Prevention of Voice Disorders
in the Teaching Profession

BACHELOR THESIS

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Declaration

I hereby declare that this bachelor thesis is completely my own work and that no other sources were used for the preparation of the thesis than those listed on the works cited page.

Prague, April 2011

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Abstract

The thesis explores the existing voice disorders in relation to the teaching profession. Furthermore, it presents the basic techniques of voice hygiene and possible treatment options. The work describes the anatomy of vocal folds, the process of phonation and pathologies of phonation apparatus. The aim of the thesis is to create a handout that would summarize advice on voice hygiene for teachers and therefore help them to avoid functional voice disorders.

Key words

prevention, voice hygiene, voice disorders, voice training, phonation apparatus

Anotace

Bakalářská práce se zabývá poruchami řeči se zaměřením na učitelskou profesi. Dále se věnuje základním hlasovým technikám a možným způsobům léčby. Práce popisuje anatomii hlasivek, proces tvorby hlásek a onemocnění hlasivkového aparátu. Cílem práce je vytvořit pracovní list, který by shroval rady týkající se hlasové hygieny u učitelů, a tím pomohl omezit vznik funčních hlasových poruch.

Klíčová slova

prevence, hlasová hygiena, poruchy hlasu, hlasový trénink, fonační ústrojí
# Table of Contents

Introduction ................................................................................................................. 1
Theoretical Part ............................................................................................................. 3
1. Anatomy and Physiology of Vocal Organs ............................................................ 3
   1.1 Lungs and Breathing ......................................................................................... 3
   1.2 Larynx ................................................................................................................ 4
      1.2.1 Laryngeal Cartilages .................................................................................. 5
   1.3 Vocal Folds ......................................................................................................... 7
   1.4 Functions of Larynx .......................................................................................... 8
Glossary ....................................................................................................................... 9
2. Speech Production .................................................................................................... 11
   2.1 Respiration .......................................................................................................... 11
   2.2 Phonation ............................................................................................................ 13
   2.3 Modulation ......................................................................................................... 15
3. Voice Disorders ....................................................................................................... 17
   3.1 Voice Properties .................................................................................................. 17
   3.2 Causes of Voice Disorders ................................................................................ 18
   3.3 Classification of Voice Disorders ....................................................................... 18
   3.4 Organic Voice Disorders ................................................................................... 19
      3.4.1 Laryngitis ..................................................................................................... 20
      3.4.2 Laryngeal Tumours ..................................................................................... 20
      3.4.3 Contact Ulcers ............................................................................................. 21
   3.5 Functional Voice Disorders ............................................................................... 22
      3.5.1 Vocal Cord Nodules .................................................................................... 22
      3.5.2 Vocal Cord Polyps ....................................................................................... 22
      3.5.3 Hyperkinetic Dysphonia ............................................................................ 23
      3.5.4 Hypokinetik Dysphonia ............................................................................. 23
      3.5.5 Aphonia ....................................................................................................... 23
   3.6 Psychogenic Voice Disorders ............................................................................ 24
      3.6.1 Puberphonia ................................................................................................. 24
      3.6.2 Phonassthenia ............................................................................................ 24
      3.6.3 Spasmodic Dysphonia ............................................................................... 24
Glossary 2 ..................................................................................................................... 25
Practical Part ................................................................................................................. 27
4. Voice Hygiene ........................................................................................................... 27
   4.1 Piloting ................................................................................................................ 27
   4.2 Feedback ............................................................................................................. 28
   4.3 The Principals of Voice Hygiene ........................................................................ 29
      4.3.1 Good Posture ............................................................................................... 30
      4.3.2 Breathing Exercises .................................................................................... 30
      4.3.3 Vocal Warm Ups ......................................................................................... 31
      4.3.4 Vocal Warm Downs .................................................................................... 32
   4.4 Other References on Voice Hygiene .................................................................. 34
Works Cited ................................................................................................................ 37
List of Figures & Tables .............................................................................................. 39
Introduction

Being a teacher is a noble though tough profession. Teachers together with singers, actors, interpreters, judges etc. belong to the so called voice professionals. This basically means that they need their voice to conduct their profession. However, the daily demands on the voice are more excessive comparing to other occupations.

Unfortunately, teachers often increase their tone of voice while teaching and consequently voice problems may occur. They might lose their voice, have difficulty in speaking and as a result cannot lecture properly. According to many studies (De Jong et al., 2003; Simberg et al., 2000), this state of uneasiness is experienced by a great number of teachers during their professional career. Therefore, a special emphasis on prevention has to be taken. Ideally, teachers should undergo voice training or learn some voice hygiene techniques during their studies or while on a training (Ilomäki et al., 2005) The situation in the Czech Republic is not very satisfactory since most faculties of education do not provide sufficient education regarding this matter.

As a former student of occupational therapy at a medical faculty, I have been interested in pathologies and how they affect the daily occupation tasks performance. Therefore, this thesis explores the existing voice disorders in relation to the teaching profession. Furthermore, it presents the basic techniques of voice hygiene and possible treatment options. The aim of the thesis is to create a handout that would summarize advice on voice hygiene for teachers and therefore help them to avoid functional voice disorders.

The theoretical part describes the anatomy and physiology of vocal organs, such as the lungs, larynx and vocal folds. Further, it focuses on speech production, especially the process of phonation and modulation of speech sounds. Lastly, a classification of pathologies of phonation apparatus is given with a special emphasis on functional voice disorders, which occur among voice professionals including teachers.

The practical part concentrates on specific voice problems. It illustrates the factors contributing to voice disorders as well as summarizes the principles of
voice hygiene taken from various studies. As a result, a user friendly handout for teachers on voice hygiene forms an integral part of the thesis.
Theoretical Part

1. Anatomy and Physiology of Vocal Organs

As it is stated in Crystal (2007), the body parts used for speech production are called the vocal organs. To this group of organs belong the lungs, the throat (namely larynx and pharynx), the mouth and the nose. The last two as well as the pharynx belong to the so called modulatory organs and will be described later. Now we will closely look at the lungs, the most important respiratory organ and larynx with its vocal folds that play a vital role in the speech production. A glossary for easier understanding of the specialized terminology is attached at the end of the chapter.

1.1 Lungs and Breathing

The lungs are spongy organs that can be found in the thoracic cavity and they are responsible for our breathing (see Fig. 1). Upwards they are connected with lower airways, starting with bronchioli, which are the smallest airways. Further, they verge into bronchi. Two main branches can be distinguished, one for each lung (Brain, 2006).

Then they are followed by the trachea or windpipe, which is in its upper part connected with the larynx that leads into the oral and nasal cavities (upper airway). The diaphragm is located at the bottom and serves as a supportive organ for breathing. The lungs are situated within the rib cage, which functions as their protection. The single ribs are interrelated by intercostals muscles. While breathing the diaphragm lowers and the intercostal muscles help to enlarge the size of the thoracic cavity by making the rib cage move upwards and outwards. Owing to this mechanism, the air pressure within the thoracic cavity lowers. This results in more air flowing into the lungs, which expand and refill with air. When breathing in ceases, the muscles and the diaphragm relax and wield a small pressure on the lungs. Consequently, air is expelled from the lungs and an airflow is generated (Ogden, 2009).
1.2 Larynx

The larynx ("organ of voice" or "voice box") is a tube about 8 cm long that "is formed by a series of cartilages interconnected by ligaments and fibrous membranes and moved by a number of muscles" (Standring, 2005: 633). Larynx is innervated by a couple of nerves, which help to move the muscles of larynx. As it is stated in Standring (2005), the larynx stretches from the back of the tongue to the trachea. It opens into laryngopharynx, which is the middle part of the pharynx. It is a flexible organ that moves especially during swallowing as well as phonation. When resting, larynx can be found opposite the third to sixth cervical vertebrae in males, but can be placed slightly higher in females and children. As Crystal (2007) points out, the larynx in primates is situated in a markedly higher position, whereas their pharynx is very insignificant. They also have a long, thin tongue that does not have enough room to move in the mouth. Therefore, they cannot produce a wide range of sounds. However, during the evolution the posture became upright and the position of the head moved forward. The larynx moved down and pharynx developed. As a result, humans have the ability to make many more
sounds. On the other hand, this anatomical change in the position and development of these organs caused breathing, chewing and swallowing less effective. Unlike the monkeys, we can choke on food that accidently enters the larynx.

In childhood the size of larynx in males and females is very similar. However, during puberty significant changes happen - the male larynx enlarges noticeably and keeps on growing until the age of 40 (Standring, 2005).

1.2.1 Laryngeal Cartilages

As mentioned earlier, the framework of larynx is made of cartilages, which will be now described in more detail. The cartilages are as follows: the single thyroid, cricoid and epiglottic as well as the paired arytenoids, cuneiform, corniculate and tritiate cartilages (see Fig. 2+3).

Thyroid cartilage (see Fig. 2a) is the largest one among the laryngeal cartilages. It consists of two thin plates of cartilage meeting anteriorly forming a laryngeal prominence called ‘Adam’s apple’ (in the midline of neck, visible especially in men, see Fig. 2c). However, the angle under which the cartilages meet is different in males and females - 90° in men whereas 120° in women. The shallower angle in males is connected with greater laryngeal prominence, longer vocal folds and consequential deeper pitch of the voice. Vocal folds are joined to the middle of thyroid angle; it is also a place where most of laryngeal foreign bodies are stopped from entering the air passage (Dhingra, 2006).

Below the thyroid cartilage lies the cricoid cartilage (see Fig. 2b), which is attached to the trachea from the other side. It has a shape of ring formed from a hyaline cartilage and is the only laryngeal cartilage interconnected with the airway.
On its surface there are many facets and places where other laryngeal cartilages are articulated and a number of muscles are attached. Comparing to the thyroid cartilage, this one is rather small but very thick and strong (Standring, 2005). Another important part of larynx is the epiglottis (see Fig. 3a), which is thin, leaf-like elastic cartilage which forms the anterior wall of the laryngeal inlet. It can be found behind the tongue and the hyoid bone, which is a separate structure placed above the larynx and connected with it by a thyrohyoid membrane (see Fig. 2e) and a couple of ligaments. The upper ending of epiglottis is free; it has a broad and round shape. On the other hand, the lower part is long and narrow and is attached by thyroepiglottic ligament (see Fig. 3c) to the back of the laryngeal prominence of the thyroid cartilage. In front of epiglottis the so called pre-glottic space is located. This area is clinically important since a high risk it could be invaded by laryngeal cancer exists, especially in people who smoke and drink alcohol. The epiglottis is not crucial for swallowing, respiration, neither for phonation. The main function is the protection of the airways against food and foreign bodies (Standring, 2005).

**Arytenoid cartilages** (see Fig. 3f) are situated at the back of the larynx (Dhingra, 2006). They are paired, small and pyramidal in shape. The arytenoid cartilages are connected with vocal folds that are attached to the inside of the thyroid cartilage. They can move and make the vocal folds open or close. Both cartilages articulate with the cricoid cartilage at the bottom (Standring, 2005).

A different structure is presented by **corniculate cartilages** (see Fig. 3d), which are two small conical nodules that articulate with the top parts of the arytenoid cartilage.
cartilages and function as a place for attachment to aryepiglottic folds (Standring, 2005). **Cuneiform cartilages** (see Fig. 4f) are another paired cartilage that has a shape of small nodules that articulate with the tops of arytenoids cartilages. They can be found in the aryepiglottic folds and function as a support there (Standring, 2005).

The last, though not very important structure are **tritiate cartilages** (see Fig. 3h), which are two very small pieces of elastic cartilage situated above the larynx, one on either side (Standring, 2005).

### 1.3 Vocal Folds

Vocal folds are a pair of muscular tissue situated within the middle part of the larynx (see Fig. 4d). As Ogden (2009) claims, they were earlier known as the vocal cords. However, this might suggest that they are like a pair of strings on a string instrument, which is imprecise. Their primary function is to prevent anything entering the lungs, for example food or water, by developing a blockage in a form of valve in the airways. Two types of vocal folds exist within the larynx – the upper folds are the vestibular or in other words false vocal folds (see Fig. 4e) and the lower ones are the true vocal folds. The gap between the latter is the rima glottidis or glottis (see Fig. 4a) (Standring, 2005). The true vocal folds are responsible for the creation of voice or phonation, while the false vocal folds have different function – they are responsible for resonance instead and do not directly play an important role in the process of sound production (Standring, 2005). The process of phonation will be thoroughly discussed in chapter 2. Regarding the size of true vocal folds, in childhood, their length is about 6 mm in females and 8 mm in males. In adults, they grow to 15-19 mm in women and 17-23 in men (Dhingra, 2006).
1.4 Functions of Larynx

The larynx has several essential functions. Firstly, it serves as a protection of lower airways. This function has been phylogenetically developed prior to the voice production, which is secondary. The larynx protects the airways by different means, e.g. by a cough reflex, closure of laryngeal opening etc. While swallowing food, it is necessary to protect the bolus (chewed food) from entering the airway passage. It happens by a closure of the three following sphincters: laryngeal inlet (aryepiglottic folds mainly), false vocal folds and true vocal folds. As a consequence of this closure, the air passage should be protected from an unwanted substance. However, in case a foreign element enters the respiratory system cough is a great instrument to eject it. As the author smartly illustrates "Larynx is aptly called the watch-dog of lungs as it immediately 'barks' at the entry of any foreign intruder" (Dhingra, 2006: 263).

Secondly, it controls the amount of air inhaled by the lungs. Vocal folds are spread apart during breathing in and closed together during the expiration (Dhingra, 2006). During forced breathing they are widened to its maximum and the glottis takes a shape of a diamond (Standring, 2005).

The last function (apart from phonation that will be looked at in the next chapter) is fixation of chest. In case the larynx is shut, the chest gets fixed better and the muscles can perform better actions. As a result of this posture, several activities, such as climbing, digging, coughing even child birth can be executed smoothly and with greater confidence (Dhingra, 2006).
Glossary

**Anterior** – přední

**Articulate** – artikelovat – v anatomické terminologii znamená spojit, skloubit (např. dvě kosti); ve fonetické terminologii – vyslovovat, vyjádřit

**Aryepiglottic folds** - párová slizniční řasa mezi hrotem chrupavky hlasivkové a okraji příklopky hrtanové

**Arytenoid cartilage** – chrupavka hlasivková

**Bronchi** – průdušky

**Bronchioli** – průdušíky

**Cervical vertebrae** – krční obratle

**Corniculate cartilage** - drobná párová chrupavka hrtanu nasedající na hrot chrupavky hlasivkové

**Cricoid cartilage** – chrupavka prstencová

**Cuneiform cartilage** – chrupavka klínovitá

**Diaphragm** – bránice

**Epiglottic cartilage** – chrupavka příklopky hrtanové

**Facet** – ploška (např. na kosti)

**Fibrous** – vláknitý

**Hyaline cartilage** – kloubní chrupavka, která je hladká, tvrdá a křehká

**Hyoid bone** – jazyłka

**Ligament** – vaz, vazivo

**Prominence** – vyvýšení, výstupek

**Sphincter** – svěrač
Thoracic cavity – dutina hrudní

Thyroepiglottic ligament – vaz spojující chrupavku štítnou s přiklopkou hrtanovou

Thyrohyoid membrane – membrána mezi chrupavkou štítnou a jazylkou

Thyroid cartilage – chrupavka štítná

Tritiate cartilage – drobná párová chrupavka hrtanu umístěná v membráně mezi chrupavkou štítnou a jazylkou
2. Speech Production

Animals mostly use the sounds they produce as a reaction to some impulses, e.g. in case they need to express fear, hunger or sexual excitement. Unlike animals, humans have the ability to organize the sounds which they produce into very effective system of communication. However, there is something regarding speech production that humans and animals have in common – they use organs whose primary function is not connected with vocal communication. These are mainly the organs situated in the respiratory tract (Cruttenden, 2001).

Speech production is a very complex mechanism, which means it involves the coordination of various organs such as lips, tongue, vocal folds as well as breathing. According to Ogden (2009), the production of even the simplest speech sounds involves synchronization of many items.

This chapter scrutinizes the process of speech production in more detail including the description of the most suitable airstream mechanism, process of phonation and the final modulation of individual speech sounds.

2.1 Respiration

As Ogden (2009) claims, speech sounds are generally produced on an out-breath. It is called pulmonic (since the airstream comes out from the lungs; in Latin lung is 'pulmo') and egressive (because the air leaves the vocal tract and is manifested further, again this word has origins in Latin). Most speech sounds are based on pulmonic egressive airstream. However, Crystal (2007) ads that humans can produce sounds on an in-breath, while they are breathing in. This kind of airflow is called pulmonic ingressive. It usually occurs when somebody attempts to talk whilst crying, laughing or when gasping for breath. An example of words produced on an ingressive airstream is 'yes' and 'no', but only in case they are pronounced in a monotonous voice (when someone reacts to what somebody else is saying). However, speech based on an ingressive airflow is considered to be of poor quality and unpleasant to listen. Hoarse voice may be present as well.
The series of breathing in and out is called the respiratory cycle. It is controlled by a respiratory centre, which is located at the back part of our brain. This cycle usually consists of two almost equal halves – the part when we inhale as well as the one when we exhale. Normally, there are 12 breaths a minute on average – it means that every 2.5 seconds we either inhale or exhale. However, during conversation the rate changes to extremely rapid inhalation (we take an in-breath only for a quarter of a second) and very fast exhalation (the time for exhaling is extended to 5 to 10 seconds). The pace depends on our emotional and physical state. The reason of such changes in the number of in and out breaths is the increase in the amount of speech sounds that are thus produced. It is absolutely normal that in everyday speech 250 to 300 syllables per minute are produced (Crystal, 2007).

As mentioned earlier, sounds are mostly produced on an out-breath. Nevertheless, there exists a category of sounds, which are not based on pulmonic egressive airstream (this means that lungs are not involved in the process of their production). They are called non-pulmonic sounds. The most prominent type is the clicks. As Crystal (2007: 21) states, “click sounds are sharp suction noises made by the tongue or the lips”. The main use of clicks in European languages is meaningful noises. Other types of non-pulmonic sounds are noises based on a glottalic airstream mechanism. In this case the gap between the vocal folds (the glottis) is used for moving the air flow. There are two types of sounds produced via this mechanism. Firstly, if the glottis moves the air inwards, the sounds produced are called implosives. They are present in various languages, but mostly in African and Native American languages. To Europeans it might sound that the sounds are 'swallowed'.

On the other hand, when the glottis causes the air to move outwards, the sounds are named ejectives. They are broadly used in numerous Native American and African languages as well as in the languages of the Caucasian family. Furthermore, English speakers in the north of England use them frequently to replace the final /p/, /t/, or /k/ at the ends of the words (Crystal, 2007).
2.2 Phonation

During speaking vocal folds have an important function – they can be made to vibrate. The process of vibration is called voicing or phonation. Sounds that are associated with voicing are called voiced sounds. On the other hand, those that do not undergo the process of vibration are called voiceless sounds (Ogden, 2009).

As described in the previous chapter, arytenoid cartilages are one of the structures forming the framework of larynx. Their most important function is that by moving (either apart or together) they also move the vocal folds, which are attached to them (see Fig. 5). In case they move apart, an opening between the folds occur – the glottis.

![Figure 5 Arytenoid cartilages causing opening and closing of the glottis (Roach, 1991: 27)](image)

There are four different states of glottis according to the position of the vocal folds. Firstly, there is the position of wide glottis - while breathing vocal folds are spread apart. This state of vocal folds allows air to pass freely across the glottis (Ogden, 2005). Vocal folds are frequently in this position for voiceless consonants like /p, f, s/ (see Fig. 6a) (Roach, 1991).

Secondly, vocal folds may be in the position of narrow glottis (see Fig. 6b).

In case the airstream passes through a narrowed glottis, a sound /h/ is produced. This sound is very similar to a whispered vowel (Roach, 1991).

Another state, probably the most important in speech production, is the position for vocal fold vibration (see Fig. 6c). Let us have a close look at the process of phonation. According to Roach (1991), in case the edges of the vocal folds are in contact with each other or they are practically touching, airstream that
passes through the glottis will usually make them vibrate. As Ogden (2009: 42) explains “the vibration of the folds is not caused directly by command from the brain telling the folds to open and close: it is caused by having the right amount of tension across the folds”. He adds that if the folds are closed, the air from the lungs cannot find its way out. Yet owing to the movement of thoracic and abdominal muscles the pressure below the folds increases. When the pressure is sufficient, the folds are forced from below to spread apart in order to let the air stream come out. Once they pass through the glottis, the pressure on both sides of the glottis starts to equalise. Afterwards, the folds are brought together and make a closure again (Ogden, 2009).

As it is stated in Cruttenden (2001), this opening and closing happens rapidly and is repeated on a regular basis, for example in a woman’s voice the frequency various approximately from 200 to 325 times per second and about 100 and 150 times per second in adult men. The cycle of opening and closing of the vocal folds repeat itself. As mentioned before, it depends on the right amount of tension across the folds as well as on the air pressure above and below the folds. This mechanism is called Bernoulli effect (Ogden, 2009).

The last state, in which vocal folds can be positioned, is when they are tightly closed (see Fig. 6d). During this phase a closure is developed and the airstream cannot pass through them. If this occurs in speech production, it is called a glottal stop.

![Diagram of glottis states](image-url)

**Figure 6** Four different states of the glottis (Roach, 1991: 28)
2.3 Modulation

Once the airflow leaves the larynx, it comes to different parts of the vocal tract, where individual speech sounds are modulated. In phonetic terminology it is the so-called place of articulation.

The modulating organs can be divided into two types: active and passive. Active articulators have the ability to move. One of them is for example the tongue tip that helps to create sounds like /s t n/ because it can move up behind the teeth. On the other hand, passive organs are the ones, which cannot move and serve as a contact place for active articulators. Regarding the same sounds /s t n/, the bony ridge behind the upper teeth is one example of passive articulators (Ogden, 2009).

In the following description, we will briefly look at individual modulating organs. At first, it is the pharynx, a hollow cavity situated above oesophagus and larynx, which is both part of respiratory and digestive system (see Fig. 7). As it is stated in Cruttenden (2001), it leads to the root of the tongue as well as to the mouth of the nasal cavity. It consists of three main parts: laryngopharynx, oropharynx and nasopharynx.

Another important modulatory organ, which is closely connected with the previous one, is called the velum or soft palate (see Fig. 7). When it is raised, it excludes the functions of nasopharynx and therefore the air cannot escape through nasal cavity. It has to leave the tract through the mouth. Vast majority of the English sounds escape through oral cavity (Cruttenden, 2001). The velum can be also lowered, which is the position for normal breathing. In this case the air may leave the tract through the nose as well as the mouth.
A different part of the oral cavity is the **hard palate**, which is situated in front of the velum (see Fig. 7). It is frequently called the 'roof of the mouth'. At the end of this structure towards the front, there is the so called **alveolar ridge**, which is located behind the top front teeth. Both organs can be easily touched by the tongue (Roach, 1991).

Another important speech organ is the **tongue**, which belongs to active articulators. It can be moved into various places within and even outside the oral cavity. The tongue can be divided into several parts: tip, blade, front, back and root (Fig. 8).

![Figure 8 Sub-division of the tongue (Roach, 1991: 9)](image)

The remaining modulating organs are teeth and lips. The upper and lower teeth can be found behind the lips, continue to the sides of the mouth and end up at the back of this cavity. The lips can be put together (in sounds like /p, b/), make contact with the teeth (e.g. in /f, v/) or be rounded in the production of some vowels (Roach, 1991).
3. Voice Disorders

Drawing on the facts from the two previous chapters in which the phonation apparatus was described in considerable detail, we can now proceed to the pathologies of the vocal organs. These will be scrutinized and illustrated in an overall classification together with their causes and suggested treatment for some of the voice disorders. A glossary for easier understanding of the specialized terminology is attached at the end of the chapter.

3.1 Voice Properties

Human voice has certain properties. According to Stein, these are pitch, timbre, inflexion, rhythm, intonation and loudness (Stein, 1942). Johnson offers an apt description of 'normal voice'. As it is stated in his work, voice should meet the following criteria (Johnson et al., 1965):

- **Quality** should be pleasant, with a certain musical quality and an absence of noise as well as inappropriate breaks.
- **Pitch** should be appropriate to the age or gender of the speaker.
- **Loudness** should be appropriate to the communication event, neither so weak as to be borderline intelligible or unintelligible under ordinary speaking circumstances, nor so loud that it calls attention to itself and aptly adjusted to the context of the event whether it is private conversation, speaking in a large lecture hall or yelling for help.
- **Adequate flexibility** – pitch and loudness variations should be available to express emphasis, meanings or nuances indicating individual feelings.
- **Adequate sustainability** – voice should meet one’s occupational and social needs even when the intonation has to be raised.

In case the above mentioned recommendations are not adopted, certain disorders might occur. In general, voice disorders are “regarded as deviations from that type of voice, which is commonly agreed upon” (Stein, 1942: 185).
Crystal (2007: 91) offers another definition. He explains that voice disorders develop if "an expressive disability in which the pitch, loudness and timbre of the voice is so inefficient that the message carried by the spoken language may be unintelligible". Crystal (2007) also adds a practical example – if we are not in control of our whisper (we cannot turn it on and off at will), we may suffer from a voice disorder.

3.2 Causes of Voice Disorders

Various causes that contribute to the development of voice disorders exist. They may result both from voice abuse as well as external factors over which individuals have no control. In relation to the teaching profession, these factors might be unhealthy classroom environment such as chalk dust, breathing dry or polluted air, external and internal noise, inadequate acoustics, poor illumination as well as work organization problems, stressful social relationships. Other causes involve excessive talking or talking too loudly, screaming, smoking and dehydration of the body. All these aspects can predispose individuals to laryngeal irritation and voice abuse or misuse, all of which induce stress on the vocal folds and may result in a voice disorder (Alves et al., 2009).

The growth of nodules, polyps and lesions on the vocal folds can bring about a voice disorder as well. Other causes of these disorders include infections, hormonal alterations, gastroesophageal reflux (also called acid reflux) or the movement of stomach acid into the throat, laryngeal cancer as well as diseases that paralyse the vocal folds (Jardim et al., 2007). There are several more diseases, which can bring about voice problems and disorders. Such medical conditions will be demonstrated later on in this chapter.

3.3 Classification of Voice Disorders

It is not easy to present an exhaustive classification of voice disorders as different authors present various categorizations. The following simplified classification was created on the basis of several important texts in this field.
As it is stated in Škodová et al. (2003) and Aronson (2009), voice disorders can be divided into three main types according to the causes: **organic disorders** are brought about “by structural (anatomic) or physiologic disease, either a disease of larynx itself or by remote systemic or neurologic diseases that alter laryngeal structure or function” (Aronson, 2009: 6). See Table 2 and Glossary 2 that list various types and causes of organic voice disorders. Secondly, there are **functional voice disorders**. This is the type of voice impairment occurring among those who use their voice incorrectly or uneconomically. It means that the problem itself is not in the tissue of the phonation apparatus whereas in its function (Škodová et al., 2003). Lastly, **psychogenic disorders** are induced as a result of psychological issues, such as psychoneurosis as well as personality disorders (Aronson, 2009).

In the following table a selection of diseases of the phonation apparatus is shown. Various more exist although only some of them will be described in detail. Another fact that is worth mentioning is the variability of causes. In some cases, it is not clear whether the cause of the disorder is rather organic, functional or psychogenic. Furthermore, different types of a particular disease can be distinguished as some disorders (for example dysphonia) might be caused by multiple factors (see Tab. 1).

<table>
<thead>
<tr>
<th>Organic</th>
<th>Functional</th>
<th>Psychogenic</th>
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<tbody>
<tr>
<td>Laryngitis, Pharyngitis</td>
<td>Hyperkinetic dysphonia</td>
<td></td>
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<tr>
<td>Hypokinetic dysphonia</td>
<td>Spasmodic dysphonia</td>
<td></td>
</tr>
<tr>
<td>Contact Ulcers</td>
<td>Vocal cord nodules</td>
<td>Phonastenia</td>
</tr>
<tr>
<td>Reinke’s oedema/Vocal cord polyps</td>
<td>Tumo of larynx</td>
<td></td>
</tr>
<tr>
<td>Functional aphonía</td>
<td>Functional aphonía</td>
<td>Psychogenic aphonía</td>
</tr>
</tbody>
</table>

*Table 1 Example of some voice disorders according to the causes (Aronson, 2009)*

### 3.4 Organic Voice Disorders

As it is stated in Table 2, organic voice disorders may be brought about by several causes (congenital, metabolic or neurologic). Among the most frequent
diseases belong inflammations of vocal organs, for example pharyngitis as well as laryngitis (the suffix – itis is of Latin origin and means inflammation).

### 3.4.1 Laryngitis

Larynx is very important in the speech production. Thus the most common diseases that affect this organ will be scrutinized. First of all, there is **laryngitis**, which is an inflammation of the vocal folds and larynx. There are two types – acute form (it has a sudden onset and is treated within three weeks at most) as well as a chronic form (if laryngitis lasts for more than three weeks and cannot be cured easily). The causes of acute laryngitis are vocal misuse or exposure to infectious agents, such as viruses and bacteria. On the other hand, the factors contributing to the onset of chronic laryngitis are different. It is usually caused by environmental factors for example inhalation of cigarette smoke or polluted air, gastroesophageal reflux etc.; vocal misuse is a mutual cause for both types. During the course of the disease patients suffer from a hoarse low-pitched voice, which is caused due to the swollen vocal folds. They stiffen and thicken irregularly along the entire length. The best treatment in people with a chronic form is vocal therapy (Shah, 2009).

### 3.4.2 Laryngeal Tumours

Apart from inflammatory diseases vocal organs can be affected by **tumours**. These are either benign (non-cancerous) or malignant (cancerous). The most common type among cancerous tumours is the **squamous cell carcinoma of larynx** (spinocelulární karcinom hrtanu), whereas the most frequent non-cancerous structure is **laryngeal papilloma** (papilom hrtanu). Tumours growing in the area of vocal folds are easily diagnosed. A hoarse voice might be one of the warning symptoms. In case it persists for more than three weeks, the individual should seek for a specialist in order to undergo an examination of larynx. Tumours located in the supraglottic (above glottis) area may be manifested by difficulty in swallowing. On the contrary, tumours located below glottis can be without any clinical signs for a long period. Therefore, their diagnosis might be more complicated. The treatment consists in surgical removal of the carcinoma with surrounding tissue in order to minimize the
possibility of another growth of the malignant tissue. If the malignant tumour of the vocal folds is diagnosed in early stages, it has to be found out whether it did not invade the surrounding tissue. Subsequently, it is possible to remove only the vocal fold tissue or to liquidate the tumour by radiotherapy. Otherwise usually the whole larynx at the affected part of the neck has to be removed. The result of such a surgical procedure is a complete loss of voice. The solution for the patients might be an artificial larynx. This is an oval device, which can be applied to the neck. It enables to create sounds through mechanical vibrations even without vocal folds. The resultant voice sounds ‘robotic’; however, it is easily understandable (Lejska, 2003). On the other hand, benign tumours are cut off without unnecessary interference in the surrounding tissue (Škodová et al., 2003).

3.4.3 Contact Ulcers

On the whole contact ulcers are less common. They occur among the individuals who use an excessive force to bring the arytenoid cartilages (the ones that move vocal folds) together. The consequences of such vocal misuse are ulcerations and little wounds near or around the cartilages. This damage to the laryngeal tissue may be also brought about by gastroesophageal reflux. The disease manifests itself in a voice, which can be tired easily as well as some sore throat while talking.

<table>
<thead>
<tr>
<th>Congenital disorders</th>
<th>Metabolic disorders</th>
<th>Neurologic disorders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal cleft (Rozštěp hrtanu)</td>
<td>Hypothyroidism (Hpothyroidismus)</td>
<td>Apraxia of phonation (Fonační apraxie)</td>
</tr>
<tr>
<td>Subglottic stenosis (Subglotická stenóza)</td>
<td>Hyperthyroidism (Hyperthyroidismus)</td>
<td>Akinetic mutism (Akinetický mutismus)</td>
</tr>
<tr>
<td>Down syndrome (Downův sybdrom)</td>
<td>Rheumatoid arthritis (Revmatoïdí artritida)</td>
<td>Hyperkinetic-chorea (Hyperkinetická chorea)</td>
</tr>
<tr>
<td>Cri-du-chat (Syndrom “kočičího křiku”)</td>
<td>Amyloidosis (Amyloidóza)</td>
<td>Organic voice tremor (Organický hlasový třes)</td>
</tr>
</tbody>
</table>

Table 2 Causes of organic voice disorders (Aronson, 2009)
3.5 Functional Voice Disorders

This is a category of voice disorders that are mainly caused by vocal abuse. Therefore, teachers as well as other voice professionals belong among those who are most affected by such pathologies.

3.5.1 Vocal Cord Nodules

These structures count among the most common disorders resulting from vocal abuse. They are basically lesions that result from mechanical damage caused to the connective tissue of the vocal folds. The lesion is very often a result of continual misuse of the voice, which usually happens among voice professionals. Therefore, they are usually called 'singer’s nodules', 'politician’s nodules' as well as 'teacher’s nodules'. When the vocal folds close aggressively, swelling may be present at the sides of the collision, usually on both vocal folds opposite each other. If voice rest follows this trauma of vocal folds, they will recover in a couple of days. Nevertheless, when repeating these episodes of mechanical damage repeat, swelling can be present most of the time and 'soft nodules' occur. If these are not treated properly, scar tissue may arise on the sites of contact. Consequently, the affected area is not able to vibrate efficiently. Such structures are called 'hard nodules' and have to be removed by a surgical procedure since a voice therapy does not reach satisfactory effects (Harris, 2009).

3.5.2 Vocal Cord Polyps

Vocal cord polyps, also called Reinke’s oedema, are structures formed only on one vocal fold. They are softer and non-cancerous. A vocal polyp is brought about by long-term cigarette smoking as well as hypothyroidism and gastroesophageal reflux. Again, vocal misuse can play an important role as a cause factor.

People with either nodules or polyps manifest similar symptoms and signs – they have a horse, low-pitched and breathy voice. In case they are complaining about hoarseness, they should be examined to exclude the occurrence of laryngeal carcinoma (Woolf, 1998).
3.5.3 Hyperkinetic Dysphonia

Hyperkinetic dysphonia is caused by the enlargement (hypertrophy) of a vocal muscle that helps to move the vocal folds. This happens due to the excessive use of vocal folds (screaming, loud talk) as well as due to different factors such as smoking, drinking alcohol or noisy environment. A further cause might be singing in an inadequate vocal technique (characteristic of children who sing in a choir). The most typical symptom of this disorder is hoarseness followed by an increased muscle tension in the area of larynx. Owing to the hypertrophy of vocal fold muscles and the surrounding area, vocal folds cannot function properly. As a result, vocal fold insufficiency may occur, which is a common symptom among teachers. If dysphonia is not cured well, vocal nodules may occur or this disorder can shift to another type, which is hypokinetic dysphonia (vide infra). The treatment of the former type consists in voice hygiene, voice rest and perhaps even in a change of lifestyle (Novák, 1996; Kučera et al., 2010).

3.5.4 Hypokinetic Dysphonia

As mentioned above, hypokinetic dysphonia can result from a hyperkinetic one. However, in some cases it might be a congenital disease. The problem here is dysfunction of the vocal muscle, which is very weak and cannot perform its task properly. In this type vocal fold insufficiency is very significant. Suggested treatment is the same as for the hyperkinetic type. In severe cases a surgical intervention has to be applied (Novák, 1996; Kučera et al., 2010).

3.5.5 Aphonia

Another voice disorder is aphonia, which is a functional disease affecting mostly young females, who are emotionally labile. It has a sudden onset. The problem is based on the dysfunction of the vocal folds, which fail to close during phonation. The result is a whispered voice or even loss of voice (Dhingra, 2006).
3.6 Psychogenic Voice Disorders

3.6.1 Puberphonia

In normal conditions, childhood voice is of a higher pitch. During puberty it 'breaks' and changes to a lower pitch. If the voice does not undergo this alteration, it is called puberphonia. This disorder usually occurs among boys “who are emotionally immature, feel insecure and show excessive fixation to their mother” (Dhingra, 2006: 290). It is treated by pressing on the larynx backwards and downwards since it reduces the tension of vocal folds and consequently low-pitched voice can be produced (Dhingra, 2006).

3.6.2 Phonasthenia

A different disturbance is phonasthenia, which is a weakness of voice as a result of fatigue of laryngeal muscles. It is manifested in abuse or misuse of voice or after an inflammation in this area. The problem is that the voice becomes easily fatigable. The therapy is based on a voice rest and vocal hygiene with a special emphasis on periods of voice rest after a period involving voice use (Dhingra, 2006).

3.6.3 Spasmodic Dysphonia

It is a neurological disorder that affects laryngeal muscles, which control the vocal folds. They are subjected to unexpected involuntary movements (also called spasms) leading to the disability of the folds to vibrate and produce voice. In individuals with spasmodic dysphonia the voice sounds tight and strained. Sudden breaks in the voice might occur once in a while in the speech. Unfortunately, this type of dysphonia is usually more severe and spasms may appear on every other word. Therefore, the individual’s speech is very difficult to be understood by other people. It is a chronic disease, which is present for the rest of one’s life. Fortunately, it is a very rare condition. Spasmodic dysphonia occurs usually in people who are between 30 and 50 years old. Surprisingly, women are more affected by this disorder than men.
**Glossary 2**

**Amyloidosis** – amyloidóza – onemocnění typické ukládáním specifických bílkovin (amyloidu) do mezibuněčných prostorů a okolí cév různých orgánů

**Akinetic mutism** - akinetický mutismus – neschopnost pohybovat se či mluvit

**Apraxia of phonation** – fonační apraxie – porucha centrálního nervového systému projevující se problémy s tvorbou hlasu

**Congenital** – kongenitální - vrozený/á (např. vada)

**Cri-du-chat** – syndrom “kočičího křiku” - geneticky podmíněné onemocnění charakteristické pláčem novorozenců, který připomíná kočičí křik/mňoukání

**Down syndrome** – Downův syndrom – geneticky podmíněné onemocnění projevující se řadou vrozených vad (např. srdeční vady, porucha funkce štítné žlázy)

**Etiology** – etiologie – původ/příčina onemocnění

**Gastroesophageal reflux** - gastroezofageální reflux – návrat potravy zpět z žaludku do jícnu díky špatně těsnícímu svěrači

**Hyperkinetic-chorea** – hyperkinetická chorea – neurologická porucha projevující se nepravidelnými, náhodnými pohyby různých částí těla

**Hypertrophy** – hypertrofie – zvětšení, zbytnění (např. svalu, orgánu)

**Hyperthyroidism** – hyperthyroidismus – nadměrná produkce hormonů štítné žlázy

**Hypothyroidism** – hypothyroidismus – nedostatečná produkce hormonů štítné žlázy

**Laryngeal cleft** – rozštěp hrtanu

**Laryngeal papilloma** – papilom hrtanu – typ nezhoubného nádoru hrtanu a hlasivek
Lesion – léze – rána, poškození

Oedema – édém – otok

Organic voice tremor – organický hlasový třes – mimovolní pohyby hlasivek

Rheumatoid arthritis – revmatoidní artritida – zánětlivé kloubní onemocnění postihující následně i jiné orgány

Sign - objektivní příznak nemoci, např. zvracení

Squamous cell carcinoma – spinocelulární karcinom - typ rakovinného nádoru

Subglottic stenosis – subglotická stenóza – vrozená vývojová vada postihující hrtan

Symptom – subjektivní příznak nemoci, např. nevolnost
Practical Part

4. Voice Hygiene

There are many ways how to protect one’s voice and avoid possible voice disorders. The aim of this part is to create a useful list of recommendations regarding voice hygiene. Furthermore, two versions of handouts on voice hygiene will be introduced as well as the general findings of a pilot research. The handouts were compiled on the facts taken from the studies by Lehto (2007) and Yiu (2002).

4.1 Piloting

A pilot study was carried out among the students of the faculty of education. They were presented a user-friendly handout summarizing the advice on voice hygiene. Some of them were asked to participate on the piloting study via email (they were sent a document) whereas others were interviewed in person. Out of thirteen people only seven replied or gave some feedback on the content and the structure of the handout.

Handout for Teachers on Voice Hygiene

- Undergo a voice screening, either at the beginning of your training or during your career.

- Try to attend any voice hygiene or voice training course in your surroundings.

- Work in a healthy environment – try to avoid risk agents such as noise, dust, chalk dust, heath, poor illumination, or ventilation, bad air quality – open windows.

- Minimize speaking distance – make the students/pupils sit in the front lines.

- Do not smoke or try to give up smoking – smoke causes irritation or swelling of the vocal folds.

- Pay attention to your working posture without unnecessary tension on cervical musculature – e.g. straight position of the neck, standing rather than sitting while speaking.
Try to recognize any alterations/problems with your voice as soon as possible, seek for a speech-language pathologist or any medical help (ENT specialist\(^1\)), keep in mind that an early diagnosis on vocal symptoms is a good prevention of laryngeal cancer as well.

- Breathe properly & practise breathing exercises.
- Drink more water.
- Do not drink too much caffeine or alcohol – it would dry your vocal folds internally.
- Speak softly and slowly if possible.
- Use amplifiers where possible.
- Avoid screaming and unnecessary high voice usage.
- Take more voice rest.
- Take throat lozenges or herbal tonic if problems occur or as a prevention.
- Avoid eating spicy food.
- Use non-verbal communication/more gestures.
- Carry out vocal exercises.
- Avoid stressful social relationships and work stressors – try to make good relationships among faculty members, students, and the school leadership.

4.2 Feedback

The students’ reactions to the handout involved a couple of constructive suggestions. Firstly, they wanted to know more about voice hygiene or how to perform specific vocal and breathing exercises. Secondly, it was proposed that it might be useful to mention where voice training courses take place or how to find out this piece of information. Furthermore, they were curious to know what kind of

\(^{1}\) Ear Nose & Throat Specialist - ORL
gestures should be used to facilitate the communication and thus relieve the voice. They were also interested about the places where it is possible to undergo the voice screening as well as how exactly functional voice disorders can be cured.

One respondent wanted to know the precise amount of water that should be drunk a day. Another student required an explanation why bad social relationships have a damaging impact on their voice. Another inquiry regarded voice rest, specifically the clarification of what it involved. A different question was aimed at the meaning of the word ‘amplifier’, which was not clear to some respondents. To recapitulate the negative or unclear reflexions, the handout should not provide such abstract ideas or advice whereas it should offer more concrete information on voice hygiene.

On the contrary, some principles were met with positive reactions. For example the logical fact, that teachers should minimize the speaking distance by making the students sit in the front of the class. Further, the vast majority of the respondents found it interesting that it is advisable to avoid eating spicy food. They did not know about the potential harmful effect of spices on their vocal folds. On the whole, the respondents’ comments provided the author with some remarkable and useful tips, which were included in the final version of the handout.

### 4.3 The Principals of Voice Hygiene

On the basis of the feedback, certain aspects regarding voice hygiene have been chosen and will be explained in more detail. These concern mostly the items, which were not clear to the respondents or were described only briefly. The following facts were mainly taken from the websites of The British Voice Association, Voice Care Network UK as well as Spine Universe. The first two websites can serve as a useful source of information on voice hygiene due to various links and other publications on this topic. The final version of the handout for teachers was drawn on the information from these websites as well.
4.3.1 Good Posture

In a sitting position, you should be seated on your sitting bones (not to rest on your back), knees ought to be lower than the pelvic bones. Your spine and head should be in one line as if constantly held by a string from the ceiling. Such a position lessens strain on the neck and shoulders. Another advantage of this posture is more space for the rib cage and lungs, which can consequently expand and inhale air sufficient for voicing much easily.

When standing, spine should be neutrally aligned with the head stretching towards the ceiling. As for the position of the shoulders, they ought to be kept back; earlobes should be in a line with their middle part. Knees as well as the back should be straight. The weight ought to be equally distributed on both feet. Lastly, both your pelvis and abdomen should not incline to the front (see Fig. 9).

![Figure 9 Good and poor posture](image)

4.3.2 Breathing Exercises

For singing as well as speaking an increased supply of breath is required. For that reason, breathing exercises should be performed. The aim of such exercises is to develop normal breathing patterns with eliminating effort.
According to Stein (1942), there are some breathing exercises:

- Stand upright with legs apart, feet next to each other, hands hanging by the sides, shoulders straight. On inspiration lift your arms quickly sideward, clap the backs of the hands against each other over your head. Inhale inaudibly through mouth and nose with your lower jaw hanging loosely. Finally, exhale while the arms return to their original position.
- The same leg positioning with arms bent, resting on the hips. Move elbows and shoulders backwards on inhalation. On exhalation return slowly to the original position.
- Strike the same posture. Hands are clasped behind your neck. Move arms back on inhalation and put the hands back on exhalation.
- Clasp the hands behind the back approximately in the waist level. Then quickly stretch both arms downwards while breathing in. Go back to the initial position on exhalation with your hands gliding upwards along the back.
- Breathe in and out the same way as in previous exercises with the exception of following the movements of the chest and abdomen with your hands. It is also possible to hold breath a number of times. Another alternative is to do the controlled breathing with arms hanging loosely at the sides.

4.3.3 Vocal Warm Ups
The muscles operating vocal folds should be stretched and warmed up as any other muscles before performing a physically demanding task. Some useful warm ups as well as warm downs will be illustrated:

- Start quietly with humming to ‘mm’ (you should be able to feel the vibration in the chest, throat as well as mouth and nose). Gradually increase the volume. Apart from warming up the muscles, it should increase the resonance.
Begin singing from low tones to high tones and backwards - 'do re mi fa so la si do'; other options are doing the same exercise with vowels, lip trills (the motorboat sound, which children make) or tongue trills.

Warm up the articulators with a couple of tongue twisters – try to say each one 6 times:

'Ty Tibetani Ti tykají'
'Vytrí ty tří trychtýře'
'Jen jeden den bez beden'
'Pan Kaplan plakal v kapli, v kapli klapli dveře'
'Sešli se na resuscitačním sálě se šesti lůžky'

Mouth & jaw massage.

Put the stress on a different word, say each line one by one quickly:

Boo boh baw bah bay bee
Boo boh baw bah bay bee
Boo boh baw bah bay bee
Boo boh baw bah bay bee
Boo boh baw bah bay bee
Boo boh baw bah bay bee

4.3.4 Vocal Warm Downs

If the voice has been used heavily, it is important to warm it down, especially after singing or talking above the background noise. Voice is usually put in a higher pitch when we perform singing or when we lecture. However, many people are not aware of this fact and they tend to remain on a higher pitch. As a consequence, vocal folds are stretched and they sometimes fail to relax. To release the tension and put the voice in a lower pitch, following technique can be carried out, for example, gliding your voice down in pitch using sounds that require a stronger airflow, such as /r/, /z/ or /v/. 
### Handout for Teachers on Voice Hygiene – Final Version

<table>
<thead>
<tr>
<th><strong>AVOID</strong></th>
<th><strong>TRY TO</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>working in an unhealthy environment (noisy and dusty classrooms with poor illumination or ventilation)</td>
<td>move to a quieter and lighter place; open windows if possible</td>
</tr>
<tr>
<td>talking above the background noise</td>
<td>use more gestures and body language instead</td>
</tr>
<tr>
<td>screaming, yelling, talking loudly</td>
<td>minimize speaking distance – make the students/pupils sit in the front lines; use amplifiers, e.g. portable microphones</td>
</tr>
<tr>
<td>whispering if you have cold and are losing your voice</td>
<td>reduce talking where possible and rest your voice; inhale steam from a basin with hot water with a towel over your head, visit a steam room</td>
</tr>
<tr>
<td>talking too much if your voice is strained or hoarse</td>
<td>take some voice rest whenever it is possible; take a day off for voice recovery (better option than a potential long-term absence from work due to a chronic illness); take throat lozenges or herbal tonic</td>
</tr>
<tr>
<td>excessive sitting while speaking as it can increase tension on neck muscles</td>
<td>put your neck into straight position; keep good posture</td>
</tr>
<tr>
<td>stressful situations (stressful social relationships as well as work stressors)</td>
<td>breath properly, carry out breathing exercises; join Yoga, Tai Chi or Pilates classes since these might be helpful for relaxation as well as improvements in breathing and posture</td>
</tr>
<tr>
<td>dehydration or drinking too much alcohol or caffeine (coffee, tea etc.)</td>
<td>drink water instead, at least 6-8 glasses each day</td>
</tr>
<tr>
<td>smoking</td>
<td>cut down on smoking or quit smoking; use nicotine patches or chewing gums</td>
</tr>
<tr>
<td>eating spicy food or meals with a high fat content</td>
<td>follow healthy diet; eat the last meal at least two hours before going to bed</td>
</tr>
<tr>
<td>coughing or throat clearing</td>
<td>sip water or glycerin based sweets to reduce the need to cough</td>
</tr>
<tr>
<td>starting your teaching without warm-ups and do not forget to calm down your voice with warm-downs</td>
<td>practise vocal warming-up and warming-down exercises</td>
</tr>
</tbody>
</table>

### GENERAL TIPS:
- Undergo a voice screening either at the beginning of your training or during your career.
- Try to attend any voice hygiene or voice training course in your surroundings.
- Try to recognize any alterations/problems with your voice as soon as possible, seek for a speech-language pathologist or any medical help (Ear Nose & Throat specialist), keep in mind that an early diagnosis on vocal symptoms is a good prevention of laryngeal cancer as well.
4.4 Other References on Voice Hygiene

Voice screening is a technique that explores the inside of larynx. Anyone can undergo this procedure either on the recommendation of the general practitioner or even without it. In case you are interested, find the nearest Ear Nose & Throat physician (ENT) or phoniatrician in your surroundings. Such specialists are ready to help both in the area of prevention and treatment of voice problems.

Voice screening is a procedure when the voice can be examined both by subjective methods as well as objective ones. Regarding the subjective assessment, the patient’s voice is being examined while voicing. Consequently, the voice properties are defined. Further, an objective examination is undertaken. It usually consists of laryngoscopy (the patient’s larynx is scanned with a small mirror or camera) or laryngostroboscopy. The latter method is drawn on a mechanism during which vocal folds are exposed to an intermittent light of similar frequency that has vocal folds while voicing. This enables the phoniatrician to spot even the littlest vibrations. Tomography as well as X-ray assessment count among other objective diagnostic methods (Lejska, 2003).

As for the education and courses on voice hygiene in the Czech Republic, there is a variety of them available in the private sector. Many companies offer courses for call centre workers and managers on confidential voice as well as improvement of communication skills. Such courses usually also include lectures on voice hygiene and vocal exercises. Unfortunately, according to the overall content of these courses, which cover topics such as ‘telephone interview’ or ‘persuasive argumentation’ they are not primarily aimed at teachers.

For that reason, a better alternative for them might be private lessons by teachers of singing or vocal coaches who can provide them with an individual plan on vocal hygiene and useful exercises.

There are very few state schools, which offer education on vocal hygiene and voice training. For example, at Charles University, Faculty of Education, the Department of Czech Language gives lessons on rhetoric, the syllabus of which contains topics on prevention of voice disorders, vocal exercises, nonverbal
communication etc. Another institution that provides education on voice training and hygiene is Academy of Performing Arts in Prague (AMU).
Conclusion

The aim of the thesis was to investigate existing voice problems in the teaching profession and suggest their prevention. Firstly, the anatomy as well as physiology of vocal organs were introduced. Secondly, the attention was focused on speech production mechanisms. Further, specific voice disorders were both categorized and exemplified. The practical outcome of the thesis is a handout for teachers presenting the advice on voice hygiene.

It is important to raise the awareness about the fact that voice should be looked after. Many teachers and other voice professionals take it for granted that they can rely on their voice in case they need it. They do not consider the prevention important. However, without prevention and voice hygiene problems or disorders might occur. Such difficulties have an impact on voice quality and, consequently, on the mental state. Following the principles of voice hygiene presented in the practical part of the thesis might serve as a good prevention of any pathological voice alterations. Unfortunately, many teachers do not take sufficient care regarding their voice and end up with a strained, hoarse voice, which can lead to a chronic illness.

Apart from voice hygiene, teachers may apply other techniques to protect their voice. While teaching they may simply reduce their talking times by getting students more involved and therefore enhance students’ talking time. Another option, which was already mentioned in the principles of voice hygiene, is gestures. These might as well reduce teachers’ talking time. Further research into the areas mentioned is needed.
Works Cited:


Stein, L. (1942) *Speech and Voice: Their Evolution, Pathology and Therapy*, London: Methuen.


List of Figures & Tables:

**Figure 1** Respiratory system. Retrieved March 9, 2011 from http://www.syvum.com/cgi/online/serve.cgi/squizzes/biology/respi.html, adjusted by the author.

**Figure 2** Larynx viewed from the front. Retrieved March 9, 2011 from http://www.yorku.ca/earmstro/journey/larynx.html, adjusted by the author.

**Figure 3** Larynx viewed from behind. Retrieved March 9, 2011 from http://www.yorku.ca/earmstro/journey/larynx.html, adjusted by the author.

**Figure 4** Vocal folds. Retrieved March 9, 2011 from http://www.bcnlp.ac.th/Anatomy/page/apichat/respiratory/page/larynx.html, adjusted by the author.

**Figure 5** Arytenoid cartilages causing opening and closing of the glottis (Roach, 1991: 27), adjusted by the author.

**Figure 6** Four different states of the glottis (Roach, 1991: 28).

**Figure 7** The articulators (Roach, 1991: 8).

**Figure 8** Sub-division of the tongue (Roach, 1991: 9).

**Figure 9** Good and poor posture. Retrieved April 8, 2011 from http://www.dancescape.com/ezine/wellness/the-posture-of-dance.

**Table 1** Example of some voice disorders according to the causes (Aronson, A.E., 2009), adjusted by the author.

**Table 2** Causes of organic voice disorders (Aronson, A.E., 2009: 6), adjusted by the author.