

Review on Vocal Cords Analysis using Speech for various Voice Disorders

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Abstract: In this paper we discuss the vocal cords structure, function, position etc. We also discuss various disorders of vocal cord such as vocal cords nodules, polyps, cysts, contact ulcer, gastro esophageal reflux disease, laryngitis, vocal cord tumors, vocal cord paralysis, vocal cord dysfunction, vocal loading, stammering etc. We also discuss various causes and symptoms of voice disorders. In this review paper we also explain various diagnosis methods method that used by various experts. The various treatments that can be used by doctors to treat the patient according to disease also explain. In this paper we discuss the various technics that can be used to protect vocal cord from overuse and misuse.

Keywords: VCD Gerd, SLP, CT, Stroboscope, Otolaryngologist.

I. INTRODUCTION

The vocal folds, also know commonly as vocal cords or voice reeds, are composed of twin in folding of mucous membrane stretched horizontally, from back to front, across larynx[1] .Vocal cords are located within larynx at the top of the trachea. They are attached posteriorly to the arytenoid cartilages, and anteriorly to the thyroid cartilage. They are constructed from epithelium, but they have a few muscle fibers in them, namely the vocals muscle which tightens the front part of the ligament near to the thyroid cartilage. They are flat triangular bands and are pearly white in colour.

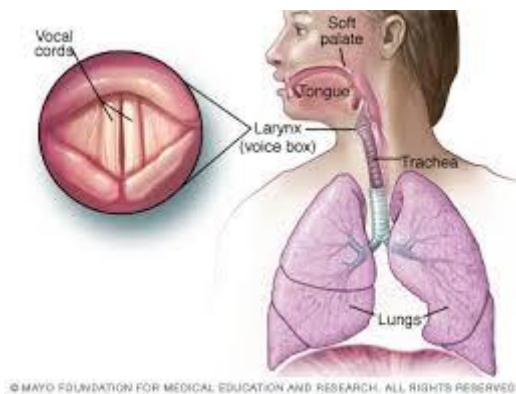


Fig 1: Vocal Cords and All Vocal organs

Male and females have different vocal folds sizes. Adult male voices are usually lower pitched due to longer and thicker folds. The male vocal folds are between 1.75 cm to 2.5 cm (approx. 0.75”to 1.0”) in length, while female vocal folds are between 1.25 cm to 1.75 cm (approx. 0.5”to 0.75”) in length [1]. The vocal cords of children are much shorter than those of adult males and females. Other studies suggest that hormones play an important role in vocal fold maturation .Voice consist of sound made by a human being using the vocal folds for talking, reading, singing, laughing, crying , screaming etc. For most of us our voices play a big part in who we are, what we do and how we communicate. Like fingerprints, each person’s voice is unique.

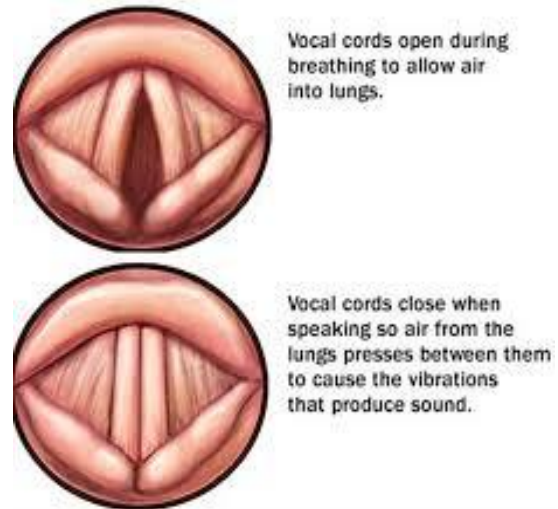


Fig 2: Vocal cords position during Breathing and Speaking.

II. LITERATURESURVEY

A famous German Composer Richard Strauss had said human voice is the most beautiful instrument but the most difficult one to play. Human voice is a major component in communication and we use our voices to connect with others through speech and songs. Of the working population, about 13% has professions where their primary tool [3]. That includes professions such as teachers, sales personnel, actors, singers, TV and radio reporters. Most of them, especially teachers, suffer from voice related medical problems. In a larger scope, this involves millions of sick leave days every year. The fundamental frequency of speech for an average male is around 110 Hz and for an average female around 220 Hz. That means that for voiced sounds the vocal folds will hit together 110 or 220 times a second, respectively. Researcher’s largest interest lies in stress exerted on vocal folds .Most scientists agree on the effect of the air humidity, hydration, background noise, pitch etc.

Dry air increases stress experienced in the vocal folds. Dehydration increases effects of stress inflicted on the vocal folds. People tend to speak louder when background noise is present, even when it isn't necessary. Increasing speaking volume increases stress inflicted on the vocal folds. Using a higher or lower pitch than normal will also increase stress in the speech organs. In addition, smoking and other types of air pollution might have a negative effect on voice production organs. Voice analysis is the study of speech sounds for purposes other than linguistic content, such as in speech recognition. Such studies include mostly medical analysis of the voice. Voice problems that require voice analysis most commonly originate from the vocal folds or the laryngeal musculature that controls them, since the folds are subject to collision forces with each vibratory cycle and to drying from the air being forced through the small gap between them, and the laryngeal musculature is intensity active during speech or singing and is subject to tiring. However, dynamic analysis of the vocal folds and their movement is physically difficult. The location of the vocal folds effectively prohibits direct, invasive measurement of movement. Less invasive imaging methods such as x-rays or ultrasounds do not work because the vocal cords are surrounded by cartilage which distorts image quality. Movements in the vocal cords are rapid, fundamental frequencies are usually between 80 and 300 Hz, thus preventing usage of ordinary video. Stroboscopic and high-speed videos provide an option but in order to see the vocal folds, a fiber optic probe leading to the camera has to be positioned in the throat, which makes speaking difficult. In addition, placing objects in the pharynx usually triggers a gag reflex that stops voicing and closes the larynx. In addition, stroboscopic imaging is only useful when the vocal fold vibratory pattern is closely periodic. The most important indirect methods are currently inverse filtering of either microphone or oral airflow recordings and electroglottography (EGG).

List of symptoms of changed voice quality:

1. Vocal fatigue
2. Unreliable voice
3. Delayed voice initiation
4. Low, gravelly voice
5. Low pitch
6. Voice breaks in first passages of sentences
7. Airy or breathy voice
8. Inability to sing high and low voice
9. Increased effort to speak or sing
10. Hoarse and rough voice quality
11. Frequent throat clearing
12. Extra force needed for voice
13. Voice "hard to find".

III. VOICE DISORDERS

When you speak, the air you exhale from your lungs is forced through the closed vocal cords. This causes them to vibrate. They vibrate faster for higher-pitched sounds, slower for lower-pitched sounds. Strained vocal cords generally aren't noticed until the problem becomes severe.

People who use their voices for a living or who shout or scream frequently are at particular risk. People who work in noisy environments that require shouting to communicate are also at risk. Voice problems occur with a change in the voice, often described as hoarseness, roughness, or a raspy quality. People with voice problems often complain about or notice changes in pitch, loss of voice, loss of endurance, and sometimes a sharp or dull pain associated with voice use. Other voice problems may accompany a change in singing ability that is most notable in the upper singing range. A more serious problem is indicated by spitting up blood or when blood is present in the mucus. If you smoke, quit. Avoid agents that dehydrate the body, such as alcohol and caffeine. Avoid secondhand smoke. Drink plenty of water. Humidify your home. Watch your diet—avoid spicy foods. Try not to use your voice too long or too loudly. Use a microphone if possible in situations where you need to project your voice. Seek professional voice training. Avoid speaking or singing when your voice is injured or hoarse. Voice changes sometimes follow an upper respiratory infection lasting up to two weeks. Typically the upper respiratory infection or cold causes swelling of the vocal cords and changes their vibration resulting in an abnormal voice. Reduced voice use (voice rest) typically improves the voice after an upper respiratory infection, cold, or bronchitis. If voice does not return to its normal characteristics and capabilities within two to four weeks after a cold, a medical evaluation by an ear, nose, and throat specialist is recommended. A throat examination after a change in the voice lasting longer than one month is especially important for smokers. Note that a change in voice is one of the first and most important symptoms of throat cancer. Early detection significantly increases the effectiveness of treatment [4].



Fig 3: Normal Vocal Cords

Common vocal cord disorders include:

[1]Nodules, Polyps and Cysts (Benign lesions of the larynx or voice box):

Benign non-cancerous growths on the vocal folds are most often caused by inefficient voice use, which causes trauma to the vocal folds. These lesions (or "bumps") on the vocal folds alter vocal fold vibration and lead to hoarseness. The most common vocal fold lesions are nodules, polyps, and cysts.

Nodules are small, hard, callus-like growths caused by vocal abuse. They occur in pairs, with one nodule on each vocal cord at the site of greatest irritation. They sometimes

are called singer's, screamer's or teacher's nodes. Typically this mass appears on the junction of the anterior 1/3 and posterior 2/3 of the vocal fold, where contact is most forceful.

Polyps are small, soft growths that usually appear alone on a vocal cord. They are caused most often by vocal abuse or long-term exposure to irritants, such as chemical fumes or cigarette smoke.



Fig 4: Vocal Cords Polyps.

Vocal fold cysts are collections of fluid in sac-like formations on the vocal cords. Cysts can deteriorate the quality of your voice. They may occur after an upper respiratory infection combined with vocal overuse. A ruptured cyst may result in a scar. Females are more likely than males to develop vocal fold cysts and the menstrual cycle may alter the size of the cyst. The cysts usually appear on one side of the vocal cord but may cause swelling on the opposite side due to irritation.

[2] Contact ulcer: This is a less common disorder. Contact ulcers are erosions and sores on the vocal cords. They tend to occur in people who consistently use great force when beginning to speak, instead of gradually increasing force and loudness. For example, contact ulcers may affect people who work as public speakers. Ulcers also can be caused by gastro esophageal reflux disease (GERD), or heartburn. Reflux is when acidic stomach contents flow back up the esophagus and irritate the larynx.

[3] Laryngitis: This is a swelling of the vocal cords caused by inflammation or infection. Swollen vocal cords vibrate differently than usual, changing the typical sound of your voice. You can lose your voice if the inflammation is so severe that you can't make a sound. Laryngitis can be caused by Vocal abuse, Allergies, Viral infection, Reflux of stomach acids, Exposure to irritating substances, such as cigarette smoke or too much alcohol.

Laryngitis is an inflammation of the larynx. It causes hoarse voice or temporary complete loss of the voice because of irritation to the vocal folds (vocal cords). Dysphonia is the medical term for a vocal disorder, of which laryngitis is one cause. Laryngitis is categorized as acute if it lasts less than three weeks and chronic if it last over three weeks. The chronic form occurs mostly in middle age and is much more common in men than women. Antibiotics do not appear to be very useful in the acute form.

Acute laryngitis is the most common cause of hoarseness and sudden voice loss. Acute laryngitis is usually caused by a viral infection that leads to swelling of the vocal folds. Swelling on the vocal folds changes the way they vibrate, and we hear this change as hoarseness.

Chronic laryngitis is a general term for inflammation of the vocal folds. Chronic laryngitis can be caused by acid reflux disease, exposure to irritating substances such as smoke, chronic misuse of the voice, and low-grade infection, such as a yeast infection of the vocal folds. People using inhalers for asthma, as well as chemotherapy patients or others with suppressed immune systems are susceptible to these infections.

[4] Vocal cord tumors: Tumors can be cancerous or noncancerous. Noncancerous tumors can be caused by a virus. Or they may be unusual growths of body tissue that cause voice problems. Cancerous tumors are most likely to occur in smokers and people who drink too much alcohol. Cancerous tumors are life threatening if not caught and treated early.

[5] Vocal cord paresis and vocal cord paralysis: Vocal cord paresis occurs when one or both vocal cords don't open and close properly, changing voice quality. When one or both vocal cords don't move at all, this is called vocal cord paralysis. If both vocal cords are paralyzed and remain in the closed position, breathing can be difficult. Vocal cord paresis and paralysis can have several causes, including surgical trauma, most often from thyroid surgery, but also from any neck or chest surgery, Head or neck trauma, Trauma during birth, a neurological disease (such as Parkinson's disease or multiple sclerosis), Stroke, tumor, viral infection, some debilitating diseases, such as myasthenia gravis .Paresis also can result from weakened vocal cord muscles. Vocal cord muscles can be weakened temporarily as a side effect of inhaled corticosteroid medicine sprays. They may also weaken after extended treatment with an artificial respirator (ventilator) in a hospital. Reduced vocal cord mobility may decrease the effectiveness of coughing, swallowing, or sneezing in removing mucosal wastes from the laryngeal area. The resultant accumulations may allow for viral and bacterial colonization with an increased tendency for infections and throat discomfort [5].

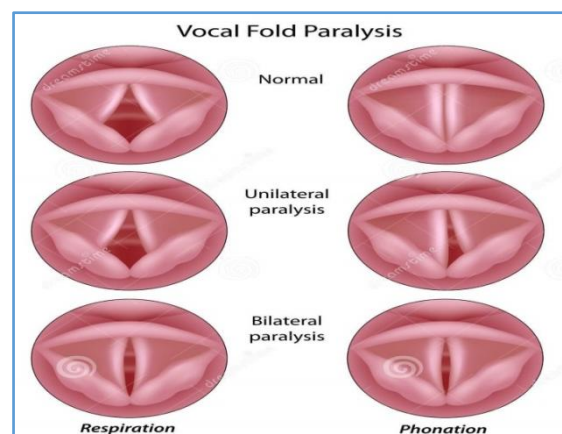


Fig 5: Vocal Fold Paralysis

[6] Gastro esophageal Reflux Disease and Laryngopharyngeal Reflux Disease:

“Heartburn on the throat”. Stomach acid may backflow to the throat, causing irritation of the voice box. This irritation is more prominent near the posterior (back) of the voice box, near the esophagus. Symptoms of this disorder include hoarseness, swallowing problems, a foreign body sensation, frequent throat clearing and sore throat. GERD is usually caused by changes in the junction between the stomach and the esophagus, including abnormal relaxation of the lower esophageal sphincter, which normally holds the top of the stomach closed, impaired expulsion of gastric reflux from the esophagus, or a hiatal hernia. These changes may be permanent or temporary.

[7] Vocal Cord (Throat) Cancer:

The first symptom of throat cancer is usually a change in voice quality that persists for more than 2-4 weeks. The voice often becomes hoarse, rough or raspy. Individuals who smoke are at the greatest risk of developing throat cancer. Early diagnosis allows for more successfully treatment, with a cure rate greater than 90 percent. Therefore, it is important that if you smoke, that you be examined if you have persistent hoarseness or change in the voice for longer than 2-4 weeks.



Fig 6: Vocal Cord Cancer

[8] Vocal Cord Dysfunction (VCD):

Vocal Cord Dysfunction means that your vocal cords do not act normally. With VCD, instead of your vocal cords opening up when you breathe in and out, your vocal cords close. This closing of your vocal cords makes it harder to get air into or out of your lungs. Common signs and symptoms of VCD are Feeling short of breath or feeling that it is hard to get air into or out of your lungs, feeling of tightness in the throat or chest., frequent cough or clearing your throat, feeling of choking or suffocation, noisy breathing (wheezing or raspy sound/stridor), Hoarse voice[6]. An attack of VCD can be sudden and may be severe. Without treatment, a severe attack may require emergency room treatment. Even if an attack is severe, the oxygen level in your blood is usually normal. VCD symptoms do not usually occur during sleep. Some are misdiagnosed with asthma, but are unresponsive to asthma therapy, including bronchodilators and steroids. Among adult patients, women tend to be diagnosed more often. Among children and teenage patients, VCD has been

linked with high participation in competitive sports and family orientation towards high achievement. Vocal cord dysfunction co-occurs with asthma approximately 40% of the time.

[9] Vocal loading:

Vocal loading is the stress inflicted on the speech organs when speaking for long periods. It is intuitively clear that the vocal fold tissue will experience some tiring due to this large number of hits. Vocal loading also includes other kinds of strain on the speech organs. These include all kinds of muscular strain in the speech organs; similarly as usage of any other muscles will experience strain if used for an extended period of time [7].

However, researchers' largest interest lies in stress exerted on the vocal folds. Objective evaluation or measurement of vocal loading is very difficult due to the tight coupling of the experienced psychological and physiological stress. However, there are some typical symptoms that can be objectively measured.

[10] Stuttering:

Stuttering also known as stammering is a speech disorder in which the flow of speech is disrupted by involuntary repetitions and prolongations of sounds, syllables, words or phrases as well as involuntary silent pauses or blocks in which the person who stutters is unable to produce sounds. The term stuttering is most commonly associated with involuntary sound repetition, but it also encompasses the abnormal hesitation or pausing before speech, referred to by people who stutter as blocks, and the prolongation of certain sounds, usually vowels or semivowels. For many people who stutter, repetition is the primary problem. Blocks and prolongations are learned mechanisms to mask repetition, as the fear of repetitive speaking in public is often the main cause of psychological unease. The term “stuttering” covers a wide range of severity, encompassing barely perceptible impediments that are largely cosmetic to severe symptoms that effectively prevent oral communication. In the world, approximately four times as many men as women stutter, encompassing 70 million people worldwide.

The impact of stuttering on a person's functioning and emotional state can be severe. This may include fear of having to enunciate specific vowels or consonants, fears of being caught stuttering in social situations, self-imposed isolation, anxiety, stress, shame, being a possible target of bullying (especially in children), having to use word substitution and rearrange words in a sentence to hide stuttering, or a feeling of “loss of control” during speech[8]. Stuttering is sometimes popularly seen as a symptom of anxiety, but there is actually no direct correlation in that direction (though as mentioned the inverse can be true, as social anxiety may actually develop in individuals as a result of their stuttering, manifesting at its peak if one has just stuttered in a situation or manner the stutterer believes especially unfortunate; as the spike in anxiety can be near-instantaneous, often becoming apparent in mid-syllable, a casual observer will tend to mistake the effect for the cause).

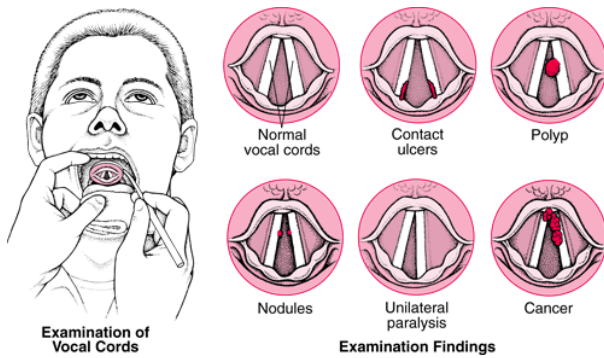


Fig 7: Various Disorder of Vocal fold.

IV. DIAGNOSIS

Your doctor will ask about your medical history. The doctor will listen to the quality of your voice and then inspect your vocal cords. This is usually done by holding a small mirror at the back of your mouth. To get a better view, the doctor may use a small, flexible lighted tube with a camera at the end. The tube is inserted through the nose to the larynx



Fig 8: Examination of Vocal Fold by Otolaryngologist

You will need to make certain sounds so your doctor can see your vocal cords in action. The examination may be videotaped so your doctor can analyze it later. This is all that is needed to diagnose most cases of laryngitis, vocal cord nodules and polyps.

In some cases, your doctor may recommend an acoustic analysis. This is a series of tests that measure the quality of your voice, including its pitch stability, range and intensity. Often, these tests are used when vocal cords are paralyzed or if a growth must be removed surgically. Using the test results, doctors and voice therapists can judge the amount of improvement after treatment.

Cancer of the larynx can look similar to a noncancerous growth or a contact ulcer. If an abnormality is found on the vocal cords, your doctor may do a biopsy. A biopsy involves removing a tiny sample of the affected vocal cord tissue so it can be examined in a laboratory.

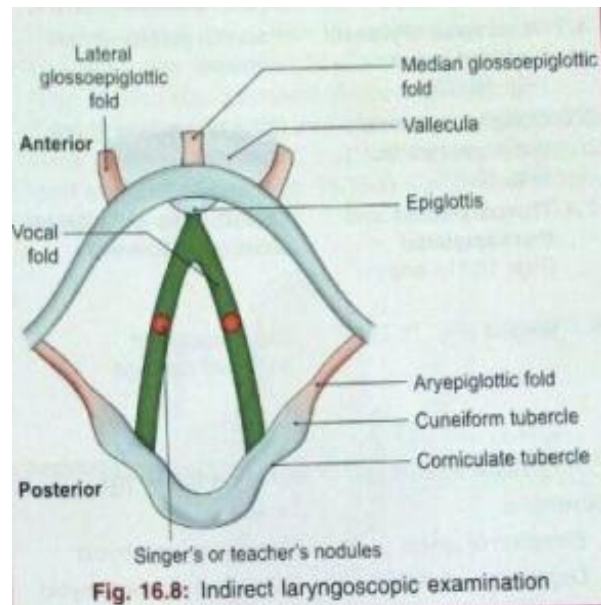


Fig 9: Indirect laryngoscopic examination

Additional tests, such as computed tomography (CT) scans, may be required in some cases of vocal cord paralysis or cancer. A CT scan, also called X-ray computed tomography (X-ray CT) or computerized axial tomography scan (CAT scan) [9]. Makes use of computer-processed combinations of many X-ray images taken from different angles to produce cross-sectional (tomographic) images (virtual 'slices') of specific areas of a scanned object, allowing the user to see inside the object without cutting.

Some characteristics of stuttered speech are not as easy for listeners to detect. As a result, diagnosing stuttering requires the skills of a certified speech-language pathologist (SLP) [10]. Diagnosis of stuttering employs information both from direct observation of the individual and information about the individual's background, through a case history. Information from both sources should span multiple, various settings and times. The SLP may collect a case history on the individual through a detailed interview or conversation with the parents (if client is a child). They may also observe parent-child interactions and observe the speech patterns of the child's parents.

The overall goal of assessment for the SLP will be (1) to determine whether speech disfluency exists, and (2) assess if its severity warrants concern for further treatment.

The terms "tumor", "mass" and "neoplasm" simply means 'growth.' Tumors may be benign or malignant (= cancer). Only a biopsy of the tumor can determine whether the mass is cancerous or not. The majority of patients with hoarseness are examined in the clinic with a small, painless telescope that only goes into mouth, but can look down the entire throat. This method of examining the voice box is only available in specialized clinics.

This is what a normal larynx looks like when examined in the office. The normal anatomy is illustrated:

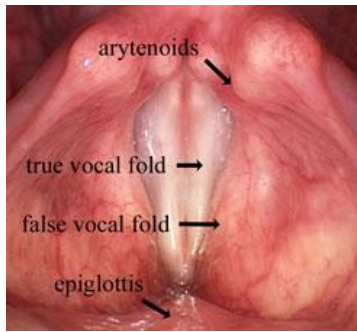


Fig 10: Normal anatomy of Larynx



Fig 12: Electroglottograph, Glottal Enterprises model EG2-PCX shown here

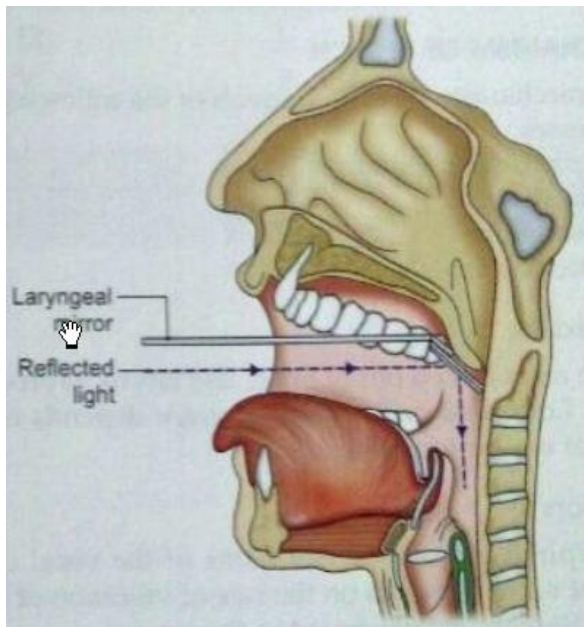


Fig 11: Parts of Larynx seen by Laryngoscopy

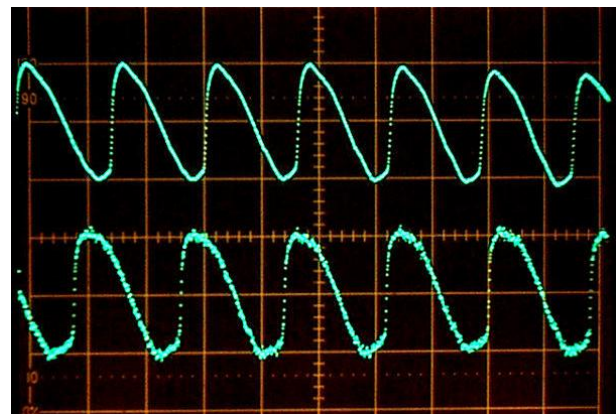


Fig13: Photograph of an EGG signal from a Glottal Enterprises EG2-PC(top) and a Laryngograph/Kay electroglottograph (bottom)

The electroglottograph, or EGG, (sometimes referred to as a laryngograph) is a device for the noninvasive measurement of the time variation of the degree of contact between the vibrating vocal folds during voice production. Though it is difficult to verify the assumption precisely, the aspect of contact being measured by a typical EGG unit is considered to be the vocal fold contact area (VFCA). To measure VFCA, an EGG records variations in the transverse electrical impedance of the larynx and nearby tissues by means of a small A/C electric current in the megaHertz region applied by electrodes on the surface of the neck [14]. This electrical impedance will vary slightly with the area of contact between the moist vocal folds during that part of the glottal vibratory cycle in which the folds are in contact. However, because the percentage variation in the neck impedance caused by vocal fold contact can be extremely small and varies considerably between subjects, no absolute measure of contact area is obtained, only the pattern of variation for a given subject.

Vocal cord dysfunction is often diagnosed only after other potential conditions have been excluded and those suffering from it will have failed to respond to medication and other treatments before VCD is considered.

This may mean several hospitalizations that are unresponsive to conventional treatments, such as asthma medication.

The most effective diagnostic strategy is to perform laryngoscopy during an episode at which time abnormal movement of the cords, if present, can be observed. If the

Endoscopy is not performed during an episode; it is likely that the vocal folds will be moving normally, a false negative finding. Spirometry may also be useful to establish the diagnosis of VCD when performed during a crisis or after a nasal provocation test. With spirometry, just as the expiratory loop may show flattening or concavity when expiration is affected in asthma, so may the inspiratory loop show truncation or flattening in VCD. Of course, testing may well be negative when symptoms are absent.

Spirometry (meaning the measuring of breath) is the most common of the pulmonary function tests (PFTs), measuring lung function, specifically the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled [11]. Spirometry is an important tool used for generating pneumotachographs, which are helpful in assessing conditions such as asthma, pulmonary fibrosis, cystic fibrosis, and COPD. The maneuver is highly dependent on patient cooperation and effort, and is normally repeated at least three times to ensure reproducibility. Since results are dependent on

patient cooperation, FVC can only be under estimated. **Treatment**
never over estimated.



Fig 14: Doing spirometry

Stroboscopy is a special method of examination of a vibrating or fast moving object, such as the vocal folds. A bright flashing light lasting a fraction of a second ($10\mu s$) is used to illuminate the vocal folds. This flash 'freezes' the movement of the vibrating vocal folds. Stroboscopy is a special method used to visualize vocal fold vibration. It uses a synchronized, flashing light passed through a flexible or rigid telescope. The flashes of light from the stroboscope are synchronized to the vocal fold vibration at a slightly slower speed, allowing the examiner to observe vocal fold vibration during sound production in what appears to be slow motion [12].

Speech-Language Pathologists provide a wide range of services, mainly on an individual basis, but also as support for individuals, families, support groups, and providing information for the general public. Speech services begin with initial screening for communication and swallowing disorders and continue with assessment and diagnosis, consultation for the provision of advice regarding management, intervention and treatment, and provision counseling and other follow up services for these disorders.

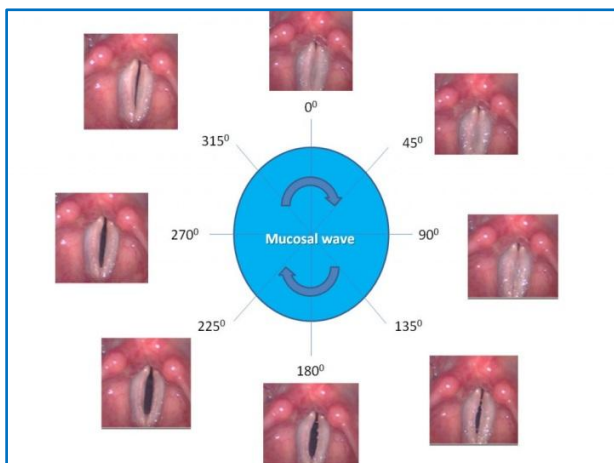


Fig 15: Stroboscopy of vocal fold

For vocal cord disorders resulting from vocal abuse, there are two main treatments:

For short-term relief, rest your voice. Speak or make sounds only when absolutely necessary. Try not to talk or whisper at all for a couple of days.

For long-term relief, voice therapy. Learn the proper way to speak to avoid straining your vocal cords.

If rest and therapy don't resolve the disorder, other treatments are available. Treatment, or voice rehabilitation, usually involves vocal training, speech therapy, and, occasionally, vocal rest. In rare cases, surgery may be required.

Removal of vocal cord nodules is a relatively safe and minor surgery. However, those who sing professionally or otherwise should take serious consideration before having surgery as it can affect the ability to sustain notes, as well as alter the vocal range. Initial treatment of the cysts involves vocal training and speech therapy along with medical interventions to decrease irritation of the cyst. In many cases, these will alleviate problems from the cyst. In other cases, the cyst grows larger necessitating surgery to remove the cyst. Vocal professionals may also require surgery if the minimal steps do not improve the voice quality enough to allow continued performance with the voice. However, microsurgery is frequently needed to maximize vocal quality. Of course, a decision to undergo surgery is always based on discussions between the otolaryngologist and the patient, and will depend on the patient's goals. Voice therapy is generally recommended before and after surgery.

Laryngitis caused by a virus needs rest and fluids. Antibiotics are not helpful to treat routine infections. The best treatment for acute laryngitis is to stay well-hydrated and to rest your voice or limit your voice use. If you make heavy use of your voice when you have acute laryngitis, you are risking serious injury to the vocal folds. Since most cases of acute laryngitis is caused by a virus, antibiotics are not effective. Bacterial infections of the larynx are much rarer and are often associated with difficulty breathing. Of course, any breathing problems during an illness require emergency medical attention.

Vocal cord tumors require surgical removal if they are noncancerous. They generally will not return. Treating cancerous tumors depends on the extent of the cancer. In the early stages, radiation, chemotherapy, surgery to remove a portion of the larynx or a combination of treatments may be needed. Some voice will remain after these procedures. In later stages of cancer, the entire larynx, including the vocal cords, must be removed (laryngectomy). You will need to learn a new speech method, using a special valve inserted surgically between the trachea and the esophagus. This allows air to be sent up the esophagus, creating enough vibrations for understandable speech.

People with vocal cord paresis or paralysis may be able to learn how to speak in different ways through voice therapy. If improvement is not satisfactory, surgery may

be recommended to change the position of the affected vocal cord. Surgery can also add bulk by injecting the vocal cord with collagen, body fat or some other substance. These types of procedures are recommended more often when one of the vocal cords is paralyzed. Both techniques bring the paralyzed cord closer to the cord that is not paralyzed. This allows the cords to vibrate enough to make sounds. For people with two paralyzed vocal cords, the goal of treatment is to improve breathing. The most common procedure is a tracheotomy. This procedure cords. A breathing tube is placed into the hole.

Vocal cord muscle weakness due to inhaled creates a hole in the neck below the level of the vocal corticosteroids may require a change in medicines. That is, if using a spacer device does not prevent symptoms.

Vocal cords cancer treatment options include surgery, radiation therapy, and/or chemotherapy. Treatment options depend on the following:

- The stage of the disease.
- The location and size of the tumor.
- Keeping the patient's ability to talk, eat, and breathe as normal as possible.
- Whether the cancer has come back (recurred).

Tracheotomy is a surgical procedure which consists of making an incision on the anterior aspect of the neck and opening a direct airway through an incision in the trachea (windpipe). The resulting stoma (hole), or **tracheostomy**, can serve independently as an airway or as a site for a tracheostomy tube to be inserted; this tube allows a person to breathe without the use of his or her nose or mouth. Both surgical and percutaneous techniques are widely used in current surgical practice. It is among the oldest described procedures

VCD is different than many other breathing problems because medicines are not the main treatment to control or prevent VCD. The main treatment for VCD is speech therapy techniques that help you learn to control your vocal cords. Speech therapy techniques are usually taught by a speech therapist or psychologist who is trained and experienced in treating VCD [13]. The techniques you will learn will help to improve your ability to relax your throat muscles. You may have to meet with a therapist at least 3 to 4 times to learn these techniques. Learning these techniques takes regular practice. You will need to practice them even when you are not having VCD, so you can be ready to control the symptoms before they become severe. Strong emotions and stress can trigger VCD, so it is important to learn to manage your stress. Relaxation techniques, biofeedback, and psychotherapy have been shown to be helpful in controlling VCD. If you have asthma and VCD, it is important that your asthma is under good control. If your VCD is triggered by post-nasal drip or acid reflux (GERD), it is important to talk to your healthcare provider about what you can do to control these.

Vocal cords loading

Objective evaluation or measurement of vocal loading is very difficult due to the tight coupling of the experienced psychological and physiological stress. The

pitch range of the voice will decrease. Pitch range indicates the possible pitches that can be spoken. When a voice is loaded, the upper pitch limit will decrease and the lower pitch limit will rise. Similarly, the volume range will decrease. An increase in the hoarseness and strain of a voice can often be heard. Unfortunately, both properties are difficult to measure objectively, and only perceptual evaluations can be performed. Basically, a normal, relaxed way of speech is the optimal method for voice production, in both speech and singing.

Stuttering

The U.S. Food and Drug Administration (FDA) has not approved any drug for the direct treatment of stuttering. Before treatment we need the assessment. Some characteristics of stuttered speech are not as easy for listeners to detect. As a result, diagnosing stuttering requires the skills of a certified speech-language pathologist (SLP) while there is no complete cure for stuttering, several treatment options exist that help individuals to better control their speech [15]. Many of the available treatments focus on learning strategies to minimize stuttering through speed reduction, breathing regulation, and gradual progression from single-syllable responses to longer words, and eventually more complex sentences. Furthermore, some stuttering therapies help to address the anxiety that is often elicited as a result of stuttering, and consequently exacerbates stuttering symptoms. This method of treatment is referred to as a comprehensive approach, in which the main emphasis of treatment is directed toward improving the speaker's attitudes toward communication and minimizing the negative impact stuttering can have on the speaker's life.

GERD treatment is typically via lifestyle changes and medications such as proton pump inhibitors, H2 receptor blockers or antacids with or without alginic acid. Surgery is an option in those who do not improve. In the Western world between 10 and 20% of the population is affected.

VI. Discussion

Voice problems usually are associated with hoarseness (also known as roughness), instability, or problems with voice endurance. The diagnosis of voice problems arise from a variety of sources including voice overuse or misuse, cancer, infection, or injury. Here are steps that can be taken to prevent voice problems and maintain a healthy voice:

Drink water (stay well hydrated): Keeping your body well hydrated by drinking plenty of water each day (6-8 glasses) is essential to maintaining a healthy voice. The vocal cords vibrate extremely fast even with the most simple sound production; remaining hydrated through water consumption optimizes the throats mucous production, aiding vocal cord lubrication. To maintain sufficient hydration avoid or moderate substances that cause dehydration. These include alcohol and caffeinated beverages (coffee, tea, soda). And always increase hydration when exercising.

Do not smoke: It is well known that smoking leads to lung or throat cancer. Primary and secondhand smoke that

is breathed in passes by the vocal cords causing significant irritation and swelling of the vocal cords. This will permanently change voice quality, nature, and capabilities.

Do not abuse or misuse your voice: Your voice is not indestructible. In every day communication, be sure to avoid habitual yelling, screaming, or cheering. Try not to talk loudly in locations with significant background noise or noisy environments. Be aware of your background noise when it becomes noisy, significant increases in voice volume occur naturally, causing harm to your voice. If you feel like your throat is dry, tired, or your voice is becoming hoarse, stop talking.

To reduce or minimize voice abuse or misuse use non-vocal or visual cues to attract attention, especially with children. Obtain a vocal amplification system if you routinely need to use a “loud” voice especially in an outdoor setting. Try not to speak in an unnatural pitch. Adopting an extremely low pitch or high pitch can cause an injury to the vocal cords with subsequent hoarseness and a variety of problems.

Minimize throat clearing: Clearing your throat can be compared to slapping or slamming the vocal cords together. Consequently, excessive throat clearing can cause vocal cord injury and subsequent hoarseness. An alternative to voice clearing is taking a small sip of water or simply swallowing to clear the secretions from the throat and alleviate the need for throat clearing or coughing. The most common reason for excessive throat clearing is an unrecognized medical condition causing one to clear their throat too much. Common causes of chronic throat clearing include gastroesophageal reflux, laryngopharyngeal reflux disease, sinus and/or allergic disease.

Moderate voice use when sick: Reduce your vocal demands as much as possible when your voice is hoarse due to excessive use or an upper respiratory infection (cold). Singers should exhibit extra caution if ones speaking voice is hoarse because permanent and serious injury to the vocal cords is more likely when the vocal cords are swollen or irritated. It is important to “listen to what your voice is telling you.”

Your voice is an extremely valuable resource and is the most commonly used form of communication. Our voices are invaluable for both our social interaction as well as for most people’s occupation. Proper care and use of your voice will give you the best chance for having a healthy voice for your entire lifetime.

Hoarseness or roughness in your voice is often caused by a medical problem. Contact an otolaryngologist head and neck surgeon if you have any sustained changes to your voice.

Watch your diet—avoid spicy foods. Try not to use your voice too long or too loudly. Use a microphone if possible in situations where you need to project your voice. Seek professional voice training. Avoid speaking or singing when your voice is injured or hoarse. Avoid agents that dehydrate the body, such as alcohol and caffeine.

If you have viral laryngitis, cover your mouth when coughing and wash your hands often to prevent others from getting your infection.

VII. CONCLUSION

Research study of Vocal cords analysis area focused on early diagnosis of laryngeal pathologies. Currently, the first used tool used to detect a laryngeal pathology is a subjective evaluation of the patient voice, performed by a physician. This is normally followed by either direct or indirect laryngoscopy, a procedure which causes pain and discomfort to the patient. It should be noted that the physician’s first impression is subjective and depend on the level of training and experience. There is also a lack of formal standard in perceptual testing.

The use of noninvasive techniques to evaluate the larynx and vocal tract helps the speech specialists to perform accurate diagnose of diseases. The pathological diagnosis of the vocal tract is a field which still demands further investigation due to the difficulty to standardize the diagnose of the speech pathologies.

We must develop a (cost-friendly) method which would provide more detailed information on the vibratory behavior of the vocal folds. The need for a new method arose from the fact that currently available methods visually observing vocal-fold vibrations are either not capable of observing fast phenomena (stroboscopy), or are not easily available due to the high costs (high-speed imaging systems).

REFERENCES

- [1] Gray SD (August 2000). “Cellular physiology of the vocal folds”. *Otolaryngol. Clin. North Am.* 33 (4): 679–98. PMID 10918654.
- [2] Thurman, Leon & Welch, ed., Graham (2000), *Body mind & voice: Foundations of voice education* (revised ed.), Collegeville, Minnesota: The Voice Care Network et al., ISBN 0-87414-123-0
- [3] Gray SD (August 2000). “Cellular physiology of the vocal folds”. *Otolaryngol. Clin. North Am.* 33 (4): 679–98. PMID 10918654.
- [4] Ibrahim WH, Gheriani HA, Almohamed AA, Raza T (Mar 2007). “Paradoxical vocal cord motion disorder: past, present and future”. *Postgrad Med J* 83 (977): 164–172. doi:10.1136/pgmj.2006.052522. PMC 2599980. PMID 17344570.
- [5] “Recurrent laryngeal nerve paralysis as intubation injury?”. *PubMed.gov*. National Center for Biotechnology Information, U.S. National Library of Medicine. Retrieved 25 August 2012.
- [6] Vlahakis, NE; Patel AM; Maragos NE; Beck KC (December 2002). “Diagnosis of vocal cord dysfunction: the utility of spirometry and plethysmography”. *Chest (America College of Chest Physicians)* 122 (6): 2246–2249. doi:10.1378/chest.122.6.2246. PMID 12475872
- [7] Carroll, T; Nix, J; Hunter, E; Emerich, K; Titze, I; Abaza, M (2006). “Objective measurement of vocal fatigue in classical singers: a vocal dosimetry pilot study”. *Otolaryngology--head and neck surgery: official journal of American Academy of Otolaryngology-Head and Neck Surgery* 135 (4): 595–602. doi:10.1016/j.otohns.2006.06.1268. PMID 17011424.
- [8] Guitar, Barry (2005). *Stuttering: An Integrated Approach to Its Nature and Treatment*. San Diego: Lippincott & Wilkins. ISBN 0-7817-3920-9.
- [9] Megherbi, N., Han, J., Flitton, G.T., Breckon, T.P. (September 2012). “A Comparison of Classification Approaches for Threat Detection in CT based Baggage Screening”. *Proc. International Conference on Image Processing (PDF)*. IEEE. pp. 3109–3112. doi:10.1109/ICIP.2012.6467558. Retrieved 5 November, 2013.

- [10] Brady, MC; Kelly, H; Godwin, J; Enderby, P (May 16,2012). "Speech and language therapy for aphasia following stroke." The Cochrane database of systematic reviews5: CD000425. doi:10.1002/14651858.CD000425.pub3.PMID 22592672.
- [11] Perez, LL (March–April 2013). "Office spirometry". *Osteopathic Family Physician* 5(2): 65–69. doi:10.1016/j.osfp.2012.09.003.
- [12] Kendall KA. High-speed laryngeal imaging compared with videostroboscopy in healthy subjects. *Arch Otolaryngol Head Neck Surg.* 2009 Mar. 135(3):274-81. [Medline].
- [13] Olivier CE, Argentão DGP, Lima RP, Silva MD, Santos RAPG. The nasal provocation test combined with spirometry establishes paradoxical vocal fold motion in allergic subjects. *Allergy Asthma Proc* 2013; 34:453-8. Pubmed.
- [14] Herbst, C. T., Fitch, W. T., and Svec, J. G. (2010). "Electroglottographic wavegrams: a technique for visualizing vocal fold dynamics noninvasively," *J Acoust So Am* 128, 3070-3078. - <http://dx.doi.org/10.1121/1.3493423>
- [15] Mihaela Frățilă, Emil Urtilă, Maria Ștefănescu (Oct 2011). "Speech therapy — criteria for determining the time of the surgical operation in surgery of labio-pala cv tovelars cleft". *Rev. chir. oro-maxilo-fac. implantol. (in Romanian)* 2 (2): 21–23. ISSN 2069-3850. 33. Retrieved 2012-06-06.

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