

CHAPTER 1

INTRODUCTION

A growing number of people seek the services of a speech-language pathologist for a variety of communication difficulties and swallowing problems. This is largely due to an increase in geriatric and medically fragile populations (Foster, 1987; Scott, 1998). Better and more effective health technology now extends life but, at the same time, challenges the functions of communication and the activities of daily living. Where mortality rates were once high, people are now living longer. Babies born to drug addicted mothers, for example, are living past their first year, and later, demonstrating significant developmental problems that require new problem solving measures (Scott, 1998). This same idea is true for patients who are treated for laryngeal cancer. The progression of cancer can often be stopped by the surgical removal of the larynx and many people are still able to speak, but use an artificial larynx to do so. The focus of this study deals with the use of artificial larynx devices.

Regardless of whether a person speaks normally or with an artificial larynx, communication is an essential part of human existence. On social and interpersonal levels, Fisher (1975) explains that speech communication is an effective modality used in interpersonal relationships, and without speech, humans would be reduced to animal sounds and unintelligible gestures. Fisher notes that speech is the conveyor for a

persons= Ainnermost thoughts, their dreams, ambitions, sorrows and joys” (p. 6).

Duguay (1978) explains that people are complex beings that work, play, and interact with others. Importantly, Duguay not only explained that speech is used to convey needs and obtain information, but also to control the environment. Some populations place a higher premium on effective communication skills used to obtain favorable status. Van Riper (1984) suggests that America is such a society, one that is highly competitive and upwardly mobile, placing higher importance on the ability to communicate than other facets of life. Because Americans often value material possessions and social status, Van Riper explains that speech becomes a critical skill that is needed to procure the things and positions that our society tends to hold as important for upward mobility.

On a psychological level, Maslow (1970) describes a hierarchy of needs whereby people have a broad order of requirements. Ranked in order, Maslow explains the hierarchy to include physiological needs, safety needs, love and belongingness, esteem needs, and self-actualization needs. Shaped in a pyramid configuration, Maslow believes that people cannot move to the next level unless they are first fulfilled at the lower levels. As a parallel, associating speech communication and achieving basic needs, Lerman (1991) explains that humans “speak because of social needs, physical needs, identity needs and practical needs” (p. 32). Because speech communication is the catalyst by which people achieve their needs, Lerman adds that Aan inability to communicate means an inability to control, influence, express feelings and desires, or to protect oneself” (p. 32).

In cases where people are unable to communicate, or where the ability to communicate has been denied, Lerman (1991) reports that a person=s physical and mental health, and even life itself, can be adversely affected. Described as the medicine of

psychotherapy, Van Riper (1984) contends that speech is the safety valve of our emotions, for it is with speech, that people express their loves and hates.

Complications of speech communication, on a clinical level, can manifest themselves under the broad categories of speech, language, fluency, and voice disorders (Van Riper, 1978). Speech production problems, most commonly seen as articulation difficulties, affect the speech mechanism and the function of the tongue, lips, mandible, teeth, and palate for speech. Errors of this nature may involve slurring, lispings, sound substitutions, and a host of other problems. Language problems show themselves as internal processing errors or limitations involving the symbol system and rules that govern a given language. Such problems may involve decreased vocabulary, word finding difficulties, impaired ability to formulate sentences and other problems. Fluency disorders involve the flow of speech which may include speech that is stuttered or speech that is produced with excessive speed. Finally, voice disorders are conditions that involve volume, quality, pitch, and resonance of the voice. Individuals who have lost their natural voice and use an artificial larynx fall within this latter category.

There are numerous etiologies, or reasons, why speech communication disorders occur. In general categories, these include developmental, neurological, psychological, physical, and idiopathic. Developmental problems can occur as a person moves through the spectrum of normally acquired behaviors. The developmental period in humans is the time between birth and 18 years old (Nicolosi, Harryman & Krescheck, 1983). Developmental disorders are a discrepancy between the natural progression of skills and actual, observed skills. Neurological disorders can occur as a result of strokes or progressive neurological conditions such as Parkinson disease or multiple sclerosis.

Neurological conditions can also occur due to the infiltration of tumors or the severing of cranial nerves. Psychological or psychosomatic communication disorders refer to disorders that have their roots in psychogenic causes such as conversion reaction which is the transformation of an emotion into a physical manifestation (Aronson, 1985). Physical communication problems are the result of trauma or ablative surgery that removes, destroys or impairs the function of a component speech organ. Disease processes such as emphysema or chronic obstructive pulmonary disease that are often the result of tobacco use are also under the umbrella of physical communication problems. Finally, the term, idiopathic disorders refers to any disorder that has no known cause.

Most communication disorders leave the patient with some amount of residual communication function. Along these lines, Van Riper (1978) defines abnormal speech as speech that is highly conspicuous, impairs communication, or causes the speaker or listeners to be distressed. In a minority of cases, however, some patients experience an illness that completely obliterates the function of speech and voice. The surgical procedure known as total laryngectomy is one such condition. Total laryngectomy refers to the complete removal of the larynx. The vast majority of patients who undergo this surgery do so to stop the progression of cancer. In an effort to treat a fatal disease, the vocal mechanism is completely lost.

For the thousands of patients who have undergone the laryngectomy procedure, otherwise known as laryngectomees, an artificial larynx is used to restore communication. Artificial larynx devices, sometimes known as artificial larynges or an electrolarynx, provide an alternative signal which is used for voicing. As the name would suggest the artificial larynx is a prosthetic device that takes the place of the human

anatomical mechanism for voice (Nicolosi, Harryman, & Kresheck, 1983).

Although various populations, such as trauma victims, combat injuries, and industrial accidents can result in laryngectomy, the vast majority of artificial larynx users are cancer victims (Van Riper & Emerick, 1984). The American Cancer Society (ACS) indicates that approximately 50,000 laryngectomees exist in the United States (ACS, 1993) with an estimated 3000 new laryngectomy procedures performed each year according to Waldrop and Gould (1994). According to the 1999 cancer statistics (ACS, 1999) however, 10,600 new cases of laryngeal cancer were diagnosed last year. A substantially lower number of laryngeal cancer cases actually go on to have laryngectomies. This is largely due to early diagnosis and other non-ablative therapies such as conservative surgery, radiation, or chemo treatments that control cancer. Shah and Lydiatt (1995) explain that radiotherapy combined with chemotherapy is a useful treatment in patients where preservation of the larynx has been feasible.

Not all laryngectomees, however, use an artificial larynx to communicate after their surgery. Salmon (1999) reports a survey study that addresses the types of alaryngeal speech used by laryngectomees. In 1997 and 1998, a total number of 203 laryngectomees responded to a questionnaire. Respondents were obtained at laryngectomee meetings in San Diego, California; Daytona Beach, Florida; Minneapolis, Minnesota; Austin, Texas; and Indianapolis, Indiana. Results show that 40 percent of the respondents use an artificial larynx to communicate. Twenty one percent use esophageal speech, and 35 percent used tracheoesophageal puncture speech. Salmon shows that a trend favoring tracheoesophageal puncture speech is currently observed. Regardless of the primary mode of communication, the majority of respondents express that the

artificial larynx is most frequently used as a back-up device. From this data, Salmon contends that speech therapists can assist their laryngectomee patients achieve excellence and acceptance of whatever speech technique is used.

Laryngectomees are optimally treated by the speech therapist beginning on a preoperative level through to outpatient services. Preoperative therapy focuses on education and counseling while inpatient and outpatient care addresses actual training of the speech modality chosen for rehabilitation. At the conclusion of outpatient services, many therapists will not see their patients again.

When selected properly and with training in their use, Salmon (1978) explains that the artificial larynx is a tool that places many laryngectomees back into the mainstream of life. In his discussion, Lerman (1991) reports on the benefits of the artificial larynx. He indicates that in addition to providing an immediate means of oral communication, the artificial larynx: 1) decreases anxiety and tension in the laryngectomee and his or her family 2) provides an opportunity to practice compensatory movements for articulation and the control of stoma noise which are important if the patient is to eventually learn other speech techniques 3) may be economically useful for patients who must return to work immediately 4) reduces the possibility of acquiring bad habits that can occur after the laryngectomy, such as attempts to whisper or communicating by writing and 5) allows a viable technique for communication when other speech techniques may fail. With consideration to present research literature, the focus of this inquiry involves the artificial larynx and the perceptions of reliability as viewed by laryngectomees and speech-language pathologists.

The Artificial Larynx And Its Use

The artificial larynx serves to replace a voicing signal that would otherwise be produced by the normal larynx. Artificial larynx devices have been generally categorized into two types which include pneumatic and electronic devices (Blom, 1978). The electronic devices are further divided into intraoral and neck-type devices (Lerman, 1991).

Pneumatic devices use pulmonary air from the tracheostoma to act upon a reed or membrane. Air moving past the membrane results in a vibration or tone that travels through a tube and into the mouth of the patient. The tone that is delivered into the user's mouth is then articulated into intelligible speech. Pneumatic devices in recent years include the Tokyo, the Van Humen DSP8, and the ToneAire. Pneumatic devices are rarely used in the United States because they are considered to be cumbersome and less hygienic than electronic devices. Interestingly, Western Electric produced several pneumatic artificial larynx devices during the first half of the 1900's. What is most striking about this fact is that the pneumatic devices contain no electric components which is seemingly unrelated to the company's name. Western Electric's interest in the pneumatic devices, however, enabled early laryngectomees to communicate over the telephone which was an electrical device.

Electronic artificial larynx devices, under the intraoral category, operate by electronically generating a tone that is placed directly into the user's mouth by way of a tube. These devices operate using batteries to activate a sound generator or oscillator. By pressing a button to activate the sound generator, a voicing signal enters the mouth where it can be articulated for speech. Since the 1970's the Cooper Rand device has been

available as an intraoral device (Luminaud, 2000). Manufacturers of the neck-type devices have made adaptors that quickly and easily transform a neck-type device into an intraoral device. Salmon (1999a) expresses that the intraoral adaptor has become more prevalent in the last 2 or 3 years because of its easy application.

The electronic neck-type artificial larynx devices are the most commonly used devices in the United States (Lerman, 1991). Neck-type devices are hand-held and operate using a battery. Using an oscillation circuit, neck-type devices generate a tone that is delivered from a rigid diaphragm. The diaphragm, when activated and held to the neck, creates a tone that penetrates the neck tissues and enters the vocal tract. This new voicing signal is then articulated into speech by moving the tongue, lips, and mandible (Blom, 1978). Several neck-type devices are available in the United States according to manufacturing advertisements and dealer catalogs. These include the: Amplicord Model 55; Amplicord Model 95; Dendrick, NuVois I and NuVois II; Optivox; Romet; Servox Inton; SolaTone; and TruTone. Generally, each of these machines use a rechargeable battery, an oscillation circuit, and a voicing coil attached to a plunger and drum assembly. With controls for frequency and intensity, the plunger strikes a drum repeatedly to create a tone that can be electronically adjusted in pitch and volume. While most devices are generally adjusted for pitch prior to use, the TruTone has a dynamic control button that alters the pitch during speech. This feature on the TruTone allows for inflection and intonation that is commonly observed during exclamations, asking questions, and singing (Griffin Laboratories, 1999). Each of these devices have battery chargers and adaptors for intraoral use.

Speech-Language Pathologists, also known as speech therapists or speech

pathologists, (these terms will be used synonymously in this paper) comprise the professional discipline working with many laryngectomees and their speech rehabilitation. These therapists hold at least a masters degree in the area of communication disorders. Many have received some training regarding laryngectomee rehabilitation at the university level. Others have received supplemental training at state and national conventions. But not all speech-language pathologists, however, are trained or have clinical experience with laryngectomees. Considered a specialty area within the realm of voice disorders (Aronson, 1985), a relatively small portion of therapists are experts in the area. The American Speech and Hearing Association (ASHA, 2002) listed 544 therapists in the voice specialty area.

Historically, artificial larynx devices experienced a time when they were rejected by physicians and speech pathologists. William Diedrich (1978) explains that the artificial larynx was abandoned in place of the less successful esophageal speech. During the 1950's and 1960's, workshops and literature were geared against the use of the artificial larynx. As a consequence, many laryngectomees were silenced. As editor of the book, *The Artificial Larynx Handbook*, Salmon (1978) explains that attitudes toward the artificial larynx began to change in the 1970's. Because many patients did not acquire serviceable esophageal speech, instruction regarding the artificial larynx became useful to many clinicians after a long hiatus.

Overall, there are two ways that laryngectomees procure an artificial larynx. According to Salmon (1999b), artificial larynx devices are either provided with the assistance of a speech therapist or by the independent selection of a patient. Some patients simply do not have access to a speech therapist for a variety of reasons. Possible

reasons may include inaccessibility due to geographical and travel constraints, poor or no insurance coverage, no physician referral, or emotional factors. Very seldom does the surgeon or physician recommend a given artificial larynx. In cases where the laryngectomee has contact with a speech therapist, certain experiences about a given device are shared. Not only is the therapist available to show placement and activation techniques, but also, the therapist has specific knowledge of the equipment that he or she is demonstrating to the patient. If a device is prone to certain problems, the therapist can share this information with the patient as well. In cases where the laryngectomee does not have access to a therapist, Salmon (1999b) suggests that the patient may be making an uninformed choice when selecting an artificial larynx. Because the procurement of an artificial larynx does not necessarily require a medical prescription, anyone can buy a device from a dealer or over the internet. Even if a patient obtained his or her first device from a therapist, he or she would not necessarily need to return to the therapist to get another one. Salmon (1999a) notes that laryngectomees, when accompanied by a spouse and given a choice of machines, will often select the most expensive device due to pressure from the spouse to do so. On the other hand, when patients are given the opportunity to trial machines, they often select one of a median or lower price. In any case, machines that are obtained without the feedback and direction of a trained therapist may or may not be a satisfactory match for the patient (Salmon, 1999b). The device may not provide optimal voicing or it may require frequent repairs and servicing.

As was mentioned before, communication is an important facet in the lives of people. Not only does speech communication provide the catalyst by which people develop themselves on a social level, but also, speech is the fastener that binds people

together socially. Psychologically, communication is important for the realization of needs (Lerman, 1991) and the control of one's environment (Duguay, 1978).

Laryngectomees who use an artificial larynx do so on a daily basis to convey their wants, needs, desires, thoughts, and dreams. They use the device for inquiries and control. As a replacement for a lost organic larynx, the artificial larynx returns the laryngectomee into the mainstream of life. If the artificial larynx should fail for any given reason, speech communication can be dramatically reduced or completely eliminated until the device can be replaced or repaired. Problems with the reliability of an artificial larynx, create great concern on behalf of the laryngectomee and his or her family according to Lerman (1991). In cases where the device is partially failing, the laryngectomee may only be partially understood when speaking. The sound quality of the device may be such that it calls more attention to itself or is excessively unnatural. Additionally, where a family member has a hearing loss, the failing device may not provide understandable speech (Salmon, 1999b).

Need for Further Study

Within the area of artificial larynx devices, studies focus their attention on perception, intelligibility, and acoustics as they relate to different devices and users (Qi & Weinberg, 1991; Goldstein & Rothman, 1976; Watterson et al., 1998; Wilson et al., 1998). No quantitative information is available that yields data describing the perceived reliability or selection of artificial larynx devices.

While some information is available on the roles of speech-language pathologists in working with laryngectomees, little or no information is available to explain why a

therapist may or may not recommend a given machine. From a survey administered to both laryngectomees and their spouses, Salmon (1986) was able to determine the therapy needs of this group. Based on the responses of 13 laryngectomees and 53 spouses of laryngectomees, Salmon developed a checklist. The protocol was developed to help direct the speech-language pathologist when working with laryngectomees and their family on a pre and postoperative level. When asked what information laryngectomees should have prior to their surgery, the most frequently occurring response was “information about the different ways to communicate after surgery” (p. 280). As ways to increase encouragement, many of the respondents indicated the following: 1) being visited by a laryngectomee, 2) being told that an artificial larynx can be used, 3) being told that they will resume a normal life, 4) being told about financial assistance, 5) hearing that they will be able to return to work, 6) hearing that surgery will be painless 7) that they will need to be patient with themselves after surgery and, 8) hearing that they will learn to cope. In keeping with the needs of the laryngectomee, Salmon indicates that the role of the speech-language pathologist should include the selection and instruction of the artificial larynx. Besides the instruction of the artificial larynx, Salmon (1999b) contends that this aspect of postoperative therapy include a discussion of the advantages and disadvantages of the various brands. Importantly, Salmon reports that many laryngectomees are faced with the selection process without the aid of a speech-language pathologist. As a replacement for a lost organic larynx, the artificial larynx returns the laryngectomee into the mainstream of communication and life. If the artificial larynx should fail for any given reason, communication can be dramatically reduced or completely eliminated until the device can be replaced or repaired.

The reliability of the various artificial larynx devices remain ambiguous to many therapists and patients due to a gap in the current literature. Hillman (2000) acknowledges that there is a need to expand the current information about surgical procedures, artificial larynx devices, and the people who use them. He states that methods are needed to measure the functional impact of laryngectomy on voice, speech, and quality of life. Additionally, Hillman reports that advances in technology should focus their attention on improving alaryngeal communication and particularly the artificial larynx. There are several groups that would benefit from this type of information, including speech-language pathologists, laryngectomees, their family, manufacturers, and distributors. Lerman (1991) contends that malfunction of the artificial larynx has a negative affect on the laryngectomee and his or her family. When a device fails, deficits in communication are immediately observed on a partial or complete basis. A malfunctioning device may impair communication or call undue attention to the user. Despite the need to do so, there is a gap in the current research that addresses the reliability of artificial larynx devices presently on the market.

Lerman (1991) expresses that a variety of mechanical difficulties may occur with regard to the artificial larynx. Breakdowns in reliability include: 1) no sound production, 2) weak sound production and, 3) intermittent sound. For each problem area, Lerman offers several possible causes. Since the artificial larynx is an intricate device that generally cannot be serviced by the user, Lerman (1991) offers only simple solutions to cure the problem. Lerman's possible causes of artificial larynx failure place heavy emphasis on the battery and include: 1) dead or discharged battery, 2) battery placed in the reverse position, 3) wrong type of battery, 4) loose fitting battery, 5) battery contacts

corroded, 6) on-off control is broken, 7) transducer exposed to moisture and, 8) malfunction of the volume control. For more complicated problems, beyond those involving the battery, Lerman recommends that the device be returned to the manufacturer for repair. Offering some cautions to avoid problems, Lerman also expresses that the artificial larynx should not be bumped, dropped, or exposed to moisture.

Two groups of people find themselves closest to the artificial larynx: speech-language pathologists who prescribe the devices to their patients, and laryngectomees, who are the end users of the equipment (Salmon, 1999b). While Lerman (1991) offers some information on device breakdowns and reliability, little is known about the experiences of breakdowns involving these two groups. The features and characteristics perceived to be important by laryngectomees and speech-language therapists is unknown. Importantly, the perceptions of these groups may be dissimilar.

In his recent address to the National Institute of Dental and Craniofacial Research (NIDCR), Robert Hillman (2000) reports a need to develop tools to measure the functional impact upon laryngectomees. According to Hillman, research and advances in technology should specifically focus on the artificial larynx. As an inquiry that seeks to describe the artificial larynx experiences of speech therapists and laryngectomees, this study fills an important gap in existing research. This research will query the experiences of these two groups and will describe their experiences with artificial larynx reliability. The study will identify aspects of artificial larynx devices that are important to these two populations.

Purpose of the Study

Artificial larynx devices are an important and essential communication tool primarily used by laryngectomees. As a critical communication device and a link to society, artificial larynx devices may vary in their frequency of failure and breakdown. Additionally, certain factors may influence how the devices wear out or break. By surveying the groups most closely associated with the artificial larynx, perhaps artificial larynx devices and the people who rely on them can be matched to obtain an optimal performance. To this end, this study explored facets of the artificial larynx using a survey study model. Through queries of laryngectomees and speech pathologists, perspectives of the various artificial larynx devices, including why a given device is selected over another were surveyed. The features and characteristics of artificial larynx devices deemed important to laryngectomees and therapists were studied.

Research Questions

In an attempt to offer new information on the topic, the following research questions were asked:

1. What are the practices of speech-language pathologists regarding advising laryngectomees in the use of artificial larynx devices?
2. What are perceived causes of artificial larynx problems among speech-language pathologists and laryngectomees?
3. What features and characteristics are important to speech-language pathologists and laryngectomees?

4. Are there significant differences in perceived importance of features and characteristics between speech-language pathologists and laryngectomees?
5. What artificial larynx devices are most highly recommended by speech-language pathologists and used by laryngectomees?
6. How satisfied are speech-language pathologists with the artificial larynx devices they recommend, and how satisfied are laryngectomees with the artificial larynx devices they use?
7. What is the perceived reliability of the artificial larynx devices recommended most by speech-language pathologists and used most by laryngectomees, and are there significant differences between these groups?

Using a survey design to query speech therapists and laryngectomees, an attempt to answer the above research questions was made. Survey questions presented to the two groups had counterparts, or associated questions, for comparison purposes. Statistical analysis was used to determine correlations of responses between these groups.

According to Babbie (1995), the survey design is the best way to obtain original data.

Babbie also suggests that the survey design is an excellent model for measuring attitudes and experiences of a given population.

Significance of the Study

According to Robert Hillman (2000), there is a recognized need to widen what is currently known about artificial larynx devices and the people who use them. Speech-language pathologists prescribe and treat patients in the use of artificial larynx devices.

Laryngectomees, on the other hand, are the end users of these devices. Because of this relationship, it is important to compare the perceptions of these two groups. Speech therapists who are the prescribing source in many cases, may or may not be in tune with the needs of the laryngectomee who actually uses the device. Not only does this have implications for speech therapists and laryngectomees, but also manufacturers. For speech therapists who are faced with prescribing artificial larynx devices, information obtained from this study may offer data that will assist the clinician in selecting equipment. Therapists may obtain a better understanding of the artificial larynx and recommend a more accurate match between the patient and the device. A better understanding may improve treatment by decreasing the amount of time necessary to train patients. Patients who favor a particular feature of a given device may offer suggestions to new users. By looking at the areas that cause artificial larynx devices to breakdown, recommendations may be offered in an effort to preserve the equipment. Lerman (1991) states that breakdowns of the artificial larynx cause anxiety, not only to the laryngectomee, but also the family members surrounding the patient. By having a wider understanding of the problems that surround artificial larynx devices, patients and family members can be given ways to avoid circumstances that cause such anxiety. Finally, manufacturers of artificial larynx equipment will be able to use this information to make more reliable devices. Based on preferences noted by patients and therapists, manufacturers may have new information that can aid in the development of more user-friendly equipment.

Definition of Terms

The following terms are used throughout this piece and are listed here for clarification.

Alaryngeal Speech

Speech without a larynx (Nicolosi et al., 1983).

Artificial Larynx

An artificial source of voicing used by persons who have undergone a total laryngectomy (Singh & Kent, 2000).

Laryngectomee

A laryngectomee is an individual who has had their larynx surgically removed, usually due to cancer (ACS, 1990).

Laryngectomy

The surgical procedure of removing the larynx or A voice box (ACS, 1990).

Speech-Language Pathologist or Speech Therapist

The professionals educated in the study of human communication, its development, and its disorders (Singh & Kent, 2000).

Overview of the Dissertation

Chapter II reviews the body of literature that relates to classic information and current studies surrounding artificial larynx devices. The review of the literature addresses scientific documentation of artificial larynx devices, current trends, and the roles of speech-language pathologists in working with individuals who need such devices.

Chapter III outlines the methodology and design of the study, and describes the research instruments and data collection procedures. Chapter IV presents the data results and analysis. Finally, Chapter V presents conclusions and discussion of the findings. Some recommendations for speech-language pathologists, manufacturers and further research are offered.