Is there any significant effect of voice therapy in Denmark? Voice Handicap Index and efficacy evaluation of logopedic voice therapy
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Introduction
Effectiveness of voice therapy has been mentioned since 1975 (Carding, Hornsley and Docherty, 1999), and nowadays we have a consensus that a voice problem includes the person as a whole, activities and participation, in accordance with the framework of the International Classification of Functioning, Disability and Health (ICF). Also the Committee on Phoniatrics of the European Laryngological Society (ELS) recommends quantitative data for the assessment of common dysphonias from perception, videostroboscopy, acoustics, aerodynamics, and subjective rating by the patients, i.e. Voice Handicap Index (Dejonckere, 2001). Voice Handicap Index (VHI) was developed by Jacobson et al. (1997) as a robust psychometrical validated tool for self measuring of the psychosocial handicapping effects of voice disorders. VHI consist of a 10-item functional (F) subscale, a 10-item physical (P) subscale, and a 10-item emotional (E) subscale.

Objectives
1) To translate, try out and apply VHI to a Danish culture and a Danish voice therapy approach.
2) Efficacy self–evaluation of voice therapy for adults.
3) To discuss environmental and non-environmental conditions affecting the therapy outcome.

Method and materials
Development of the Danish VHI-version
The thirty items from the VHI was translated individually by a phoniatricians and three voice therapists, all Danish native speakers. Afterwards the individual translations were reviewed for specificity and restricted semantic fields, and edited to a version accredited by the translation team and the editing author. The Danish translation was then translated back into English by a bilingual Danish–American speech therapist. The two English versions were semantic identical, and it was taken for an optimal translation of the Danish version of the thirty VHI–items. In a test period other voice therapists, who used the VHI were asked to give their feedback in case some clients misunderstood some items. Very few items were slightly modified, but not in relation to the semantic content. One item was modified due to the difference between Danish and America culture. Thus, original item F22 was: “My voice problem causes me to lose income”. This is very much related to the American labor marked and culture. Therefore this item was changed to “I have fewer job opportunities due to my voice problems” in the English translation. Due to technical development of telephones item F6 was changed from “I use the phone less often than I would like,” to: “I talk less often on the phone than I would like,” since phones nowadays also are used for text and internet communication. The few modifications did not change the semantic content, but did only reduce the possibility for misunderstandings, although we know that clients may understand the statements differently. In the US we have two different VHI-forms, one from Detroit (Jacobson et al., 1997) and one from University of Pittsburgh Voice Center, http://voicecenter.upmc.com/VoiceHandicapIndex.pdf. In the Detroit form the clients have to mark their ratings in a square, and in the Pittsburgh form the clients have to circle the score number most closely representing their views. We tried both forms, but to circle the scores gave less overlooking, so we decided to circle the score numbers. The items were presented in random order, like the Detroit version, in order to get spontaneous ratings. The ratings are 0=Never, 1=Almost never, 2=Sometimes, 3=Almost always, and 4=Always. We also asked about professional use of voice as
in the Pittsburg form, and the supplementary question from the Detroit form about how you feel concerning your voice today on a rating scale from 1 (Normal) to 7 (Severe). Talkativeness ratings - as in the Pittsburgh form - from 1 (Quiet listener) to 7 (Extremely talkative) were also recorded.

**Voice therapy**

Voice therapy in Denmark is not standardized, and neither are the referral procedures. Some clients are referred from a university phoniatric-logopedic voice clinic, some from different general otolaryngologists, and some are self-referred. Voice therapy in Denmark is also practiced with different approaches, so we will only be able to present what the clients will gain from voice therapy in general, not from specific voice therapy approaches. The therapy is always given on an individual basis, no group sessions are given. There is no pre-set time schedule, length of therapy or specific number of therapy sessions outlined. It depends on the therapist and the client and the progression of therapy, and there are no therapy fees. The therapy is provided in logopedic centers, and most clients have their therapy sessions within a distance of 50 km from their homes. The clients are reimbursed for their transportation costs, and the therapy is provided within the framework of special needs education for adults, organized as public integrated systems, which combine financing, ownership and governance functions at the public level.

**Material**

Out of 417 consecutive voice clients, 248 managed to evaluate their voice problems before and after voice therapy. The data were collected from June 2002 to June 2006. The main diagnoses were primarily the functional disorders, such as dysphonia, phonashesia, or aphioma, however also organic diagnoses on vocal folds and larynx, such as paralysis, polyps, nodules, cysts and edemas were main diagnoses. Additional diagnoses varied and were often lifestyle-disease diagnoses. A total of 26 different voice therapists in the Western and Northern part of Denmark were involved in collecting data from the 417 voice clients.

**Procedure**

The 417 clients ranked the 30 *VHI*-items on a *VHI*-form, based on paper and pen, before voice therapy. 248 of the 417 were able to rank the 30 *VHI*-items again when the voice therapy was terminated, and they were asked to do the ranking again three months after the therapy had ceased. A new *VHI*-form was mailed to the clients three month later, and they were asked to return the form with all the ranked *VHI*-items in a self-addressed stamped envelope.

The sum of the functional F-score, physical P-score, emotional E-score, and the total F+P+E-score were entered in the SPSS Data Editor. The data from all the available forms from the clients were entered in the data file. In addition the year of birth, main diagnosis, additional diagnoses, the year of the first manifestation of the voice disorder, the year of the first voice therapy, a code for the speech therapist involved, the total number of therapy hours, the time period, the number of therapy sessions, maximum phonation time, and number of cigarettes smoked per day were recorded – depending on data availability. Additional information and comments relevant to the voice disorder and its prognosis were entered as well. It might be vocal hygiene instruction, vocal function exercises, respiratory retraining, relaxation exercises, articulation exercises, correction of body posture and muscular hypertonicity, shimmer, jitter, and/or Voice Turbulent Index. Because voice therapy is organized differently and approaches are varied there are no uniform and complete recordings available.

**Statistics**

The SPSS data file was possessed with SPSS Basis, version 12 ([www.sps.com](http://www.sps.com)). Means were compared with a two-tailed paired t-test for F-score, P-score, E-score and total score for the three different administrations of the *VHI*-form. Because we do not know if the clients have regarded the score scale as an interval level scale or an ordinal scale, chances are that the requirements for parametric statistics are not met. Therefore, non-parametric statistics with a Wilcoxon signed-ranks
test and the Sign Test for Paired Data were performed. Non–parametric hypothesis testing with data
organized in cross tables were performed with the McNemar test, and non–parametric rank
correlation with the Spearman rho ($\rho$) and Kendall’s tau ($\tau$) statistics. Null hypothesis testing of two
independent samples was performed with the Mann–Whitney rank test. The Kruskal–Wallis k–
sample test is used for independent samples of talkative scores and $VHI$ total scores.

Results and Discussion

Gender distribution

Out of the total cohort of 417 clients 74% (308) were females and 26% (108) males; born between
1921 and 1989; 50 % born between 1941 and 1962. The mean age was 46 years and the median age
48 years. The men were 5 years older than the women on an average, and the difference was
significant ($p<0.01$). One person did not submit gender information.

Effect of voice therapy

For the cohort of 248 clients as a whole, the voice handicap was reduced significantly ($p<0.005$)
due to voice therapy. The total $VHI$ score was on an average reduced from 43.2 to 25.6, which is a
score reduction of 17.6. The functional $F$–scale score was on average reduced from 11.6 to 6.8, the
physical $P$–scale score from 19.5 to 11.9, and the emotional $E$–scale score from 12.2 to 6.8 (Fig. 1).
The two–tailed paired t–test for total score, $F$–score, $P$–score, and $E$–score showed that those
average score reductions were significant ($p<0.005$). Non-parametric statistics with Wilcoxon
signed–ranks test and the Sign Test for Paired Data were also performed with the same significance
($p<0.005$).

![VHI-score before and after voice therapy](image)

Fig.1.

The significant reduction was also effective 3 months after the therapy has ceased. 193 clients from
the cohort managed to evaluate their voice handicap before voice therapy started and again 3
months after voice therapy stopped. In this cohort of 193 clients the voice handicap was reduced
significantly also 3 months after voice therapy. The total $VHI$ score was on an average reduced from
42.4 to 26.7, which is a score reduction of 15.7. The $F$–scale score was on average reduced from
11.3 to 7.2, the $P$–scale score from 19.4 to 12.6, and the $E$–scale score from 11.6 to 7.0 (Fig. 2).
The two–tailed paired t–test for total score, $F$–score, $P$–score, and $E$–score showed that those
average score reductions were significant ($p<0.005$). Non-parametric statistics with Wilcoxon signed–ranks
test and the Sign Test for Paired Data were also performed with the same significance ($p<0.005$).
No significant change of the mean VHI-scores were recorded in the cohort of 181 clients who managed to evaluate their voice handicap when the voice therapy ceased and three month later. The total mean score increased 0.5, from 25.46 to 25.96. The mean F-score was increased from 6.70 to 7.02, P-score from 12.10 to 12.16, and the E-score from 6.60 to 6.81. There is no significance or tendency in the differences, and all the correlation coefficients are about 0.7. Non-parametric statistics with Wilcoxon signed-ranks test and the Sign Test for Paired Data did not show any significant differences or tendencies.

**Individual clients**

The results above show that voice therapy for the cohort as a whole is effective. According to Jacobson et al. (1997) the voice handicap for an individual is significantly modified if the total score is reduced with minimum 18, or if one of the subscales is reduced with 8. Hakkesteeg et al. (2006) mentioned that 14 are the limit score for the total score in the Dutch version of VHI. The limit score for the Danish version is not known, but some Danish clients were above the limit scores of 18, 14 or 8, and others below the limits. We do not know if there are some parameters responsible for lack of voice therapy effects, but from our data we can conclude that smoking, polyp of vocal cord, and talkativeness significantly modified the effect of the voice therapy.

**Tobacco smoking**

For 141 of the 417 clients we had an anamnesis relating to smoking habits and significance of reduction in voice handicap before and after therapy. 104 were non-smokers and 37 smokers, reflecting the prevalence of smokers in Denmark. With the limit score values described by Jacobson et al. (1997) 86 clients of the 141 clients in voice therapy had a significant modified voice handicap. 55 did not modify their voice handicap significantly. Non-parametric statistics with the McNemar test showed that non–smokers significantly more often had their voice handicap modified after voice therapy than smokers did (p<0.005). It is illustrated in Fig. 3.
Non-smokers and smokers
VHI score reduction

Fig. 3.
Correlation between number of cigarettes smoked per day and VHI score reduction after therapy can not be calculated as a parametric correlation. But the level of significance may be estimated non-parametric by calculating the Kendall’s coefficient of concordance $\tau-b$ and the Spearman’s rank correlation coefficient $\rho$. The estimations show that more smoking gives less reduction of VHI score. Kendall’s $\tau-b$ was $-0.13$ and Spearman’s $\rho$ was $-0.16$ by correlating number of cigarettes smoked per day with the total reduction of VHI score. Those coefficients are significantly different from zero ($p=0.031$ and $p=0.036$) in a one-tailed test. We used a one-tailed rather than a two-tailed test since we predicted the direction of the correlation. The correlation was also calculated for VHI score 3 months after therapy had ceased with a Kendall’s $\tau-b$ of $-0.12$ and Spearman’s $\rho$ of $-0.16$ ($p=0.051$ and $p=0.052$).

Polypus plicae vocalis et laryngis (J38.1)
We have also separated the cohort who had an organic polyp of the vocal cord or larynx, such as vocal polyps and Reinke's polypoid degeneration. No laryngeal polyps were diagnosed. Out of our 248 clients recorded with VHI score before and after therapy, 131 had a vocal diagnosis, 16 clients with a J38.1 ICD-10 diagnosis. On average those 16 clients had a reduction of VHI score of 6.2 as a result of therapy. 115 without a J38.1 diagnosis had a mean score reduction of 19.9. The two means are significant differently ($p=0.005$), and a J38.1 diagnosis does reduce the effect of voice therapy. The same effect is seen 3 months after the therapy was ceased. 108 clients had a vocal diagnosis, 15 with a J38.1 diagnosis who had a mean VHI score reduction 3 months after therapy of 6.2. The 93 clients without this diagnosis had a mean score reduction of 17.2, and the two means are significant differently ($p=0.041$), so a J38.1 diagnosis does also reduce the effect of voice therapy 3 months after the end of therapy (Fig. 4).
Other relations and lack of relations
The number of needed therapy hours – according to a professional judgment – was not correlated to the change of scores between two administrations of the VHI-form. The number of voice therapy sessions or the total duration of therapy were not correlated either. Only a very weak tendency towards some kind of relation between the number of therapy sessions and the change between two administrations might be noticed, but no therapy actions should be taken due to this tendency other than further investigation.

There is no correlation between the professional or semi-professional use of voice function at work or in social relations, but there is a tendency for more talkative persons to have less score reduction between the two administrations before and after therapy. For 247 available recordings of talkativeness and VHI score reduction, the Kruskal–Wallis test gave an asymptotic significance with \( p = 0.016 \). The age of the client and the genus did not affect any statistical correlations, and the different clinicians did not differ significantly in relation to reduction of VHI score between the two administrations.

You might see a tendency towards short maximum phonation time before therapy starts reduce the VHI score more between the initial VHI administration and the second administration. From 136 clients we had anamnesis about the duration of the clients’ voice problems, and there was a tendency that a longer period with a voice problem gave less reduction of the VHI-score after therapy. It might reflect that chronic voice disorders are more difficult to treat with logopedic voice therapy.

Conclusion
Evaluation with a translation of a robust psychometrical validated tool for self measuring of the psychosocial handicapping effects of voice disorders showed a significant effect of voice therapy and the effect remained significant 3 months post therapy. Tobacco smoking, polyps of the vocal cords significantly reduced the shift in psychosocial function due to voice therapy. Talkativeness and longer periods with voice problems also had a tendency to reduce the effect of therapy. Professional use of the voice, age and/or gender did not change the effect of voice therapy. It seems that there were no significant differences among the various clinicians. A shorter maximal phonation time, recorded when therapy was initiated, might increase the shift in psychosocial functions between the two administrations. More uniformed organization of voice therapy in Denmark might unfold more correlations relating to voice therapy.
References
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