CONTENTS

PREFACE

INTRO is designed for the beginning university-level student who has an interest in entering the field of communication sciences and disorders, or for a student who may be interested in entering one of the companion health professions. As is the case for any book claiming to be *introductory*, the aim is to paint a picture for the student using broad strokes. This book provides straightforward and essential information concerning a wide range of communication disorders found in children and adults.

The book is organized into four sections. Section 1 provides background information related to communication disorders. The chapters in this section cover the topics of communication science, the professions of audiology and speech-language pathology, and anatomy and physiology. Section 2 is concerned with developmental communication disorders, and includes chapters on child language disorders, child phonological disorders, fluency disorders, and cleft lip and palate. Section 3 covers acquired and genetic communication disorders. The chapters in this section describe voice disorders, neurogenic communication disorders, dysphagia, and genetic-based communication disorders. Section 4 addresses audition and contains chapters on hearing disorders and aural rehabilitation.

Unique aspects of the book include its use of an identical structure for each chapter to assist beginning students in grasping new vocabulary and concepts. Each chapter provides a focus on "past and present." An introduction to each of the various disorders would not be complete without knowing some of the fascinating historical background surrounding each disorder, as well as up-to-date information concerning current theories and research. The book holds worldwide appeal and is written for an international audience. A portion of each chapter is dedicated to cultural aspects of communication disorders, as well as prevalence information about various communication disorders as found in English-speaking countries around the world, including Australia, Canada, the United Kingdom, the United States, and New Zealand. The chapters include a series of FYIs (for your information), which present interesting and novel information about the particular topic area. A number of Web sites are listed at the end of the chapters to provide students an opportunity to learn more about each topic. Many of these Web sites provide links to streaming video examples.

The sole authorship of the book ensures a balanced writing style that is missing from existing introductory texts. *INTRO* is a clear and concise primer for students wishing to obtain fundamental information about the myriad of communication disorders that occur across the life span. For some, this information will serve as a springboard for pursuit of a professional career in audiology and speech-language pathology. For others,

my hope is that you will acquire an appreciation of the gift of communication that we so often take for granted.

I wish to thank the following reviewers for their comments on various chapters of the book: Kenn Apel, Maggie Lee Huckabee, Emily Lin, Greg O'Beirne, and Natalie Rickard. The book illustrations were made possible by the tireless work of Chia Pan. Finally, I am particularly indebted to Ray Kent who encouraged me to write a book of this kind and provided valuable oversight throughout its creation.

Michael P. Robb

8

VOICE DISORDERS

OBJECTIVES

After reading this chapter, the student should be able to:

- Demonstrate an understanding of anatomic, neurologic bases of vocal behavior, and physiologic processes of normal voice production.
- Demonstrate an understanding of the historical aspects of normal voice production and advances in the profession of otolaryngology.
- Demonstrate an understanding of current theories in voice production.
- Demonstrate an understanding of current research areas in the area of normal voice production and voice disorders.
- Demonstrate knowledge of the occurrence, classification, and symptoms of voice disorders.
- Describe appropriate counseling strategies and features of vocal hygiene.
- Demonstrate knowledge of laryngectomy including physiologic changes, and the various options for alaryngeal speech.
- Describe sociocultural influences in voice disorders.

INTRODUCTION

The use of **voice** is an integral part of communication. Dogs bark, growl, and howl. Cats purr and mew. Birds use different calls to warn other birds about threats or food. Each animal has a distinct voice and all animal species have some form of set vocal patterns that they use to communicate. The use of voice allows animals to recognize each other and convey messages like "get away," "danger," and "that feels good." Humans also use voice to communicate basic needs and wants. Because humans have also developed the capacity to use language, our use of voice has become more specialized. When we open our mouths to speak, the voice we use is uniquely special to us. Our voice is one of the defining features of our individuality, and it shares a lot of information about you. It tells others if you are happy or sad, healthy or unwell, young or old. Our voice can also reveal to others our background, such as the region of the world where we live, and even our social economic status. Although some people are expert at voice impersonations, our voice is what helps to define who we are. Indeed, many past and present celebrities are readily identifiable as a result of their voice. A list of some well-known voices is provided in Table 8.1. A "normal voice" is one that is pleasing to the ear, has a balance of sound through the mouth and nose, and matches a person's size, age, and sex. When a voice is produced that is perceived by others as unusual or strange and draws attention to the person who is speaking, it is quite likely the person is demonstrating a voice disorder.

Table 8.1. Unmistakable Voices of Well-Known and Some Not So Well-Known Celebrities

Humphrey Bogart	Actor
Bette Davis	Actor
Janeane Garofalo	Actor
Cary Grant	Actor
Arnold Schwarzenegger	Actor
Sylvester Stallone	Actor
Luciano Pavarotti	Singer
Elvis Presley	Singer
Justin Timberlake	Singer
Madonna	Singer
Kanye West	Singer
Bing Crosby	Singer
Barbra Streisand	Singer
Christopher Martin	Singer
Nat King Cole	Singer
Dan Castellaneta	Voice of Homer Simpson
James Earl Jones	Voice of Darth Vader
Andy Serkis	Voice of Gollum—Lord of the Rings
Frank Oz	Voice of Yoda—Star Wars
Mel Blanc	Voice of Looney Tunes cartoon characters
Don Pardo	Voice of Saturday Night Live introduction
Jim Henson	Voice of Kermit the Frog

Voice disorders occur in people of all ages. Voice disorders are also likely to be found among individuals whose occu-

pation is dependent on having a healthy voice. These vocal performers work in a variety of settings such as the music industry, theatre, clergy, the courtroom, or the classroom. Voice disorders reflect a special form of communication disorder that involves a close working relationship between the patient, SLP, and medical personnel. Amazingly, most instances of voice disorders are preventable by simply taking the proper precautionary steps. The fact that many voice disorders could be prevented also makes this form of communication disorder unique.

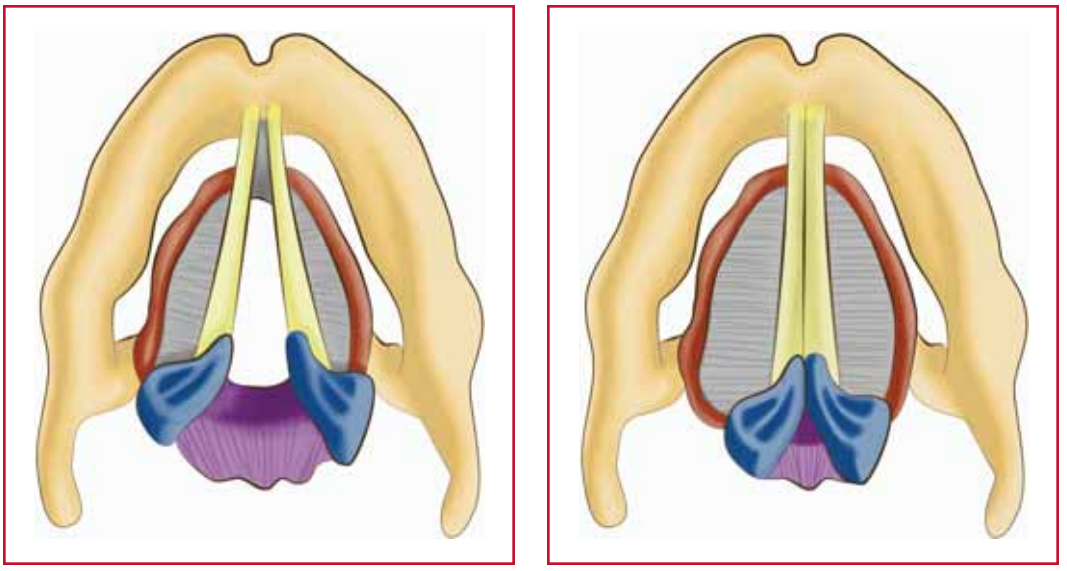
TERMINOLOGY AND DEFINITIONS

The key anatomic structures required for the production of voice can be found within the framework of the larynx. The **larynx** consists of a number of muscles and cartilages that work cooperatively to produce voice. To appreciate the nature of various voice disorders it is necessary to reacquaint ourselves with the basic anatomy and physiology of the larynx that was covered in Chapter 3. The larynx is positioned between the base of the tongue and the top of the **trachea** (windpipe), the passageway to the lungs. The larynx is not designed for the daily wear and tear we place on it for the production of voice. The key function of the larynx is to protect the breathing airway from foreign matter (i.e., food, liquid) that may be heading toward the lungs. The primary muscle involved in the generation of voice is the **thyroarytenoid muscle**, which is the formal term for the **vocal folds**. The thyroarytenoid muscle is comprised of two bands of smooth muscle tissue that lie opposite each other and sit prominently over the trachea. One end of the muscle is inserted to the inside of the thyroid cartilage. The other end is attached to the arytenoid cartilages. When the vocal folds are **abducted** (open) a space forms between the two folds known as the **glottis**. During breathing, air flows in and out of the lungs and passes through the glottis. When the vocal folds are **adducted** (closed), the space (or glottis) disappears. During heavy duty activities such as lifting or pulling, as well as during moments of swallowing, the vocal folds are adducted. A depiction of the vocal folds in abducted and adducted positions is shown in Figure 8.1.

To produce voice, we "exploit" the structure of the larynx by deliberating adducting the vocal folds and cause them to vibrate. The technical term for the physiological process of generating voice is **phonation**. To produce voice, the brain precisely coordinates a series of events involving the three subsystems of voice: (1) respiration, (2) phonation, and (3) resonance. The respiratory

FYI

A bird's larynx, called a **syrinx**, is anatomically simpler than that found in humans. Instead of being located at the top of the windpipe (trachea), it is located at the bottom, much closer to the lungs. This close proximity to the lungs is what allows very small birds to sing so loudly.



A B

FIGURE 8.1. A superior (*top-down*) view of the larynx depicting abducted (*open*) vocal folds (**A**) and adducted (*closed*) vocal folds (**B**).

system serves as the driving force of voice production. Without the forward (exhaled) flow of air from the lungs, we would not be able to produce voice smoothly. Upon exhalation of inspired air, the phonatory system is then responsible for closing the vocal folds in a deliberate but relaxed fashion. Once the vocal folds close, air from the lungs builds up underneath them until they are blown open, causing them to vibrate and produce sound. This sound then travels outward through the oral and nasal cavities, which serve to shape or resonate the sound quality as it leaves our mouth. The number of vocal fold vibrations per second determines the fundamental frequency (F_0) (or **pitch**) of our voice. A person's voice pitch can be high or low, variable (sing-song) or flat (monotonic). An individual might also demonstrate natural pitch breaks such as the case when young males undergo puberty. These hormonal changes can affect voice production as a young male's voice pitch begins to lower with age.

Voice **quality** refers to the subjective aspect of voice that is perceived by

FYI

A **castrato** is a male singer with an artificially created falsetto (high pitched) voice, the result of castration in childhood that stunts the growth of the larynx. The combination of the larynx of a boy and the chest and lungs of a man produced a powerful voice of great range and unique sound. Castrati were especially popular in churches and opera in Europe during the 17th and 18th centuries.

listeners. The size and shape of the vocal folds, as well as the size and shape of the oral and nasal cavities, help to determine the quality of voice. Terms such as a **breathy** voice (i.e., excessive and audible air leakage), **hoarse** voice (i.e., a grating voice with pitch breaks), or **hyper/hyponasal** voice (e.g., too much or too little voice through the nasal cavity) are examples of qualitative descriptions of voice. Another aspect of voice quality is the dynamic range or **register** of voice. A typical speaking voice has three registers that cover the low, middle, and high range of voice. The lowest register is called **pulse** register. The middle and high registers are called **modal**, and **falsetto**, respectively. Voice **loudness** is somewhat self-explanatory. A voice can be produced excessively soft or loud. The term **voiced sounds** encompasses all vowels, as well as approximately half of all consonants.

A voice disorder is a condition whereby which a person's voice pitch, quality, or loudness differs from that of people the same sex, age, geographic region, or cultural background. **Dysphonation** refers to any type of impaired voice and includes a condition called **aphonia**, which is the inability to produce any sort of voice. The term **phonatory disorder** is synonymous with a voice disorder. **Edema** refers to the buildup of fluid in tissue that is a natural, protective reaction to trauma or misuse. The vocal folds are a delicate muscle that is prone to edema, even under the slightest instances of misuse. Edema may also develop in tissue as a side effect to certain drugs. **Hyperfunctional** voice refers to speaking with excessive muscular effort and force resulting in a tense, high-pitched voice. **Hypofunctional** voice refers to inadequate muscle tone of the laryngeal mechanism during the production of voice often resulting in a weak, low-pitched voice that may also sound breathy. An **otolaryngologist** is a surgeon who specializes in disorders of the ear, nose, and throat (i.e., ENT surgeon, or otolaryngology, head, and neck surgeon). These professionals provide the initial diagnosis of a voice disorder. Most recently, the physicist **Ingo Titze**, who is one of the world leaders in the scientific study of the human voice, coined the term **vocology** to reflect the practice of voice rehabilitation (Figure 8.2).

HISTORIC ASPECTS OF VOICE DISORDERS

Man has sung through the ages and so it is not surprising to find accounts of normal or unusual voice production

FIGURE 8.2. Ingo Titze. One of the world leaders in the scientific study of human voice. Permission granted by I. Titze.

dating back many centuries. **Hippocrates** described the importance of the lungs, trachea, lips, and tongue in phonation in the early 5th century BC. In 350 BC, **Aristotle** was the first to mention the larynx in his book, *Historia Animalium*, in which he describes the neck as the part between the face and the chest. He noted that the larynx was located at the front of the neck, and it was through this structure that speech and breathing occurred.

Claudius Galen (129–200 AD) of Pergamum (Figure 8.3) was a physiologist considered the most important contributor to medicine following Hippocrates, and the founder of laryngology and voice science. Because dissections of human corpses were against Roman law in the second century, Galen uncovered information about laryngeal physiology and anatomy based on dissections of apes and pigs. Galen was the first to recognize that the larynx was the primary organ of voice, as well as for the regulation of breathing, and called it "an instrument of pneuma." Galen theorized that the larynx functioned similarly to a flute, where the vocal folds were the beak (mouthpiece) and the trachea was the body of the flute. Even though Galen learned much about the larynx, he had no ability to observe how it worked in a living person; therefore, knowledge regarding the specific aspects of voice production would not come about for many centuries.

Julio Casserius (1552–1616) was an Italian anatomist who made a major contribution to the study of voice with his 1600 publication of *The Anatomy of Voice and Hearing*. The book contained plates of the anatomy of the larynx in humans and mammals that were remarkably accurate from an artistic standpoint.

In 1741, a French anatomist **Antoine Ferrein** (1693–1769) (Figure 8.4) concluded that the larynx functioned similarly to that of a stringed instrument, in which the loudness and variety of tones

FIGURE 8.3. Claudius Galen. The founder of laryngology and voice science.

FIGURE 8.4. Antoine Ferrein. The 18th century French anatomist who coined the term *vocal cords.*

produced by the voice were a result of different degrees of tension and length. The concept of a vibrating string led Ferrein to develop the term **vocal cords**.

Henri Dutrochet (1776–1847) (Figure 8.5) was a French botanist who was primarily interested in plant physiology. His research involved investigations of the mechanisms responsible for physical movement in plants that led to his discovery of cell biology. His interest in the natural biological movement of organisms also carried over to the examination of certain excitability responses in animals, namely the production of voice. In 1806, he published *A New Theory of Voice* and theorized about the manner in which the vocal folds vibrated. His view was different from that of Ferrein—he recommended dropping the term vocal cords in favor of the term vocal folds because of the observation that the vocal ligaments of the larynx did not act as cords but like a reed of a clarinet.

FIGURE 8.5. Henri Dutrochet. Theorized about the manner in which the vocal folds vibrated.

In early days, the larynx was often times singled out as the root cause of various diseases. The primary symptom of many diseases such as diphtheria, typhus, and tuberculosis was a marked change in voice or coughing. Because the voiced failed to function normally, considerable interest grew in examining the larynx from both a physiological and a clinical viewpoint. By the early part of the 19th century, there was an overwhelming curiosity to examine the interior of the larynx through the development of various types of viewing instruments. However, it was not until the Spaniard **Manuel García** (1805–1906), created the laryngeal mirror in 1855 that clear examinations of the larynx were possible. García was an opera singer who had a personal interest in the physiology of voice production. Using a dentist's mirror, he placed the mirror in the back of the throat, and by positioning it at a proper angle, he was able to see the reflection of his vocal folds in an opposing mirror (Figure 8.6). The procedure was originally referred to as autolaryngoscopy but today is referred to as **indirect laryngoscopy**. García was hardly the first to look into the physiology of voice but what made his work different was that he experimented on himself, seeking the cause of his own voice disorder.

Elizabeth Blackwell (1821–1910) was the first woman to obtain a medical degree in the United States by graduating at the top of her class from the Geneva Medical College of New York. Blackwell enabled many more women to follow in her footsteps, including one of the first female otolaryngologists, **Margaret F. Butler** (1861–1931) (Figure 8.7). Dr. Butler initially decided to specialize in

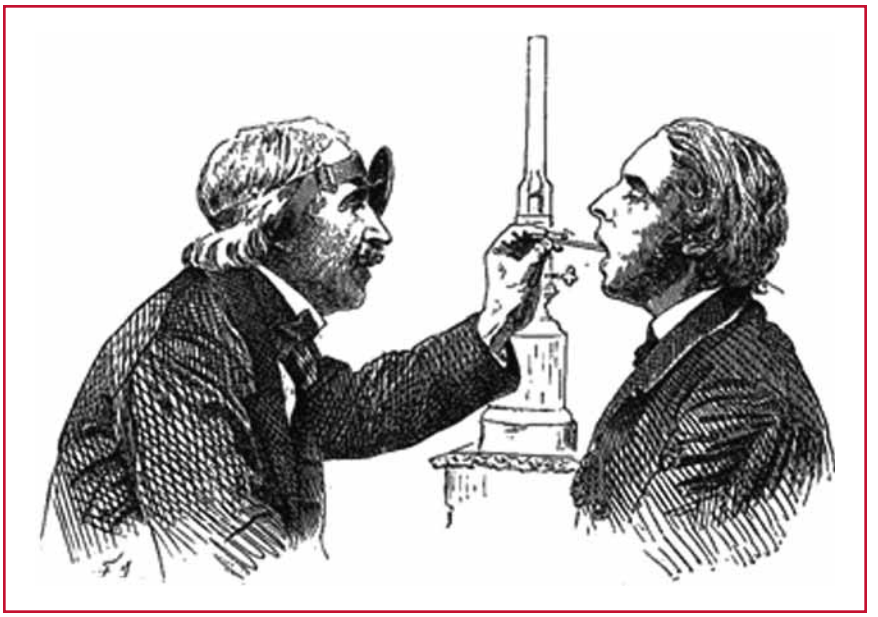


FIGURE 8.6. Manuel García performing an indirect laryngoscopy. Note that the light source is an oil lamp.

FIGURE 8.7. Margaret Butler. One of the first female otolaryngologists. Photo courtesy of Archives and Special Collections on Women in Medicine and Homeopathy, Drexel University College of Medicine.

gynecology, but recognized the need for her skills in otolaryngology. She was a clinical professor of laryngology and chief of the Nose and Throat Department at the Woman's Medical College of Pennsylvania in 1906. She was the sole representative from the United States at the First International Congress of Rhinolaryngology held in Vienna in 1908. She invented a number of ENT surgical in-

FYI

As late as 1947, there were 77 approved medical colleges in America with four still closed to women, including the world-renowned Harvard Medical College. Of the colleges that accepted both women and men during that time, most limited their enrollment of women to 5%.

struments, including a device to remove tonsils, called the Butler tonsil snare.

The assessment and management of voice disorders remained exclusively within the domain of otolaryngologists or singing teachers throughout the 19th century and the early 20th century. **Friedrich Brodnitz** (1899–1995) was a German physician who introduced the concept of **phoniatrics** (i.e., voice science) in the late 1930s (Figure 8.8). When he arrived in the United States in 1937, he was something of a novelty among ENT surgeons, having been trained in both otolaryngology and speech therapy. Prior to this time, there was little interest in the field of voice disorders among otolaryngologists. He established one of the first clinics in the United States for voice disorders, and devoted his life to problems of the voice, especially if they interfered with the livelihood of opera singers, actors, or other professional voice users. Dr. Brodnitz was a pioneer in the so-called chewing method, which were exercises designed to strengthen and realign the throat muscles to produce less strain and better control of the vocal folds.

The development of the speech-language pathology profession served to greatly advance assessment and treatment approaches to voice disorders. Two textbooks were published in the 1930s that contained material concerning voice disorders that were specifically designed for use by SLPs in their clinical practice. The first of these books was *The Rehabilitation of Speech* (West et al., 1937), followed by *Speech Correction: Principles and Methods* (Van Riper, 1939).

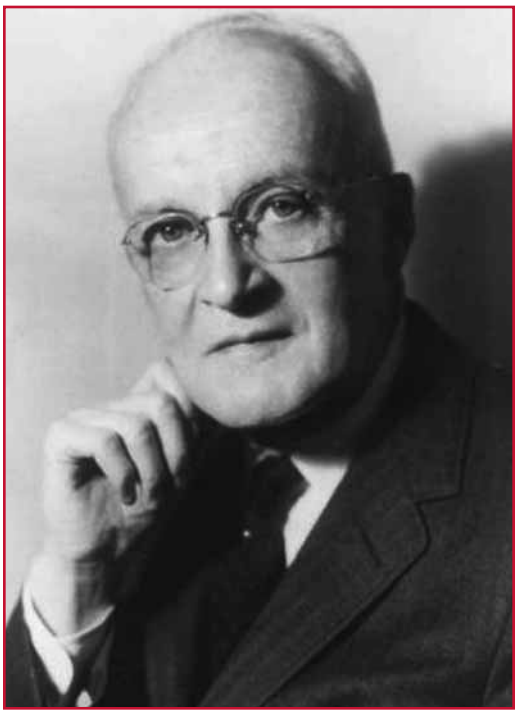


FIGURE 8.8. Friedrich Brodnitz. German physician who introduced the concept of *phoniatrics*.

TYPES OF VOICE DISORDERS

It is rare for a voice problem to occur instantaneously; they do not occur overnight. Rather, it is likely for a voice disorder to result from daily lifestyle behaviors, including occupational or social demands on the voice, as well as issues related to overall health. Voice disorders are classified according to the causal basis of the disorder. Colton et al. (2006) have organized voice disorders into three categories, those resulting from: (1) vocal misuse, (2) nervous system involvement, or (3) organic disease and trauma. Some of the more frequently encountered voice disorders found in each of these categories are highlighted below. A comprehensive list of the wide range of voice disorders can be found in Table 8.2.

Table 8.2. Types of Voice Disorders and the Vocal Quality Associated With Each Disorder (from Colton et al., 2006)

Classification	*Type and Vocal Quality*
Vocal Misuse/Phonotrauma	*Nodules*—breathiness and lowered pitch
	Polyps—breathiness and lowered pitch
	Edema—lowered pitch
	Laryngitis—breathiness and lowered pitch
	Aphonia—total loss of voice in spite of apparent normal vocal anatomy
	Puberphonia—unusually high pitch in spite of normal vocal anatomy
Nervous System Involvement	*Parkinson Disease*—monopitch and reduced loudness
	Myasthenia Gravis—breathiness
	Spasmodic Dysphonia—vocal strain/struggle
	Lesions of Peripheral Nerves—breathiness
	Huntington's Chorea—hoarseness
	Motor Neuron Disease—hoarseness or strain/struggle
	Multiple Sclerosis—impaired loudness control and hoarseness
Organic Disease and Trauma	*Laryngeal Granuloma*—hoarseness
	Contact Ulcer—hoarseness
	Papilloma—hoarseness
	Vocal Fold Hemorrhage—hoarseness and intermittent aphonia
	Laryngeal Web—hoarseness
	Inhalation Trauma—hoarseness
	Carcinoma—hoarseness

Vocal Misuse

The first type of voice disorders are those related to vocal misuse. In these particular disorders, the basic anatomy of the larynx is normal but the manner in which the larynx is being used contributes to a voice disorder. Vocal misuse (also called **phonotrauma**) is any improper or inefficient speaking behavior that can damage the vocal folds and cause temporary or permanent changes in vocal function, voice quality, and possible loss of voice. Examples of vocal misuse include excessive talking, throat clearing, coughing, inhaling irritants, smoking, screaming, or

10

DYSPHAGIA

OBJECTIVES

After reading this chapter, the student should be able to:

- Describe the basic anatomic and neuromuscular systems involved in swallowing.
- Demonstrate understanding of bedside methods of dysphagia assessment.
- Demonstrate understanding of instrumentation for the assessment and treatment of swallowing functions.
- Demonstrate knowledge of swallowing disorders including their etiologies.
- Describe current surgical techniques related to communicative and swallowing functions, and prosthetics.
- Describe various nonsurgical techniques related to the management of dysphagia.
- Describe multicultural considerations in the assessment and management of dysphagia.

INTRODUCTION

People swallow a thousand times or more each day. Swallowing begins at the lips and ends at the stomach. Swallowing is an activity that we tend to take for granted and perform easily. Yet the process of normal swallowing actually is a highly complex activity. Approximately 30 to 40 pairs of muscles, and at least six pairs of nerves, are involved in moving food from the lips to the stomach. To add to this complexity, these structures must perform in sequence with our breathing patterns to ensure the material being swallowed is directed toward the stomach rather than the lungs.

Among some disabled children and adults there is a breakdown in coordination of swallowing. This breakdown may be due to the person's: (1) wakefulness or awareness (2) brain functioning, and / or (3) muscular strength. The medical term for swallowing difficulty is called **dysphagia** ("dis fay ja" or "dis fah ja"). Dysphagia is one of the newest specialty areas in the SLP profession. Speech-language pathologists are called upon tens of thousands of times every day to evaluate swallowing in the estimated 18 million adults suffering from dysphagia in the United States and many millions more internationally. Dysphagia can severely affect an individual's quality of life and can also require a person to be dependent on others to be fed. Aside from these social issues, disordered swallowing may be life threatening. A person can run the risk of choking or having the airway blocked. Malnutrition, weight loss, and increased risk of dehydration are possible outcomes of prolonged periods of swallowing difficulties. Dysphagia also could pose a threat for respiratory infections resulting from food entering the lungs rather than the stomach. What is generally considered an automatic and even pleasurable experience can be one of discomfort and worry.

FYI

Most people believe they chew their food thoroughly before swallowing but this may not be the case. It is recommended that, on average, we should chew food between 20 and 30 times before swallowing. The more we chew the more saliva we generate which helps break down food and facilitate the digestion process.

TERMINOLOGY AND DEFINITIONS

There are a variety of terms associated with normal and disordered swallowing. To begin, the formal term used to describe the act of normal swallowing is **deglutition**. We swallow for two reasons. The first reason is maintenance. This type of swallowing is used to remove the natural buildup of saliva in the oral cavity. **Maintenance** swallowing tends to occur subconsciously and happens even when we sleep. Maintenance swallowing also has been observed in infants prior to birth. Although in most cases this type of swallowing occurs automatically, we also can swallow deliberately whenever we feel like clearing our throats. The second reason we swallow is for **ingestion**. This type of swallowing is for the consumption of liquids and foods. Ingestive swallowing of **per oral** (p.o.) nutrition (i.e., food

taken by mouth) requires that we are awake and cognizant of the presence of food or fluid in the mouth. Typically, the process of swallowing food involves chewing. The technical term for chewing is **mastication**. When we chew, the food inside the mouth is turned into a soft mass referred to as a **bolus**. During deglutition, the bolus moves through the tubes of the digestive system in waves of alternating contraction and relaxation (i.e., snakelike movement) known as **peristalsis**.

The term dysphagia is a combination of the prefix *dys* (disordered) and the Greek word *phagein* (eat). Dysphagia can occur at locations anywhere from the lips to the stomach and is found in approximately 7% of the general population. Among people aged 50 years or older, the occurrence of dysphagia ranges anywhere from 15% to 30% and may be as high as 60% in acute hospital wards and nursing homes. The frequency of occurrence of dysphagia does not differ between females and males. A primary indicator of dysphagia is coughing moments after swallowing. This can lead to **aspiration**, which refers to the situation where food or liquid inadvertently enters the breathing airway (trachea) before, during, or after the swallow (Figure 10.1). Among individuals who experience a stroke, it is not uncommon for them to be susceptible to aspiration during the earliest days of recovery. A condition known as **reflux** is also indicative of dysphagia. Reflux is a backward flow of food or liquid. Esophageal reflux is a condition in

FYI

We swallow during our sleep; however, much less so compared to when we are awake. On average, we swallow approximately once per hour.

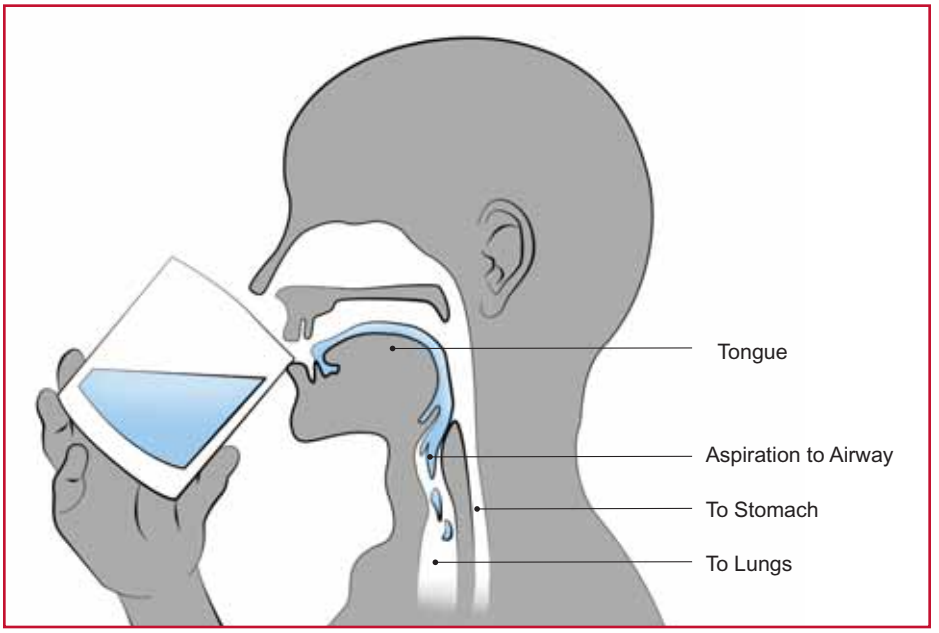


FIGURE 10.1. Illustration of aspiration.

which the stomach contents flow backward into the esophagus.

Due to the obvious anatomic and physiologic processes underpinning swallowing behavior, it is important to be familiar with some of the primary physical structures involved in swallowing. Most of the key structures were covered in Chapter 3. A summary of these structures and their function in regard to swallowing is provided in Table 10.1. A corresponding illustration of the

Table 10.1. Primary Anatomic Structures Involved in Swallowing

Structure	*Description*
Oral Cavity	
Lips	Are responsible for sealing the oral cavity for preparation of swallow.
Tongue	Is responsible for pushing food toward the hard palate and back toward the pharynx.
Teeth	Are required for mastication (chewing).
Saliva	A special digestive enzyme for softening and moistening food. Glands are located in the cheeks, the underside of tongue, and the underside of mandible.
Nasal Cavity	
Velum	The soft palate muscles that rise during swallowing to close off the nasal cavity from the oral cavity.
Pharynx	
Muscles	A series of overlapping muscles in the throat cavity. The cavity extends from the back of the nasal cavity to the top of the larynx.
Epiglottis	A leaf-shaped cartilage which protects the vocal folds from collecting foreign matter and diverts the bolus around the airway.
Valleculae	The space between the base of the tongue and the epiglottis. The collection of residue in this space indicates a problem with tongue movement during swallowing.
Upper Esophageal Sphincter	A specialized muscle that separates the pharyngeal and esophageal cavities.
Trachea	
Cartilage	A series of cartilaginous rings that form the wind pipe. The trachea branches off from the base of the pharynx and leads to a series of smaller tubes comprising the lungs.
Esophagus	
Muscle	A long muscular tube that branches off from the pharynx and sits behind the trachea. This is the “food tube” that serves as the conduit to the stomach. The esophagus normally is collapsed and only opens during swallowing.

major structures used for swallowing and their anatomic location is provided in Figure 10.2.

From start to finish, normal swallowing is almost instantaneous activity, taking around 2 minutes to accomplish. Although swallowing is relatively quick and automatic, the process of moving liquid or food towards the stomach is extremely complicated. To conceptualize swallowing, it is useful to think of the process of swallowing as occurring in a series of three sequential stages: (1) oral, (2) pharyngeal, and (3) esophageal. Each stage represents specific physiologic activity in the progression of moving material from the mouth to the stomach. These three stages are illustrated in Figure 10.3.

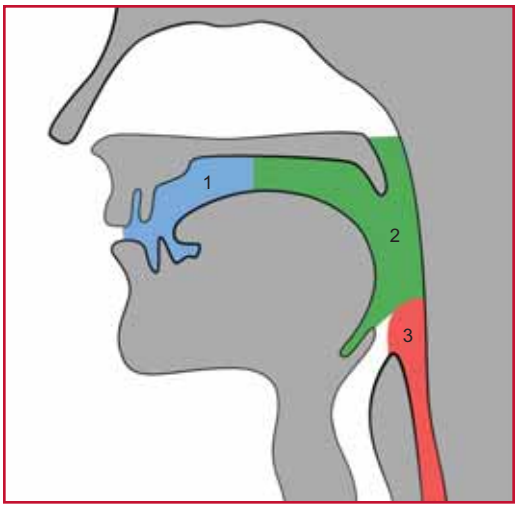


FIGURE 10.3. The three stages of swallowing, including the oral (transfer), pharyngeal (transport), and esophageal (entrance) stages.

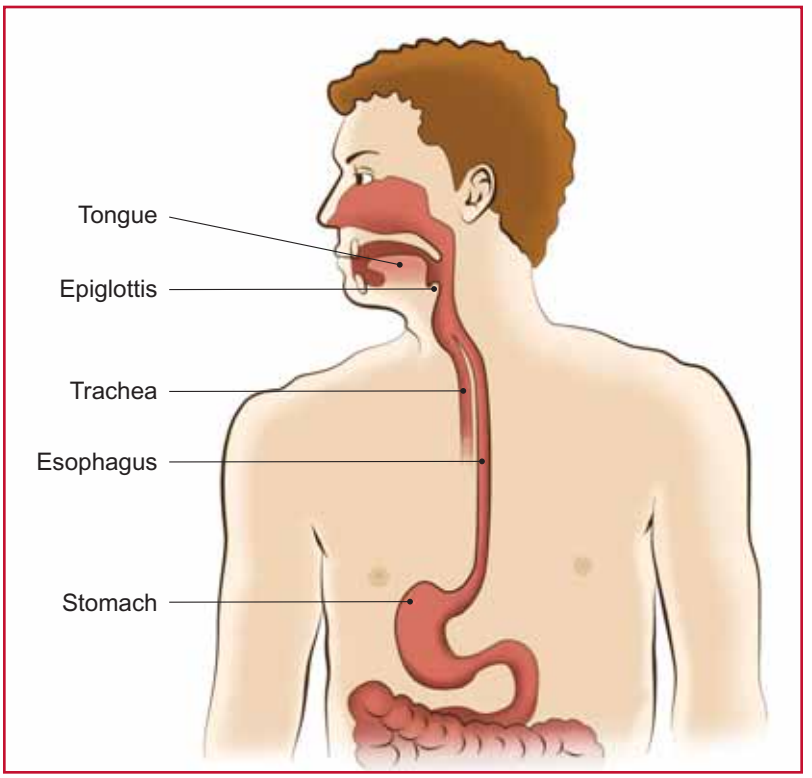


FIGURE 10.2. Swallowing anatomy.

Stage 1 of Swallowing: The Oral (Transfer) Stage

The **oral stage** begins when we take food or drink into our mouths. Once material is placed in the mouth, the lips are sealed. The tongue then moves the material around the mouth for mastication. Saliva helps to soften and moisten food to create a bolus that is easy to swallow. This stage is one of preparation for swallowing by transferring the food or drink to the back of the mouth. We maintain normal nasal breathing during this stage.

Stage 2 of Swallowing: The Pharyngeal (Transport) Stage

The **pharyngeal stage** begins once the tongue transfers the food or liquid bolus to the back of the throat. Once the bolus reaches the back of the mouth, a reflex automatically occurs that transports the bolus through the pharynx. During this stage of the swallow, the nasal cavity is closed off from the oral cavity to prevent food from going through the nose. Muscles of the throat serve to shorten the pharynx and push the food toward the esophagus. The larynx closes tightly and breathing stops to prevent food or liquid from entering the lungs.

Stage 3 of Swallowing: The Esophageal (Entrance) Stage

The **esophageal stage** begins when the bolus is directed away from the trachea and enters the esophagus, which is the canal that carries food and liquid to the stomach. The esophagus is separated from the pharynx by a sphincter muscle which relaxes and is pulled open by muscles of the throat. After the bolus exits the pharynx, the normally collapsed esophagus is pushed open by the propelling bolus. During this process of the swallow, peristalsis occurs to move the bolus through the esophagus into the stomach. Once the bolus is fully in the esophagus and the sphincter is again closed, the airway is re-opened and normal breathing resumes.

HISTORIC ASPECTS OF DYSPHAGIA

To an outsider, an SLP may not seem to be the most qualified individual to deal with swallowing difficulties. By the very nature of their professional title, an SLP supposedly works exclusively with speech and language problems. Yet some SLPs have been indirectly treating aspects of dysphagia since the early 1930s. This early work was focused primarily on young children with oral-motor disorders such as cerebral palsy, as well as head and neck surgery patients. One of the core features in the educational curriculum of an SLP student has always been knowledge of the anatomy and physiology of the head, neck, and respiratory system. This coursework, along with extensive clinical education with clients who have disordered function of the oral, pharyngeal, and laryngeal systems, made SLPs the prime candidates for assessing and treating dysphagia. Prior to the involvement by the SLP profession, no other health professions specifically included dysphagia as part of their scope of practice.

Two individuals from the United States are often given credit for advancing the profession in regard to helping people with swallowing problems. The first is **George L. Larsen**, who in the early 1960s developed the SLP program

FYI

One of the pioneers of speech-language pathology, Dr. Grant Fairbanks (1910–1964) died by asphyxiation as a result of choking on a piece of food that had lodged in his throat. Dr. Fairbanks died tragically while onboard an airplane in 1964 traveling from San Francisco to Chicago (see also Chapter 5).

at the Seattle Veterans Administration Hospital. Due to Larsen's employment in a hospital setting, he was aware of a large number of people who experienced difficulties with both speech and swallowing. To his dismay, he found that most SLPs tended to address only speech difficulties, leaving the swallowing difficulties to either go unaddressed or be dealt with by some other health profession (e.g., neurologist, otolaryngologist, nurse, physiotherapist, occupational therapist). Larsen believed that a patient who showed both speech and swallowing problems was the result of a similar nervous system disturbance. Therefore, by working on swallowing it would be expected that improvements in speech production would follow. Although this was not found to be the case, Larsen is credited with establishing a range of therapeutic techniques to help individuals regain the ability to swallow. His approach to the evaluation, management, and treatment of swallowing difficulties was considered artistic and intuitive (Miller & Groher, 1993).

The next major advancement in dysphagia was made by **Jeri A. Logemann** who completed a PhD from the Department of Communication Disorders at Northwestern University (Illinois) in the early 1970s with particular emphasis in dysphagia (Figure 10.4). Logemann applied a more rigorous scientific methodology to assessing and treating dysphagia compared to Larsen by undertaking controlled examinations of swallowing physiology and treatment efficacy. Logemann also made major contributions in regard to outlining the

FIGURE 10.4. Jerilyn A. Logemann has made important clinical contributions to the field of dysphagia. Permission granted by J. Logemann.

essential educational and clinical training required of SLPs dealing with dysphagia. Education in dysphagia is now a standard component among all SLP university programs worldwide.

It is important for SLPs to recognize that due to the complex medical issues involved in management of the dysphagic patient, this area of clinical practice is by necessity and design an interdisciplinary clinical field. Appropriate management includes input from a variety of health professionals, including but not limited to neurology, otolaryngology, radiology, and dietetics. Indeed substantial research that guides our understanding of swallowing comes from outside of speech language pathology. One such example involves the research of the French physiologist **Andre Jean** (Figure 10.5). Over the past 20 years, Professor Jean has been instrumental in defining the role of the brainstem in normal and disordered swallowing.

FIGURE 10.5. Andre Jean has examined the role of the brainstem in normal and disordered swallowing. Permission granted by A. Jean.

The past 20 have witnessed a dramatic growth of involvement by SLPs in the field of dysphagia both in regard to service delivery and research. More than one-third of present day SLPs deal with dysphagia as part of their annual caseload. For SLPs working in a health care setting, dysphagia can often exceed 80% of the total caseload. In 1986, a research journal entitled *Dysphagia* was created. This is an interdisciplinary journal dedicated exclusively to the many aspects of normal and disordered swallowing.

TYPES OF DYSPHAGIA

There are three generally agreed-on types of dysphagia: (1) **oropharyngeal dysphagia**, (2) **esophageal dysphagia**, and (3) **functional dysphagia**. The first two types are related to known anatomic or physiologic difficulties with swallowing. The third type is a form of dysphagia with no known causal factors.

Oropharyngeal Dysphagia

This is the most common type of dysphagia. The anatomical description of this form of dysphagia indicates that the condition affects the transfer of liquid or food from the mouth and pharynx into the esophagus. This type of dysphagia results from abnormalities of muscles, nerves, or structures of the oral cavity and pharynx. Attempts to swallow food may be misdirected upward toward the nasal cavity. Many patients choke or cough when swallowing and may have

food or fluids enter the trachea instead of the esophagus. This can allow harmful bacteria to grow in the lungs or bronchial tubes, resulting in a condition known as **aspiration pneumonia** (Figure 10.6). Patients often complain of difficulty chewing and swallowing both liquids and foods. They appear to have a hoarse or wet-sounding voice which may be accompanied by bad breath.

Esophageal Dysphagia

This type of dysphagia is less common than oropharyngeal dysphagia and arises during the latter stages of the swallowing sequence. Patients with esophageal dysphagia have difficulty passing a bolus of food from the esophagus to the stomach. Patients usually complain of swallowing solid foods, as opposed to both solid foods and liquids. Their swallowing difficulty is due to either an obstruction or stricture (i.e., narrowing) of the esophagus or else problems with peristalsis (i.e., a motility problem). Patients report that it feels like food is stuck in the base of their throat or in the chest. Patients generally point to their neck as the primary region of the problem, indicating that the site is at or below this region.

Functional Dysphagia

The least frequently occurring type of dysphagia is known as **functional dysphagia**. This form of dysphagia is poorly understood, primarily because there is no identifiable anatomic cause. Examples of functional dysphagia include difficulty in swallowing pills and

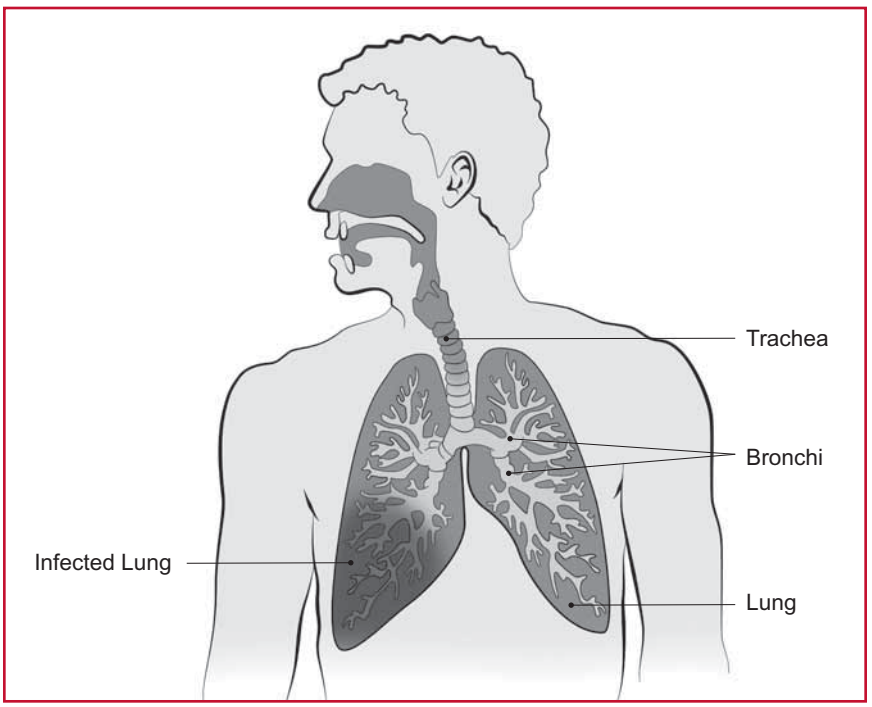


FIGURE 10.6. Illustration of lung infection that can result from aspiration.

a condition known as **globus**, which is the sensation of having a lump in one's throat. The International Foundation for Gastrointestinal Disorders defines functional dysphagia as the sensation of solid and / or liquid foods sticking, lodging, or passing abnormally through the esophagus. Functional dysphagia is diagnosed based on symptoms present for at least 3 months and not associated with anatomic abnormalities such as reflux (Galmiche et al., 2006).

CAUSES OF DYSPHAGIA

Although there are three primary types of dysphagia, the causes of dysphagia are numerous. Swallowing requires healthy functioning of many different oral structures, muscles, and nerves, so a wide range of medical and even dental conditions can cause dysphagia. Dysphagia actually is a symptom of an underlying condition. A list of likely causes associated with the three types of dysphagia is provided in Table 10.2. A common cause of oropharyngeal dysphagia is a **cerebrovascular accident** (i.e., stroke). Dysphagia can result from strokes that affect the area of the brain that controls motor actions, particularly the frontal lobes of the cerebrum. Strokes that affect the area of the brain that houses the **swallowing center** also can lead to dysphagia. The swallowing center is made up of a network of neurons in the brainstem that are responsible for the reflexive act of swallowing. About half of all stroke victims experience some degree of dysphagia during the earliest days following the stroke. In most cases, normal or near-normal swallowing function returns within 1 week poststroke,

Table 10.2. Some Likely Causes of Various Types of Dysphagia

Type	*Cause*
Oropharyngeal dysphagia	Stroke Parkinson disease Muscular dystrophy Cleft palate Tumors of mouth or pharynx Drug/radiation-induced dry mouth (xerostomia)
Esophageal dysphagia	Esophageal spasms Tumors of the esophagus Age-related changes of motor function of esophagus Lack of involuntary esophageal peristalsis (achalasia) Pill-induced inflammation of the esophagus Esophagitis due to gastroesophageal reflux disease (GERD) Narrowing of lower esophageal ring (Schatzki's ring)
Functional dysphagia	Stress