

MAGDALENA KOZŁOWSKA
Maria Curie-Skłodowska University in Lublin
Department of Logopedics and Applied Linguistics

Training of articulation after total laryngectomy

SUMMARY

Total laryngectomy is the most radical way to get rid of the cancer of the larynx. Laryngectomy removes sound generator that function is assumed to the esophagus. A crucial stage in the speech therapy procedure is to introduce air into the oesophagus and achieve its vibrant ejection (*ructus*). The three basic methods are distinguished among the methods of voice and speech rehabilitation of laryngectomees: the classical method (speech therapy), surgery or by using the so-called electronic larynx.

Key words: total laryngectomy, the speech of laryngectomees, methods of voice formation after laryngectomy

LARYNGECTOMY, SITUATION OF THE PATIENTS AFTER REMOVAL OF THE LARYNX

1. Recognition of the laryngeal cancer

The most common and the most specific symptoms of the laryngeal tumour include: hoarseness of breath, lack of voicing, sore throat, dry cough, feeling of obstacles while swallowing, ear pain, pain while speaking, and wheezing breath. Still, unfortunately, too many patients downplay these symptoms and report to the doctor at a very advanced stage of the disease, while early diagnosis and treatment are crucial for the effectiveness of further rehabilitation.

2. Methods of treating tumours of the larynx

Total laryngectomy is the most radical way to get rid of the cancer. There are methods less disabling, giving greater likelihood of complete recovery and better

therapeutic effects. The condition of their use, however, is the early diagnosis of neoplastic development.

The classification of cancer treatments by A. Pruszewicz (Pruszewicz 1992: 185):

- a. Treatment radiation energy.
- b. Surgical operation of very early neoplastic lesions inside the larynx.
- c. Partial laryngectomy enabling maintenance of physiological breathing:
 - Cordectomy – procedure involving the removal of the tumour along with the voice fold.
 - Horizontal Partial Laryngectomy – procedure is performed just above the fold voice.
 - Hemilaryngectomy (Vertical Partial Laryngectomy) – removal of the tumour with half of the larynx along the midline.
- d. Total laryngectomy – enucleation of the entire larynx. “After dissection of the skin flap, the larynx is incised just below the hyoid bone and dissected from the esophagus. The rear wall of the larynx in the upper part is firmly adherent to the wall of the throat and esophagus, so that after resection a hole in the wall of the throat remains. At the bottom, the larynx is cut from the trachea below the first cartilage. The lower part of a skin flap is sutured to the trachea and thus forms tracheostomy equipped with a metal tube or an individually tailored tube, made of plastic” (Iwankiewicz 1991: 290).

The vast majority of patients brought to the speech therapy surgeries are people who have used the most radical method of treatment – total laryngectomy. Not only that, the patients after the so-called laryngectomy are in minority – experience shows that in Poland laryngectomy extends to include other anatomical structures: resection of lymph nodes, elements of the throat, jaw or tongue is often made.

3. TNM classification of tumours of the larynx

Developed by the Union for International Cancer Control (UICC), and introduced to Poland Stanisław Bień (Bień 1990) TNM classification determines the stages of tumour development on a scale of I to IV. The fourth highest degree is a large tumour in the larynx anatomical structures and tumour cells in the lymph nodes and frequent distant metastases. Patients with III and IV clinical stage are the largest group of patients in Poland.

TNM classification is a method of determining the anatomical spread of cancer, based on the following three features (Bień 1990: 110):

- T (*tumour*) – defines the extent of the tumour in its original placement;
- N (*nodulus*) – determines the degree of the tumour spread to regional lymph nodes;
- M (*metastatis*) – specifies the extensive tumour metastasis.

4. The etiology of the laryngeal cancer

Although the etiology and pathogenesis of the larynx carcinoma are not established, the role of carcinogenic agents is attributed to genetic and environmental factors (lifestyle, occupation, climatic conditions). The factors significantly increasing the risk are smoking, alcohol consumption, and harmful external factors (eg. chemicals and constant work with voice). Carcinogenic effect of tobacco has been proven. The shape of the larynx causes it to become a kind of filter for cigarette smoke tar. The greatest amount of tar is deposited on the larynx compared to the other sections of the airways.

5. Life situation of patients after total laryngectomy

Indeed, the diagnosis of tumour malignant tumour is associated with tremendous stress. The consequence of the surgical treatment of laryngeal cancer is a significant disability. Laryngectomy has consequences in the psychological, social, family, physiological, as well as economic sphere. The quality of life is largely impaired by depriving the patient of verbal communication with the environment.

Laryngectomy changes the basic function of the body, that is breathing. During the operation of enucleation of the larynx, the trachea exits through hole in the midline of the neck, where it is in close proximity of the bronchi and lungs. The nasal cavity has been excluded from breathing, which in the physiological respiratory track is responsible for warming, air purification and humidification. The shortening of the airway causes the cold air to flow into the lungs. Frequent infections and pneumonia are very serious consequences of the laryngectomy surgery.

The larynx also acts as a stabilizer of chest and stomach muscles. It helps to maintain the proper pressure and intra-muscular tension. The lack of the larynx causes movement disorders and a significant decrease in overall physical capacity.

The consumption of food proceeds normally, but the elimination of nose from the nasal airway causes a lack of activation of olfactory cells. It is possible to receive only the intense smell and the taste of most food is not sensed. The olfactory receptors are not damaged during laryngectomy, their activation requires restoration of the air inflow reaching the nose. This requires the inclusion of olfaction rehabilitation into speech therapy.

REHABILITATION AFTER TOTAL LARYNGECTOMY

1. The speech of laryngectomees

Speech sounds are created owing to the work of the respiratory, phonating and articulating organs. Laryngectomy removes one small element in the chain-sound generator – “The function of the voice generator (vocal cords) is assumed by the soft tissue at the entrance to the esophagus. As a result of their vibrations, the sound wave is formed. Laryngectomy changes the aerodynamic conditions,

cluding it difficult to obtain the right pressure necessary for phonation. Resonant conditions, affecting the production of voice, do not change” (Jastrzębowska, Pelc-Pękala 2001: 623).

A crucial stage in the speech therapy procedure is to introduce air into the oesophagus and achieve its vibrant ejection (*ructus*). The actuated structures of the oesophagus or throat produce sound effects. Their function is the same as vocal ligaments in the physiological respiratory tract.

Oesophageal speech is a place where a sound is created. Types of a substitutive speech are distinguished after a location of oesophageal speech.

Types of substitutive speech by A. Pruszewicz (Pruszewicz 1992: 188–196):

A. Oesophageal voice

It is the best form of voice obtained with conventional methods, rated as the best by most patients. The air removed from the oesophagus through antiperistaltic movements leads to vibrations of the oesophagus mouth (oesophageal speech) to form a basic sound, which then is properly modulated in a slightly altered resonant cavities and articulation organs.

B. Pharyngeal voice

Oesophageal speech lies in the oropharynx. Pharyngeal speech is created with excessive pressure it exhibits a screeching timbre, and it is less economical than oesophageal speech but it is well understood.

C. Oropharyngeal pseudo-whisper

These are primarily unvoiced consonants created by the air which accumulates in the mouth cavity. Almost all patients after laryngectomy are able to master pseudo-whisper it is however understandable only by the nearest surroundings.

D. Fistula speech

It is obtained through surgery, using voice prosthesis implantation, which connects the trachea and oesophagus. The fistula allows a patient after laryngectomy to use the air from the lungs to produce phonation. We distinguish two types of fistulas: primary, created during laryngectomy, and secondary, created when the patient is not able to learn a natural substitutive speech. Fistula speech has a more pleasant tone, smoothness, a longer phonation time. A characteristic feature of the fistula speech is decreased effort while speaking and a shorter rehabilitation period.

2. A rehabilitation methods after total laryngectomy

The rehabilitation procedure after laryngectomy seeks to improve the quality of a patient's life. Because of so many consequences a multi rehabilitation including speech therapy, physiotherapy and psychological support is important.

Psychosocial rehabilitation helps the patient accept the illness, to get rid of fear and prevents depression. A significant therapeutic effect is displayed in the

course of participation in support groups, in rehabilitation treatments and contact with people who are struggling with similar problems.

A physiotherapy treatment is primarily a physical exercise that “improves the overall physical and respiratory efficiency and increases overall fitness of organism. The physiotherapy treatments should include primarily isometric exercises of core muscles, breathing and facial exercises as well as relaxation exercises” (Sinkiewicz 2004: 754).

According to laryngectomees, the loss of voice and speech is the basic problem after enucleation surgery of the larynx. It is strongly advised to begin speech therapy before the complete larynx resection surgery. The therapy is not about exercises but about the necessary information which needs to be provided. The explanation of the changes and their consequences that occur in the body. Speech re-education should begin a few days after the removal of the patient’s food probe.

3. Main factors of the effectiveness of voice and speech rehabilitation of the laryngectomees by A. Pruszewicz (Pruszewicz 1992: 191–192):

Factors that existed before surgery:

- Age
- Sex
- Intelligence level
- Hearing condition
- State of dentition
- the clinical stage of the disease
- Location of the tumour
- Family history

Factors associated with the surgery and radiation treatment:

- The extent of operation – a resection extended to other anatomical structures worsens the prognosis
- Drain retention time in the esophagus
- Tracheoesophageal fistula
- X-radiation and ^{60}Co gamma irradiation treatment

Consequences of surgical treatment:

- a pressure of larynx entrance – when the pressure in the oesophagus amounts to 0.7–5.3 it contributes to quick mastering of oesophageal speech (Pruszewicz 1992: 191–192)
- Morphology of the substitute vocal organ
- Environment.

VOICE REPLACEMENT. METHODS OF FORMATION

The three basic methods are distinguished among the methods of voice and speech rehabilitation of laryngectomees: the classical method (speech therapy), surgery or by using the so-called electronic larynx.

1. Surgical way of modelling a substitute voice

The voice and a speech formed after a surgical method of rehabilitation are called the fistula voice and speech. A larynx is shaped in a surgical way – the oesophageal fistula, into which a voice prosthesis is inserted – a valve that allows the air to flow from the lungs into the oesophagus, it prevents the intrusion of food content and saliva from the esophagus into the lungs. The air from the lungs gets into the esophagus with simultaneous covering of the tracheotomy hole with a hand or a special attachment. The lung air incites the oesophageal membrane generating voice.

An unquestionable advantage of the method is a short time of speech mastering. In addition, it ensures certainty of positive effects- almost every patient is able to commence speaking again. The speech rate and volume are satisfactory, breathing and speaking are coordinated – patient speaks thanks to the air from the lungs, and not, as in the case of classical methods, by the air accumulated in the esophagus. The speech is efficient and it resembles the physiological speech more than esophageal speech.

Despite the growing popularity of the method, many patients are still afraid of a foreign object retention in the oesophagus and related complications such as the formation of a fistula or the nutritional content intruding into respiratory tracts, as well as the necessity of periodic prosthesis replacement.

2. Classical methods of esophageal voice formation

There are several methods of voice reconstruction and esophageal speech. They all have one fundamental assumption – to incite the mucosa of oesophagus or of the throat to vibrate in order to obtain a basic voice. The oral and nasal cavity of a patient after total laryngectomy are excluded from breathing. The breathing apparatus has an ostium in the tracheostomy hole of the trachea. The most difficult part of rehabilitation is to collect the air in the mouth, then to swallow it, and at the height of the oesophagus to resonate the air (*ructus*). After the air is removed from the esophagus, the entrance of the oesophagus vibrates creating a voice. This task is difficult because “*You need to change the existing function of the cricopharyngeus muscle, which before the operation prevented the air from being swallowed during physiological speech*” (Pruszewicz 1992: 189). After laryngectomy it is necessary to learn muscle relaxation, so that the air can get into the esophagus, giving rise to speech.

A. Aspiration method (Seeman)

As a method of introducing air into the esophagus the author suggests “trans-nasal insufflation of air into the oesophagus, together with the inspiratory position of a chest. The patient instantly eructs the insufflated air and starts a simultaneous creation of vowels and words. Thus, the exercise is significantly simplified and shortened’ (Seeman 1966: 88). The air is introduced into the oesophagus using the Politzer’s balloon. The ability to independently introduce the air into the oesophagus depends on the pressure needed for the air to flow into the mouth: the lower pressure is needed, the more smoothly the rehabilitation runs. The coordination of speech and breathing is recommended. Seeman proposes to initiate rehabilitation from vowels, i.e. sounds which appear autonomously when articulated.

B. The injection method

The method consists in “producing overpressure inside the mouth, with the participation of the lips, cheeks and tongue, which results in opening the pseudo-glottis and pushing air into the oesophagus. The tongue moves air backwards and “injects” it into the oesophagus” (Pruszewicz 1992: 189). Overpressure in the mouth can be created by using plosive and stop consonants. Initial sounds are: “p”, “t”, “k”. They should be pronounced with the proper alignment of a tongue, cheeks and lips.

C. Mitrynowicz-Modrzejewska’s vocalistic method

This method of rehabilitation was developed in Poland. The air goes into the esophagus through the use of breath support – the so-called appoggio. ‘Appoggio is a specific function of respiratory muscles, involving the simultaneous tension of inspiratory and expiratory muscles, and the prolongation of the expiratory phase’ (Hołejko-Szuladzińska 1975: 297). An important factor is the creation of the diaphragm-rib-abdomen respiratory tract. The difference between the breathing support used in vocal arts, and the one used in the rehabilitation of the laryngectomees is that the inspiratory phase of in the latter variant is slowed down; negative pressure appears then in the chest, which allows air to be sucked through the mouth into the esophagus.

THE SPEECH THERAPY PROCEDURE AFTER LARYNGECTOMY

The task of a speech therapist is to create an individual schedule of speech rehabilitation, taking into account the possibilities and limitations of a given patient. The aim of speech therapy is to teach the patient to communicate verbally with the world.

Stages of speech therapy by Magdalena Kowalczuk (Kowalczuk 2001):

1. Posture exercise

2. Relaxation of facial muscles
3. Breathing exercise
4. Introducing air into the oesophagus
5. Exercising resonant reflection of the air
6. Introduction and practice of sounds
7. Phrasing utterances
8. Modelling the produced substitute voice

Posture exercise is a set of tests, whose repetition allows for proper muscle tension, especially in the face, neck, shoulder girdle, chest and abdomen. Exercise to improve speech motor skills and self-massage instructions for the patient should also be taken into account.

The next level is exercising to practice breathing through the diaphragm-rib-abdomen track. The principle of breathing exercises for laryngectomees is no different from those performed during classes of voice emission.

After laryngectomy the patient does not take a breath of the air through the mouth. To introduce air into the oesophagus, natural reflexes should be used, e.g. whistling, accumulating a mass of air in the mouth and then swallowing it. The next step is to master the skill of resonant reflection of the swallowed air. The sound, in physiological phonation, makes vocal cords in the larynx vibrate, *ructus*, whereas in the case of the laryngectomees, it makes the pseudo-glottis vibrate. As time goes by, the mouth of the oesophagus are trained to such an extent that making them vibrate occurs automatically, the desire to speak activates the muscles (Kowalczyk 2001: 189).

The sequence of introducing particular sounds differs, depending on the method used. Some experts propose to begin the treatment with vowel production. From the point of view of speech therapy, plosives and stops are the easiest ones to produce. The order of articulated sounds introduced in the rehabilitation process according to A. Kowalczyk (Kowalczyk 2001: 51) p, t, k, cz, c, ć, f, ś, s, sz, d, w, b, dz, dź, dż, ź, ż, z, g, ch, ł, r, l, ń, m, y, o, a, e, u, i.

The norm of the introduction and practising sounds is no different from the one while treating dyslalia: we put a sound in an open syllable, practice it in different types of syllables, propose a sound in initial, middle and final positions, record and eventually automate in sentences.

The next stage, phrasing of utterances, includes practising free regulation of the length of the expiratory phase, executing phrases determined by punctuation. Modelling the substitute voice produced is, in turn, a prosodic exercise: lengthening the basic sound, proper word and sentence stress as well as proper intonation and tempo.

OLFACTION EXERCISE

Additional step in a speech therapy should be a training aiming at recovering the sense of smell and taste. Exercise consists in automating the ability to introduce air into the nasal cavity through the use of such natural reflexes as yawning and olfaction training, i.e. an attempt to identify different scents.

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