



**ACADEMICIA**  
**An International  
 Multidisciplinary  
 Research Journal**  
 (Double Blind Refereed & Peer Reviewed Journal)



**DOI: 10.5958/2249-7137.2021.00852.1**

## VOICE FORMATION MECHANISM AND CAUSES OF VOICE IMPAIRMENT

**Shokhista Shaikramovna Shaabdurakhimova\***

\*Trainee Teacher of the Tashkent State Pedagogical University,  
 Tashkent, UZBEKISTAN

### ABSTRACT

*Violations of speech and voice, regardless of the reasons for their occurrence and the structure of the defect, complicate the communicative function. The human voice is a unique phenomenon and the ability to speak, express one's thoughts characterizes a person as a person. Voice disorders are the absence or disorder of phonation due to pathological changes in the vocal apparatus. In the presence of pathological changes in the larynx, the normal function of the voice is disrupted - the sonority of the voice decreases, hoarseness appears, the voice can completely disappear. Particularly persistent voice disorders are found with organic changes in the larynx. In this article, we will consider the anatomical and physiological mechanisms of speech and voice and the causes of voice disorders.*

**KEYWORDS:** Voice, Voice Disorders, Vocal Apparatus, Respiration, Pathology, Pseudo-Voice, Organic And Functional Causes, Congenital And Acquired Causes.

### INTRODUCTION

Speech is the main form of human activity and is characteristic only of a person. Speech supports the individual with society. On the basis of modern scientific data, speech can be taken as a phenomenon of the mechanical function of speech organs, the central part of which in the brain is closely connected with the cortical centers of the auditory, kinetic and visual analyzers. The speech apparatus can function normally only under the condition of clear coordination and regulation of the functions of anatomophysiological structures, which communicate back to the central nervous system how the orders received from it are carried out on the periphery.

The human voice is a unique phenomenon as an acoustic phenomenon, as an anatomical and physiological product, and also due to its social significance:

1. As an acoustic phenomenon, the human voice cannot be replaced by anything, even the most modern sound-producing acoustic installations.
2. As an anatomical and physiological product, following the development of the human nervous system against a single enzyme-endocrine background, the voice objectively reflects higher nervous activity within the framework of the mechanisms of the second signaling system.
3. the social significance of the voice is extremely important. Vocal function, inextricably linked with expressive speech, is a social category of paramount importance. The ability to speak, express one's thoughts characterizes a person as a person.

A voice is a set of sounds that are diverse in their characteristics, resulting from the oscillation of the elastic vocal folds. The phonatory apparatus is a composite anatomical concept. It includes the structure of the respiratory system throughout the respiratory tract. The respiratory system provides the basic vital function of the body, without the maintenance of which no living creature could exist. The main mechanism of this function - gas exchange - underlies all other functions of the body. The first life phase of this function is inhalation. Behind it lies a somewhat longer, no less important second phase - exhalation. The exhaled air, moving under pressure along the airway canal, is directed in the form of an air stream to the initial sections of the respiratory tract and goes out through the oral opening and nasal passages. In this phase, due to the presence in the larynx of certain muscle mechanisms formed here in direct connection with the primary function, conditions are created for the physical production of sounds and their transformation, after appropriate processing, into phonemes

Voice disorders are the absence or disorder of phonation due to pathological changes in the vocal apparatus. In the presence of pathological changes in the larynx, the normal function of the voice is disrupted - the sonority of the voice decreases, hoarseness appears, the voice can completely disappear. Particularly persistent voice disorders are found with organic changes in the larynx. Voice is one of the structural components of expressive speech, ensuring its intelligibility, expressiveness and emotionality, plays an important role in the social life of society, performing a communicative and informative function, and for many people, including number of teachers, is a "tool of production", a tool that ensures professional activity.

In the presence of pathological changes in the larynx, the normal function of the voice is disrupted - the sonority of the voice decreases, hoarseness appears, the voice may completely disappear. Particularly persistent voice disturbances occur with organic changes in the larynx. Preliminarily, we present some data on the anatomical and physiological mechanisms of voice formation. The vocal apparatus produces sound by vibrating the elastic vocal cords, or vocal membranes. The work of the vocal apparatus is subordinated to the cerebral cortex. Cortical impulses play a starting and regulating role here. But fine control of the muscles of the larynx (especially in the acts of speech and singing) is impossible without the participation of afferent impulses coming from the receptor endings, which are enclosed in the vocal cords, muscles, tendons of the vocal apparatus. In this case, the analytical role of the cerebral cortex takes place, therefore, they speak of the speech-motor analyzer as a particular form of the activity of the motor analyzer. There are also subcortical centers of the vocal reaction, subordinate to the cerebral cortex, which can inhibit these reactions. Undoubtedly, the reflex manifestation of these vocal reactions can be checked, for example, with pain. The human vocal apparatus consists of three parts:

- 1) The cavity of the lungs, bronchi and trachea;
- 2) The larynx, in which the vocal cords are located;
- 3) Upper respiratory tract - pharynx, nasopharynx, nasal cavity, paranasal sinuses and oral cavity (the so-called supra-tube).

In special literature, a person's vocal apparatus is usually compared with a musical - wind, or reed instrument, in which the sound is obtained due to the vibration of an elastic solid body - the reed, caused by a stream of air. The vocal cords are like a double tongue, with the ability to change their size, tension and elasticity. The lungs play the role of bellows; the extension tube serves as a resonator. When lowering the root of the tongue, the larynx falls, and this lengthens the extension tube; this lengthening can be increased by pushing the lips forward. The main part of the vocal apparatus - the vocal cords - are located in the larynx. The larynx is the tube that connects the windpipe (trachea) to the pharynx. The walls of the larynx consist of cartilage - cricoid, thyroid, epiglottis and two arytenoid.

The muscles of the larynx are divided into external and internal. The external muscles connect the larynx to other parts of the body, they raise and lower it. The internal muscles, during their contraction, set in motion certain cartilages of the larynx. They set in motion the vocal cords, widen or narrow the glottis. In the upper part of the larynx are the false vocal cords, in which the muscle fibers are poorly developed. Below them are the true vocal cords, they protrude in the form of folds, have a triangular shape and mainly consist of muscle tissue. The space between the vocal cords is called the glottis. When breathing, the vocal cords diverge and form a wide opening for the passage of air, the glottis takes the shape of a triangle. During phonation, the vocal cords come closer and the lumen of the glottis disappears. The innervation of the larynx is carried out by the sympathetic nerve and two branches of the vagus nerve - the superior and inferior laryngeal nerves. The superior laryngeal nerve consists of two branches: internal and external. The inner branch is more powerful, it is a sensory nerve. The outer branch is the motor nerve. The lower laryngeal nerve supplies motor fibers to all the internal muscles of the larynx, except for the anterior cricoid-thyroid. Damage to the lower laryngeal nerves paralyzes the vocal apparatus and the voice disappears. With damage to the superior laryngeal nerves, only a slight change in voice occurs. The larynx performs three functions: 1) respiratory; 2) protective; 3) voice. The respiratory function is to carry air into the lungs. In this case, the vocal cords diverge, forming a gap in the form of an isosceles triangle. The protective function prevents the penetration of foreign bodies into the lower respiratory organs. With regard to the vocal function of the larynx, i.e. in the question of the mechanism of voice formation, recently there have been two theories - tonic and clonic. The tonic theory, shared by most researchers, unites the formation of voice as follows. A stream of exhaled air coming under pressure from the lungs and bronchi meets resistance from the closed and tense true vocal cords (and sometimes, with the defeat of the latter, false vocal cords). An air jet that breaks through causes the vocal cords to vibrate.

This is how sound waves arise, which undergo changes and transformations in the extension tube and are perceived by the auditory organs as sounds of a particular height, strength, timbre. The clonic theory, denied by many scientists, gives a more independent role to the vocal cords. French physiologists (Isson et al.) Believe that impulses pass along the recurrent nerve that coincide in frequency with the sound emitted by the patient. Based on this, Esson believes that

the recurrent nerve sets in motion the vocal cords and the pitch of the voice depends only on the degree of excitability of the recurrent nerve. The emergence of a person's vocal function is attributed to the moment of his birth - to the first cry of a child, which is of a reflex nature. Later (by the end of the second month of life), the child develops sound complexes, which include some consonants. But these sound complexes have not yet been formed into words. As he grows, the child gradually masters articulate speech, in the formation of which the speech of others, hearing, vision and kinesthetic control play a decisive role. For the formation of articulate and loud speech of a person, a combination of voice function with respiratory, resonator and articulatory functions is necessary.

The voice is divided into spoken and singing (from the point of view of the mechanism of voice formation, methods and purposes of use). A professional singing voice differs from the everyday one in a wide range, the strength of sounds, a beautiful timbre, good diction and the ability to move from one register to another in the process of singing. The range of the voice is a combination of successively rising sounds emitted by a given subject. The pitch depends on the number of vibrations of the true vocal cords per second. The strength of the voice is determined by the amplitude of the vibrations of the vocal cords. The timbre of the voice depends on the addition of additional tones to the main tone - overtones. The timbre of the voice is greatly influenced by the movement of the muscles of the pharynx, soft palate, lips, cheeks, tongue, as well as the movement of the epiglottis, the larynx itself, the activity of the respiratory muscles. Breathing while speaking and singing is significantly different from breathing at rest. When at rest, it is done automatically, mainly through the nose. A resting inhalation is almost equal in duration to an exhalation. When inhaling, the glottis looks like an isosceles triangle. With a rest expiration, the glottis narrows somewhat. Exhaled air volume - 500-600 cm<sup>2</sup>

Speech and singing breathing has the following features in comparison with breathing at rest:

- 1) it is done arbitrarily, not automatically;
- 2) inhalation is made quickly, but silently, and exhalation is slow;
- 3) mainly oral breathing is used, and not nasal;
- 4) when inhaling, the vocal cords diverge widely, and the glottis acquires the shape of a pentagon. When you exhale, the glottis narrows.
- 5) Speech breathing is usually acquired independently, while the assimilation of singing breathing requires special training.

The varieties of voice (in addition to the usual spoken voice) include a whispering voice, a false-connective voice, a pseudo-voice (in persons after extirpation of the larynx, etc.). A whispering voice is formed without the participation of the vocal cords; when whispering, the vocal cords come closer, but do not touch. A whisper is obtained due to the friction of the exhaled and inhaled air stream against the walls of the cavities of the larynx, pharynx, mouth and nose. Not only true vocal cords, but also false vocal cords take part in the formation of a false vocal cords. Such a voice is characterized by hoarseness, monotony, narrowing of the range of sounds, a peculiar unpleasant shade, reminiscent of the croaking of frogs. The voice, like any other function of the body, can be subject to one or another violation. Diseases of the larynx, extension tube, lungs, bronchi and trachea, heart and cardiovascular system, as well as non-observance of

the rules of hygiene of the spoken and singing voice, non-observance of the rules of general hygiene (excessive smoking, alcohol abuse, lack of sleep, etc.) can lead to voice disorders.

Especially deep, difficult to treat, voice disorders are found with organic, deforming the larynx, changes. Stenosis of the larynx, papillomatosis of the larynx, tracheotomy operations and later plastic surgery in order to restore the respiratory function of the larynx and close the stoma - this is the main list of reasons leading to severe organic changes in vocal function. A speech therapist in his daily practice has to meet with various voice disorders. Especially great difficulties in terms of providing speech therapy assistance have to be experienced with patients suffering from severe voice disorders after organic lesions of the larynx. Restorative work in these cases does not yet have firm, established speech therapy methods. We studied Russian and foreign literature on the etiology, pathogenesis, clinical picture and treatment of typical organic voice disorders - aphonia and dysphonia. It should be noted that there are almost no indications on the issue related to the peculiarity of the method of work in cases of organic voice disorders. However, we found it possible to use the guidelines available in the literature on the treatment of functional aphonia and dysphonia (in particular, some provisions of the method of voice restoration in functional aphonia and dysphonia can be used with benefit in the treatment of organic aphonia and dysphonia).

Etiology. The causes of organic changes in the larynx can be various processes - diphtheria, laryngeal stenosis, laryngeal trauma, false croup, laryngeal papillomatosis, laryngeal neurinoma, as well as the laryngeal membrane, and in some cases, stumectomy.

MI Fomichev, ANSafarov (1936) indicate that organic aphonia result from painful changes in the voice-forming apparatus (tuberculosis, syphilis, tumors) or as a result of operational injuries. These phenomena change the structure of the vocal apparatus. The transitional step from aphonia to the voice is the false-ligamentous voice - the voice of the false ligaments. The prognosis for organic aphonia depends on the nature of the organic lesion. Far-reaching changes in the vocal apparatus will affect the outcome. L. Stein (1942) divides the causes of voice disorders into organic and functional.

Organic causes - nodules on the vocal cords (in singers), paralysis of the recurrent nerve, the absence of true vocal cords. If the paralysis is bilateral, then the voice will be aphonic; if the paralysis is unilateral, then the voice may not be sharply disturbed. If the true vocal cords are absent as a result of the operation, then their role is assumed by the false vocal cords. This is how the so-called "voice of the false ligaments" is formed. It arises as an attempt to compensate for the lost function of the true vocal cords.

M. Beri and D. Eisenson (1956) also believe that voice disorders can be caused by organic and functional reasons. The cause of a hoarse voice is pharyngitis (inflammation of the pharynx), laryngitis (inflammation of the larynx), tuberculosis of the larynx, paralysis of the ligaments, residual effects after diphtheria, scarlet fever, enlargement of the thyroid gland, aneurysms (protrusion of the palatine tonsil), pathological weakness of the phonatory musculature, chronic throat, nose. The authors divide the organic causes of a laryngeal-harsh voice into congenital and acquired. Congenital is a pathological weakness of one or more parts of the phonatory system, weakness of the laryngeal muscles. Acquired - as a result of the transferred operation tonsilloectomy (removal of the palatine tonsil). Violations of speech and voice, regardless of the reasons for their occurrence and the structure of the defect, complicate the communicative

function. Among the many disorders, a special place is occupied by a violation of the voice-speech function in people after removal of the larynx. The first removal of the larynx was performed by T. Bilroth in 1873. From that moment on, it became necessary to look for a replacement mechanism for the formation of a voice. Such a mechanism could be the esophagus, which has sufficiently movable walls and is innervated by branches of the recurrent nerve. The voice replacing phonation is called esophageal, that is, esophageal. At the beginning of the last century, the mechanism and methods of the esophageal voice were described by M. Seaman.

In Russia SL Taptapova (1963, 1975, 1984, 1985 [39, 40, 41] conducted a clinical and experimental study and developed a method of teaching the esophageal voice of patients after removal of the larynx. Muscular weakness after paralysis of the phonatory system. Organic causes of nasal voices are clefts of the hard palate, paralysis or muscle weakness of the soft palate, the presence of adenoids. Green M. (1957) indicates that the cause of voice disorders can be stenosis (congenital and acquired), as well as laryngeal papillomatosis. Sometimes children are born with a membrane through the anterior part of the ligaments. For treatment, a tantalum plate is inserted between the ligaments, which remains here for 3-4 months. As a result, the voice can be deep and hoarse. Acquired stenosis occurs from an accident, after serious injury during injury, scalding.

Surgery is necessary here, but it can be complicated by damage to the cartilage and the formation of fibrous scar tissue. Speech therapy improves the voice after surgical treatment. Laryngeal papillomatosis usually develops in early childhood. The development of the voice is affected by papillomatosis of the larynx and, although it can be restored, the hoarseness of the voice remains for several years. If, as a result of elimination of papillomatosis, scars are formed on the vocal cords, then the quality of the voice cannot be restored completely. The author points out that in some cases, dysphonia exists as a habit, and the violation of the voice is aggravated by emotional layers (the child sees that he is different from other children). The clinical picture of pathological changes in the larynx with organic voice disorders is very diverse, it is difficult to fit it into certain frameworks and schemes. Various authors indicate that such patients have extensive, severely deforming the larynx, persistent organic changes inherent only in this patient.

We list these changes: deformity of the larynx, limitation of mobility of the right or left half of the larynx, hyperemia of the true vocal cords, their thickening, incomplete closure, limitation of the mobility of one or the other true vocal cords, the gap between the vocal cords, false ligaments can move to the true, with phonation come closer ; breathing is usually noisy, shallow, during phonation there is a sharp tension in the muscles of the neck and face. MI Fomichev and AN Safarov (1936) note the "stiffness" of articulation with organic lesions of the larynx, disorganized speech breathing. They consider a pseudo-connective voice to be a transitional step from aphonia to a voice - "croaking", monotonous, hoarse, colorless, stifled.

V.P. Khrakovskaya-Chernyak (1937) divides patients with voice disorders into three groups:

Group 1 - purely functional diseases,

Group 2 - functional with pseudo-organic layers and

Group 3 - organic with functional moods.

For the third group of patients, the author considers a discrepancy between the severity of organic changes in the larynx and the degree of voice disorder characteristic. After the restoration of the voice, the laryngoscopic picture changes slightly. L. Stein (1942) notes that with the formation of the voice of the false ligaments, all muscles move. The pseudo-ligaments converge and produce an unpleasant low, monotonous sound. NF Lebedeva (1952) defines the hyperfunction of the false ligaments. Their role is in the protective function of the true vocal cords. At first, when the false ligaments perform the function of the true ones, they seem to drown out the work of the weakened true ligaments and the patient can only speak in a whisper. As you train, the false ligaments begin to move. The phonation of the false ligaments is characterized by a croaking voice, of a rough timbre, with an admixture of noise. With papillomatosis of the larynx, the voice is deaf in the initial stages, soundless in the presence of a large number of papillomas or frequent relapses. IA Voznesenskaya (1958) indicates two symptoms of laryngeal papillomatosis: 1) change in voice, 2) change in breathing. The author divides the change of voice into three degrees: 1) the voice is rough, hoarse, but loud; 2) a hoarse voice; and 3) aphonia. Aphonia is associated with multiple papillomas

The question of the treatment of organic voice disorders (aphonia, dysphonia, pseudo-ligamentous voice) is very difficult due to the presence of deep organic changes in the Larynx - scars, ankylosis of the cartilaginous joints, adhesions, etc. These changes make it difficult to restore the voice. The vocal mechanisms providing sound production in these cases are preserved and functionally activated remnants of the true vocal cords or false vocal cords.

As mentioned above, there are a significant number of reports in the literature on the treatment of functional disorders of voice formation, while there are almost no indications on the treatment of organic voice disorders. In these cases, it is still advisable to apply some provisions of the method of voice restoration in case of functional disorders.

## REFERENCES

1. Krasavina E.A. "Adaptive biocontrol in voice rehabilitation of patients with laryngeal cancer": abstract - Novosibirsk 2010.
2. Stilidi E. "Voice restoration after removal of the larynx, taking into account the specifics of the Greek language": abstract - Moscow 2004.
3. Novozhilova E.N. "Restoration of voice and respiratory functions in patients after laryngectomy and laryngopharyngectomy for cancer": abstract - Moscow 2009.
4. Almazova E.S. "Speech therapy work to restore the voice in children", - Textbook. Moscow 1973, "Education".
5. Taptapova S.L. Corrective speech therapy for voice disorders: Book. for a speech therapist. - Moscow 1984, "Education".
6. Ed. Volkova L.S., Seliverstova V.I. "Reader on speech therapy" - Moscow 1997, "Humanitarian publishing center VLADOS».