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The Efficiency of DoctorVox Voice Therapy Technique in Conversion Dysphonia / Aphonia

Running title: DoctorVox Voice Therapy Technique in Conversion Dysphonia / Aphonia

Authours:

1. Engin BAŞER, MD. (Corresponding Author)

   Otorhinolaryngology, Head&Neck Surgery Department.

   Adres: ENTU Clinic, Pasakent mahallesi, NO34, D21, Bandırma, Balıkesir, Turkey

   E-mail: dr.enginbaser@hotmail.com

   Phone: +90 232 469 69 69, +90 532 579 45 38

   Orcid ID: 0000-0002-7989-829

2. İsmail İlter Denizoğlu, MD

   Audiologist and Speech Pathologist; Otorhinolaryngologist.

   Vocology Center, 1357 s. No2 D2 Mimar Sinan Mahallesi Konak, İzmir, Turkey

   E-mail: ilterdenizoglu@gmail.com

   Orcid ID: 0000-0002-3677-8872

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ABSTRACT

Objectives: The main purpose of this study is to retrospectively evaluate the efficiency of DoctorVox Voice Therapy (DVT) in psychogenic dysphonia/aphonia (PD/PA) patients and share the mid-long term results of the method.

Methods: The study was carried out on patients who underwent DVT therapy for PD/PA between January 2015 and September 2019. As the evaluation methods; VHI-10, GRBAS scale and videolaryngostroboscopy recordings were used.

Results: While the mean VHI-10 measurements of the patients were 30.91 ± 2.97 before the treatment, the average was 8.14 ± 3.82 after the treatment, and 3.36 ± 1.78 in the final follow-up examination. According to the GRBAS evaluation, our results are; pre-treatment: 9 ± 0.67, post-treatment: 0.78 ± 0.80, final follow-up: 0.57 ± 0.64.

Conclusions: DVT method seems to be an efficient treatment method for PD/PA by developing phonatory muscle functions, using multidimensional biofeedback mechanisms, and increasing the patients' therapy adherence.

Keywords: Psychogenic voice disorder; Voice therapy; Functional dysphonia/aphonia ; DoctorVox voice therapy; LaxVox voice therapy.

Introduction

Psychogenic dysphonia/aphonia (PD/PA) is also known as type-4 muscle tension dysphonia (MTD), conversion dysphonia, phononeurosis, or hysterical aphonia/dysphonia.[1,2,3] Its general prevalence has been reported as 0.4%.[4] PD/PA is a disease primarily characterized by voice changes without organic laryngeal lesions or neurological disease.[5] PD/PA is traditionally regarded as a conversion disorder with a psychological background.[4] Conflicts related to family and work environments may make the individual prone to such changes.[6]

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Diagnosis is confirmed by stroboscopic analysis. Abnormal muscle tension in the absence of organic lesions in the larynx combined with abnormal voice (muteness, aphonia, or dysphonia), whereas vegetative phonation, unrelated to the communicative behavior, e.g. cough, throat clearing, yawn-sigh are normal.[7,8] For the differential diagnosis, insufficient glottic closure, presbyphonia, and certain hyperfunctional voice disorders due to vocal fold atrophy may be considered. Among various treatment methods recommended for PD/PA, voice therapy accompanied by psychological approaches seems to be the best treatment of choice.[1] Furthermore, the disease has high rates of recurrence rate in the long term follow-up.[8]

Phonation involves an intricate interplay between physical and emotional factors that creates a vocal personality. A person's tone of voice often carries more meaning than the words he/she speaks. In moments of fear, the throat constricts and breathing is uneven. When the person is angry, his/her voice is raised. When the person is sad, his/her speech may be interrupted by sobbing or choking noises, and so on. In more extreme cases, where neurotic conditions affect the voice, the person may suffer from PD/PA. As with other somatic symptoms, it may be difficult to determine whether the symptom or illness is psychological, biological, or both, especially after some time.[9]

The scientific background of voice therapy practice has two dimensions. The first one is the physioanatomy of the vocal apparatus. The glottis is the visor of the physioanatomy; which gives clues about muscles affecting voice production. When the clinician is able to analyze the dynamic glottic behavior, it is easier to determine the type of the vocal exercise to be applied. By this way, the clinician can correctly give answers to 'which exercise for which situation and why' questions. The second dimension is the psychoneurological side. The new vocal skill is constructed on the motor learning principles and the new skill is transformed into a behavior by the behavioral therapy principles.[10]

LAX VOX exercises with a silicone tube were first demonstrated by the voice pathologist Marketta Sihvo. These exercises were modified and expanded by Ilter Denizoglu into the DoctorVox Voice Therapy Technique (DVT). DVT is a direct holistic method consisting of two main physical tools: artificial elongation and semi-occlusion of the vocal

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tract. Semi-occlusion applies a backpressure to the phonatory system. In DVT, backpressure with a secondary vibrating resistance provided by water bubbles and/or a continuous backpressure provided by a valve are possible to be used for altering the vocal tract impedance. Beyond physical applications, the DVT framework concerns about the psychoneurological side of the voice therapy. The exercise models, feedback strategy and monitorization of the patient are included in the whole structure. The DVT program combines different approaches (physical, clinical, and pedagogical) and provides a multidimensional-multilevel approach to voice therapy (figure 1).[11]

The main purpose of this study is to retrospectively evaluate the efficiency of DVT in PD/PA patients and share the mid-long term results of the method.

Material and Methods

The study was carried out on patients who underwent DVT therapy for PD/PA between January 2015 and September 2019. Videolaryngostroboscopy was performed by the authors of the study, using a rigid telescope (70^0, 7 mm; 90^0, 10 mm) or flexible fiber optic nasopharyngoscope (3.3 mm) in those patients who did not consent to examination with the telescope. Aphonic or severely dysphonic patients who did not have organic or neurological pathologies (e.g., inflammation, paralysis, tumors, vocal fold atrophy, etc.) who were observed to have incomplete/improper adduction of the vocal folds during phonation while having complete/proper vocal fold adduction during normal non-communicative reflexive vocal production (coughing, such as crying and laughing) were considered PD/PA and were included in the study.[4] History of psychiatric diagnoses and previous treatments were noted and the patients were encouraged to have a psychiatric examination. Patients who had reports of recent comorbidity related to respiratory tract infection or existing dysphonia and those with laryngeal lesions and suspicious diagnoses were excluded from the study. Patients who did not complete the

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treatment survey, whose records were unavailable, and who underwent a different voice therapy protocol were also excluded.

Evaluation method

The validated Turkish version of the Voice Handicap Index-10 (VHI-10)[12] was used for positive self-reporting of the severity of vocal symptoms. The purpose of the VHI-10 questionnaire is not to differentiate between different pathologies, but to enable the patient to evaluate his/her problem; the higher the score, the greater the problem with the voice. VHI-10 evaluates psychogenic perception as well as physical and physiological evaluation.[12] VHI-10 values were recorded three times: before treatment, after the completion of the sessions, and at least six months later. Since most of our patients had CA, acoustic voice analysis methods were not used since complete response could not be obtained before therapy. GRBAS[13] scale (G: Grade, R: Roughness, B: Breathiness, A: Asthenia, and S: Strain) was used (by the same clinician) for subjective evaluation before therapy, after therapy, and at final follow-up (at least six months later). In videolaryngostroboscopy records, the observation that the vocal folds were completely closed with proper vibratory behavior after DVT was used for objective evaluation. Patients were invited to our clinic for their final examinations to present in our study, VHI-10, GRBAS scale, videolaryngostroboscopy were performed and they were questioned as to whether or not they received psychiatric treatment.

Application of the DVT technique

The sessions were all performed for all patients by the same phoniatrician, who was experienced with DVT. The DVT procedure applied in this study for PD/PA was as follows:

1. Counseling: the nature of the disorder was explained in detail using the laryngeal images. Mostly, patients are referred under the stress of an accusation of malingering. Therefore, care was taken in order not to make the patient feel offended. In light of the fact that PD/PA generally occurs in response to a psychological stressor, the clinician was mindful and tactful in regards to patient's psychological history. The patients were informed about the 'normal' timbre and pitch of the voice beyond physioanatomy. Patient and the family were informed

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about the nature of the problem and the importance of the active support (being a third ear during homework exercises, giving proper feedback and being tactful and patient during treatment process). At this level, psychiatric medical support was recommended; its importance and major contribution to treatment was also stressed.

2. The DoctorVOX Apparatus® (figure 2) was used for the vocal exercises. Patients have expressed that they have been highly motivated to use a device for their disorder. In addition to the feeling that care is being taken about their vocal problem, we assume that using a device has a placebo effect on increasing the moviation. The auditory masking also helped the phonatory act (while bubbling the water by phonation, the patient cannot hear self-voice directly. By this way, the air-conduction of self-voice is masked). In the first session, the amount of backpressure was decided empirically and raised until the chest register was observed. The water depth and a backpressure valve were used to adjust the amount of the backpressure

3. Patients then performed the DVT exercises (started with sostenuto then glissando) at home. The homework exercise rate was a few minutes every hour.

4. When the patient was not able to able to use the modal register in low backpressure levels, the backpressure was increased (over 15 cmH_2O), then gradually decreased and adjusted in-between 4 to 7 cm H2O levels.

5. Linguistic load step was started by applying the new vocal skill to vowels using the oral mask (maskVOX®). The patients were then motivated to phonate simple phrases (counting) and speak into the mask while continuously (except nasal consonants) bubbling the water. Reading into the mask exercise was given as homework 4-5 times - 10 minutes each time in a day. Family members were also motivated to 'assist' and accompany during home exercises.

6. The new vocal skill, was then transferred to speech by sustaining the phonatory muscle setup with and without the device during speaking (counting, reading, conversation) and singing as well.

7. Adaptation to the social environment (family, friends, etc.) was then achieved through counseling. Reading and speaking with the new motor skill was encouraged by the participation of the family or friends in the therapy. Patients were instructed to start exercising immediately if the voice problem recurred, and it was suggested that the patient's immediate environment should be accompanied.

Ten sessions of therapy (each session lasting approximately 25 minutes) were given. The first five sessions were given every consequent workday. The subsequent sessions were set at twice a week, then once a week. When the sessions were completed, behavioral transfer and adaptation period was started. Patients were called for their one-month and six-month examinations.

Voluntary consent form was obtained from all patients included in the study. This case-control study obtained ethics approval from the local ethics committee (No: 2020 / 1-1; Date: 23/01/2020).

Statistical Reviews

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum) were used when evaluating the study data. Kolmogorov-Smirnov, Shapiro-Wilk test, and graphical evaluations were used to test the normality distribution of quantitative data. Mann-Whitney U test was used for comparisons between two groups of data without normal distribution. Friedman test was used to evaluate the follow-up of variables without normal distribution and the Bonferroni Dunn test was used to evaluate binary comparisons. Significance was evaluated at the level of $p < 0.05$.

Results

Our study was performed with a total of 14 patients, consisting of 14.3% (n=2) males and 85.7% (n:12) females. Age ranged between 18 and 72, with mean age of 48.93 ± 18.73 years. While 57.1% (n:8) of the patients were unemployed, 42.9% (n:6) were actively

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employed; 21.4% (n:3) were primary school graduates, 42.9% (n:6) high school graduates, and 35.7% (n = 5) were university graduates (Table 1).

All of the patients had a sudden onset of voice disorders and recent history of intense stress or mental fatigue. In the ENT examinations of the patients, no findings suggesting simulation were encountered and this situation was excluded. Patients did not declare any other somatic complaints.

According to the results of our physical examination, 21.4% (n:3) of the cases were extremely dysphonic (it was observed that one patient phonated in a breathy falsetto register, and two patients had ventricular folds closed and that transglottic airflow was almost absent). Among the patients, 78.6% (n:11) were aphonic in which the mucosal vibration was not observed in the videolaryngostroboscopic examination of these patients due to the large glottic gap. Eight patients of the aphonic group were whispering, while the other three were completely silent, only moving their lips. The duration of complaints of the cases ranged from 4 to 365 days, with an average of 77.07 ± 101.22 days and a median of 37.5 days. Complaint duration of 35.7% (n=5) of the patients was less than one month, while 64.3% (n=9) was one month or more. While 42.9% (n = 6) of the patients had their first attack at referral, 57.1% (n=8) had recurrent attacks before. All of our patients stated that they were dysphonic/aphonic since their last attack. In total, 71.4% (n=10) of the patients have previously presented to an ENT and were first diagnosed as upper respiratory infection; 28.5% (n=4) had their first referral to the voice clinic.

Follow-up duration varied between 6 and 40 months, with an average of 17.00±9.60 months and a median of 14 months. While no recurrence was observed in 50.0% (n:7) of the patients who participated in the study, 21.4% (n:3) developed recurrence only once, and 28.6% (n:4) developed recurrence twice or more. At the last follow-up examination, 71.4 % (n:10) of the patients reported that they had not experienced any dysphonia/aphonia attacks for at least six months. On the other hand, 28.6% (n:4) identified short-term voice disorders and stated that their voice had recovered with DVT exercise. At the

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last follow-up, complete glottic closure was observed in the laryngostroboscopic examinations of all patients.

While 28.6% (n=4) of the cases received psychiatric treatment before treatment, 28.6% (n:4) received psychiatric treatment after treatment. Three of these cases received psychiatric treatment both before and after treatment; one of the patients received psychiatric treatment only before the treatment and only after the treatment. Data of the patients are given in Table 2.

While the mean VHI-10 measurements of the patients were 30.91 ± 2.97 before the treatment, the average was 8.14 ± 3.82 after the treatment, and 3.36 ± 1.78 in the final follow-up examination. The change in the pre-treatment, post-treatment, and final follow-up VHI-10 measurements of the cases were found statistically significant ($p = 0.001$; $p < 0.05$). According to the results of the binary comparisons, the decrease in post-treatment and the final follow-up VHI-10 measurements compared to pretreatment was statistically significant ($p=0.024$; $p=0.001$; $p < 0.05$, respectively). The decrease in the final follow-up VHI-10 measurements after treatment was also statistically significant ($p = 0.024$; $p < 0.05$) (Table 3). In Figure 3, the pre-, post- and final follow-up VHI-10 values of the patients are graphically presented .

The change between pre-treatment, post-treatment, and final follow-up VHI-10 measurements according to the attack status at the time of referral (whether there were single or multiple attacks), whether or not they received psychiatric treatment, and employment status was not statistically significant ($p > 0.05$). However, the decrease in the final follow-up VHI-10 measurements of the unemployed group was found to be statistically significant compared to the post-treatment group ($p = 0.049$; $p < 0.05$).

The patient group with complaints lasting longer than one month had significantly greater amount of pretreatment - posttreatment change and posttreatment - final follow-up change in VHI-10 measurements compared to patients with complaints lasting less than one month ($p=0.041$; $p=0.044$; $p<0.05$, respectively).

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The R score of the GRBAS was always evaluated as zero for the PD/PA patients in the study group; the other scores had different values. In one severe patient the strain voice was dominant, where others were generally seem to have breathy and asthenic voice. According to GRBAS evaluation (Pre-treatment: 9±0.67, post-treatment: 0.78±0.80, final follow-up: 0.57±0.64), there was a statistically significant change between pre-post treatment and pre-treatment - final follow-up values ($p = 0.001$; $p < 0.05$). The change between post-treatment and final follow-up was not statistically significant ($p = 0.257$; $p > 0.05$).

Discussion

Phonation performed using high backpressure was observed to provoke the use of the chest register.[11] DVT method was used to increase auditory feedback and to provoke chest register in PD/PA patients and the results were analyzed in our study.

PD may be defined as a rough and breathy phonation, on the other hand PA refers to involuntary whispering, the larynx is normal in both cases.[13] There are difficulties in diagnosing PD/PA because of the variable clinical manifestations and it may be mixed up with other functional voice disorders. MTD may also have similar findings, such as failure of the true vocal folds to adduct, vocal fold bowing, hyperadduction of the true vocal and ventricular folds, anterior-posterior squeezing of the supraglottic structures, and paradoxical movements of the vocal folds.[14,15] Therefore, videolaryngostroboscopic evaluation may not always distinguish PD/PA from other functional dysphonias. The most important distinguishing factors in the evaluation of this group of patients are the history of the patient, the course of the disease, and the non-communicative reflexive voices (such as coughing, crying, and laughing).[1] In our study, it was first ensured that our patients met the specified criteria before the diagnosis of PD/PA and the differential diagnosis was made with non-type-4 MTD.

PD has been noted to be highly predominant in women.[16] Baker et al.[15] reported that PD was 7 times (14: 2) more common in women, while Martins et al.[17] revealed that it was 13

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times (26: 2) more common in women . Especially today, with the significant contribution of women to household budgets, the stress and demands of both domestic and professional tasks can be partially responsible for the increased utilization of psychologic and psychiatric consultations among women.[15] In our study, PD/PA was 6 times (12:2) more prevalent in women, in line with the literature. In addition, nearly half of the patients (57.1% (n = 8) were retired, or unemployed and had no significant difference in terms of response to treatment.

The most frequent form of clinical presentation was conversion aphonia, followed by musculoskeletal tension, and intermittent voicing.[17] Sudden onset of vocal symptoms due to psychogenic dysphonia can be accurately identified by the patient. In a study by Tezcaner et al.,[1] the majority of the patients (86.2%) stated that vocal complaints appeared suddenly. Among our patients, onset was also sudden, which is also important in the differential diagnosis. Eleven of our patients were aphonic and 3 were highly dysphonic. The intermittent nature of psychogenic dysphonia is the most prevalent form of evolution, in which periods of normal voice alternate with periods of aphonia or dysphonia.[17] Eight (57.1%) of our patients stated that they had two or more dysphonic / aphonic attacks before DVT.

Dysphonia due to psycho-emotional and psychosocial factors (anxiety, distress, depression, conversion reaction, personality disorders, and interpersonal conflicts in the family or professional setting) are defined as psychogenic vocal disorder.[1,2,18] Nemr et al.[5] stated that 22.4% (13/58) of patients diagnosed as PD/PA have had a previous psychiatric diagnosis and 17.2% (10/58) of them received medical treatment. While 28.6% (n:4) of the patients in our study stated that they had previously received psychiatric treatment, 71.4% (n:10) had not received treatment before voice therapy. Multidisciplinary approach (voice therapy, psychotherapy) has been stated to be vital in the literature; however, it has also been reported that most PD/PA patients do not accept psychiatric evaluation.[1,4,8,14] In our study, only one of the 10 patients (10%) who did not have any prior psychiatric interventions consented to psychiatric intervention. Furthermore, the decrease in the final control VHI-10 measurements of the group with a complaint period of one month or more compared to the pre-treatment, post-treatment, and pretreatment was higher than the group with a complaint

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duration less than one month ($p < 0.05$). This situation leads us to believe that as the duration of the voice disorder experienced by the patient increases, he/she is more affected psychologically and response to the treatment is more appreciated.

Some studies have reported that in most patients, PD/PA can produce normal voices in the first 5 sessions.[2,19] While 92.8% of the patients in our study (n:13) started phonation in the first three sessions, one patient (7.1%) began phonation in the sixth session. Emotional responses were especially remarkable in VHI-10 results which gave us clues about the therapy survey. Reiters et al. used VHI-10 to evaluate the treatment results of 40 patients, in which 70% achieved total recovery and only 37.5% accepted psychotherapy. They stated that 30% of patients improved with intensive voice exercises with visual feedback of the laryngostroboscopic finding and therapeutic counseling, and in some cases, voice therapy could also be used alone.[8] In our study, VHI-10 values of our patients before DVT, after DVT, and at final follow-up were: 30.91 ± 2, 97, 8.14 ± 3. 82, 3.36 ± 1.78, and there was a significant change between these periods. The successful VHI-10 results obtained at the final follow-up suggests that DVT has a positive effect on the patients' coping strategies.

There are various treatment approaches available for PD/PA, with a consensus on the use of symptomatic voice therapy, counseling, treating underlying psychological factors, and a combination of these elements.[19] Little information exists about long term success or recurrence after voice therapy; a high recurrence rate is inevitable if the underlying psychogenic factors (anxiety, depression, and somatic complaints) remain unchanged in these patients.[16,8,19,20] In the study by Tezcaner et al., recurrence was observed in 10 of 20 patients (50%) who received only voice therapy. On the other hand, only 14.7% (5/34) of patients who underwent additional psychiatric intervention showed recurrence. The psychiatric intervention was stated to be effective in the long-term follow-up, but did not alter the response to voice therapy.[1] In our study, 28.6% (n:4) of our patients were receiving psychiatric/psychogenic

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treatment simultaneously with DVT. However, no statistical relationship was observed between the VHI-10 values and the number of attacks/recurrences between the group who received and did not receive psychiatric/psychogenic therapy ($p > 0.05$). Complete recovery was achieved in all of our patients after therapy with the DVT method. However, 50% (n=7) of our patients stated that they had experienced one or more dysphonia/aphonia attacks and recovered with DVT exercises (early-onset self-therapy). Especially in patients with recurrence, the self-therapy option of DVT may be an important advantage. This provides an additional confidence to the patient and the family as well.

In PD/PA, the high failure rate of voice therapy may inadequately reflect trained clinicians and speech therapists or inadequate therapy technique(s) [1]. According to the literature, direct and indirect voice therapy in combination with cognitive behavior therapy has achieved significant success in the treatment of PD/PA.[8,21] While the DVT method offers an activation plan and exercise program structured in line with motor learning principles, it shifts the patient's attention from the voice production to the use of a 'device'. Therefore, in addition to vocal exercises, the method, with its devices and biofeedback strategy, has similar processes with cognitive behavior therapy. The technique, after being taught to the patient, can be used by the patient and repeated if necessary. DVT may also be regarded as a supportive approach with its placebo effect. On the other hand, need for using specific devices may be regarded as a limitation for the DVT program. Also, patients who are not allowed to try hard (i.e. uncontrolled hypertension, intracranial pressure deficits, etc) may not be suitable for vocal exercises made with high backpressure levels (over 10 cmH2O) as sometimes used in DVT. All the patients were suitable for DVT in our group.

Although PD/PA is the result of a psychiatric etiology, the application of vocal exercises is of great importance. In a patient presenting with aphonia, the personal and environmental expectation is primarily vocal recovery.[4] In a study with immediate symptomatic intensive voice therapy, psychotherapy was not always considered

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necessary.[22] Although most patients may declare that they do not have any psychiatric problems, psychiatric intervention, in our opinion, cannot be substituted by any other means, and patients are to be motivated for psychiatry consultation, especially for the severe psychogenic stress. In addition, psychological support in the voice clinic helps both sides for better therapy adherence and the social environment of the patient can be included in the therapy process as well. Aronson et al.[21] stated that the voice clinician, serving as a *temporary supporting psychotherapist* , may encourage the patient to explain and solve the problem by understanding personal/behavioral and environmental/social causes.

There are several limitations to this study. The study requires longer follow-up duration, a larger number of cases for better statistical results, and better psychiatric consultation-liaison for all cases. In addition, the study should be conducted by different clinicians multicentrically, and the method should be compared with other therapy methods.

Conclusions

DVT method seems to be an efficient treatment method for PD/PA by developing phonatory muscle functions, using multidimensional biofeedback mechanisms, and increasing the patients' therapy adherence. Also, the DVT method provides self-precaution exercises for recurrences in PD/PA patients.

Bullet Point

Psychogenic dysphonia/aphonia (PD/PA) is also known as type-4 muscle tension dysphonia (MTD), conversion dysphonia, phononeurosis, or hysterical aphonia/dysphonia.

LAX VOX exercises with a silicone tube were first demonstrated by the voice pathologist Marketta Sihvo.

DoctorVox Voice Therapy (DVT) is a direct holistic method consisting of two main physical tools: artificial elongation and semi-occlusion of the vocal tract.

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There are various treatment approaches available for PD/PA, with a consensus on the use of symptomatic voice therapy, counseling, treating underlying psychological factors, and a combination of these elements.

DVT method seems to be an efficient treatment method for PD/PA.

This study and authors have not been funded for this study by any means.

The second author has a conflict of interest: He is the founder, inventor, and patent owner of the DVT method and devices.

Ethical approval: "All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."

Informed consent: "Informed consent was obtained from all individual participants included in the study."

Conflict of Interest: The first author declare that they have no conflict of interest. The second author has a conflict of interest: He is the founder, inventor, and patent owner of the DVT method and devices.

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Table 1: Demographic Features

		N	%
Age (year)	*Min-Max (Median)*	18-72 (53.5)	
	Mean±Ss	48.93±18.73	
Gender	**Men**	2	14.3
	Female	12	85.7
Job status	**Working**	8	57.1
	Not working	6	42.9
Education status	**Primary school**	3	21.4
	High school	6	42.9
	University	5	35.7

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Table 2: Disease Features Distribution

Complaint duration (days)	*Min-Max (Median)*	4-365 (37.5)	
	Mean±Ss	77.07±101.22	
		N	**%**
	< 1 month	5	35.7
	≥ 1 months	9	64.3
Attack status at the time of application	**First**	6	42.9
	Recurrent	8	57.1
Follow-up time (months)	*Min-Max (Median)*	6-40 (14)	
	Mean±Ss	17.00±9.60	
Recurrence	**No**	7	50.0
	Yes	7	50.0
Number of relapses	*Min-Max (Median)*	0-3 (0.5)	
	Mean±Ss	0.86±1.03	
	No	7	50.0
	1 recurrent	3	21.4
	≥ 2 recurrents	4	28.6
Psychiatric treatment before DVT*	**No**	10	71.4
	Yes	4	28.6
Psychiatric treatment after DVT*	**No**	10	71.4
	Yes	4	28.6
Pathology	**Severe dysphonia**	3	21.4
	Aphonia	11	78.6

**DVT: DoctorVox Therapy*

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Table 3: Evaluation of VHI-10 Measurements in Follow-up

		Min-Max (Median)	Mean±Ss
VHI-10	**Pretreatment**	24-36 (30.5)	30.91±2.97
	Posttreatment	2-14 (7.5)	8.14±3.82
	Final control	0-6 (4)	3.36±1.78
	P		***[a]0.001*****
	Pre-post-treatment		***[b]0.024****
	Pretreatment- Final control		***[b]0.001*****
	Posttreatment- Final control		***[b]0.024****

[a]Friedman Test *[b]Bonferroni Dunn Test*

**p<0.05* ***p<0.01*

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Table 4: Evaluation of VHI-10 Measurements in Follow-up by Complaint Duration

			Complaint duration		
			< 1 ay (n=5)	**≥ 1 ay (n=9)**	**[c]*p***
VHI-10	**Pretreatment**	*Min-Max (Median)*	24-32 (29)	30-36 (32)	***0.026****
		Mean±Ss	28.60±2.97	32.22±2.17	
	Posttreatment	*Min-Max (Median)*	4-14 (8)	2-14 (7)	***0.687***
		Mean±Ss	8.80±4.15	7.78±3.83	
	Final control	*Min-Max (Median)*	0-6 (4)	1-6 (4)	***0.891***
		Mean±Ss	3.20±2.28	3.44±1.59	
		[a]p	***0.007*** **	***0.001*** **	
	Pre-post-treatment	*Min-Max (Median)*	14-24 (20)	19-34 (24)	***0.041****
		Mean±Ss	19.80±4.02	24.44±4.25	
		[b]p	***0.342***	***0.102***	
	Pretreatment-Final control	*Min-Max (Median)*	22-28 (25)	26-35 (28)	***0.044****
		Mean±Ss	25.40±2.61	28.78±2.59	
		[b]p	***0.005*** **	***0.001*** **	
	Posttreatment-Final control	*Min-Max (Median)*	2-10 (4)	1-9 (4)	***0.456***
		Mean±Ss	5.60±3.29	4.33±2.92	
		[b]p	***0.342***	***0.102***	

[a]Friedman Test *[b]Bonferroni Dunn Test* *[c]Mann Whitney U Test*

**p<0.05* ***p<0.01*

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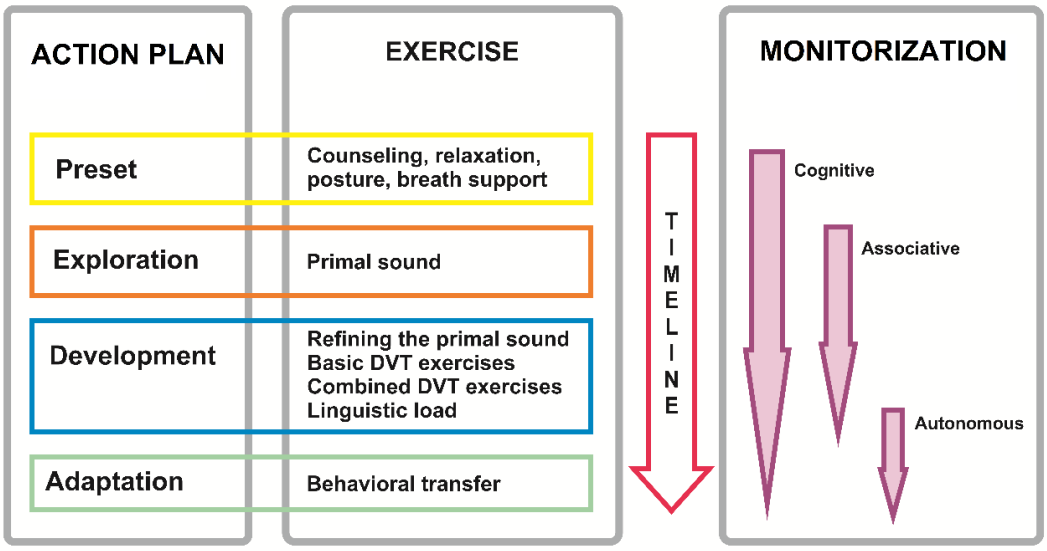
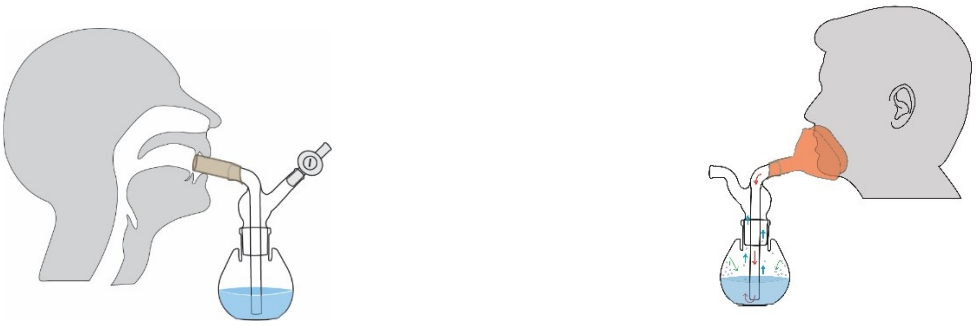


Figure 1: DoctorVox Voice Therapy framework: Four levels and three dimensions are considered through timeline.



a: without mask (adjustable back pressure) b: with mask

Figure 2 (a-b): DoctorVOX Apparatus® images

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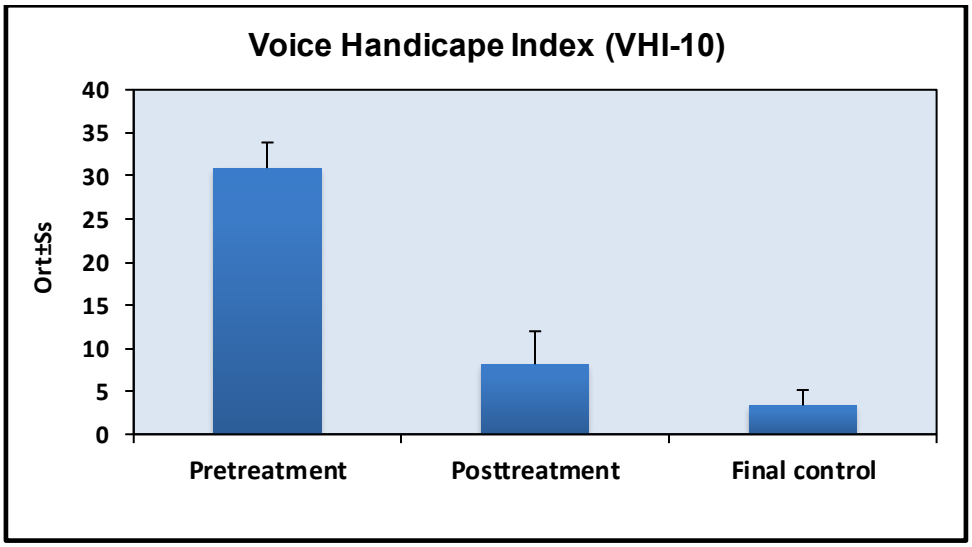

Figure 3: Graphical representation of VHI-10 Measurements in Follow-up

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