drinking in public?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>12. Do you ever feel like you have a lump in your neck or throat?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>13. Do you notice any tenderness in your back or shoulders?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
<tr>
<td>14. Do you have any pain or trouble swallowing?</td>
<td>Never, Infrequently, At least once per month, At least once per week</td>
</tr>
</tbody>
</table>

coping with an incapacitating voice disorder (Roy et al., 1997b). In this view, psychological factors should be considered with all voice disorder types (organic and functional/psychogenic), because “all disease processes carry components of emotional stress” (Colton & Casper, 1996, p. 196). Although the clinician may believe it necessary to refer the patient for formal psychological testing (Murry, 1982), it would appear valuable to include questions dealing with the presence of stressors, anxiety, and somatic complaints in the case history interview. Although the clinician may be met with some degree of patient resistance to this line of questioning (Aronson, 1990b), the possible value obtained in terms of diagnostic accuracy and success in treatment will be well worth the effort.

SPEECH MECHANISM EXAMINATION—BASIC OVERVIEW AND FOCUS ON ASPECTS OF LARYNGEAL EVALUATION

During a voice evaluation, our attention is primarily focused on the function of the respiratory/laryngeal complex. However, it is important that the speech clinician also assess the form and function of the other components of the speech mechanism (face and lips, mandible, velar function, etc.). In particular, the clinician should pay close attention to signs of possible neurological deficits in which abnormalities (unilateral or bilateral) in muscle strength, speed, range, accuracy, steadiness, and/or tone may be present (Darley, Aronson, & Brown, 1975). Neuromuscular deficits affecting one part of the speech mechanism may also be reflected in phonatory function. The clinician is directed toward a comprehensive oral-facial mechanism examination outline such as the Dworkin-Culatta Oral Mechanism Examination (Dworkin & Culatta, 1980) for an extensive assessment of speech mechanism function.

Several key components of the speech mechanism examination are focused on laryngeal function. Detailed evaluation of factors such as pitch, loudness, quality, and durational capability will be discussed in substantial detail throughout the following chapters and, therefore, will not be considered here:

- The sharp cough: During the speech mechanism evaluation, the patient should be asked to produce a sharp cough. Laryngeal weakness may be indicated by the presence of a weak, “mushy” cough (Prater & Swift, 1984).
- Vocal fold diadochokinesis: Observation of the patient's capability to carry out vocal fold diadochokinesis (VF-DDK, a.k.a. laryngeal diadochokinesis [L-DDK]) refers to the repetition of rapid adductory-abductory movements over time. Renout, Leeper, Bandur, and Hudson (1995) described diadochokinesis “as the action of arresting one motor impulse and substituting in its place a movement that is diametrically opposed” (p. 74). Patients may be asked to produce the syllable /hA/ (i.e., initiation of a centralized vowel with a glottal stop production [Verdolini, 1994]) or the syllable /hA/ (Renout et al., 1995). Use of the syllable /hA/ may be preferable because it requires the patient to shift rapidly between abducted and adducted positions. Patients are asked to repeat the selected syllable as fast as possible on one uninterrupted breath (Renout et al., 1995). The patient's production will ideally be recorded and then closely reviewed for the number of repetitions within a 5-second (Renout et al., 1995) or 7-second (Verdolini, 1994) time period. The VF-DDK is then generally reported as the number of syllable repetitions per second.

Verdolini (1994) mentions three characteristics of VF-DDK that should be observed by the clinician:

1. The rate of glottal plosives per second
2. The strength of the plosives
3. Steadiness (i.e., ability to produce rhythmic repetitions) overtime

In terms of rate, normal VF-DDK for adults has been reported in the range of five to six syllables per second (Canter, 1966; Shanks, 1966 in Renout et al., 1995) or similar in nature to the expected diadochokinetic rate for the syllable /kA/ (Verdolini, 1994).

- Head twisting during phonation: The action of twisting/turning the head sharply to the side has the effect of compressing the pyriform sinus on the side to which the patient is turning. In addition, this movement may serve to push the vocal fold on the side to which the patient is turning more toward the midline of the glottis. This may be an effective technique of improving voice function, particularly for those patients who show some degree of unilateral vocal fold paralysis/paresis (Boone & McFarlane, 1988; Hutchinson, Hanson, & Mecham, 1979; Logemann, 1998). The patient should be asked to twist/turn the head toward the right shoulder and then phonate (sustain the vowel /a/) —the procedure should be repeated by having the patient turn toward the left shoulder. The clinician should listen closely for changes in voice quality. If unilateral paralysis/paresis is present, the patient may be able to achieve better quality voice with the head twisted toward the weak side.

In addition to the aforementioned laryngeal tasks, the clinician should be aware of signs of excessive muscle tension that may be affecting voice production. Characteristics consistent with increased muscle tension may be head or
hand tremors, abnormal breathing patterns, visible tightness in the neck or jaw region, or unusual downward or upward excursions of the larynx during speech (Andrews, 1995; Boone & McFarlane, 1988; Stemple, 1993). The reader is referred to Chapter 6 for a detailed description of evaluation procedures and the possible effects of excessive musculoskeletal tension on voice production.

Hearing Evaluation

In addition to evaluating the integrity of the peripheral speech mechanism, it is also important to assess the hearing mechanism. Murry (1982) stresses that "under no circumstances should the voice evaluation be completed without information about the patient's hearing ability" (p. 485). Difficulty controlling vocal loudness or use of appropriate loudness levels in speech may result secondary to hearing loss (Colton & Casper, 1996; Murry, 1982; Stemple, 1993). Dworkin and Meleca (1997) state that abnormally quiet/soft voices may accompany cases of conductive hearing loss, whereas sensorineural hearing loss may cause the patient to speak in an abnormally loud voice. In the case of a conductive hearing loss, bone conduction is better than air conduction. Therefore, the patient may believe that he or she is producing an adequately loud voice when it is, in fact, too quiet. In sensorineural losses, both air and bone conduction are detrimentally affected, causing the patient to increase vocal loudness as compensation. With these possibilities in mind, hearing screening is certainly a necessary aspect of the voice diagnostic. Referral for a full audiological examination may also be necessary in some cases.

SUMMARY

The Voice Diagnostic Protocol is a set of clinical methods and procedures by which a comprehensive evaluation of phonatory voice disorders may be carried out. We begin the VDP with the gathering of background information and significant information regarding the patient's possible voice problem(s) in the case history interview. During this interview, the clinician should always be listening/observing so the statements that the patient/caregiver is providing may be verified. In this way, a number of the descriptions that we are provided with (symptoms) become verifiable facts (signs) (Colton & Casper, 1996). The clinician will follow the interview with an examination of the speech and hearing mechanisms to identify any significant characteristics of form or function that may be related to the patient's voice deficits. Finally, initial hypotheses dealing with the differential diagnosis of the voice problem are being formed at this point. These hypotheses will eventually be proved or disproved through (1) the addition of the formal observations we will be making in our application of specific tests/procedures and (2) comparisons with normative data.