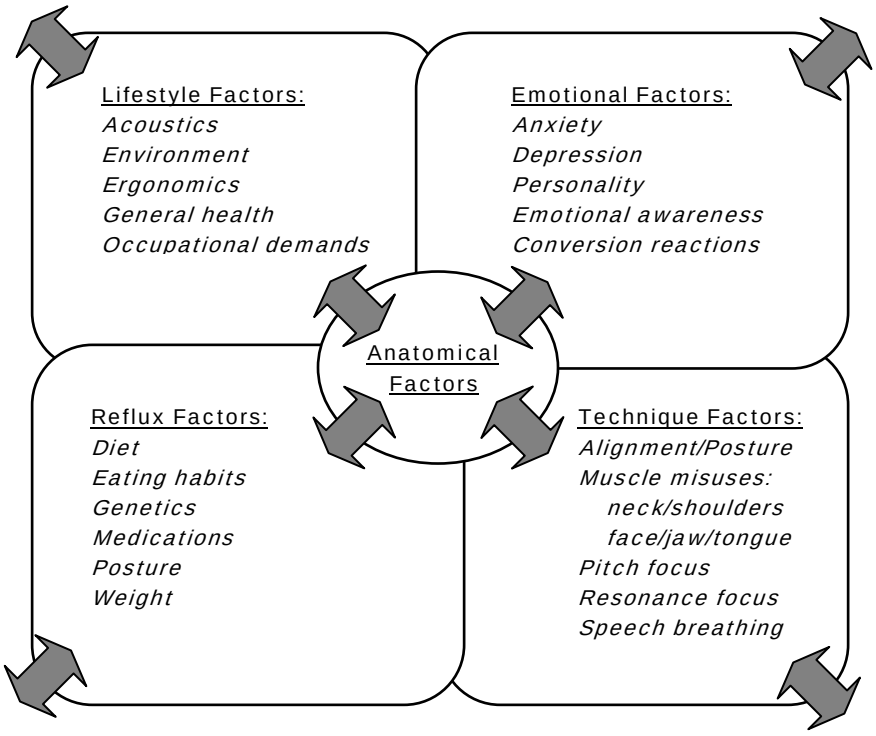
What causes Voice Dysfunction?

Disorders of the voice and larynx (voice box) are often caused by a complex interaction of factors. Members of the inter professional voice care team in the PVCRP/Voice Clinic have developed a model for evaluating individuals with voice dysfunction. The ALERT model guides clinicians in a comprehensive approach to evaluation of the problem and informs the most appropriate treatment plan.

The ALERT model provides a framework to encompass four basic realities of human function and behaviour that may contribute to voice/laryngeal dysfunction. It reminds us to consider vocal anatomy and physiology within the context of the living, breathing, emoting human being. Four broad areas of human function: **L**ifestyle, **E**motion, **R**eflux and **T**echnique may influence muscle tone and coordination for vocal communication/performance as well as primary laryngeal functions (breathing, airway protection, coughing, etc.). The model allows for a primary or secondary anatomical factor, such as lesion(s) or other disease processes, to be superimposed on the four core platforms influencing muscle postures and activities in the vocal system. Predictable developmental or aging factors could be considered within this anatomical sphere. Within the ALERT model, a distinct anatomical factor affecting muscle tone/coordination is always considered as having a potential influence or interaction with the four core functions. More specifically, pathological processes that effect changes in anatomical relationships will inevitably lead to adjustments in laryngeal posture and muscle use in an effort to adapt to or compensate for changes in anatomical status. Conversely, lifestyle, emotional, reflux and technique factors may be seen as causing or exacerbating anatomical changes. In some cases one or more of the four core factors are the primary cause of anatomical features. Each of the 5 ALERT components will be discussed in greater detail below.



The ALERT Model of Voice Dysfunction: This model provides clinicians, student clinicians and patients with a model for examining and understanding the potential factors and relationships among key factors contributing to voice dysfunction. During the evaluation, information is obtained for each of the potential areas to determine specific factors related to Anatomical/disease-related processes; Lifestyle; Emotion; Reflux and Technique factors that may be contributing to voice dysfunction. Examples of common contributing factors are included for each category. The conceptual model allows for each component to be “sized” (see arrows) to represent its relative weight in the formation of the symptoms and complaints, based on the collective perspective of the patient and the rest of the voice care team. Interactions between the various components can be depicted by greater or lesser over-lapping of the components and by adding/subtracting arrows to indicate the direction(s) of the influence. Ultimately, the ALERT model informs the patient and health care team about treatment priorities.

Anatomical Factors:

Anatomical factors may be temporary conditions that alter the structure of the vocal folds, larynx or vocal tract, such as respiratory viruses (cold, flu); fluctuating conditions such as odour sensitivities, allergic reactions or asthma; or more permanent conditions, such as injuries, Parkinson's Disease, or predictable effects of aging that alter the structure or muscle tone in the larynx and other speech mechanisms.

Anatomical factors can often be delineated as primary factors contributing to voice dysfunction or secondary effects of other ALERT factors. For example, the human papilloma virus can cause primary anatomical lesions to grow on the vocal folds. Over-using or abusing the voice (eg., yelling and screaming) can result in secondary lesions, such as nodules or bruising on the vocal folds due to vibratory trauma. During evaluation, detailed history of the problem and examination of the larynx is undertaken, allowing the voice care team to identify or rule out any anatomical factors. Frequently, no specific anatomical/aging/disease factors are identified, suggesting some combination of the other core ALERT factors are primarily responsible for voice dysfunction.

Lifestyle Factors:

Lifestyle factors include vocal demands associated with occupational, domestic and recreational activities. The environments in which vocal demands are met are also considered. Acoustic factors, such as vocalizing over noise, and airborne factors, such as exposure to noxious fumes, may contribute to vocal abuse and chronic over-use, muscle tension in the vocal system, anatomical changes in the larynx and symptoms such as coughing or difficulty breathing. All of these factors are explored through discussion about an individual's lifestyle, vocal demands and environments.

A common cause of occupational voice disorders is extensive voice use in poor acoustic conditions, such as talking in noisy classrooms, swimming pools, hockey rinks or outdoors. These environments cause individuals to raise their voices

above a comfortable and efficient loudness level and to change muscle patterns in the respiratory system, larynx and speech articulators.

Personality characteristics and interaction styles may contribute to “vocal dose” (duration/type of voice use and influence of environments in which vocal activities take place). Speech, singing, and non-speech vocal activities such as yelling, screaming, throat-clearing and coughing or imitation of non-speech noises all contribute to vocal dose. Socio-linguistic influences may also be at play, when individuals consciously or sub-consciously emanate a particular vocal style, such as that of peers, parents, media personalities or other role models.

Lifestyle factors that affect general health also affect vocal health, among them smoking (nicotine and other drugs), excessive caffeine or alcohol intake, body hydration, and fitness.

Emotional Factors:

Emotional reactions frequently contribute to vocal dysfunction through the nervous system. The voice is used to express ideas and emotions, and voice changes may be caused by intense or suppressed emotion and in individuals who have difficulty recognizing emotional experiences.

Two types of physical responses to emotional experiences may contribute to voice dysfunction. The involuntary or “autonomic nervous system” contributes to “fight or flight” reactions such as dry mouth and throat, racing heart and involuntary shaking and may lead an individual to tense muscles in the breathing system or larynx. For example, a person experiencing “stage fright” may feel the heart racing and muscles shaking (autonomic nervous system preparations for flight from danger). The vocal expression of fear (screaming) might accompany these other physiological symptoms in cases of imminent physical danger, but in most cases, the “nervous speaker” will suppress this natural emotional response. Tensing muscles in the breathing system or larynx are common subconscious attempts to hide vocal expressions of fear, and long-term misuses of the muscles will lead to vocal changes and strain.

The “voluntary nervous system” is responsible for reactions of muscle tension under conditions of intense emotional stress, particularly when the cause of the emotional reaction cannot be recognized and reconciled, or when there is a conflict about expressing the emotion physically/vocally. For example, when an individual experiences anger but cannot express it vocally, clenching the teeth, breathing system and/or vocal folds will suppress the physical ability to yell, just as tightening the shoulders and arms will suppress the physical ability to strike out and hit the offender.

Emotional contributions to voice dysfunction may be primary or secondary. Primary causes, such as chronic suppression of emotional expression, are associated with muscle tension in the vocal system. Since muscles do not contract as efficiently when they are tense, chronic “misuse” in muscles of the voice will make the voice function less efficiently. In contrast, voice changes due to other ALERT factors may cause secondary emotional distress, which in turn compounds the voice dysfunction through those autonomic and voluntary nervous system responses discussed above.

By exploring history of traumatic experiences, general life stressors, coping styles and other possible emotional factors with individuals experiencing voice dysfunction, the voice care team can help them determine the degree to which physiological reactions to psychological stressors are contributing to voice and throat symptoms and whether these should be addressed during treatment.

Reflux Factors:

Gastro-esophageal (GE) reflux refers to upward release of gastric contents into the esophagus (swallowing tube). This is occurs most often after eating or drinking, and is commonly associated with supine (lying down) or inverted body positions. “Normal” amounts of reflux activity may go undetected and without symptoms several times a day in healthy individuals: Relaxation of the sphincter between the lower esophagus and stomach is thought to be a normal adaptive function that relieves pressure on the stomach after eating to enhance the digestive process. When these events are more frequent or severe, symptoms may arise.

Gastro-esophageal Reflux Disease (GERD) is typically related to chronic failure of the lower esophageal sphincter to contain stomach contents and sometimes is associated with stereotypical symptoms such as heartburn or indigestion. Anatomical effects of chronic GE reflux can include changes to the lining of the esophagus, throat (pharynx) and/or larynx due to chronic irritation from digestive acids and other stomach contents. Chronic reflux, particularly during sleep, may result in burning, swelling and other changes in the larynx.

GE reflux also can affect tension of laryngeal muscles, including those of the vocal folds, because the larynx is actually a system of valves that protect the lungs from fluid, food or other foreign substances. Each time we swallow, cough, hold our breath or clear our throats, the larynx is acting as a valve, and closing the airway to protect it from the activity in our esophagus, mouth and pharynx. In cases of chronic reflux, the vagus nerve may be stimulated so often that the brain puts the larynx and pharynx into a constant state of defense, making the muscles chronically tense. Since the vocal folds need to be more relaxed to vibrate well when we speak or sing, GE reflux interferes with normal voice function as long as it is in "valving" mode. If the larynx and pharynx are in a chronic state of valving, the muscle contraction may be felt as symptoms of postnasal drip, "globus" (a feeling of a lump in the throat), dry throat, coughing and the feeling of a need to clear the throat. Habitual throat clearing and coughing can traumatize the vocal folds. The voice care team considers these symptoms to determine what role GE reflux may play in dysfunction of the voice and larynx.

A number of lifestyle, diet and health issues contribute to reflux. Eating and drinking before lying down, certain dietary items, smoking, caffeine and alcohol may all play a role in creating reflux symptoms, sometimes in the absence of stereotypical symptoms of heartburn and indigestion. These contributions are explored as the voice care team discusses your health and lifestyle history.

For more information about the potential effects of GE reflux on your voice, please refer to the video "But Doctor" on the program website: www.vch.ca/voicecare

Technique Factors:

Motor Learning Theory tells us that both desirable skills and maladaptive motor patterns (bad habits) become programmed through repetition and feedback and that brain cell structures change as a result of this, a process known as “neural plasticity”. Sometimes technique changes are secondary to other ALERT factors. Anatomical changes or disease processes can lead to poor postures and tension in specific muscles. For example, whiplash injuries sometimes result in long-term “splinting” of neck, shoulder, throat and jaw muscles, which contributes to voice dysfunction. A lesion (such as a benign cyst) on the vocal folds will impede appropriate vocal fold vibration, and the body may react by squeezing other muscles too tightly to “compensate” for this disruption. Another example of compensation is sub-conscious muscle reactions to expected age-related vocal changes, which may improve or degrade the vocal signal, depending on whether they are adaptive or maladaptive. We have also learned that GE reflux can make muscles tense in the larynx and pharynx and impact voice function.

Body alignment, linguistic competence/comfort (for example, speaking in the “first” language learned), acoustic environment, communication strategies and pragmatics are among the technique factors that influence movement commands in the brain, which in turn orchestrate complex muscle patterns for vocal communication.

Good body posture is essential to healthy vocal production. Poor posture is often related to both technique and unhealthy ergonomic support such as inappropriate furniture and poor placement of electronic props: computer keyboards, screens, telephones. Common postural misuses, such as over-extending the neck (jaw jut), collapsing the torso (slouching) and clenching the jaw frequently are associated with voice dysfunction and throat discomfort.

Communication style (“pragmatics”) can also influence vocal technique. For example, a speaking rate that is very fast will disrupt normal speech breathing patterns, which often leads to maladaptive muscle use in the torso, neck and

larynx. Speaking in stressful communication environments, and speaking while suppressing emotions are associated with muscle tension in the vocal system.

Since GE reflux can cause chronic tension in throat muscles as they “protect” the larynx, it also can have a major influence on voice function. Often, managing reflux is the first step in improving faulty vocal technique.

Throughout the evaluation, the voice care team observes general and specific postural patterns that can contribute to voice dysfunction. They also inquire about postures and ergonomics that may jeopardize good vocal technique, in your work, recreational and domestic activities. It is common for the voice clinician to learn more about specific muscle tension sites by palpating (feeling) areas of the face, neck and larynx with the hands. The team members assess features of muscle use in the larynx while examining your vocal folds with a laryngoscope. The speech-language pathologist may ask you to adjust certain postures, monitor specific muscle tension sites and produce sounds in different ways to explore the degree to which technique is contributing to voice dysfunction, and to indicate effective treatment approaches.