

Basics of Voice Dysfunction – Etiology and Prevention of Voice Damage

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ABSTRACT

Voice is one of the most important means of communication and as such should be taken care of. The etiology of voice disorders is diverse. Due to the development of the society we live in, way of life, environmental factors, and exposure to pharmacological agents as well as demands we make towards our voice, there is a substantial growth in the number of people with voice disorders. We tasked ourselves to find out if it is possible to enlighten people on the importance of voice, to motivate them to take care of it, to notice the changes in its quality and eventually ask for help. We assessed in which measure do we understand the importance of a healthy voice, and do we know which is the most important factor that adds to its decline. For a long number of years voice therapists and other experts in the voice disorder field have been discussing the optimal voice impostation as well as vocal exercises and methods behind voice recovery. They have all come to the same conclusion that phonation is dependant on the sort of the voice disorder and the patient motivation. We wanted to go one step further and investigate, dependence of voice quality and the damage etiology (organic – functional), which are the predominant causes, what are the factors that account for the damage and how the disorder motivates the patient and therefore influences the rehabilitation success rate.

Key words: voice, etiology, therapeutic procedures, rehabilitation, prevention

Introduction

Voice is a sound that is produced by the passage of air from the lungs through the larynx. There are two muscular creases in the larynx that we call vocal cords. Vocal cords vibrate in two distinct phases: open and closed (Figures 1 and 2). The basic characteristics of voice are tone as well as level which is directly dependant on the vocal cords flickering (fundamental frequency), intensity which we perceive as volume and depends on the subglottis pressure, voice color which is the product of resonance. The voice color defines us and distinguishes individuals from each other. The average F0 for males is 120–150 Hz, for females 180–220 Hz and for children around 300 Hz^{1,2}. The lungs determine the intensity characteristics of voice³.

When we talk about a good voice we primarily mean a voice of a pleasant quality, solid resonance, appropriate level, suiting volume with vocal diversity, appropriate exhale support and correct pronunciation of all spoken sounds. What are considered to be a problematic voice are hoarseness, roughness, and loss of voice, sharp or

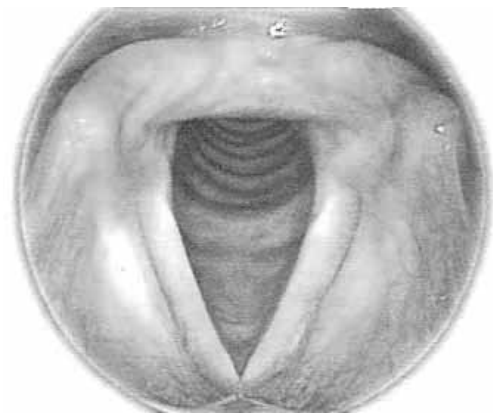


Fig. 1. Open phase.

blunt pain in the larynx area as well as changes in the ability to sing. Hoarseness is the most common and is

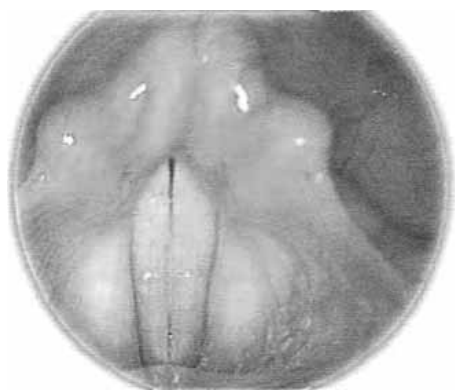


Fig. 2. Closed phase.

characterized by a rough and creaky voice, volumeness, tickling, suffocation and prolonged voice warming⁴.

Changes in voice quality are influenced by various causes. The basic and most important classification is to organic and functional causes. Organic causes are numerous and are related to organic changes of the phonation apparatus⁵. Functional dysphonias are a result of a wrong way the phonation is done and are divided into psychological and habitual (changes in the vocal cords can originate in other diseases related to endocrinal and respiration systems)⁶.

When one experiences one of the above mentioned difficulties, such as hoarseness or neck muscle pain, an Otorhinolaryngology exam should be scheduled. The modern phonation science with all of its complexities cannot function without optical fibers, electronical potential recording, and vocal cord video recording and synergy movement digital recording. There are numerous ways the diagnostic of vocal cord dysfunction can be done⁷. One of them is vocal cord recording by endoHRES camera. We used this camera to investigate and diagnose vocal cord damage. The camera itself is a new approach to vocal cords diagnostic. Camera has two drives, high-speed mode (4000 bzw. 2000 Pic/sec.) and high-resolution mode (25 pictures per second). It allows us to observe vocal cords in slow motion and to save high-speed digital images. In order to ascertain the importance of this camera in diagnostic of vocal disorders we will show several images of patients that were included in our study (Figures 3–5). After a phoniatrics exam including a camera vocal cords recording, if needed, patients are directed towards a speech therapist for voice therapy. Depending on the phoniatrics diagnosis a voice therapy programme is created for each patient. It is mostly begins by conservative voice therapy which is constituted in several levels⁸: general level, neuromotor level, respiratory level and relaxation, vocalization level, laryngeal level, resonance-articulation level, feedback level exercises, two side deafening method, auscultation method. In this examination we did not use these, most common, forms of therapy. Instead we used two new ones: RVT⁹ resonant vocal technique »voice with forward focus« and the Smith accent method¹⁰.



Fig. 3. Vocal nodules.



Fig. 4. Single sided vocal cord paresis.



Fig. 5. Polyp.

RVT method includes: light voice connected to cheekbone vibration, grumbling during conversation is used, grumbling for 5 seconds, grumbling for 5 seconds with progressive intonation accentuation, grumbling for 5 seconds with gradual lowering of intonation, grumbling for 10 seconds, isolated speech sounds, vowels and consonants with grumbling (mo-mo, ma-ma), words with grumbling, conversation, singing.

Materials and Methods

The examination included 30 patients of various age, sex and profession (Table 1). All patients have been recommended voice hygiene and preservation as well as breathing exercises. Voice hygiene included the following¹¹: avoiding smoking and smoked areas, avoidance of alcohol and sparkling drinks, drinking lots of fluids, healthy diet (avoiding sweet, salty, spicy, dairy products, hot-cold, caffeine), no eating two-three hours before sleep, living areas to be aired, no cleaning of throat, avoiding all vocals other than speech. Voice preservation had presumed a soft phonation start, longer pauses of speech during the day and no talking in noise conditions. During the actual rehabilitation vocal breathing played a great role. The thorax including the respiration system with muscles contribute to voice activation. Exhaling

TABLE 1
PATIENT PROFESSION AND WORKING CONDITIONS

Patient	Age	Sex	Profession
1. V.M.	1987.	F	Student, amateur singing, works at animal shop
2. M.R.	1955.	F	Works behind glass counter
3. S.D.	1963.	M	Waitor, amateur singing
4. M.P.K.	1968.	F	Education worker, teaches Croatian
5. G.D.	1964.	F	Accountant
6. T.J.	1962.	F	Post office worker, behind counter
7. N.K.	1974.	M	Sings in a band, long and frequent appearances
8. A.D.	1982.	F	Student
9. V.H.	1948.	F	Pediatric surgeon
10. A.R.	1990.	F	Student
11. N.B.	1970.	F	Music arts teacher
12. B.B.	1952.	M	Exposure to agens, physical worker, PTSD
13. B.V.	1941.	M	Physical worker, noise exposure
14. B.L.	1971.	F	School teacher
15. C.J.	1960.	F	Tourist agency worker
16. C.D.	1948.	F	Housewife
17. Č.M.	1965.	M	Exposure to agens, physical worker
18. D.S.	1961.	F	Office clerk, answering phones
19. G.M.	1944.	F	Worked at a groceries store, retired
20. J.N.	1953.	F	Office clerk
21. H.G.	1965.	F	Housewife
22. N.Đ.	1934.	M	Retired factory worker
23. K.A.	1996.	M	Student
24. K.V.	1940.	M	Retired office clerk
25. T.P.	1964.	F	Waitress
26. P.P.	2001.	F	Student
27. A.M.	1974.	F	Client office work
28. K.L.	1995.	F	Student
29. T.F.	1962.	M	Actress singer, works at the theatre
30. A.Č.	1990.	F	Student

current allows for vocal cords to vibrate. Use of exhale air current plays a great role in voice formation but all in the coordination with vocalization¹². There are several breathing exercises that we used in our study. Inhale through the nose so that the diaphragm is lifted up and forcedly exhale making the sound (»HA«). Exercise to be repeated 2 to 3 times.

Inhale through the nose so that the diaphragm is lifted up and forcedly exhale making the sound (»S«). Exercise to be repeated 2 to 3 times. Inhale through the nose so that the diaphragm is lifted up, put your hand with fingers intertwined on the belly and make the sound »S« in intermittent intervals. Inhale through the nose so that the diaphragm is lifted up, put your hand with fingers intertwined on the belly and make the sound »S« in random intervals.

A subjective and objective voice assessment has been made. Objective assessment had begun by ENDO-hres camera during a phoniatrics exam. After a diagnosis has been established, a phoniatrics specialist would instruct the patients to a speech therapist who filled out a questionnaire based on patient answers. The quality of voice is also examined by a speech therapist. Subjective assessment implied patient motivation and a subjective sensing description without a given describing attribute.

Motivation questionnaire was made up of a scale from 1 to 5 and which respectively represented following values: not motivated, doesn't make a difference, I am motivated, I am very motivated, I am concerned. Rehabilitation consisted of two methods: RVT and accent method. Half of the patients, regardless of the sort of disorder, conducted the exercises individually at their homes with consideration to speech therapist instructions. The remaining 15 patients had come once a week for a half hour session with the continuation of the exercise at home. The questionnaire for objective assessment included: diagnosis, etiology, voice quality, smoking, alcohol, gender, HPV infection, age, nutrition, working conditions, reflux, rehabilitation success rate. By the end of each rehabilitation, which in average lasted 6 to 8 weeks it's success, rate was evaluated by the following form A to E respectively: no change, satisfactory voice, very satisfactory voice, excellent voice »new voice« (Satisfying voice quality with new way of phonation established).

Results

Patients with organic voice defects have had more rehabilitation success than the ones with functional defects. From the total of 20 patients with organic defect, 12 had a satisfactory voice, 3 of them very satisfactory, 3 excellent and 2 excellent voice with a new way of phonation established. From the total of 10 patients with functional defects, only 6 had a satisfactory voice and 4 showed no change (Table 2). Before rehabilitation patients characterized voice quality as: throat pain, trouble swallowing, hoarseness, tension, loss of breath, voice »crackling«, inability to produce high pitch tones, fatigue. In most cases, organic defects were with better outcome than functional ones.

TABLE 2
REHABILITATION SUCCESS RATE

Success rate	Functional causes	Organic causes	Total
No change	4	0	4
Satisfactory voice	6	12	18
Very Satisfactory voice	0	3	3
Excellent voice	0	3	3
»New voice«	0	2	2
Total	10	20	30

All of them, regardless of the difficulty, indicated higher level of defect than the one ascertained by a speech therapist. Speech therapist used the following descriptions: hoarseness, ruggedness, noise, and croak.

TABLE 3
VOICE QUALITY EVALUATION

Degree	Hoarseness	Ruggedness	Noise	Croak
Mild	8	2	14	0
Moderate	12	15	2	1
Strong	4	2	3	0
Total	24	19	19	0

Considering the motivation, patients with organic defects were, as expected, more motivated. Most of them were »motivated« and »very motivated«. With functional defects answers were mostly the same in all categories (Table 4). Data obtained show that organic defect motivated patients and therefore produced better rehabilitation results. Accent method has shown more complex for the patients but also more efficient. Ascertained by both speech therapists and the patients, voice quality depending on the cause shows to be better in organic defects. Most of the dysfunctions were of organic cause and only

TABLE 4
PATIENT MOTIVATION

Degree of motivation	Functional causes	Organic causes	Total
1 not motivated	1	0	1
2 Don't care	3	2	5
3 Motivated	3	7	10
4 Very motivated	2	4	6
5 I am concerned	2	6	8
Total	11	19	30

the minority reports because of functional causes. The major factors to influence the defect cause were working conditions (profession) and the method of phonation (Table 5).

TABLE 5
INFULENCE OF VARIOUS FACTORS

Factors/ Causes	Smoking	Alcohol	Diet	Reflux	*Profession
Organic	7	5	8	5	16
Functional	4	2	7	4	5
Total	11	7	15	9	21

*Diet referred to the care of healthy nutrition (avoiding salt, sweet, fat, sparkling and dairy products)

*Profession/specific working conditions were working in a noise area, exposure to agents and frequent and abundant speech (teachers, clerks, factory workers, singers)

Conclusion

Patients perceived organic dysfunction mostly with great concern because it was the first time they have seen the actual picture of their vocal cords through a camera and it made them understand the importance of healthy cords. With functional dysphonic usually it was music professionals and they were worried for their voice. They also gave up the rehabilitation very quickly¹³.

All of them had shown resilience to changing the phonation that led to the damage, especially when their voice had returned to normal after rehabilitation¹⁴. Some of the patients were hoping for medicamentous therapy without the strain of vocal exercises or meant the therapy was useless (functional disorders mostly¹⁵). As voice, therefore speech, is one of the most common and important ways of communication, it has to have sufficient quality. Use of voice and speech today, especially in the working place, is presenting more and more demands towards individuals every day¹³. These working conditions as well as cultural habits are the factors that endanger voice and speech function the most as we have proven in our study¹⁶. The facts stated in this investigation represent a secure basis from which we can start assessing voice function. Phonation is primarily a motor action and must be learned. It develops and changes under constant effect of the environment¹⁷. With that stated, we consider that the care for voice and its health should begin at a pre-school level¹³. Through schooling and career counseling, speech therapists and other health professionals should make a quality assessment of potential professional speakers, help them develop optimal phonation and in such manner contribute to preventing voice dysfunction¹⁸.

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OSNOVE POREMEĆAJA GLASA – ETIOLOGIJA I PREVENCIJA GLASOVNIH OŠTEĆENJA

SAŽETAK

Glas je jedno od najvažnijih sredstava komunikacije te bi trebalo voditi brigu o njegovom zdravlju. Etiologija glasovnih poteškoća je raznolika. Zbog razvoja društva u kojem živimo, načina života, okoline, izloženosti farmakološkim agensima, te zahtjeva koje postavljamo naspram glasa dolazi do značajnog rasta broja osoba koje imaju glasovne teškoće. Istražili smo u kojoj je mjeri moguće istaknuti važnost glasa, motivirati pacijent da vode brigu o glasu, da uočavaju promjene u njegovoj kvaliteti i na kraju potraže pomoć. Dugi niz godina glasovni terapeuti i ostale stručne osobe koje se bave poremećajima glasa i njihovom rehabilitacijom raspravljaju o optimalnoj impostaciji glasa, te vokalnim vježbama i metodama njegova oporavka. Svi su došli do istog zaključka da fonacija ovisi o vrsti glasovne teškoće i motivaciji samog pacijenta. Željeli smo otići još dalje i istražiti kakva je kvaliteta glasa ovisno o etiologiji oštećenja (organski-funkcionalni), koji su uzroci najčešći, odnosno koji čimbenici najviše pridonose kojem oštećenju, te kako oštećenje motivira pacijenta odnosno utječe na uspješnost rehabilitacije.